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30,398	597	27,711	103	1599	498	4702	705	7272	503	9191	612	11,470	799
		27,836	93	1636	364	4736	195	7291	190	9203	433	11,553	211
		27,949	93	1664	591	4766	212	7364	371	9267	418	11,568	254
		28,057	92	2075	98	4808	587	7367	242	9277	185	11,569	742
1911.		28,078	94	2081	198	4809	587	7422	524	9301	621	11,587	212
		28,167	85	2136	241	4830	11	7457	800	9314	548	11,588	673
5867	541	28,171	232	2140	234	4838	305	7480	381	9463	591	11,614	709
5872	541	28,177	111	2141	229	4887	363	7498	763	9471	768	11,664	164
14,065	78	28,178	111	2149	234	4897	622	7499	763	9500	253	11,679	455
17,554	445	28,179	158	2176	365	4903	351	7555	421	9509	481	11,680	690
17,648	369	28,184	92	2190	622	4908	351	7616	444	9541	597	11,713	586
18,503	36	28,279	92	2213	210	4944	151	7635	526	9574	593	11,754	828
19,330	77	28,328	159	2282	235	4989	30	7669	156	9586	552	11,771	792
19,923	93	28,485	20	2300	288	4997	275	7687	483	9603	629	11,775	529
20,917	146	28,521	142	2315	222	5024	527	7712	478	9623	309	11,776	80
20,928	47	28,605	85	2324	495	5026	691	7727	294	9668	688	11.792	415
20,975	19	28,609	524	2328	224	5027	691	7728	363	9672	87	11.799	235
20,976	80	28,630	48	2348	143	5028	692	7740	363	9719	594	11.836	238
20,977	133	28,723	39	2382	371	5039	456	7767	307	9723	548	11,838	289
20,979	133	28,809	305	2405	435	5063	377	7768	417	9737	443	11,860	376
21,059	13	28,877	104	2407	453	5080	354	7829	477	9747	484	11,909	409
21,327	143	28,920	85	2416	94	5091	199	7869	503	9765	702	11,960	305
21,661	30	28,929	146	2423	93	5098	369	7892	226	9841	289	11,992	671
21,880	530	28,974	162	2461	275	5144	451	7939	208	9842	289	12,007	527
22,452	183	28,990	209	2468	279	5169	446	7945	493	9856	820	12,027	793
22,513	232	29,057	151	2545	210	5183	12	7969	550	9912	622	12,051	289
22,670	183	29,211	112	2552	195	5246	276	7975	742	9929	254	12,067	755
23,139	235	29,220	224	2572	275	5263	187	7977	354	9941	591	12,095	528
23,224	20	29,301	221	2597	29	5328	544	7978	86	9953	239	12,128	360
23,447	13	29,313	221	2682	765	5343	415	8002	550	9967	612	12.141	530
23,696	78	29,318	91	2709	238	5386	192	8018	11	9981	540	12,162	191
24,050	104			2735	193	5411	535	8056	819	9986	94	12.163	594
24,562	93			2756	228	5429	47	8065	35	10,036	195	12,165	299
24,748	77			2839	198	5430	99	8076	141	10,062	712	12,168	432
24,960	110	**1912.**		2862	354	5436	108	8077	527	10,090	664	12.171	146
25,177	187			3002	455	5445	369	8097	602	10,147	602	12,185	604
25,206	82	29	134	3008	666	5500	353	8106	619	10,203	886	12,224	739
25,256	98	82	79	3010	157	5587	407	8194	544	10,222	34	12,237	712
25,451	24	91	143	3057	305	5601	553	8218	40	10.244	662	12,242	792
25,506	29	105	152	3142	78	5633	434	8219	47	10,256	13	12,243	792
25,532	18	157	142	3147	364	5635	105	8227	671	10,260	284	12,257	691
25,533	18	173	152	3152	275	5659	133	8228	792	10,307	613	12,308	790
25,534	19	272	125	3191	98	5667	372	8230	189	10,338	755	12,321	705
25,672	31	277	212	3213	284	5706	222	8246	541	10,352	621	12.346	412
25,681	364	292	35	3228	281	5742	354	8249	526	10,370	590	12,349	755
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25,731	20	473	192	3312	299	5806	541	8322	159	10,381	607	12,390	794
25,800	739	535	95	3327	300	5852	527	8323	821	10,399	607	12.467	960
25,879	42	550	198	3342	296	5853	29	8332	834	10,422	229	12,468	960
25,919	30	564	206	3367	277	5855	429	8341	604	10,424	604	12,469	756
25,980	365	584	97	3368	294	5859	214	8397	543	10,430	531	12,479	691
26,029	35	721	11	3481	246	5869	448	8426	541	10,443	672	12,542	610
26,068	42	808	192	3512	276	5975	755	8479	368	10,471	621	12,544	647
26,128	29	821	184	3525	790	6002	233	8486	628	10,541	610	12,562	690
28,184	30	885	607	3535	210	6003	448	8498	535	10,548	19	12,563	690
26,240	30	914	613	3607	354	6019	25	8509	418	10,552	526	12,597	530
26,349	353	969	353	3628	310	6033	132	8510	419	10,564	914	12,599	621
26,484	238	989	208	3674	377	6080	529	8511	246	10,565	903	12,615	481
26,576	229	1001	199	3752	198	6095	449	8512	205	10,643	662	12,616	281
26,622	21	1002	232	3795	278	6118	94	8524	446	10,657	611	12,617	418
26,623	80	1003	199	3805	363	6176	426	8546	543	10,706	597	12,618	529
26,809	10	1004	199	3837	353	6261	242	8547	613	10,721	644	12,619	528
26,824	421	1005	199	3870	252	6268	420	8554	706	10,731	608	12,620	307
26,829	10	1066	235	3873	449	6293	298	8609	546	10,732	529	12,642	945
26,935	438	1076	427	3891	197	6294	298	8617	289	10,789	779	12,675	224
26,941	87	1136	535	3899	42	6299	545	8668	294	10,793	527	12,696	861
26,958	85	1161	289	3914	10	6300	545	8676	544	10,810	141	12.720	648
27,005	187	1177	214	3917	295	6301	768	8679	422	10,819	187	12,737	740
27,150	93	1194	377	3929	283	6363	436	8704	297	10,822	295	12,742	991
27,151	30	1197	110	3951	146	6391	238	8712	528	10,877	352	12,743	991
27,266	38	1232	224	3969	358	6405	202	8738	229	10,929	524	12,744	991
27,281	455	1254	216	4003	455	6462	428	8751	85	10,947	705	12,745	991
27,342	94	1269	35	4004	455	6533	409	8758	691	10.992	657	12.746	991
27,343	30	1293	93	4010	276	6603	235	8791	542	11,137	585	12,749	700
27,344	30	1328	209	4064	358	6652	284	8824	531	11.147	585	12,752	692
27,345	94	1338	295	4161	372	6683	85	8865	415	11,193	674	12,753	372
27,354	78	1346	239	4162	185	6732	782	8871	550	11,252	187	12.770	712
27,357	74	1350	30	4163	407	6738	412	8872	190	11.273	98	12,771	711
27,378	78	1372	132	4248	697	6772	369	8876	36	11,274	705	12,773	706
27,424	98	1378	192	4332	283	6790	99	8908	624	11,347	644	12,845	363
27,451	94	1469	455	4359	249	6791	421	8957	307	11.360	625	12,848	377
27,487	105	1479	199	4377	353	6808	492	8974	299	11,363	909	12,854	940
27,491	214	1490	234	4412	249	6825	414	8990	823	11,390	699	12,869	94
27,589	110	1540	40	4504	444	6891	766	8991	548	11,391	657	12,991	968
27,612	77	1549	253	4505	445	6971	540	9053	192	11,392	600	12,995	19
27,620	14	1554	80	4508	446	6981	187	9065	412	11.393	657	13,009	148
27,661	98	1555	18	4619	368	7202	239	9141	547	11,394	363	13,010	759
27,665	35	1569	354	4620	368	7203	294	9146	199	11,395	657	13,019	528
27,666	98	1598	498	4692	294	7259	252	9167	508	11,455	527	13,049	278

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13,051	740	14,742	694	16,237	1125	17,836	662	19,051	903	20,900	861	22,626	1129
13,141	971	14,755	495	16,249	446	17,840	874	19,097	354	20,926	285	22,634	807
13,229	591	14,764	780	16,262	816	17,842	759	19,100	1000	20,950	982	22,653	1029
13,248	740	14,805	239	16,275	703	17,862	206	19,101	1000	20,952	872	22,699	1077
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[illegible]	409	15,868	192	17,431	868	18,822	907	20,363	586	22,114	969	23,789	899
[illegible]	408	15,888	608	17,467	357	18,823	925	20,367	1102	22,144	980	23,846	1120
14,464	662	15,906	816	17,472	882	18,824	919	20,387	820	22,201	531	23,853	1097
14,476	79	15,931	161	17,482	869	18,825	372	20,448	969	22,237	624	23,863	1094
14,494	[illegible]	15,934	142	17,485	748	18,834	1168	20,527	823	22,240	1171	23,867	526
14,496	25	15,937	842	17,487	878	18,835	242	20,536	1168	22,255	298	23,869	796
[illegible]	593	15,965	901	17,502	838	18,844	377	20,553	707	22,280	1019	23,870	829
[illegible]	246	15,966	610	17,529	749	18,851	799	20,554	836	22,316	436	23,898	364
[illegible]	[illegible]	15,977	927	17,532	499	18,854	998	20,555	990	22,342	1028	23,959	654
[illegible]	760	16,001	831	17,534	832	18,883	290	20,556	990	22,352	868	24,009	608
14,585	752	16,014	872	17,543	540	18,925	902	20,557	833	22,406	159	24,027	857
[illegible]	[illegible]	16,036	765	17,546	279	18,946	920	20,558	1164	22,414	1151	24,035	979
[illegible]	359	16,040	148	17,554	671	18,947	920	20,568	587	22,435	233	24,041	374
14,606	[illegible]	16,041	370	17,569	444	18,948	920	20,585	740	22,436	748	24,051	200
14,607	186	16,044	235	17,594	198	18,949	920	20,615	970	22,440	130	24,057	1104
[illegible]	[illegible]	16,060	706	17,603	601	18,950	920	20,621	416	22,449	1021	24,059	951
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14,670	[illegible]	16,111	712	17,672	790	18,998	917	20,760	1009	22,550	980	24,156	836
14,710	[illegible]	16,156	786	17,676	94	19,001	907	20,789	978	22,554	804	24,196	511
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11,096	1102
11,228	1098
11,290	821
11,384	1074
11,530	1078
11,567	1124
11,749	945
11,828	867
11,837	911
11,853	1070
11,854	1130
11,872	981
11,927	934
11,938	948
12,070	1147
12,090	975
12,152	906
12,163	1125
12,208	1117
12,217	938
12,228	863
12,376	1034
12,444	1159
12,536	910
12,567	1007
12,833	1120
12,837	1162
12,913	970
13,071	1094
13,072	1070
13,109	1074
13,110	906
13,193	1167
13,237	1060
13,258	1010
13,327	924
13,433	959
13,501	1171
13,518	1150
13,598	934
13,805	1016
13,882	1130
13,901	977
13,922	868
14,046	1100
14,058	1157
14,063	1163
14,128	1170
14,231	1128
14,249	921
14,256	921
14,391	1162
14,409	1030
14,632	1157
14,808	1081
15,028	937
15,161	959
15,162	990
15,581	1063
15,613	1167
15,726	1150
15,933	1032
15,945	1148
15,946	987
16,011	1076
16,048	1075
16,050	1168
16,283	989
16,387	1030
16,452	1059
16,470	1066
16,483	1128
16,710	990
16,711	962
16,935	1028
17,104	943
17,523	1163
17,533	1030
17,582	1078
17,759	950
17,919	1059
18,060	1163
18,262	1163
18,427	1166
18,842	1148

LIST OF JOURNALS ABSTRACTED, WITH ABBREVIATIONS USED, AND ADDRESSES OF PUBLISHERS.

Journal.	Abbreviation.	Address of Publisher.
Agricultural Ledger	Agric. Ledger	Reporter on Economic Products to the Government of India, Calcutta.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation	Allgem. Z. Bierbrau. u. Malzfabr.	Michaelerstrasse 25, Vienna XVIII/$_1$.
American Journal of Pharmacy	Amer. J. Pharm.	145, North Tenth Street, Philadelphia, Pa., U.S.A.
American Journal of Science	Amer. J. Sci.	New Haven, Conn., U.S.A.
Analyst	Analyst	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 2, 4, 6, 8, Orange Street, London, S.W.
Annalen der Chemie	Annalen	C. F. Winter'sche Verlagshandlung, Leipzig, Germany.
Annales de Chimie Analytique	Ann. Chim. Analyt.	M. Crinon, 45, Rue Turenne, Paris, 3e.
Annales des Falsifications	Ann. Falsific.	56, Rue Madame, Paris, 6e.
Annali della R. Stazione Chimico Agraria Sperimentale di Roma	Ann. R. Staz. Chim. Agrar. Sperim. Roma	R. Stazione Chimico-Agraria Sperimentale di Roma, Rome.
Apotheker-Zeitung	Apoth.-Zeit.	Levetzowstrasse 16b, Berlin, N.W. 87.
Archiv der Pharmazie	Arch. Pharm.	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany.
Atti della Reale Accademia dei Lincei, Roma	Atti R. Accad. dei Lincei, Roma	Tipografia della R. Accademia dei Lincei, Rome.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W. 6, Germany.
Berichte der Deutschen Pharmazeutischen Gesellschaft	Ber.deuts.Pharm.Ges.	Verlag von Gebr. Bornträger, Berlin, W. 35, Schöneberger Ufer 12A, Germany.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr.	O. Leiner, Königstrasse 26B, Leipzig, Germany.
Bio-chemical Journal	Bio-chem. J.	Bio-chemical Dept., The University, Liverpool.
Biochemische Zeitschrift	Biochem. Zeits.	Verlag von J. Springer, Berlin, W. 9, Linkstrasse 23/24.
Board of Trade Journal	Bd. of Trade J.	Messrs. Wyman and Sons, Fetter Lane, London, E.C.
Brewers' Journal	Brewers' J.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C.
British and Colonial Druggist	Brit. and Col. Drug.	194-200, Bishopsgate, London, E.C.
Bulletin de l'Association Chimique de Sucre et de Distillerie	Bull. Assoc. Chim. Sucr.	156, Boulevard Magenta, Paris, 10e, France.
Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases	Bull. Bureau Agric. Intell.	International Institute of Agriculture, Rome.
Bulletin de la Société Chimique de Belgique	Bull. Soc. Chim. Belg.	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de la Société Chimique de France	Bull. Soc. Chim.	Masson et Cie., 120, Boulevard Saint-Germain (6e), Paris.
Bulletin de la Société Française de Photographie	Bull. Soc. Franç. Phot.	51, Rue de Clichy, Paris, 9e.
Bulletin de la Société Industrielle du Nord de la France	Bull. Soc. Ind. Nord	Rue de l'Hôpital Militaire 116, Lille, France.
Bulletin de la Société Industrielle de Mulhouse	Bull. Soc. Ind. Mulhouse	Berger-Levrault et Cie., 5, Rue des Beaux-Arts, Paris.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale	Bull. Soc. d'Encour.	Secrétariat, Rue de Rennes 44, Paris, France.
Le Caoutchouc et le Gutta-Percha	Caoutchouc et Gutta-Percha	A. D. Cillard fils, 49, Rue des Vinaigriers, Paris, X.
Chamber of Commerce Journal	Ch. of Comm. J.	Oxford Court, Cannon Street, London, E.C.
Chemical News	Chem. News	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
Chemical Trade Journal	Chem. Trade J.	Davis Bros., Danes Inn House, 265, Strand, London, W.C.
Chemiker-Zeitung	Chem.-Zeit.	Dr. v. Vietinghoff-Scheel, Cöthen, Anhalt, Germany.
Chemische Industrie	Chem. Ind.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany.
Chemische Revue über die Fett- und Harz Industrie	Chem. Rev. Fett Ind.	Dr. L. Allen, Catherinenstrasse 25, Hamburg, Germany.
Chemisches Zentralblatt	Chem. Zentr.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W. 6, Germany.
Chemist and Druggist	Chem. and Drug.	42, Cannon Street, London, E.C.
Collegium	Collegium	K. Schorlemmer, Sebastian-Munster-Strasse 28, Worms am Rhein, Germany.
Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences	Comptes rend.	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg	Comptes-rend. Trav. Lab. Carlsberg	H. Hagerup, Copenhagen.
Deutsche Zuckerindustrie	Deuts. Zuckerind.	Verlag der Gesellschaft, Die Deuts. Zuckerindustrie, Berlin.
Elektrochemische Zeitschrift	Elektrochem. Zeits.	F. Siemenroth, Hafenplatz 9, Berlin, S.W. 11.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C.
Engineering and Mining Journal	Eng. and Min. J.	505, Pearl Street, New York City.
Färber-Zeitung	Färber-Zeit.	Julius Springer, Linkstrasse 23/24, Berlin, W. Germany.
Ferrum	Ferrum	W. Knapp, Mühlweg 19, Halle on Saale, Germany.
Feuerungstechnik	Feuerungstechnik	O. Spamer, Täubchenweg 26, Leipzig-R., Germany.
Foreign Office Annual Series (Cons. Reports)	F. O. Ann. Series	Wyman and Sons, Fetter Lane, London, E.C.
Gazzetta Chimica Italiana	Gazz. Chim. Ital.	La Direzione della "Gazzetta Chimica," Via Panisperna, 89, Rome.
Gerber	Gerber	VI/$_2$ Gumpendorferstrasse 89, Wien, Austria.
Gummi-Zeitung	Gummi-Zeit.	Geschäftsstelle der "Gummi-Zeitung," Blücherstrasse 31, Berlin, S. 61, Germany.
Imperial Institute Bulletin	Bull. Imp. Inst.	John Murray, Albemarle Street, London, W.
India-Rubber Journal	India-rubber J.	Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C.
International Sugar Journal	Int. Sugar J.	2, St. Dunstan's Hill, London, E.C.
Internationale Zeitschrift für Metallographie	Internat. Z. Metallog.	Gebr. Bornträger, Schöneberger Ufer 12a, Berlin, W. 35.
Journal of Agricultural Research	J. Agric. Res.	U.S. Department of Agriculture, Washington, D.C., U.S.A.
Journal of Agricultural Science	J. Agric. Sci.	University Press, Cambridge.
Journal of the American Chemical Society	J. Amer. Chem. Soc.	C. L. Parsons, Box 505, Washington, D.C., U.S.A.
Journal of the American Leather Chemists' Association	J. Amer. Leather Chem. Assoc.	American Leather Chemists' Assoc., Easton, Pa., U.S.A.
Journal of Biological Chemistry	J. Biol. Chem.	2419–21, York Road, Baltimore, Md., U.S.A.
Journal of the Canadian Mining Institute	J. Canad. Min. Inst.	3 & 4, Windsor Hotel, Montreal, Canada.
Journal of the Chemical Society of London, Transactions and Proceedings	Chem. Soc. Trans. *or* Chem. Soc. Proc.	Gurney and Jackson, 33, Paternoster Row, London, E.C.
Journal of the Chemical, Metallurgical, and Mining Society of South Africa	J. Chem. Met. Soc., S. Africa	F. Rowland, 9, South African School of Mines Building, Eloff Street, Johannesburg.
Journal de Chimie Physique	J. Chim. Phys.	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Journal of the College of Agriculture, Tokyo Imperial University, Japan	J. Coll. Agric., Tokyo	Director of the College of Agriculture, Tokyo Imperial University, Japan.
Journal of the College of Engineering, University of Tokyo	J. Coll. Eng., Univ. Tokyo	The University, Tokyo.
Journal of the College of Science, Imperial University of Tokyo	J. Coll. Science, Tokyo	Director of the College of Science, Tokyo Imperial University, Japan.
Journal of the Franklin Institute	J. Franklin Inst.	The Actuary, The Franklin Institute, Philadelphia, Pa., U.S.A.
Journal für Gasbeleuchtung und Wasserversorgung	J. Gasbeleucht.	R. Oldenbourg, Glückstrasse 8, München, Germany.
Journal of Gas Lighting	J. Gas Lighting	W. King, 11, Bolt Court, Fleet Street, London, E.C.
Journal of Industrial and Engineering Chemistry	J. Ind. Eng. Chem.	C. L. Parsons, Box 505, Washington, D.C., U.S.A.
Journal of the Institute of Brewing	J. Inst. Brewing	Harrison and Sons, 45, Pall Mall, London, W.
Journal of the Institution of Mechanical Engineers	J. Inst. Mech. Eng.	Storey's Gate, Westminster, S.W.
Journal of the Russian Physical-chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Impériale, St. Pétersbourg, Russia.
Journal of Physical Chemistry	J. Phys. Chem.	W. D. Bancroft, Ithaca, N.Y., U.S.A.
Journal de Pharmacie et de Chimie	J. Pharm. Chim.	O. Doin et fils, Place de l'Odéon, Paris, 8.
Journal für praktische Chemie	J. prakt. Chem.	J. A. Barth, Dörrienstr. 16, Leipzig, Germany.
Journal of the Royal Society of Arts	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	Pear Assurance Buildings, Market Street, Bradford, Yorks.
Journal of the Washington Academy of Sciences	J. Wash. Acad. Sci.	The Waverley Press, Baltimore, Md., U.S.A
Kolloid-Zeitschrift	Kolloid-Zeits.	T. Steinkopff, Bismarckplatz 16, 1., Dresden-A, 14, Germany.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
L'Industria Chimica	L'Ind. Chimica ..	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scala A), Turin, Italy.
Memoirs of the College of Science and Engineering, Kyoto Imperial University	Mem. Coll. Sci. and Eng. Kyoto Imp. Univ.	The University, Kyoto, Japan.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Salpêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Metall und Erz	Metall u. Erz	W. Knapp, Mühlweg 19, Halle on Saale, Germany.
Metallurgical and Chemical Engineering	Metall. and Chem. Eng.	McGraw Publishing Co., 239, West 39th Street, New York City, U.S.A.
Mining and Engineering World ..	Min. and Eng. World	Monadnock Building, Chicago, Ill., U.S.A.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Linkstrasse 23/24, Berlin, W. 9, Germany.
Mittheilungen aus der Centralstelle für wissenschaftlich-technische Untersuchungen	Mitt. Centralst. Wiss.-techn. Unters.	Prof. Dr. W. Will, Neu-Babelsberg, bei Berlin, Germany.
Mittheilungen des k.k. Technischen Versuchsamtes	Mitt. k.k. Techn. Versuchsamtes	Verlag der k.k. Hof- und Staatsdruckerei, Wien, Austria.
Monatshefte für Chemie der kaiserlichen Akademie der Wissenschaften, Wien	Monatsh. Chem. ..	A. Hölder, Rothenthurmstrasse 25, Wien I, Austria.
Moniteur Scientifique	Monit. Scient. ..	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris.
Oesterreichische Zeitschrift für Berg- und Hüttenwesen	Oesterr. Z. Berg- u. Hüttenw.	Kohlmarkt 20, Wien I, Austria.
Oil, Paint, and Drug Reporter ..	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A.
Papier-Fabrikant	Papierfabr.	Otto Elsner, Oranienstr. 140-142, Berlin, S. 42.
Perfumery and Essential Oil Record	Perfumery and Essent. Oil Rec.	6, Serle Street, London, W.C.
Petroleum	Petroleum	Verlag für Fachtliteratur, Motzstrasse 8, Berlin, W. 30.
Pharmaceutical Journal	Pharm. J.	150, Holborn, London, E.C.
Philippine Journal of Science ..	Philippine J. Sci. ..	Bureau of Science, Manila, Philippine Islands.
Philosophical Magazine and Journal of Science	Phil. Mag.	Taylor and Francis, Red Lion Court, Fleet Street, London, E.C.
Photographic Journal	Phot. J.	Harrison and Sons, 45, Pall Mall, London, S.W.
Proceedings of the American Institute of Mining Engineers, *and also* Bulletin	Proc. Amer. Inst. Min. Eng.: Bull. Amer. Inst. Min. Eng.	124-128, North Seventh Street, Philadelphia, Pa., U.S.A.
Proceedings of the American Society of Civil Engineers	Proc. Amer. Soc. Civ. Eng.	220, West 57th Street, New York City, U.S.A.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	2511, Oliver Building, Pittsburg, Pa., U.S.A.
Proceedings of the Faraday Society	Proc. Faraday Soc. ..	The Secretary, 82, Victoria Street, London, S.W.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng. ..	The Secretary, Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	1, Finsbury Circus, London, E.C.
Proceedings of the Royal Society	Roy. Soc. Proc. ..	Harrison and Sons, 45, St. Martin's Lane, London, W.C.
Recueil des Travaux Chimiques des Pays-Bas	Rec. Trav. Chim. Pays-Bas	A. W. Sijthoff, Leiden, Holland.
Revue Générale des Matières Colorantes	Rev. Gén. Mat. Col. ..	L. Lefèvre, 4, rue de Stockholm, Gare St. Lazare, Paris, France.
Revue de Métallurgie	Rev. Mét.	H. Dunot and E. Pinat, 49, Quai des Grands Augustins, Paris.
School of Mines Quarterly ..	Sch. Mines Quart. ..	T. H. Harrington, Columbia University, New York.
Science Reports of Tohoku Imperial University	Sci. Reports, Tohoku Imp. Univ.	The Maruzen-Kabushiki-Kaisha, Sendai, Japan.
Scientific American	Scient. Amer. ..	361, Broadway, New York City, U.S.A.
Scientific Proceedings of the Royal Dublin Society	Scient. Proc. Roy. Dublin Soc.	Leinster House, Dublin.
Silikat-Zeitschrift	Silikat-Zeits.	Verlag von Müller und Schmidt, Coburg, Germany,
Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss. ..	Verlag der Königlichen Akademie der Wissenschaften, Berlin.
Sprechsaal	Sprechsaal	Verlag von Müller und Schmidt, Coburg, Germany.
Stahl und Eisen	Stahl u. Eisen ..	A. Bagel, Breitestr. 27, Düsseldorf 74, Germany.
Tonindustrie-Zeitung	Tonind.-Zeit.	Dreysestrasse 4, Berlin, N.W. 21, Germany.
Transactions of the American Ceramic Society	Trans. Amer. Ceram. Soc.	The Secretary, Columbus, Ohio, U.S.A.
Transactions of the American Electrochemical Society	Trans. Amer. Electrochem. Soc.	Lehigh University, South Bethlehem, Pa., U.S.A.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Transactions of the American Foundrymen's Association	Trans. Amer. Foundrymen's Assoc.	R. Moldenke, Watchung, N.J., U.S.A.
Transactions of the American Institute of Metals	Trans. Amer. Inst. Metals	Buffalo, N.Y., U.S.A.
Transactions of the American Institute of Chemical Engineers	Tr. Amer. Inst. Chem. Eng.	D. Van Nostrand Co., New York, and F. & N. Spon, Ltd., London.
Transactions of the Australian Institute of Mining Engineers	Tr. Austral. Inst. Min. Eng.	57-59, Swanston Street, Melbourne, Victoria, Australia.
Transactions of the English Ceramic Society	Trans. Engl. Ceram. Soc.	Victoria Institute, Tunstall, Staffordshire.
Transactions of the Institute of Metals	Trans. Inst. Metals	Institute of Metals, Caxton House, Westminster, London, S.W.
Transactions of the Iron and Steel Institute	Trans. Iron and Steel Inst.	28, Victoria Street, London, S.W.
Transactions of the North of England Institute of Mining and Metallurgy	Tr. N. Eng. Inst. Min. and Met.	Newcastle-on-Tyne.
Tropenpflanzer	Tropenpflanzer	Pariser Platz, 7, Berlin, N.W., Germany.
United States Bureau of Mines, Bulletins and Technical Papers	U.S. Bureau of Mines, Bull. & Tech. Papers	Bureau of Mines, Washington, D.C., U.S.A.
United States Department of Agriculture Bulletins	Bull. U.S. Dept. Agric.	Department of Agriculture, Washington, D.C., U.S.A.
Wasser und Gas	Wasser u. Gas	G. Stalling, Oldenburg i. Gr., Germany.
West Indian Bulletin	West Ind. Bull.	Imperial Dept. of Agriculture, Barbados, W.I.
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Bieberach a. d. Riss, Württemburg, Germany.
Wochenschrift für Brauerei	Woch. f. Brau.	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift der analytischen Chemie	Z. anal. Chem.	C. W. Kreidel's Verlag, Wiesbaden, Germany.
Zeitschrift für angewandte Chemie	Z. angew. Chem.	Verlag von Otto Spamer, Nürnberger Strasse 48, Leipzig, Germany.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem.	Verlag von L. Voss, Leipzig, Germany.
Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind.	Vereins-Direktorium, Kleiststrasse 32, Berlin, W. 62, Germany.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw.	R. Oldenbourg, Glückstrasse 8, München, Germany.
Zeitschrift für das gesammte Schiess- und Sprengstoffwesen	Z. ges. Schiess- u. Sprengstoffw.	J. F. Lehmann, Paul Heysestrasse 26, München. Germany.
Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem.	W. Knapp, Mühlweg 19, Halle a. S., Germany.
Zeitschrift für Farben-Industrie	Z. Farben-Ind.	Verlag für Textil-Industrie, Kottbuser Ufer 39/40, Berlin, S.O. 26, Germany.
Zeitschrift für öffentliche Chemie	Z. öffentl. Chem.	M. & H. Schaper, Hannover, Germany.
Zeitschrift für physikalische Chemie	Z. physik. Chem.	W. Engelmann, Mittelstrasse 2, Leipzig, Germany.
Zeitschrift für physiologische Chemie.	Z. physiol. Chem.	Verlag von K. J. Trübner, Strassburg, Germany.
Zeitschrift für Spiritusindustrie	Z. Spiritusind.	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel	Z. Unters. Nahr. u. Genussm.	Julius Springer, Linkstrasse 23/24, Berlin, W. 9, Germany.
Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm.	Die Administration, Vodickova No. 704 (Palais Lucerna), Prag II, Bohemia.

LIST OF ERRATA, 1913.

Issue.	Page.	Column.	Line from Top.	Line from Bottom.	Errata.
No. 1—Jan. 15	45	1	..	39	*For* " nitro-*bis*-apomethyldihydro-" *read* " nitro-*bis*-apomethylhydro-".
" "	45	1	..	37	*For* " nitro-*bis*-apomethyl-*iso*-quinolone " *read* " nitro-*bis*-apomethyl-*iso*-brucinolone."
No. 2—Jan. 31	81	2	..	12	*For* " been anticipated by " *read* " anticipated."
No. 4—Feb. 28	215	1	2	3	*For* " bisulphate " *read* " sulphate."
" "	215	2	2	..	*For* " bisulphate " *read* " sulphate."
No. 5—Mar. 15	228	..	Table		*Under* " Percentage yield of pulp, No. 11, Pulp wood." *For* " 4 " *read* " 45 per cent."
" "	247	1	..	2	*For* " Fredo " *read* " Redo."
" "	247	2	18	..	*For* " Menoseal " *read* " Menoscal."
No. 7—Apr. 15	359	1	15	..	*After* " material " *add* " by ——."
" "	363	2	11 and 12	..	*The* " I " *in line* 11 *should be deleted, and for* " used " (*line* 12) *read* " fused."
No. 8—Apr. 30	408	2	Title of last patent		*For* " Mason " *read* " Masson."
" "	420	2	..	37	*For* " Lillienfeld " *read* " Lilienfeld."
" "	434	2	..	14	*For* " Chisholm " *read* " Chisolm."
" "	446	1	..	17	*For* " 1914 " *read* " 1912."
" "	448	2	..	28	*For* " Savery-Carlier " *read* " Savary-Carlier."
No. 9—May 15	488	1	9	..	*For* " 1919 " *read* " 1909."
No. 10—May 31	554	1	1	..	*For* " Deraud " *read* " Deruad."
No. 12—June 30	656	2	..	..	" Graphite industry of Madagascar." *All the figures should be multiplied by* 1000.
No. 13—July 15	688	1	Third Title		*For* " Gouthière " *read* " Goutière."
No. 14—July 31	724	2	..	5	*For* " Dawber " *read* " Daubeny."
" "	725	1	12	..	*For* " lessons " *read* " letters."
" "	725	1	20	..	*Before* " agriculture " *insert* " the practice of."
No. 15—Aug. 15	772	2	35	..	*For* " m.mg." *read* " mgrms."
" "	802	1	28	..	*For* " Von Alphen " *read* " Van Alphen."
No. 17—Sept. 15	859	1	Second Title		*For* " Boute " *read* " Bonte."
" "	873	2	..	26	*For* " 1910 " *read* " 1913."
" "	883	1	First Title		*For* " Zaloue " *read* " Laloue."
No. 18—Sept. 30	912	2	..	36	*For* " 15 mins." *read* " 15 mm."
" "	914	2	..	9	*After* " London " *insert* " From General Electric Co., Schenectady, U.S.A."
No. 19—Oct. 15	956	2	..	34	*For* " Grieg " *read* " Greig."
No. 21—Nov. 15	1009	2	..	21	*Before* " Fr. Pat." *insert* " Berlin-Anhaltische Maschinenbau-A.-G."
No 22—Nov. 29	1059	2	..	22	*For* " Leflaine " *read* " Leflaive."
No. 23—Dec. 15	1095	2	8	..	*For* " 1913 " *read* " 1912."
" "	1106	1	11	..	*For* " Seheutz " *read* " Scheutz."
No. 24—Dec. 31	1167	1	11	..	*For* " Rosenburg " *read* " Rosenberg."
" "	1167	2	21	..	*For* " 247 " *read* " 249."

Journal of the Society of Chemical Industry.

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Birmingham Section.

Meeting held at Birmingham University on Thursday, October 31st, 1912.

MR. E. C. ROSSITER IN THE CHAIR.

A SIMPLE FORM OF GAS GENERATOR.

BY FRANK SHEDDEN, B.SC., F.I.C.

The author described a large-sized Wöhler apparatus, for use as a gas generator for general laboratory purposes. It consists of a cylindrical jar 48—50 cm. high and 18 cm. diameter, fitted with a stopcock at the bottom. The inner tube is 10 cm. diameter, narrowed at the top to a neck about 6 cm. diameter, which is closed by a rubber stopper and glass stop-cock. About 8—10 cm. from the bottom, the inner tube is constricted till the diameter is reduced to 1—2 cm. It rests on a glass triangle arranged so as to allow free circulation, and is held in place by a wooden cover. In order to keep it down when small quantities of solid are being used, a loose leaden collar can be placed round the neck.

When using powdery substances or fine-grained material, a filter plate can be placed on the constriction before charging. A generator of the above dimensions will hold 5 litres of liquid and several kilos. of solid. When the acid becomes exhausted, it can be drawn off and fresh acid added without interfering with the quality of the gas being produced. The pressure is strong enough to maintain a steady current through a whole series of wash-bottles, etc. The lower part of the apparatus being made entirely of glass, it can be left for any length of time filled and ready for immediate use.

THE SEPARATION OF IRON AND MANGANESE.

BY F. H. CAMPBELL, M.SC.

(University of Melbourne.)

The reactions upon which the method to be described depends are similar to those of which advantage is taken by Alfred Stock[*] in the method for the precipitation of aluminium proposed by him. When a mixture of potassium iodide and iodate is added to a solution containing a ferric salt, the iron is immediately and completely precipitated; manganous salts, on the other hand, are unaffected in the cold. The method has not been applied in the case of chromium, but there is no reason to doubt that this might be done successfully. Ferric salts are hydrolysed, in absence of excess of free acid, producing basic salts, ferric hydroxide ultimately resulting if a reagent be present which is capable of removing the acid simultaneously produced. A mixture of an iodide and an iodate is such a reagent, as is shown by the equation, $6\mathrm{H}^{\cdot}+\mathrm{IO}_3'+5\mathrm{I}'=3\mathrm{H}_2\mathrm{O}+3\mathrm{I}_2$. The hydrolytic equilibrium being destroyed in this way, iron is precipitated as a light brown hydrated ferric oxide which can be readily filtered and washed. It will be seen from the results given below, that this precipitate cannot be ignited to pure ferric oxide; the reason for this has not been fully elucidated, but that it is not due to co-precipitation of manganese is sufficiently certain, it is probable that basic salt is retained.

The method used is as follows: The cold solution of iron and manganese salts, preferably the sulphates, is almost neutralised with ammonia, a mixture of equal volumes of a 25 per cent. potassium iodide solution and of a saturated solution of potassium iodate is then added. The precipitate is allowed to settle, the liberated iodine removed by the addition of a slight excess of 20 per cent. sodium thiosulphate solution, and the precipitate is again allowed to settle; the supernatant liquid is then decanted off through a filter, to which the precipitate is next transferred and washed with water, the temperature of which is gradually increased, the final washings being with boiling water. The filtrate is made acid with dilute hydrochloric acid, and about 5 c.c. of a saturated solution of ammonium phosphate and 20 grms. of solid ammonium chloride are added; the solution is then made faintly alkaline by the addition of ammonia drop by drop and the amorphous precipitate at first produced rendered crystalline by digestion at about 80° C. The precipitate is filtered off through a Gooch crucible, washed with very dilute ammonia, and ignited to manganese pyrophosphate.

This method for the estimation of manganese, suggested by Gooch and Austin,[*] was adopted because the presence of iodide rendered the ordinary methods, depending on the oxidation of the manganese to the manganic condition, inconvenient. The results obtained are slightly too high, but the errors are no greater than those attending the use of other methods; they are not due to the presence of iron.

When metals such as calcium and magnesium are present, the manganese should be separated as sulphide, redissolved in acid, and reprecipitated as above. Nickel, cobalt, and zinc do not interfere on account of the solubility of their phosphates in ammonia.

The method of separation has been tested by the analysis of mixtures of solutions of ferric sulphate and manganous sulphate in various proportions (Table II.). The iron content of the former was determined by precipitation with ammonia and by titration with standard potassium bichromate solution, after reduction of the iron with stannous chloride. The results obtained by the two methods were identical. The strength of the manganese solution was determined by Gooch and Austin's method.

As a check on this method duplicate determinations of the manganese content of a standard potassium permanganate solution were carried out. A known volume, 50 c.c., was evaporated to dryness with hydrochloric acid, diluted to about 300 c.c., with water, and treated exactly as described above. The results, given in Table I., show close agreement with those obtained by titrating the permanganate against pure sodium oxalate.

TABLE I.

Potassium permanganate.	$Mn_2P_2O_7$.	Gravimetric.	Manganese volumetric.
c.c.	grm.	grm.	grm.
50	0·1470	0·0567	0·0565
50	0·1470	0·0567	—

TABLE II.

	Iron.			Manganese.		
No.	Taken.	Found.	Difference.	Taken.	Found.	Difference.
	grm.	grm.	mgrms.	grm.	grm.	mgrms.
1	0·0287	0·0284	—0·3	0·0657	0·0662	+0·5
2	0·0287	0·0291	+0·4	0·2628	0·2632	+0·4
3	0·0575	0·0587	+1·2	0·0657	0·0661	+0·4
4	0·0575	0·0586	+1·1	0·1315	0·1323	+0·8
5	0·0575	0·0587	+1·2	0·1315	0·1317	+0·2
6	0·1150	0·1169	+1·9	0·0657	0·0681	+2·4
7	0·1150	0·1165	+1·5	0·0657	0·0664	+0·7
8	0·2300	0·2321	+2·4	0·0328	0·0336	+0·8

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[*] Comptes rend., 1900, **130**, 175 (this J., 1900, 276).

[*] Z. anorg. Chem., 1898, **18**, 339.

In regard to the results given in the above table it should be mentioned that in the Experiments 3, 6, and 8 the iron precipitate was redissolved in dilute sulphuric acid and reprecipitated with iodide-iodate mixture, in Experiment 2 reprecipitation was effected with ammonia, while in Experiments 1, 4, 5, and 7 the iron was not reprecipitated. These variations in treatment and the approximate proportionality between the weight of the precipitate and the errors, support the conclusion that the latter are due to the presence of basic salts.

The advantages of this method over the basic acetate and basic carbonate methods are, that when conducted in the manner described, a complete separation of iron and manganese is brought about without a second precipitation of the former, that the iron precipitate shows no tendency to redissolve, and that the most favourable conditions are easily arranged.

The fact that the results for iron are too high does not lessen the value of the method of separation, since solution, reduction, and titration of the iron with potassium permanganate or bichromate gives good results.

The conditions set out must be adhered to, as it has been proved that correct results cannot be obtained when the solution is hot, as under these conditions part of the manganese is precipitated; when the thiosulphate is added before the whole of the iron is precipitated, as complete precipitation takes place very slowly; when either iodide or iodate is added alone and then the other. When the iodate is first added, a mixture of the insoluble iodates of manganese and iron is thrown down and is not completely decomposed subsequently by the iodide.

DISCUSSION.

Mr. W. B. **PARKER** stated that from the analytical point of view, merely, the method appeared satisfactory; but he feared it would never come much into favour owing to the expense involved in using potassium iodide.

Mr. F. H. **ALCOCK** pointed out that in precipitating iron salts by potassium and sodium salts one got the sodium down with the iron. It was extremely difficult to remove potash and soda by prolonged washing. He did not know if the author took up the iron once more with acid and precipitated with ammonia.

Mr. **O'SHAUGHNESSY**: He does not.

Mr. **ALCOCK** said if it were not done it would be unsatisfactory. When one agent had to be added to another the order of mixing was of importance. If the iron were precipitated by adding ammonia to it the possibility was that one would get a basic salt precipitated. If, however, the iron salt were placed into the ammonia solution then one would not get a basic salt. If ammonium compounds were used instead of the potassium iodate the results would be better. There was precedent for that in pharmacy. When one required ferrous carbonate free from fixed alkaline impurity ammonia carbonate was invariably recommended although the pharmacopœia used both the K_2CO_3 and Na_2CO_3 for a similar purpose in several formulæ.

Mr. **SILVESTER** agreed that the main objection to the process, in commercial laboratories, was the cost. Salts might be got rid of by precipitating with ammonia. He thought most chemists who had to estimate iron never weighed iron directly. They preferred the volumetric method, dissolving the precipitated monoxide and then applying bichromate volumetric process. As to the separation of small quantities of manganese in steel by the ammonium acetate method he did not agree that two precipitations were necessary. Very excellent results were to be obtained by one precipitation provided that the neutralisation was skilfully done, and the proper amount of the acetate added. If the process were to be used where large amounts of manganese had to be estimated, and [illegible], etc., were present the Pattinson volumetric method would be used. He did not feel there was a great future for the process in ordinary commercial analysis, but thought it might be useful as a check method. It would not he thought supplant present processes.

Manchester Section.

Meeting held at Grand Hotel, on Friday, December 6th, 1912.

DR. G. J. FOWLER IN THE CHAIR.

THE SEPARATION OF SUSPENDED SOLIDS FROM PERCOLATOR EFFLUENTS.

BY LEONARD CLEMENT, M.A. (CANTAB.), F.I.C.

Experience has shown that when sewage is treated on percolating filters the effluents obtained are not sufficiently purified to permit of their being sent direct to the river. At least 50 per cent. of the impurities of such bed effluents is attributable to the presence of suspended solids, as the following figures indicate.

	Parts per 100,000.				
	No. of Samples.	Albuminoid Ammonia.	Ogyxen absorbed in		Suspended Solids.
			3 mins.	4 hours.	
Bed effluent	3	0·137	0·46	1·25	4·3
,, filtered through filter paper .	3	0·063	0·27	0·65	nil

In practice percolator effluents are now almost invariably deprived of their suspended solids by settlement in shallow tanks, and the efficiency of such tanks measured by the decrease in the suspended solids between inlet and outlet. Under normal conditions, a reduction of the suspended solids to 3 parts per 100,000 is, by this means, not a matter of great difficulty.

Perhaps because the mere settlement of solids from a bed effluent offers no great scope for scientific control, the working of these sedimentation tanks has been regarded as a simple matter, unworthy of any considerable amount of attention.

It may be well, therefore, to review briefly the principal factors involved.

(1) *The preparation of a good bed effluent, i.e.*, an effluent with granular and easily settled suspended solids, depending as it does on the preceding process, may be left here with the remark that an unsatisfactory bed effluent, *i.e.*, one containing much colloidal matter, is not easily freed from its suspended solids by mere sedimentation. Excessive sedimentation tank capacity will, therefore, never compensate for a shortage of bed area, or for an unsatisfactory condition of the beds themselves.

(2) *Cleaning.* The necessity for regular and frequent cleaning of the tanks is so obvious that it need not be laboured. Where the capacity of such tanks is equivalent to two hours settlement, three weeks will be found to represent the maximum period between cleaning operations, and, in summer, a shorter time. In contradiction of many statements to the contrary it may be said here that sedimentation tank sludge is always putrescible, and, in bulk, is invariably characterised by a nauseating odour all its own. Such popular methods of gauging the necessity for cleaning as the observation of gasification or the rising of sludge to the surface, constitute the hall-mark of sluggish or incompetent management.

(3) *Rate of flow.* Other things being the same, the settling power of a tank will vary inversely with the rate of flow. Assuming the tank to be constructed so as to utilise its whole capacity, its size will be a measure of its efficiency, and on this theoretical consideration such tanks are usually constructed.

The tendency to make sedimentation as large as space and means will allow is, therefore, based on a principle sound enough in itself, if we are to regard the efficiency of such tanks as measured by the reduction in suspended solids alone. Before going on to combat this idea, it may be as well to point out that even from the point of view of settling out the solids the desire for mere size has resulted in much waste of money. In order to utilise pieces of ground that happened to be available, many large, irregularly shaped tanks have been constructed, with inlet and outlet so near together that only an extremely complicated series of baffles could render the theoretical settling space available in practice. Setting aside this aspect of the matter, which is entirely one of engineering, it is the author's intention to emphasise the fact that a satisfactory reduction in the suspended solids ought not to constitute a final standard in the matter of sedimentation tanks; and that great efficiency in this respect may, at certain seasons, be only obtained at too great a price in another.

In Table I. a few results of bacteria "counts," etc., are given for a sedimentation tank* in operation at the Nelson Sewage Works. The count in each case is the average for three samples collected over a period of six hours during the day time, the three results always agreeing very closely amongst themselves.

The results are limited in number but they represent experiments over a period of more than a month and are sufficient to indicate the liability of bacteria to enormous multiplication under the conditions defined, at any rate during the warmer seasons of the year. Systematic results for samples collected during the winter are not available but, judging from those for a large number of casual samples, there is every reason to believe that an increase in the number of bacteria rarely, if ever, occurs in sedimentation tanks during the colder seasons of the year.

In seeking an explanation of the increase in the number of bacteria as an effluent passes through a sedimentation tank, it would not seem necessary to look further than the rise of temperature between inlet and outlet. The avidity with which a sedimentation tank effluent will absorb radiant heat as compared with a good tap water is indicated by the following figures, obtained by reading the temperature of equal volumes of such samples exposed to sunlight in white porcelain dishes of the same shape and size.

Interval in minutes.	Temperature (° C.) of		Rise in temperature of effluent. / Do. of water.
	1000 c.c. tap water.	1000 c.c. sed. tank effluent containing 3·2 pts. per 100,000 suspended solids.	
0	13·5	13·5	
6	13·8	14·0	1·7
5	14·1	14·5	1·7
5	14·6	15·0	1·0
5	15·0	15·4	1·0

As ordinarily constructed, shallow sedimentation tanks, with their black deposit of sludge at the bottom, constitute a very effective means of absorbing radiant heat on a large scale. This is brought out by the temperature observations set out in Tables 2 and 3.

In Table 2 temperature readings at inlet and outlet of a sedimentation tank at the Nelson Sewage Works are given for five consecutive days in May. No attempt was made to fix or control the rate of flow and the results here given merely indicate the degree of variation in temperature which may occur when such tanks are worked normally.

It will be noticed that, during the daytime, even over a period of five days the temperature at the outlet was never lower than that at the inlet, and at times as much as 1·4° C. higher.

In Table 3 temperature observations on three Nelson sedimentation tanks are given for an average day in June and two consecutive, exceptionally hot days in July. In this table maximum differences of temperature are as great as 2·5° C. in the case of No. 1 tank, 4·8° in that of No. 3 tank, and 4·8° in that of No. 4.

Considering the two tables together we have the average rise of temperature between inlet and outlet for:—

		Temp. ° C.
Five consecutive days in May ..	Tank No. 4	0·7
One day in June	,, ,, 1	1·6
,, ,, ,, ,, ...	,, ,, 3	1·05
,, ,, ,, ,, ...	,, ,, 4	1·4
Two consecutive days in July ..	,, ,, 1	1·8
,, ,, ,, ,, ...	,, ,, 3.........	3·2
,, ,, ,, ,, ...	,, ,, 4..........	3·1

Other temperature readings, too numerous to set out here, all go to prove that for at least six months of the year sedimentation tank effluents are perceptibly heated during the process of settlement, and that at times the rise in temperature is very marked. Bearing in mind the readiness of bacteria to respond to small increases in temperature by greatly enhanced reproduction, the results of Table 1 become intelligible enough. In addition, it must be remembered that the stimulation to bacterial increase may be only very roughly gauged by such readings as are given in Tables 2 and 3. Thus, those portions of a tank effluent which are stationary or only slowly moving, will be strongly heated and afterwards cooled on their way to the outlet, and the multiplication of organisms therein may be out of all proportion to the rise in temperature actually observed. As a matter of fact, the absorption of radiant heat in these tanks practically all occurs in the superficial layers, and a thermometer just immersed in the water will generally show a marked fall when sunk another inch.

In the use of sedimentation tanks, then, there is a grave danger of sacrificing bacteriological to chemical purity. During the summer, at least, the more slowly a bed effluent traverses such tanks the greater will be the separation of suspended solids on the one hand, and the greater the rise of temperature and the increase of organisms on the other.

Two such opposite effects call for a compromise and, in the author's opinion, the proper solution of the difficulty will probably be found in the use of smaller sedimentation tanks followed by "strainers," that is, beds of fine grade material on which the sedimentation tank effluent is treated continuously. By this means the bulk of the suspended solids could be separated by a rapid settlement in the tanks, heating effects being thereby reduced to a minimum, and the remaining suspended solids retained on the superficial layers of the strainer.

Such strainers have been in operation at Nelson for a number of years where they were adopted to correct certain difficulties arising from the use of sedimentation tanks. Before going on to discuss the working of these strainers it may be well to enumerate the practical difficulties of sedimentation tanks other than those already mentioned. Briefly, these are:—

(1) *Variation in flow.* Every variation in flow is accompanied by disturbance of the tank and a consequent washing out of the previously settled sludge.

(2) *Wind.* This, again, agitates the contents of the tank, reduces its settling power, and, by disturbing the settled sludge, nullifies work previously done.

(3) *Hot weather.* On exceptionally hot days even recently deposited sludge ferments and rises to the surface, carrying with it worms, dead and alive, to contaminate the effluent. *Vorticelli*, etc., grow rapidly under such conditions, become detached, and are borne to the outlet.

(4) *Ice.* When ice forms on the surface it impedes the normal flow of the effluent, with the result that sludge is often washed up from below. During a keen frost, ice frequently forms on the sides of the tank and at the bottom; when the thaw occurs it then becomes detached and rises to the surface bearing great masses of sludge along with it.

(5) *Fly scum.* In anything but the coldest weather, percolator beds are literally "alive" with the sewage fly, a constant stream of which is borne to the sedimentation

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* This (No. 4), like the other sedimentation tanks at Nelson, has a working depth of rather more than 2 ft. Their united capacity allows of considerably more than two hours settlement under normal (dry weather) conditions.

tanks on the surface of the effluent. In the tanks this fly scum can only be partially prevented from escaping at the outlet by means of baffles.

The objectionable nature of this scum is indicated by the following analytical figures. For the sake of comparison results for a sedimentation tank sludge are also given.

Fly scum and sedimentation sludge, dried at 100° C.

	Fly scum.	Sedimentation tank sludge.
	per cent.	per cent.
Volatile matter	82·1	49·1
Non-volatile matter (ash)	17·9	50·9
Nitrogen (Kjeldahl)	8·8	3·1
*Fat	15·0	Nil.

* Green in colour; semi-solid; possessing a powerful and unpleasant odour.

(6) *Solids remaining in suspension.* Under the best conditions sedimentation tank effluents always contain some solids in suspension. Even in cases where these have been reduced to a minimum, filtration through filter paper results in a further purification of 30 per cent.

	Parts per 100,000.				
	No. of samples.	Albuminoid ammonia.	Oxygen absorbed in		Suspended solids.
			3 mins.	4 hours.	
Sedimentation tank effluent	3	0·12	0·40	1·02	1·1
Do. filtered through filter paper	3	0·08	0·29	0·75	nil.
Purification per cent.	—	33	27	26	

At Nelson it has been found that strainers overcome all the difficulties 1 to 5, as well as consistently reducing the suspended solids to a mere trace, the chemical purification effected on the sedimentation tank effluents closely agreeing with that of the above table. In addition, there is a slight increase in the nitrates and a marked reduction in the organisms per c.c.

Particulars of strainers in operation at Nelson.

Strainer No. 1 was originally constructed as a secondary contact bed, though never actually used for this purpose. The bed is rectangular in shape, lined with concrete, and drained by a herring-bone arrangement of pipes at the bottom. It contains 1288 cb. yards of ¼ in. clinker. The surface of the bed is divided into three, by two ridges of clinker at right angles to the direction of flow of the effluent. This arrangement ensures that no portion of the effluent can reach the outlet without having permeated a certain thickness of clinker; it also confines the deposition of sludge to a limited area of the bed and allows of this being removed more rapidly and with less labour than would otherwise be the case. The outlet, a double one, is devised to draw from the bottom and top of the bed at one and the same time. It consists of a 9 inch valve at the bottom, and, above this, a 15 feet sill at a level several inches lower than that of the surface of the bed.

Strainer No. 2 was dug out of clay, only the sides being concrete lined. It contains 952 cube yards of clinker, 75 per cent. being ¾ inch in grade and the remainder ¼ inch: in every other respect it is similar to Strainer No. 1. The material in each bed is approximately 2 feet 4 inches in depth.

Method of working, etc., of strainers. The strainers are filled, opened, and afterwards worked continuously. A little experience soon renders the extent to which the valve should be opened a matter easily estimated, and, since any increase in flow is compensated by an automatic increase in discharge over the sill, it is rarely necessary to readjust the valve during a day. The strainers are put into operation each day at about 7.30 a.m., and continue working until 5 or 6 p.m. Sunday is a day of rest.

Strainer No. 1 has now worked in this way for a period of 5 years. During that time that (one-third) portion of the surface which retains the bulk of the sludge has been removed to a depth of two inches and replaced by fresh clinker at average intervals of six months.

Strainer No. 2 has been in operation for 3½ years. The greater coarseness of the material prevents the sludge from being located in the topmost layers and, for this reason, no attempt has been made to remove it. In course of time it will, doubtless, be necessary to remove and wash a very large portion of the material of the bed.

Results obtainable by the use of strainers. Results for six effluents, before and after, treatment are set out in Table 4. The method of sampling, the same in each experiment, was as follows: The time taken for the effluent to pass through the strainer, for the particular rate of treatment adopted, having been first determined by means of dye solution, the strainer was allowed to run full for two hours. Samples before and after (the previously determined interval intervening) were then taken in sterilised bottles and immediately plated. Three lots of samples were taken in this way during the day. Finally, the three samples "before," and the three "after," were bulked in equal proportions for chemical analysis. It will, therefore, be understood that in Table 4 each figure for organisms per c.c. is the average of three samples.

For the sake of comparison the purification per cent. has in each case been calculated and tabulated separately (Table 5). Since the six sets of results represent experiments on different sedimentation tank effluents they are not strictly comparable, and must, therefore, be considered with caution. Allowing for this, however, the following conclusions would seem to be justified:—

(1) It is practicable by means of suitably constructed strainers to remove all the suspended solids from a sedimentation tank effluent, even when these are as low as one part per 100,000.

TABLE 1.

Continuous-flow sedimentation tank effluents—before and after.

Date	Sample.	No. of samples.	* Period of settlement.	No. of days since tank was cleaned.	† Suspended solids.	‡ Organisms per c.c.	Increase of organisms.
			hours.				per cent.
April 2, 1912 ..	At inlet ..	3	1½	48	10·0	112,000	
.. ..	At outlet ..	3	..	..	2·9	124,000	9
.. 11 ..	At inlet ..	3	2½	57	12·9	55,000	
.. ..	At outlet ..	3	..	..	0·4	150,000	65
May 1, 1912 ..	At inlet ..	3	1½	4	6·4	570,000	
.. ..	At outlet ..	3	..	..	1·4	3,493,000	84
.. 8, 1912 ..	At inlet ..	3	2½	10	14·0	130,000	
..	At outlet	3	..	..	2·7	186,777	30

* Determined by actual tests with dye; not calculated from size of tank, etc.

† Parts per 100,000.

‡ Grown on gelatin at 20° C.

Table 2.

No. 4 Sedimentation tank.

Date.	Time.	Temperatures ° C. Inlet.	Outlet.	Atmosphere.	Conditions.
May 13th, 1912	10.18 a.m.	11·9	13·0	11·1	Continuous sunshine from 12 noon.
,, ,,	1.30 p.m.	12·1	13·25	12·2	
,, ,,	2.25 p.m.	13·0	14·0	15·5	
,, ,,	5 p.m.	12·9	14·3	16·5	
May 14th, 1912	2.25 p.m.	14·0	14·0	—	Sky cloudy: sunshine at intervals.
,, ,,	4 p.m.	13·4	14·0	17·5	
May 15th, 1912	11.25 a.m	14·2	14·2	—	No sunshine: much rain.
,, ,,	4.45 p.m.	14·0	14·25	11·6	
May 16th, 1912	11.15 a.m.	12·75	13.25	—	Little sunshine: some rain: cold.
,, ,,	2.30 p.m.	12·2	13·4	9·2	
May 17th, 1912	11.30 a.m.	12·0	11·9	12·0	Fresh breeze: considerable sunshine.
,, ,,	2.40 p.m.	12·2	13·2	13·0	
,, ,,	4.40 p.m.	12·2	13·25	13·8	

Table 3.

Sedimentation tanks Nos. 1, 3, and 4.

Date.	Time.	Temperatures in ° C. No. 1 Tank. Inlet.	No. 1 Tank. Outlet.	No. 3 Tank. Inlet.	No. 3 Tank. Outlet.	No. 4 Tank. Inlet.	No. 4 Tank. Outlet.	Conditions.
June 7th, 1912	10 a.m.	14·4	14·9	14·0	15·2	14·0	15·0	Continuous sunshine until 12.30 p.m.: afterwards dull.
,, ,,	11.40 a.m.	14·0	16·5	14·0	15·0	14·0	16·8	
,, ,,	2.15 p.m.	14·5	16·5	14·4	15·0	14·6	15·0	
,, ,,	4 p.m.	14·3	15·6	14·3	15·8	14·3	15·5	
July 15th, 1912	10 a.m.	—	—	18·6	21·6	19·0	21·4	An exceptionally hot day. Sunshine continuous and powerful.
,, ,,	11.45 a.m.	—	—	19·2	22·9	20·0	22·5	
,, ,,	2.45 p.m.	—	—	20·2	24·9	19·9	24·7	
,, ,,	4.5 p.m.	—	—	19·5	24·3	19·5	24·5	
July 16th, 1912	10.30 a.m.	19·8	21·0	19·2	21·5	20·0	21·0	As above.
,, ,,	11.45 a.m.	20·2	22·0	19·7	22·3	19·7	22·2	
,, ,,	2 p.m.	20·2	22·0	20·6	23·2	20·0	23·2	
,, ,,	4 p.m.	20·0	22·25	20·8	23·0	20·0	23·5	

Table 4.

Treatment of sedimentation tank effluents by strainers.

Sample.	Parts per 100,000. Chlorine.	Free ammonia.	Albuminoid ammonia.	Oxygen absorbed in 3 mins.	Oxygen absorbed in 4 hours.	Nitric and nitrous nitrogen.	Suspended solids.	*Organisms per c.c.	Rate of treatment, gallons per cb. yd. per day.
No. 1 Strainer at inlet	6·2	1·53	0·20	0·68	1·56	1·47	3·6	972,000	485
,, ,, outlet	6·2	1·35	0·14	0·48	1·13	1·59	†1·6	814,830	
No. 1 Strainer at inlet	3·6	0·10	0·10	0·32	0·78	1·20	0·6	75,000	614
,, ,, outlet	3·6	0·02	0·07	0·23	0·58	1·29	Trace	35,000	
No. 1 Strainer at inlet	5·5	0·47	0·15	0·44	1·28	1·65	4·0	562,000	982
,, ,, outlet	5·5	0·33	0·08	0·26	0·80	1·76	0·8	330,000	
No. 2 Strainer at inlet	7·9	0·14	0·12	0·56	1·37	2·13	0·5	396,666	470
,, ,, outlet	7·9	0·09	0·11	0·46	1·16	2·18	Trace	263,333	
No. 2 Strainer at inlet	5·8	0·53	0·11	0·33	—	1·76	0·7	265,000	642
,, ,, outlet	5·8	0·31	0·10	0·26	—	1·96	Trace	155,000	
No. 2 Strainer at inlet	4·8	0·19	0·09	0·33	0·82	1·57	0·9	730,000	1,200
,, ,, outlet	4·8	0·05	0·07	0·26	0·67	1·60	Trace	476,666	

* Grown on gelatin at 20° C.

† The largeness of this figure is due to the fact that the surface of the strainer had been renewed just prior to this experiment.

Table 5.

Purification per cent. effected by strainers.

Strainer	No. 1.	No 2.	No. 1.	No. 2.	No. 1.	No. 2.
Rate of treatment—gallons per cube yd. per day	485	470	614	642	982	1,200
Free ammonia	12	36	80	41	30	74
Albuminoid ammonia	30	8	30	9	47	22
Oxygen absorbed in 3 minutes	29	18	28	39	41	21
,, ,, ,, 4 hours	28	15	26	—	37	18
Nitric and nitrous nitrogen	8 (increase)	2·0 (increase)	7 (increase)	10 (increase)	7 (increase)	2 (increase)
Total organisms	16	34	53	42	41	35

(2) The chemical purification effected, resulting, as it does, almost wholly from the retention of suspended solids, is of the same order as that which obtains when sedimentation tank effluents are filtered through filter paper. Other biological effects, such as the increase in nitrates, are rarely of practical importance.

(3) The bacteriological purification is always marked (16 to 53 per cent.).

(4) Within wide limits, the purification is independent of rate of treatment. The quantity of liquor which can be satisfactorily treated on a strainer being limited solely by the physical capacity of such strainer.

(5) A strainer composed of fine grade material gives better results than one of coarser grade. The life of a strainer composed of ¼ inch material may, with little expense, be prolonged almost indefinitely; whereas that of a strainer of coarser material is strictly limited, and its cost of upkeep comparable with that of a secondary contact bed. For practical purposes, therefore, strainers composed of material not greater than ¼ inch are the best.

To sum up, then, the separation of the last portion of the suspended solids from percolator effluents by means of continuous-flow sedimentation tanks is a matter of great difficulty and, during six months of the year, can only be obtained by a sacrifice in bacteriological purity. Freedom from suspended solids is, however, possible when strainers such as have been described are adopted, and, in this case, it is neither necessary nor desirable to have such extensive sedimentation tank capacity as is now usual. The author, therefore, advocates economy in the construction of sedimentation tanks and a compensating extravagance in the form of strainers, believing that such a policy would result in purer effluents both from the chemical and bacteriological points of view.

DISCUSSION.

Mr. H. L. Terry said it was now recognised that a percolating filter alone was not sufficient and that a sedimentation tank must also be used. Those who had come to the conclusion that a strainer in addition was necessary for a satisfactory effluent would find their views fortified by what the author had said. He (the speaker) had obtained a result of from 20 to 30 per cent. further purification of the sedimentation tank outflow by means of strainers. With respect to the composition of the sedimentation tank sludge no two people appeared to get the same result. Some witnesses in the Royal Commission stated categorically that sedimentary tank sludge was 40 volatile and 60 mineral. His (the speaker's) results were 59 volatile and 41 mineral. Mr. Clement's figures formed the mean of those results, 49·1 volatile and 50 non-volatile. Possibly results depended upon the individual sewages treated.

Mr. Gaunt said that if the development of organisms due to the rise of temperature proved, as the author suggested, to be one of importance, the desirability of using vertical flow tanks wherever practicable would apparently be indicated, since not only would the exposed surface be less, but the liability to excessive heating of any one portion of the liquid would be reduced. The whole question of the presence of organisms was, of course, one to be considered, as the Royal Commission had suggested, in relation to the stream into which the effluent passed. If the discharge were to a drinking water stream it might be desirable to reduce the number of organisms, or possibly to sterilise the effluent, but in the case of an ordinary stream, the number of organisms was probably of less importance, than the amount of matter discharged, in which it was possible for them subsequently to develop. At two of the works he had visited, they had adopted strainers, placed across the settling tanks, consisting of perforated walls four or five feet apart, the space between being filled with filtering material of about half-inch grade. One strainer was placed about half-way along the tank, and the other at the exit end. The filtering medium was washed without removal, when the tank was sludged. These strainers were said to be effective in the retention of surface scum, and of a certain amount of fine suspended matter.

Another point suggested by the paper, was that the general proportions of the tanks used for this purpose might be modified with advantage. The usual mean depth was 2 feet 9 inches. It would probably be advantageous to increase as far as practicable the length of the tank in proportion to its width, so as to reduce the risk of dead water or the accumulation of an excessive depth of sludge in any one portion of the tank. The influence of the variation of weather and other conditions pointed to the desirability of dividing the available tank space into a large number of units. Usually only two tanks were provided, thus affording very limited opportunity for varying the time of tankage.

Mr. E. Ardern said that it was well known that excellent results had been obtained with deep tanks working with upward flow, of the Dortmann type, as, *e.g.*, at Birmingham, where the whole of the effluent from a large area of percolating filters was successfully dealt with by such treatment. He thought Mr. Clement attached too much importance to the question of the increase in the number of organisms in the effluent during treatment in the sedimentation tanks. Unless the effluent was practically sterilised either by suitable chemical treatment or efficient sand filtration, it did not appear to him that the actual number of organisms present was of much significance from the public health point of view, especially as the increase would very probably be due to the development of organisms other than those of intestinal origin. If the figures given for the amount of suspended matter in the tank effluent passing on to the strainers represented the average effluent, it would appear that, in the majority of instances, the necessity for further treatment would scarcely arise, as the suspended matter was in some cases under one grain per gallon and only rose to a maximum of four grains per gallon. On the general question of the treatment of percolator effluents he was inclined to agree with the author's conclusions. that sedimentation tanks of low capacity followed by rapid treatment on fine grade strainers would yield satisfactory results, especially as the strainers would obviate the trouble due to sludge disturbance when tank treatment alone was adopted.

Mr. W. Thomson considered the rise of temperature in the sewage at the outlet was most interesting. Was it possible that this might be accounted for by the enormously rapid growth of the bacteria?

The Chairman said he was interested in the paper largely from the fact that Mr. Clement had presented the problem from a rather new point of view. Usually one associated sedimentation sludge with something that had settled out of sewage, but Mr. Clement had used the term with reference to what was settling in the humus tanks, and consequently there would be no grease therein. He would like to know when it was stated that the sludge was not inoffensive whether the sludge was offensive under all conditions. One could understand that if it was allowed to remain long in the tank it would undergo decomposition and possibly become offensive, but one would have thought, on the other hand, that if it was quickly run on to drying beds there would be no very troublesome odour arising from it beyond what there was from ordinary garden soil, with the exception, perhaps, of the high percentage of fly scum, namely, 15 per cent. It occurred to him that possibly the flies fed upon the grease. Mr. Clement spoke of the fly scum being green in colour and possessing a powerful and unpleasant odour, or was it merely the case that the fat was entangled in the mass?

Professor Haldane Gee inquired whether it would not be possible to acquire valuable information at a sewage works by the installation of an Actinometer which would record the amount of sunshine and its actinic value. He asked this question because the author had noted in his tables whether there was sunshine or not on the days of observations.

Mr. Clement in reply said that the suggested use of vertical flow tanks for the purpose of keeping down the temperature recalled to his mind the fact that at Nelson they had often considered the adoption of the Dortmann tank and others, but there, as in many works, it was quite hopeless to attempt to build tanks of that sort. No doubt vertical tanks would serve a useful purpose in keeping down temperatures. The importance of the number of organisms was a matter of opinion. Once organisms were created there was always an element of doubt. It seemed a very disappointing thing to have a sort of incubator on the works. Whether the organisms were harmful or not was a very big question, and he was neither disposed nor in a position to discuss the point. With regard to the strainer referred to, he imagined the result depended upon the thickness of the filtering material—that was presuming nothing ran over the top layer. His point was that it would not be sufficiently efficient, and that, when the thickness was increased by so much that it did become efficient, strainers of the type he had mentioned might just as well be employed; in addition there would be the difficulty of cleaning and that this cleaning could not be effected without discontinuing the process. The virtue of the strainer used at Nelson was that all the deposited sludge went on to a comparatively small area and the strainer could be cleaned in a few hours by a few men and the process continued with only slight delay. The design of the filters came in really in the question of the vertical flow. He had no doubt that a great improvement might be effected in that respect, but being a chemist and not an engineer, he was not qualified to speak upon the matter. A very important point had been mooted about the results from strainers not being very encouraging. He was afraid he was somewhat to blame for that because, in selecting the results to put in the tables produced, he deliberately chose effluents which contained a very small proportion of suspended solids. He did not suggest that at Nelson their average effluent from sedimentation tanks contained one part per 100,000 of suspended solids. The point was that if it was possible to take out one part it was possible to take out more, and the purification would go up with increasing impurity of the tank effluent. At Nelson they had had a great deal of trouble with their effluents in trying to work to a standard of 0·10 parts per 100,000 albuminoid ammonia. It was quite easy to do it by the use of the strainers. As to the temperature rising in the tanks owing to a fermentation process, that possibility had occurred to him, but looking at the table and noting the composition of the effluents used, it scarcely seemed likely to be the case. In speaking of the offensiveness of the sludge he had referred to the time when the water had just been run off. It then had a sweet and very objectionable odour which was quite characteristic. In his opinion the fat in the fly scum came from the flies themselves and not from anything floating on the sewage. For analysis he had very carefully chosen layers of the scum which were brown and, as far as he could see, free from matter directly derived from sewage. The fly scum at times was almost black, owing to admixture with sewage fat, etc., although undoubtedly the bulk of it was composed of sewage fly. It would be extremely interesting to procure a measurement of the sunlight for the purpose of investigating the power of the rays. The question had occurred to him during the experiments and, had he known an instrument of the kind could be employed, he would most certainly have used it, since, as had doubtless been observed by others, the rise in temperature showed no sort of parallelism with the conditions. It was possible to have a day with a great deal of sunshine when the temperature of the exposed water did not rise as much as on a day when the conditions were quite different.

SOME BASIC COPPER SULPHATES.

BY G. FOWLES, B.SC.

A paper by W. F. A. Ermen, entitled "Some Basic Copper Sulphates," has recently appeared (this J., April 15, 1912, 312—314). The author is, perhaps, not aware that some of the work described by him has been previously published. The conversion of basic copper sulphate to copper hydroxide by continually washing with caustic soda is well known, and the method employed is the one used to obtain crystalline copper hydroxide, which can be digested in boiling water without decomposition. It was obtained in this way by Böttger as early as 1857, and Habermann (Z. anorg. Chem., 1906, 318) has confirmed his work. Others have also investigated it, *e.g.*, Bullnheimer (1900) and Van Bemmelen, Ber., **33**, 817.

The method of formation of a basic copper sulphate by boiling copper oxide with copper sulphate, was employed by Sabatier in his investigation of basic salts (Comptes rend., 1897, **125**, 104). By prolonged digestion of a solution of copper sulphate with the brown hydrate, $4CuO,H_2O$, Sabatier obtained a compound to which on analysis he assigned the formula, $4CuO,SO_3,4H_2O$.

The other methods described by Mr. Ermen for the production of basic copper sulphates, namely, treatment of solutions of copper sulphate with less than their equivalent of ammonia solution or sodium carbonate, have been mentioned many times in the literature of the subject. Reindel (J. prakt. Chem., 1867, **102**, 204) showed that when sodium carbonate was added to boiling copper sulphate solution a precipitate was formed to which on analysis he assigned the formula, $6CuO,2SO_3\,5H_2O$. Habermann (Monatsh., 1883, **4**, 789) repeated the work and confirmed the results of Reindel. A precipitate of similar constitution was likewise obtained by Reindel by the action of ammonia, but Habermann (Monatsh., 1884, **5**, 435), who estimated the CuO and SO_3 in three different preparations gave it the formula $7CuO,2SO_3,6H_2O$.

He describes it as a bluish green powder, which appears under a microscope of high power to consist of ill-defined crystals. It is quite insoluble in water, is unchanged when heated to 127° C., and does not blacken until a temperature approaching 300° is reached.

The precipitation of solutions of copper chloride by caustic potash, which Mr. Ermen proposes to investigate, has been studied by Lash Miller and Kendrick (Proc. Roy. Soc. Canada, 1901, 2nd Series, Vol. 7, Sect. 3, p. 35), where they state that when *N*/5 potassium hydroxide solution is allowed to act on *N*/5 cupric chloride solution at 85° C., the solid phase consists exclusively of $CuCl_2.3CuO,2H_2O$ until all the copper is removed from the solution; on further addition of caustic potash the precipitate blackens, the basic salt being converted into the oxide.

Scottish Section.

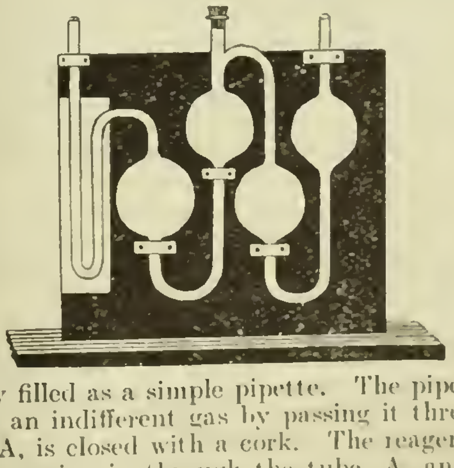
Meeting held at Glasgow on Tuesday, 22nd October, 1912.

DR. THOMAS EWAN IN THE CHAIR.

A HEMPEL DOUBLE PIPETTE, MODIFIED TO FACILITATE FILLING.

BY ALEXANDER CHARLES CUMMING.

The filling of a Hempel double pipette, as ordinarily constructed, offers some little difficulty. By the addition of a side-tube, shown in the diagram at A, the pipette is as easily filled as a simple pipette. The pipette is first filled with an indifferent gas by passing it through while the tube, A, is closed with a cork. The reagent is introduced by pouring in through the tube, A, and water is poured in through B to form a water-seal. The tube, A, is then closed with a well-fitting rubber cork.



Obituary.

HENRY DE MOSENTHAL.

Henry de Mosenthal was born in 1850 at Port Elizabeth, South Africa. Having become associated with Alfred Nobel, the inventor of dynamite, he was appointed technical secretary of the Nobel Dynamite Trust Company, Ltd., on its formation in 1886, and this position he held until his death, from heart failure, on December 17th.

A Fellow of the Institute of Chemistry for twenty years, he served twice on its Council.

He was a member of the Society of Chemical Industry from 1888, and contributed to the Society the following papers, viz.:—

"Treatment of Gold Ores at the Witwatersrand (Transvaal) Gold Fields." This J., 1894, 326.

"The Life Work of Alfred Nobel." This J., 1899, 443.

"Observations on Cotton and Nitrated Cotton." This J., 1904, 1907 and 1911, pp. 292, 443 and 782 respectively.

He contributed articles on "Nitroglycerine and Nitroglycerine explosives," and on "Permitted explosives," to the work published by the Explosives Section of the 7th International Congress of Applied Chemistry, entitled: "The Rise and Progress of the British Explosives Industry."

De Mosenthal was an expert in microscopy and microphotography, and was also a great linguist. The five languages which he spoke, he knew with remarkable thoroughness.

JOHN McARTHUR.

John McArthur, F.R.S.E., received his chemical training at Anderson's College, Glasgow (now the Royal Technical College) under Dr. Wm. Dittmar, F.R.S., to whom he acted for several years as Chief Assistant. In recognition of their joint researches on the atomic weight of platinum, on the determination of potash in sea water, and elaborate investigations of samples brought back from the voyages of H.M.S. "Challenger," he was elected to a Fellowship of the Royal Society of Edinburgh. Entering the Battersea Works of Price's Patent Candle Co., Ltd., in 1887, under the late John Calderwood, F.R.S., he remained as Chief Chemist, General Technical Manager, and Technical Adviser for over 25 years. He died suddenly on 19th December, 1912.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Furnaces. J. Sackett, Charlton, Kent. Eng. Pat. 26,809, Nov. 30, 1911.

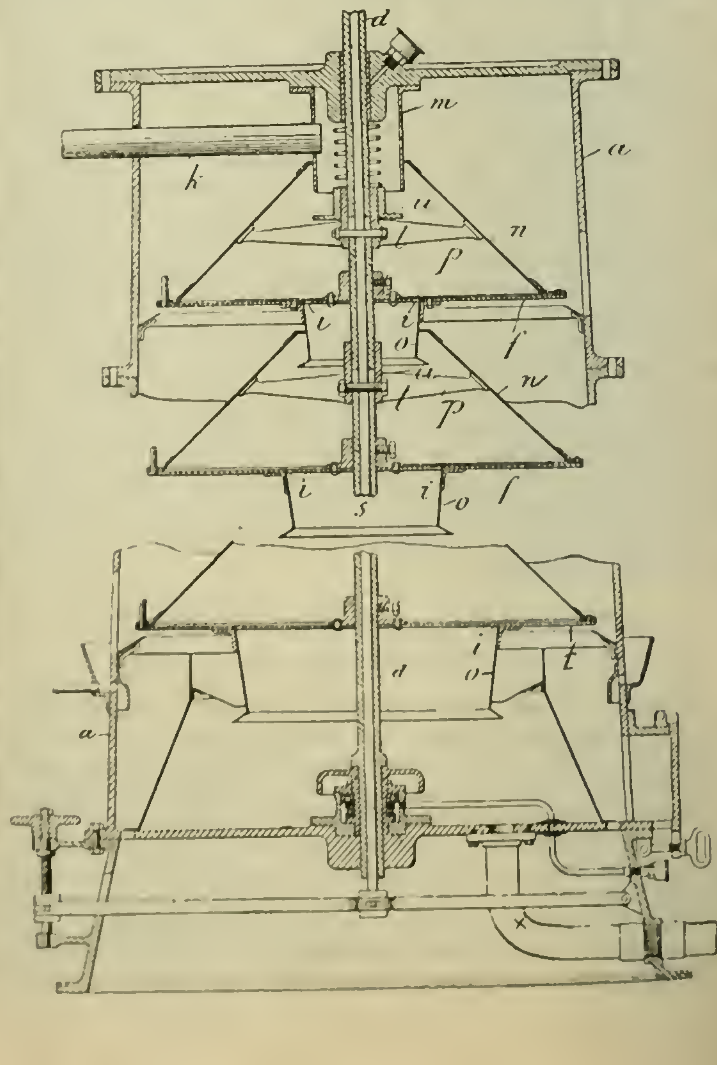
Very high temperatures are obtained in an oil-fired furnace by preheating both the oil and the air necessary for combustion. Both the oil and the air, the former in an atomised state, are passed through a separate set of refractory tubes which are heated by oil burners in a furnace. Oxygen or other gases may be mixed with the air before it enters the preheater.—W. H. C.

Raising or forcing liquids and apparatus therefor. W. A. Humphrey, London, and W. J. Rusdell, Dudley. Eng. Pat. 26,829, Nov. 30, 1911.

The claim is for a method of operating internal combustion pumps, so that the length of the stroke of the reciprocating fluid is determined by the work done, and the energy stored up. The exhaust gases are allowed to escape under such conditions of pressure, that they act upon auxiliary apparatus and cause suitable proportionate amounts of scavenging air and fresh combustible charge to enter the combustion chamber.—W. H. C.

Centrifugal separation of solids and liquids in admixture, and apparatus therefor. C. S. Watson, Newcastle-on-Tyne. Eng. Pat. 3914, Feb. 16, 1912.

A number of horizontal discs, *f*, are mounted on a vertical hollow shaft, *d*, which is rotated by any suitable means. Truncated conical covers, *n*, are mounted above the discs, being normally in contact with them, and are supported by spiders, *p*, from sleeves, *t*, which are attached by bolts through the slots, *u*, in the hollow shaft from a rod, *s*, which passes through the hollow shaft. The materials to be separated are fed into the chamber, *m*, from the pipe, *k*, and pass into the interior of the upper cone, *n*; the solids are thrown to the periphery by the centrifugal



force and the partly separated liquid passes through the holes, *i*, in the disc to the sleeve, *o*, by which they are conducted into the cone below. The liquid is finally discharged through the pipe, *x*, and the solids are from time to time discharged into the casing, *a*, by raising the cones. This is effected by lifting the central rod, *s*, by which the cones are supported, the solids being discharged through the space thus left between the lower edge of the cone and the disc.—W. H. C.

Centrifugal separator. H. de Raasloff and T. E. Brown, New York. U.S. Pat. 1,044,570, Nov. 19, 1912.

The liquid flows through a vertical hollow shaft, and pipes at right angles thereto, into horizontal separating chambers which are partly cylindrical and partly conical in shape. The outer conical ends of the separating chambers are connected with conveyer tubes passing upwards and inwards at an angle of about 45° to a point near the central hollow shaft. The hollow shaft, separating chambers, and conveyer tubes are rotated together, and the solid particles which separate and pass into the conical portions of the separators are conveyed to discharge orifices by screw conveyers working in the conveyer tubes. The liquid, freed from solid particles, is discharged from the inner cylindrical ends of the separators. —H. H.

Centrifugally drying, sifting or filtering substances ; Method of and apparatus for ——. J. Leigh, Liverpool. Eng. Pat. 4830, Feb. 27, 1912.

A number of perforated cylinders are mounted around a horizontal axis about which they are rotated. A spiral conveyer is mounted on a shaft, within each cylinder, and is rotated about its own axis by means of sprocket wheels and chains driven from the central axis. The materials to be separated are fed into the cylinders at the one end and caused to pass through by the conveyers. The liquid portion passes through the perforations and the solids are discharged from the other end.—W. H. C.

Gases ; Method of and apparatus for treating ——. A. N. Diehl, Duquesne, Pa. U.S. Pat. 1,045,003, Nov. 19, 1912.

The process consists in subjecting the gas to the action of a number of intermittent sprays of liquid projected in the direction of flow of the gas. The streams of liquid flowing to the various spraying nozzles are interrupted in succession, so that pockets of gas are formed between the various sprays, and a thorough commingling of gas and spraying liquid thereby effected.—H. H.

Evaporator. G. W. Heisserman, jun., Philadelphia, Pa. U.S. Pat. 1,045,023, Nov. 19, 1912.

An evaporator is formed with outer and inner cylindrical casings through which pass longitudinal pipes for low- and high-pressure steam respectively. In a modified form a third casing of semi-annular shape is mounted between the outer and inner casings and the steam is passed successively through pipes running through all the three casings. —H. H.

Agglomeration of powdered materials such as fine ores, dust from gas, and all kinds of powdery waste. A. Kroll. Fr. Pat. 444,979, May 21, 1912. Under Int. Conv., May 22, 1911.

The material together with chlorides, silicates, carbonates, sulphates or other fluxes is fused in a cupola furnace. The lower part of the furnace is heated by solid, liquid or gaseous fuel. The materials to be treated are fed into the upper end of the furnace through an inclined rotating tube in which a preliminary heating is effected.—A. T. L.

Evaporating and concentrating fluids ; Process for —— *and apparatus therefor.* D. M. Neuberger, New York. Eng. Pat. 5872, March 8, 1911.

See Fr. Pat. 427,077 of 1911 ; this J., 1911, 1101.—T. F. B.

Drying apparatus ; Vacuum ——. E. C. A. Fleurent, A. Ravautte, and Soc. Anon. des Etabl. Egrot, Paris. Eng. Pat. 721, Jan. 9, 1912. Under Int. Conv., April 11, 1911.

See Fr. Pat. 428,374 of 1911 ; this J., 1911, 1147.—T. F. B.

Desiccating fluid substances ; Methods of ——. W. B. McLaughlin, Brooklyn, U.S.A. Eng. Pat. 8018, April 3, 1912. Under Int. Conv., April 3, 1911.

See Fr. Pat. 441,742 of 1912 ; this J., 1912, 947.—T. F. B.

Filtering apparatus. J. M. Neil, Toronto. U.S. Pat. 1,045,095, Nov. 19, 1912.

See Eng. Pat. 14,388 of 1912 ; this J., 1912, 1169.—T. F. B.

Absorption of dilute gases by liquids : Apparatus for ——. I. Moscicki, Fribourg, Switzerland. U.S. Pat. 1,046,212, Dec. 3, 1912.

See Eng. Pat. 17,355 of 1911 ; this J., 1912, 801.—T. F. B.

Calcining furnaces and the like ; Nozzle for ——. G. Bierhals, Berlin. U.S. Pat. 1,046,726, Dec. 10, 1912.

See Eng. Pat. 2503 of 1912 ; this J., 1912, 761.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Coal stacking and coal firing. H. Kendrick. J. Gas Lighting, 1912, **120**, 740—751.

An abnormal number of fires have broken out in the coal stores of gas works since March last, and a number of possible causes are suggested. Among these are the high atmospheric temperature in April and May, when stocks were being replenished after the coal strike ; dampness of the pits after the stoppage ; insufficient cleaning of the coal during the period immediately following the resumption of work at the mines ; the stacking of freshly-mined coal, which absorbs oxygen more readily. It is found that the temperature of coal as received exceeds atmospheric temperature by 2° to 12° F. (1°—7° C.) in summer, and 4° to 20° F. (2°—11° C.) in winter. If stacked rapidly by conveyors, cooling is very slow, and the conditions are favourable for the absorption of oxygen with further rise of temperature. Slack coal is more liable to become overheated than is screened coal, and when unscreened coal is stacked from conveyors, the slack accumulating at the top of each heap is specially liable to heat up. Coal is stacked in heaps up to 30 ft. in height in gas-works, although coal-owners stack small coal in heaps not higher than 15 ft. The author does not recommend ventilation of the stacks as a preventive. The following suggestions are made for the prevention and treatment of fires. Coal from different seams should be stacked in separate heaps ; different kinds of coal should be stacked separately ; fine slacks should not be stacked and damp coals should not be stacked under cover ; surface ventilation only should be used ; lumps or "nuts" and fine should be mixed thoroughly together ; small heaps are less dangerous than large ones ; the piles should not be higher than 20 feet in the open or 16 feet under cover ; external sources of heat and leaking roofs, gutters or pipes should be avoided ; the temperatures of coals as received and in stock should be recorded, and when it rises to 90° or 100° F. (32°—38° C.) the top layers should be removed, and the pile watched carefully ; in case of overheating, the pile should not be disturbed by pushing in bars, etc. ; ammoniacal liquor should be used instead of water for quenching, and the heated coal should be removed as soon as possible. (See also this J., 1909, 759 ; 1912, 112.)—A. T. L.

Coal ; Testing the liability to spontaneous ignition of ——. M. Dennstedt and L. Schaper. Z. angew. Chem., 1912, **25**, 2625—2629.

The danger of spontaneous ignition during transport and storage varies with different kinds of coal. To test this property, the coal is ground to pass through a sieve of standard mesh, moistened, drained and packed with a thermometer in an ignition chamber; the whole is heated in a paraffin oil bath to about 100° C., and a current of carbon dioxide is passed through until the coal is dry. The temperature of the bath is then adjusted until the thermometer inside the ignition tube indicates a specified "initial temperature," and a strong current of oxygen is substituted for the carbon dioxide. The temperature of the thermometer in the coal rises and the temperature of the bath is raised to keep pace with it, until the reaction becomes so intense that the coal catches fire. The lowest "initial temperature" starting from which, under these conditions, the coal ignites in one hour, is taken as a measure of the danger of spontaneous ignition. If the coal does not ignite within an hour with an initial temperature of 150° C., it may be regarded as practically safe even under dangerous conditions. The development of heat by the absorption of oxygen leading ultimately to spontaneous ignition is largely due to the reaction with unsaturated hydrocarbons, but the tendency to spontaneous ignition is not necessarily proportional to the iodine value of the coal. In the absence of suitable testing apparatus, information may be gained by a determination of the moisture in the air-dried coal by drying in a current of hydrogen at 100° C., also by a determination of the re-absorption of moisture by coal so dried on exposure in a vessel containing moist filter-paper. Further, the percentage of oxygen in the coal found by analysis also affords an indication of the danger of self-ignition. These relationships are illustrated by the figures in the following table:—

Coal	Moisture calculated on the original coal.	Re-absorption calculated on the dried coal.	Specified "Initial temperature."	Oxygen by analysis.
	per cent.	per cent.	° C.	per cent.
Fifeshire ..	15·09	17·31	100	11·50
Merrys ..	8·08	11·16	109	13·74
Durham	3·52	5·79	130	6·56
Germania	1·58	2·74	138	4·11
Nixon Navigation	1·41	2·16	156	4·92

The most satisfactory conclusions are those based on the "initial temperature" test, with due regard to the friability of the coal. The production of much fine dust in handling increases the danger of spontaneous ignition. Friability is tested under standard conditions by revolving suitably graded lumps of coal in a porcelain mill, with or without balls, for a given time (one hour) and sifting out the dust produced. For the treatment of coal to reduce the danger of spontaneous ignition, a rich (20 per cent.) emulsion of soft coal-tar pitch or mineral oil residues appears to be the best preventive.—J. F. B.

Naphthalene as fuel for explosion engines; Use of ——. L. Venton-Duclaux. Mem. et Compte. Rendus des Trav., Soc. Ing. Civ. de France, 1912, **65**, 514—519, 598—638.

The use of naphthalene is suggested by its low price compared with other hydrocarbon fuels. The percentage of carbon is 93·7 compared with 92·3 for benzene, and the quantity of air required for the complete combustion of 1 grm. is 13·34 grms. as against 13·04 grms. for benzene. Special apparatus is necessary for obtaining the explosive mixture of air and naphthalene, since the melting point (79° C.) is well above atmospheric temperature. The advantages gained are (1) low cost, which may be only 0·035 fr. (0·32d.) per horse power-hour; (2), security from fire, since even in the liquid state naphthalene is ignited only with difficulty, and a leak of the liquid is not dangerous as it solidifies immediately; (3), uniformity of composition, since naphthalene is a definite compound. The heat required for melting and vapourising the naphthalene is obtained from the cooling water or the exhaust gases of the engine, and the engine must be run for the first few minutes with a light fuel such as petrol, until the parts are warmed up. Hence naphthalene is only suitable in cases where stoppages of any substantial duration are infrequent. Naphthalene has been chosen for fuel for locomotives on the Trans Siberian Railway, where water containing less than 5 per cent. of salts cannot be obtained. The available annual supply of naphthalene is given as follows:—France, 14,000 tons; Germany, 175,000 tons; England, 126,000 tons; and Belgium 12,000 tons. Carburettors for naphthalene are of two principal kinds; (*a*) using naphthalene dissolved in a liquid fuel; and (*b*) using naphthalene melted either by the heat of the exhaust gases, or of the engine cooling water. In type (*a*) the solid naphthalene is carried in a cage which can be dipped into a reservoir of benzene, alcohol, petrol, etc., the liquid being heated by the engine cooling water or by the exhaust gases. In type (*b*) the liquid may issue from a spraying nozzle, or the air may be bubbled through the liquid, or the liquid may drop on to a heated surface in the air pipe. A single-cylinder engine of diameter 140 mm. and stroke 200 mm., fitted with a Bruneau carburettor (Fr. Pat. 411,565 of 1910) used 0·342 kilo. of naphthalene per h.p.-hour at full load, and 0·495 kilo. at half load, the fuel costing 9 fr. per 100 kilos. (= about £3 13s. per ton). Analysis of the exhaust gases gave 0·08 per cent. of carbon monoxide, and nitrogen equivalent to 1·065 times the air required theoretically for complete combustion. A two-cylinder engine with cylinders 88 × 140 mm., fitted with the Noel carburettor (Fr. Pat. 413,792 of 1910), used 0·340 kilo. of naphthalene per h.p. hour at full load, 0·460 kilo. at half load, and 0·608 kilo. at one-quarter load, the fuel costing 7 fr. per 100 kilos. (= about £2 17s. per ton).—A. T. L.

Kambara earth. A decolourising material for mineral oils, etc. K. Kobayashi. J. Ind. Eng. Chem., 1912, **4**, 891—893.

Kambara earth is found chiefly in the province of Echigo, but occurs also in Fukushima and Ishikawa, Japan; the production has greatly increased in the last three years. The earth, which is of the type of fullers' earth or Florida earth, is usually of a white or yellowish colour, sometimes bluish and sometimes greenish. It is more efficient than fullers' earth as a decolourising agent. It appears to be composed chiefly of aluminium silicate and hydrates of silica, the proportion of the latter (extracted by boiling for 5 hours with caustic soda solution of sp. gr. 1·115) being 29·35, 24·54, and 18·03 per cent. respectively in three samples, as compared with 24·72 per cent. in a sample of fullers' earth. The decolourising power of the earth is increased by heating it to 100°—150° C. The earth is weakly acidic in character and decolourises an alcoholic solution of guaiacum resin, a solution of aniline sulphate, and solutions of various basic dyestuffs, becoming coloured itself in the process. The decolourising action of the earth appears to depend upon both its chemical and physical properties, and the following tests should be applied: acidity, fineness, determination of hydrates of silica, loss of weight on ignition, action on guaiacum resin solution, and decolourising action on standard oils. The earth decolourises crude petroleum and absorbs unsaturated hydrocarbons therefrom, and is useful for the purification of animal and vegetable oils. It also promises to be of use for the removal of impurities from methyl alcohol and acetone from wood distillation and for the separation of tar from pyroligneous acid.—A. S.

PATENTS.

Water clarifying apparatus for use in coal washing and like operations. W. Reid, Hamilton, N.B. Eng. Pat. 5183, March 1, 1912.

The settling tank is divided into three compartments, which are in communication with each other near the bottom. The water carrying finely divided coal in suspension, enters a launder in the first compartment, over the edge of which it flows in a gentle stream, so that the water in the tank is not disturbed to any great extent. The coal settles to the bottom and is removed by a scraper conveyor and elevator and the partially clarified water is discharged by a "floating launder" in the third compartment. The "floating launder" is provided with a skimming device to prevent any scum entering. A floating box or tank in the centre compartment is so weighted that it slowly sinks and becomes filled, through valves in the bottom, with clear water, which is discharged through a flexible pipe.—W. H. C.

Coke ovens; Process for rendering inoffensive the gases which escape when charging ——. Soc. Anon. Burkheiser-Eloy. Fr. Pat. 444,927. June 13, 1912. Under Int. Conv., June 24, 1911.

In order to prevent the escape of gases into the retort-house during recharging, an auxiliary main is run parallel to the hydraulic main, and the retort to be charged is connected with this auxiliary main so that the gases are led away to the chimney. A portable connection is provided for this purpose. The ascension pipe from each retort can be shut off from the hydraulic main by a valve. The top end of the ascension pipe is normally closed by a hinged cover-plate, and there are similar hinged cover-plates on the auxiliary main adjacent to each ascension pipe. The portable connection fits on to the end of the ascension pipe when the cover-plate has been lifted, and it also carries a dip-pipe which enters the opening in the auxiliary main and forms a hydraulic seal.—A. T. L.

Coke ovens; Regenerative ——. Soc. Anon. Burkheiser-Eloy. Fr. Pats. 445,906, 445,907, and 445,908. July 9, 1912. Under Int. Conv., July 11, 1911.

(1) The regenerators are divided into sections so that there is one regenerator at each side of the oven for every combustion chamber, and the air for each combustion chamber passes through a separate regenerator with suitable dampers. In this way the air supply can be controlled so as to be quite uniform throughout the length of the oven. Fr. Pat. 351,962 of 1905 (this J., 1905, 884) and Ger. Pat. 233,363 of 1908 are referred to. (2) See Eng. Pat. 16,226 of 1912; this J., 1912, 864. (3) See Eng. Pat. 16,225 of 1912; this J., 1912, 1071.—A. T. L.

Gas producers. The Dowson and Mason Gas Plant Co. Ltd., Manchester, and J. W. B. Stokes, Glasgow. Eng. Pat. 14,893, June 26, 1912.

A central hollow shaft, supported by the rotatable water-luted cover of the fuel-charging hopper, depends vertically downward through the hopper into the fuel in the producer. At the lower end, the shaft branches out and forms a number of pokers, which extend into the fuel. The shaft and pokers are formed of two D-shaped tubes, having their flat sides adjacent. The shaft and pokers are cooled by water circulating through them, and are rotated by suitable mechanism.—W. H. C.

Purifying or desulphurising hydrocarbon gases; Process and apparatus for ——. J. A'H. Fearon, London. Eng. Pat. 23,447, Oct. 24, 1911.

The hydrocarbon vapours contaminated with sulphur compounds are mixed with hydrogen, prepared by the action of steam on heated iron, and with oxides of nitrogen prepared by heating ammonium nitrate or other suitable nitrate. The mixing takes place in a vessel heated to between 500° and 700° F. (260°—371° C.). The sulphur in the hydrocarbon vapours is said to be converted into hydrogen sulphide, and to be in part oxidised by the nitrogen oxides into sulphuric acid, which combines with ammonia and is partly eliminated by passing the vapours through ferric oxide. The hydrocarbon vapours are condensed in scrubbers or towers and any ammonia still remaining, is passed into a vessel containing sulphuric acid, by which it is absorbed. The hydrocarbon liquids obtained are said to be free from sulphur compounds. —W. H. C.

Gases; Recovery of by-products contained in ——. Dr. C. Otto und Co., G. m. b. H. Fr. Pat. 445,402, June 25, 1912. Under Int. Conv., July 10, 1911.

The crude hot gases are passed first through a cooling tower, then through a scrubbing tower, a separating chamber for the removal of water carried in suspension by the current of gas, a saturator containing acid liquor for the removal of free ammonia, and finally a cooling tower. The liquor condensed in the first cooling tower collects in a tank, is freed from tar by decanting, and is passed through a cooler. This liquor then forms the cooling agent for the first cooling tower, and after being heated in its passage through this tower it is caused to flow through the scrubbing tower, and finally back to the collecting tank. In this way, the gas in the scrubbers takes up the greater part of the condensed water, and the quantity of liquor to be dealt with is small.—A. T. L.

Solidification of hydrocarbon oils; Process and apparatus for the ——. J. T. Armstrong, London, and J. Mordan, Hughenden, Bucks. Eng. Pat. 21,059, Sept. 23, 1911.

The hydrocarbon oil is caused to flow in a shallow stream down an inclined plane, and is sprinkled with a suitable liquid binder, such as a solution of glue, so that the particles of oil become enveloped in a film of the binder. The mixture is then sprayed in succession with finely divided particles of coal and a hardening agent, which may be a solution of iron sulphate, after which it is discharged, either with or without being passed through a mixer, into a vessel where the solidification is completed by drying or cooling. An alternative method of mixing the hydrocarbon oil, the binder, the finely-divided coal and the hardening agent is claimed, in which they are severally discharged from atomising jets, in such a manner that the jets of material converge and intermingle before entering the mixer.—W. H. C.

Ceresin and the like from residues of mineral oil; Process of obtaining ——. J. Mijs, Bussum, Holland. Eng. Pat. 10,256, April 30, 1912.

The claim is for the use of toluene as a solvent.—W. H. C.

Separation of sulphur from hydrogen sulphide and gases containing the same. Eng. Pat. 25,454. *See* VII.

Recovery and manufacture of ammonia. Fr. Pat. 445,556. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood; Distillation of resinous —— *with saturated steam.* L. F. Hawley and R. C. Palmer. U.S. Dept. Agric., Forest Service. Bull. 109, Aug. 26, 1912, pp. 31.

Distillation of the wood of the longleaf pine with steam has been carried out in America since 1903, where the process appears to have been introduced for the purpose of utilising sawmill waste and "lightwood" and of producing a crude oil of turpentine free from the products of decomposition of wood and rosin which are formed during destructive distillation. Although the oil of turpentine produced is of good quality, it is the only product of value, and the process has only proved successful in a few instances, not more than 15 plants being worked in 1911. Experiments were undertaken by the authors chiefly with a view to determine the effect of: (1), the size of chips of wood; (2), the pressure of steam; and (3), the speed of distillation, on the yield and composition of the oil obtained and also on the efficiency of the process as measured by the steam consumed. The experimental distillations were made in a cylindrical copper still (15 in. in diameter and about 36 in. in height) capable of being worked at pressures up to 70 lb. per sq. in. The samples of wood used were sawn from a log of longleaf pine, special care being taken to ensure uniformity of sample. The following are the principal conclusions arrived at. Distillation at atmospheric pressure is not sufficient to effect complete removal of oil even from such finely-divided material as sawdust, but distillation at 40 lb. per sq. in. will do so. Chips larger than 1 in. (with the grain) × $\frac{1}{8}$ in. × $\frac{1}{2}$ in. could not be completely distilled even at 70 lb. per sq. in., but it seemed probable from the experimental results that 80 to 85 per cent. of the oil could be obtained from chips as large as 2 in. × 4 in. × 4 in. at that pressure. Increased speed of distillation beyond certain limits resulted in decreased yield and efficiency. No very marked differences in composition were found to exist in oils distilled at different pressures, provided the distillation was not stopped before the oil was completely removed from the wood, but dipentene (identified by its tetrabromide, m. pt. 125°—126° C.), seemed to be more abundant in oils distilled at high pressures, and such oils also showed indications of contamination with products of decomposition of rosin. A certain amount of fractionation took place during the distillation of finely-divided wood such as sawdust; the oil of turpentine passed over first, while the last distillates consisted of almost pure pine oil; when, however, large chips of wood were distilled, very little fractionation took place, indicating that fresh supplies of oil came into contact with the steam throughout the distillation. The tabulated results of these experiments serve to indicate the most economical methods of working the process under any given conditions, which are governed by such factors as the kind of wood—whether sawdust or chips—by the pressure and cost of available steam supply, and also by the value of the products. Although many of the plants erected have ceased working, the authors consider that the process is a promising one, especially where some method of utilising the steamed chips, such as extraction of the rosin by solvents, can be employed.—R. G. P.

Kambara earth. A decolourising material for mineral oils, etc. Kobayashi. *See* IIa.

Patent.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 27,620, Dec. 8, 1911.

In order to avoid the flickering of the arc, which occurs when electrodes of titanium or titanium carbide are used, and which is attributed to the non-conducting slag which is formed, two or three per cent. of copper or of a copper compound are added to the material of which the electrodes are formed.—W. H. C.

III.—TAR AND TAR PRODUCTS.

Oxidations effected by osmium tetroxide, and its use in rendering chlorate solutions active. Hofmann. *See* XX.

Patents.

Carbon bisulphide; Process for the removal and recovery of —— from substances containing the same. S. R. Illingworth, West Ham, and The Gas Lighting Improvement Co., Ltd., London. Eng. Pat. 15,777, July 5, 1912.

In order to remove carbon bisulphide from liquids or solids which are immiscible with and insoluble in water, a mixture of an alkali and alcohol is added, and the alkali xanthate formed is washed out, together with uncombined alcohol: on treating the washing waters with acid, the carbon bisulphide is separated, and the alcohol may be recovered from the residue. The process is described in detail as applied to the separation of carbon bisulphide from benzol.—T. F. B.

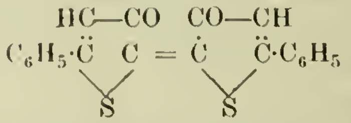
IV.—COLOURING MATTERS AND DYES.

Bis-Phenylthiophen indigo. P. Friedlander and S. Kielbasinski. Ber., 1912, **45**, 3389—3396.

Thiobenzoylthioacetic acid disulphide, obtained by heating ethyl cinnamate with sulphur at 250° C. (see Baumann and Fromm, Ber., 1897, **30**, 111), was heated with sodium sulphide and the reaction product treated with chloracetic acid, whereby an acid of the formula,

$$COOH.CH_2.S.C(C_6H_5):CH.CO.S.CH_2.COOH,$$

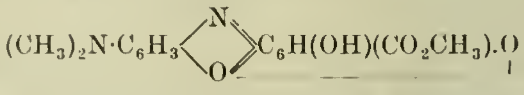
was produced. When this acid was heated with acetic anhydride and sodium acetate, ring formation took place and thioglycollic acid and phenylacetoxythiophen were produced. The latter, on hydrolysis, yielded 5-phenyl-3-hydroxythiophen having properties analogous to those of oxythionaphthene. For example, on oxidation with potassium ferricyanide in alkaline solution it was converted into *bis*-5-phenyl-2-thiophen-indigo,



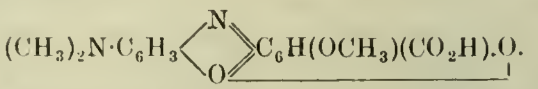
which gave with alkaline hydrosulphite a yellowish vat, with a strong greenish yellow fluorescence; the dye had only a very slight affinity for cotton. 5-Phenyl-2-thiophen-3-indole-indigo (yellowish hydrosulphite vat dyeing cotton brown) and 5-phenyl-2-thiophen-2-indole-indigo were also prepared from the phenylhydroxythiophen.—A.S.

Gallocyanine, Pyrogalline and Azurine; Methylation of ——. F. Kehrmann and A. Beyer. Ber., 1912, **45**, 3338—3345.

The methyl ester of Gallocyanine,



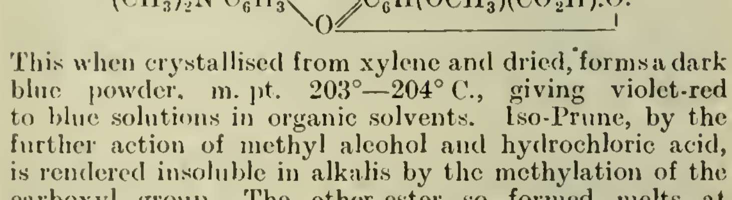
is used in dyeing under the name of "Prune." An isomeride of this is produced by treating Gallocyanine in dilute caustic soda solution with dimethyl sulphate at room temperature. In this way the phenolic hydroxyl group is methylated, yielding "Iso-Prune," or the methyl ether of Gallocyanine,



This when crystallised from xylene and dried, forms a dark blue powder, m. pt. 203°—204° C., giving violet-red to blue solutions in organic solvents. Iso-Prune, by the further action of methyl alcohol and hydrochloric acid, is rendered insoluble in alkalis by the methylation of the carboxyl group. The ether-ester so formed melts at 197° C., does not dye on metallic mordants, but dyes tannined cotton a violet blue shade. Pyrogalline, differing from Gallocyanine in that it contains no carboxyl group, when treated with dimethyl sulphate yields a methyl ether of m. pt. 199°—200° C., dyeing tannined cotton a pure blue shade. In the same way Azurine, differing from Gallocyanine in that it contains no phenolic hydroxyl group, forms an ester, insoluble in alkalis, of m. pt. 190° C.—G. H. F.

Diphenyl series; Studies in the ——. Part III. Diphenyldiphthalamic acids and pyronine colouring matters containing the diphenyl group. J. C. Cain and O. L. Brady. Chem. Soc. Proc., 1912, **28**, 285—286.

Diphthalamic acids of benzidine, tolidine, and dianisidine are produced by the interaction of phthalic anhydride and the diamine at 100° C. in the presence of nitrobenzene. They condense with resorcinol in the presence of zinc chloride to give colouring matters of the formula:



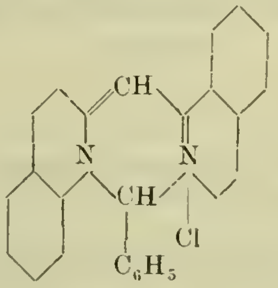
(where R = H, CH_3, or OCH_3). These colouring matters are also obtained by heating a mixture of (i) the diamine, phthalic anhydride, and resorcinol with zinc chloride; (ii), fluorescein, the diamine, and the hydrochloride of the diamine; and (iii) the diphthalimino-derivative of the diamine with resorcinol and zinc chloride. On bromination they yield octabromo-derivatives which can also be obtained by heating eosin with the diamine and the hydrochloride of the diamine. The reaction appears to be a general one, as it takes place when di- and tetrachlorophthalic or succinic anhydrides are used instead of phthalic anhydride, and when diethyl-*m*-aminophenol is substituted for resorcinol. Condensation takes place also with quinol, catechol, and pyrogallol, but in these cases the colouring matters produced are brown, and probably have a constitution different from the above.

Quinoline Red; Constitution of ——. E. Vongerichten and W. Homann. Ber., 1912, **45**, 3446—3452.

The basic compound produced by the oxidation of Quinoline Red with chromic acid (see this J., 1910, 265) has been shown by further research to be *a*-*a*-quinolyl-*iso*-quinolyl-ketone. It is formed together with benzaldehyde according to the following equation:—

$$C_{26}H_{19}N_2Cl+2O=C_{19}H_{12}N_2O,HCl+C_6H_5.CHO.$$

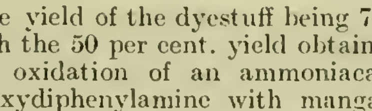
On fusion with caustic potash, it yields quinaldinic acid and isoquinoline. Better results are obtained by reacting upon the methiodide of the base in dilute caustic soda solution with an oxidising agent, when quinaldinic acid and N-methyl-isoquinolone are produced. Quinoline Red is formed by condensation of quinaldine and isoquinoline with benzotrichloride, and the authors find that the quinaldine cannot be replaced by lepidine or any other methyl-quinoline, and as the benzaldehyde complex is present in the dye, together with the residue of *a*-*a*-quinolyl-isoquinolyl ketone, the only explanation concordant with these experiments is that Quinoline Red has the following constitution:—



—G. H. F.

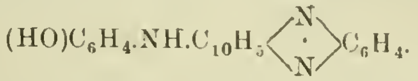
Indamines. F. Ullmann and J. Gnaedinger. Ber., 1912, **45**, 3437—3446.

By blowing air through an alkaline solution of *m*-phenylenediamine and *p*-aminophenol hydrochloride, a product is obtained identical with that obtained by Nietzki (Ber., 1895, **28**, 2974) by the oxidation of diaminohydroxydiphenylamine and described by him as an aminoindophenol. The reactions of this substance, however, show that it is not an indophenol, but an indamine derivative (compare this J., 1912, 978), and it is therefore 5-aminoquinoneimide-(1)-*p*-hydroxyanil-(4), $NH:C_6H_3(NH_2):N.C_6H_4(OH)$; the yield is 70 per cent. of the theoretical yield. On reduction with hydrosulphite the indamine yields 2·4-diamino-4-hydroxydiphenylamine. On oxidation with air in hot ammoniacal solution, 6-amino-3-hydroxyphenazine,



$$(NH_2)C_6H_3\langle\overset{N}{\underset{N}{\cdot}}\rangle C_6H_3(OH),$$

is formed, the yield of the dyestuff being 70 per cent., as compared with the 50 per cent. yield obtained by Nietzki (*loc. cit.*) by oxidation of an ammoniacal solution of diaminohydroxydiphenylamine with manganese dioxide. These reactions are of a general character. For example, a mixture of *m*-toluylenediamine and *p*-aminophenol when oxidised with air in alkaline solution, gives a yield of 98 per cent. of the theoretical quantity of 2-methyl-5-aminoquinoneimide-(1)-*p*-hydroxyanil-(4). The latter on reduction with hydrosulphite gives 5-methyl-2.4-diamino-4′-hydroxydiphenylamine, and on oxidation with air, 7-methyl-6-amino-3-hydroxyphenazine. 2-Methyl-5-aminoquinoneimide-(1)-hydroxychloroanil-(4) (from 2-chloro-4-aminophenol and *m*-toluylenediamine), 3-chloro-5-aminoquinoneimide-(1)-*p*-hydroxy-anil-4 (from 1-chloro-2.4-diamino-benzene and *p*-aminophenol), 2-chloro-5-aminoquinoneimide-(1)-*p*-chlorohydroxy-anil-(4) (from 1-chloro-2.4-diaminobenzene and 2-chloro-(4)-aminophenol), and *β*-hydroxynaphthoquinone-*p*-hydroxyanil (from *a*-naphthol and *p*-aminophenol and from potassium 1.2-naphthoquinone-4-sulphonate and *p*-aminophenol) were also prepared. The last-named, when condensed with *o*-phenylenediamine in alcoholic solution, yielded hydroxyanilidonaphthazine,



$$(HO)C_6H_4.NH.C_{10}H_5\langle\overset{N}{\underset{N}{\cdot}}\rangle C_6H_4.$$

—A. S.

[*Vat dyestuffs.*] *Aromatic nuclei; Condensation of —— by means of aluminium chloride, with elimination of hydrogen.* R. Scholl and C. Seer. Annalen, 1912, **394**, 111—177. (See also this J., 1911, 1204.)

Individual instances of the catalytic acceleration by anhydrous aluminium chloride of the pyrogenic condensation of aromatic nuclei have long been known, but the authors show that the reaction is a fairly general one with certain types of compounds. For example when aromatic ketones are heated with anhydrous aluminium chloride at temperatures between 80° and 140° C., condensation usually takes place, especially in cases where the elimination of hydrogen leads to the formation of new rings. When *a*-naphthylphenyl ketone is heated with aluminium chloride at 140° C., 1·9-benzanthrone (Ber., 1911, **44**, 1656) is obtained in good yield (76 per cent. of the theoretical) and in a state of great purity: hydrogen is evolved only to a small extent, most of that produced acting as a reducing agent on the reaction product; this reducing action is counteracted in many cases by atmospheric oxidation accelerated by the aluminium chloride. Under similar conditions, *a*-naphthyl-*o*-, *m*-, and -*p*-tolylketones yield respectively 5-, 6-, and 7-methyl-1·9-benzanthrones. When melted with alcoholic potash (Bally, this J., 1905, 192), 5- and 6-methylbenzanthrones give respectively 5·5′- and 6.6′-dimethylviolanthrones, which are vat dyestuffs similar to Violanthrone (Indanthrene Dark Blue BO). *a*-Naphthyl-*p*-diphenylketone when heated with aluminium chloride gives 7-phenyl-1.9-benzanthrone; when fused with alcoholic potash, this is converted into a blue vat dyestuff, probably 7.7′-diphenylviolanthrone, which dyes unmordanted cotton blue. *a*(1)-Naphthylphenylketone-2′-carboxylic acid (*a*-naphthoyl-*o*-benzoic acid) on heating with aluminium chloride gives 1.2-benzanthraquinone (naphthanthraquinone). 2-Anthraquinonyl-*a*-naphthylketone (from anthraquinone-2-carboxylic acid chloride and naphthalene by Friedel and Craft's reaction) gives 6.7-phthaloyl-1.9-benzanthrone, which gives a dark green vat with alkaline hydrosulphite, from which cotton is dyed in green shades changing to yellow on exposure to the air. When fused with alcoholic potash, this dyestuff is converted into a dark blue vat dyestuff, probably 6.7.6′.7′-diphthaloylviolanthrone. Violanthrone (Indanthrene Dark Blue BO) can be obtained by heating 4.4′-dibenzoyl-1.1′-dinaphthyl with aluminium chloride, and this method of formation confirms the correctness of Bally's views as to its constitution (see this J., 1905, 192).—A. S.

Phthaleïns and benzeïns of orcinol; Ethers and esters of the ——. F. Kehrmann. Ber., 1912, **45**, 3505—3514.

The preparation and properties of the following compounds are described: *a*-orcinolphthaleïn methyl ester, dimethyl-*a*-orcinolphthaleïn and its methyl ester, *β*-orcinolphthaleïn and its methyl ester, dimethyl-*β*-orcinolphthaleïn and its methyl ester, *γ*-orcinolphthaleïn, *β*-orcinolbenzeïn, *γ*-orcinolbenzeïn, and the dimethyl ether of *β*-orcinolbenzeïn.—A. S.

Benzeïns of xyloquinols. F. Kehrmann and T. E. Stiller. Ber., 1912, **45**, 3346—3349.

Continuing this work (this J., 1910, 620) on the condensation of the three isomeric xyloquinols with benzaldehyde, much better yields are now obtained by using a mixture of the quinol together with its corresponding quinone. Thus the ortho-derivative gives a yield of 70 per cent., and the para-derivative one of 25 per cent. of the theoretical, and only with the *m*-xyloquinol is an insufficient yield obtained to serve for an analysis. The preparation and properties of *o*-xyloquinol-benzeïn chloride and of the para-derivative are described.—G. H. F.

Hydrosulphite in volumetric analysis [*of dyestuffs*]. W. Siegmund. Monats. Chem., 1912, **33**, 1431—1445. (See also Grandmougin and Havas, this J., 1912, 1024).

THE author has applied a solution of hydrosulphite to the analysis of azo-, nitro-, and triphenylmethane dyestuffs. The solution is made by adding 10 grms. of hydrosulphite, 15 c.c. of acetone and 35 c.c. of ammonia solution of sp. gr 0·91 to a litre of water. It is preserved in a large vessel from which a burette can be filled without allowing air to enter. In the reservoir the solution is covered with a layer of paraffin oil, and in the burette with a layer of toluene. The titration is carried out in a flask in an atmosphere of carbon dioxide which is carefully freed from oxygen by passing through a wash-bottle charged with a solution of ferrous sulphate containing ammonium carbonate and Rochelle salt. The hydrosulphite solution must be standardised before use by running it slowly into a solution containing a known amount of ferric sulphate and a little ammonium thiocyanate. The titre is found to diminish slowly with time. In the analysis of azo- and nitro-colouring matters a solution is made of about 0·2 per cent. concentration, and 50 c.c. are taken. To this are added 10 c.c. of 10 per cent. tartaric acid and the mixture is well boiled to drive out dissolved oxygen. The titration flask is kept at 70° to 80° C. by means of a water-bath and the hydrosulphite is slowly run in till the colour is destroyed. For the analysis of triphenylmethane derivatives (which are reduced to colourless leuco-compounds), 25 c.c. of a 20 per cent. solution of Rochelle salt and 1 c.c. of dilute hydrochloric acid are added to 50 c.c. of solution (about 0·2 per cent.) of the colouring matter. The paper contains the results obtained with various pure colouring matters of commercial origin.—W. H. P.

Triphenylmethane colour bases. E. Noelting and J. Saas. Chem.-Zeit., 1912, **36**, 1422.

ON treating triphenylmethane dyestuffs with caustic alkalis, a coloured solution containing the ammonium base is obtained at first, then the solution gradually becomes decolourised and the colourless carbinol-base separates, or in many cases, *e.g.*, with Victoria Blue, the strongly coloured imine-base is precipitated. With ammonia instead of caustic alkali, analogous phenomena are observed, but decolourisation and precipitation take place more rapidly: Victoria Blue B, Night Blue and some other dyestuffs give coloured precipitates of the corresponding imine-bases, but some dyestuffs, *e.g.*, Magenta, Crystal Violet, Ethyl Violet, Naphtho Blue, and Malachite Green yield colourless precipitates not of the carbinol-base, but of the corresponding amine-base, $R_3C.NH_2$. These amine-bases are crystalline and can be easily purified: they dissolve in dilute acids, forming colourless solutions, from which on heating, ammonia is evolved, with formation of the coloured salt of the dyestuff base:

$$(NH_2.C_6H_4)_3C.NH_2+2HCl$$

$$(NH_2.C_6H_4)_2C:C_6H_4:NH.HCl+NH_4Cl.$$

Victoria Blue B gives first the imine base and this by prolonged heating with ammonia is converted into the amine base. It was not found possible to obtain amine-bases from Victoria Blue B and Night Blue. (See also this J., 1912, 1073.)—A. S.

Oxidations effected by osmium tetroxide and its use in rendering chlorate solutions active. Hofmann. *See* XX.

PATENTS.

o-Hydroxymonoazo dyestuffs; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 252,915, Sept. 8, 1910.

DIAZOTISED picramic acid is combined with 1-acidylamino-4-naphthols. When used in the single-bath process, in presence of alkali chromate and ammonium sulphate, the resulting dyestuffs dye wool extremely fast olive-green shades.—T. F. B.

Wool [*azo*] *dyestuff; Process for preparing a red* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 252,916, April 7, 1911.

A DYESTUFF which dyes wool from acid baths scarlet shades, very fast to light, is obtained by combining the tetrazo compound of 4.4′-diamino-2.2′-dimethyldiphenylmethane with two mols. of 1.5-naphtholsulphonic acid. —T. F. B.

Condensation products of the anthraquinone series containing nitrogen; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,238, Nov. 15, 1910. Addition to Ger. Pat. 246,085, Sept. 30, 1910 (see this J., 1912, 529).

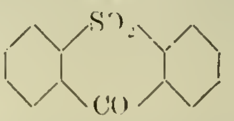
β-DIAZOANTHRAQUINONE is treated with ammonia.—T. F. B.

Vat dyestuffs of the anthraquinone series containing sulphur; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,507, Dec. 20, 1908. Addition to Ger. Pat. 249,225, Nov. 11, 1908 (see this J., 1912, 766).

DYESTUFFS which produce faster dyeings than those described in the principal patent, are obtained by heating salts of anthraquinonyl-mercaptans with perchloroethylene or penta- or tetrachloroethane in presence of a substance which will combine with acid.—T. F. B.

Vat dyestuffs of the anthraquinone series containing nitrogen; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,714, June 1, 1911.

AMINOANTHRAQUINONES are condensed with halogen-substituted, oxidised thioxanthone derivatives of the type,



,

or their analogues or substitution products. The products may be used as vat dyestuffs.—T. F. B.

Anthraquinone derivatives containing sulphur and nitrogen; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 253,089, Sept. 15, 1911.

o-AMINOANTHRAQUINONE-MERCAPTANS are condensed with ketones by aid of acid condensing agents. The products are probobly anthraquinone-thiazolines.—T. F. B.

Sulphide dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 253,239, Jan. 21, 1912.

NITRO- or amino-derivatives of phthaloperinone are melted with sulphur and alkali sulphides in presence of copper or copper compounds. The products dye cotton fast, rich brown and claret shades. When the nitro-phthaloperinones are heated with sulphur and alkali sulphides alone, feebly coloured products of no tinctorial value are obtained. —T. F. B.

Indanthrene and its derivatives; Process for converting —— *into a form suitable for their use as pigment colours.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 253,240, June 2, 1911.

THE hydro-compounds of indanthrene or its derivatives, prepared by reduction by means of carbohydrates and alkalis, are treated with phenols.—T. F. B.

Anthraquinone-acridones; Process for separating ——, *and for freeing them from by-products.* Badische Anilin und Soda Fabrik. Ger. Pat. 253,090, Nov. 7, 1911.

ANTHRAQUINONE-ACRIDONES may be separated from one another or from impurities by converting them into salts and separating these by taking advantage of the differences of solubility. The process is particularly applicable to the production of pure substitution products (*e.g.*, halogen derivatives) of anthraquinone-acridones. —T. F. B.

Indigo and its derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 253,508, Feb. 4, 1912.

INDOXYL, indoxylcarboxylic acid, or their derivatives are oxidised to the corresponding indigo by means of quinones or their derivatives. It is stated that the products are obtained in a purer condition than when air is used for the oxidation, and that they are in a finely-divided state, especially suitable for use in the vat.—T. F. B.

Indigo and other indigoid dyestuffs in a finely-divided state; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 253,509, Feb. 4, 1912.

The leuco compounds of indigo or other indigoid dyestuffs are treated in alkaline solution with organic oxidising agents, such as quinones of the benzene, naphthalene, anthracene, or phenanthrene series, or aromatic nitrocompounds.—T. F. B.

Vat dyes of the anthracene series; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 13,612, June 10, 1912.

See Fr. Pat. 444,819 of 1912; this J., 1912, 1073.—T. F. B.

Azo dyestuff. K. Schirmacher, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,045,196, Nov. 26, 1912.

See Fr. Pat. 441,044 of 1912; this J., 1912, 809.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton; Determination of the degree of bleaching of ——. C. Piest. Z. angew. Chem., 1912, **25**, 2518—2522.

On a series of typical nitrating cottons, both normal and chemically modified, the author has carried out a comparative investigation of the principal analytical methods for the estimation of the chemical condition. The "wood-gum value" represents the matter soluble in 5 per cent. sodium hydroxide solution on long standing in the cold. It is a complex function comprising small quantities of fatty acids, gum (xylan) and a portion (β-oxycellulose) of the products of over-bleaching. The multiplicity of factors deprives this character of absolute value, but with normally purified cottons it lies between 0·5 and 1·1 per cent. The "copper value," standardised by Schwalbe (this J., 1907, 548; 1910, 689) is the most definite measure available for the diagnosis of chemical modification, particularly by over-bleaching. Normally purified cottons show a total "copper value" considerably below 2, and preferably not exceeding 1, whereas the copper value of strongly over-bleached cottons may rise as high as 16; hydrocellulose likewise shows an increased copper value but in a minor degree. The "hydrate copper value," *i.e.*, the cupric hydroxide absorbed from Fehling's solution in the cold, is regarded as indicative of the state of hydration of the cellulose, being specially pronounced in the case of mercerised cellulose, normal (about 0·5) in the case of oxycellulose and particularly low in the case of hydrocellulose. The "acid value," according to Vieweg (this J., 1909, 623), is the amount of sodium hydroxide neutralised on boiling for half an hour with a 1 per cent. solution. This also is a complex function indicating primarily the chemical modification due to oxycellulose and hydrocellulose in approximately equal degrees, and secondarily the specific susceptibility of the cellulose itself to alkaline hydrolysis. It is particularly low in the case of cellulose which has already been treated with strong alkali, *e.g.*, mercerised cotton, and which is not otherwise modified by drastic oxidising or acid treatments which would increase the tendency to hydrolysis. The "copper sulphate value," *i.e.*, the cupric hydroxide absorbed from a solution of copper sulphate, is of little diagnostic importance; it tends to be low in the case of oxidised cellulose but the differences are too small for practical use. Ost's viscosity test is a most valuable measure of chemical condition, but in the case of chemically modified cellulose, shows no distinction between the various causes of modification. If the cuprammonium cellulose solution, prepared as prescribed by Ost (this J., 1911, 1247), be diluted with water in the proportion prescribed, after 5 days, it should show a viscosity of about 10 in the case of normally treated cotton. Mercerised cotton also shows normal viscosity, but the very prolonged action of mercerising alkali modifies the cellulose quite as strongly as oxidising agents and acids.—J. F. B.

Oxycellulose and its reactions. W. Harrison. J. Soc. Dyers and Col., 1912, **28**, 359—362.

The author reviews the work of Witz (this J., 1883, 378), Nastjukoff (this J., 1900, 733; 1901, 573; 1902, 63), Berl and Kláye (this J., 1907, 1157), and von Faber and Tollens (this J., 1899, 1014), and shows that none of the tests described by them nor those of Vetillart (Bull. Rouen. 1883, **11**, 234) and Ditz (this J., 1908, 1129) are capable of distinguishing between oxycellulose and hydrocellulose. The evidence available indicates that the different forms of oxycellulose and hydrocellulose are adsorption compounds of peptised cellulose and the products of hydrolysis of cellulose. The dyeing properties depend mainly upon the colloidal state of the cellulose portion, and the reducing properties are due to the products of hydrolysis. It is probable that the adsorbed reducing substances are of an aldehydic nature in hydrocellulose and of an acidic nature in oxycellulose. For the detection of reducing substances (oxycellulose or hydrocellulose) in fabrics, the author recommends a reagent prepared by adding silver nitrate to sodium thiosulphate solution, with vigorous stirring, and then adding sodium hydroxide, so as to obtain a liquid containing 1 per cent. of silver nitrate, 4 per cent. of sodium thiosulphate, and 4 per cent. of sodium hydroxide. If the material be boiled in, or padded with, this solution, and then steamed, the parts containing oxycellulose (or hydrocellulose) are stained. The effect is enhanced if the material be heated with a 1 per cent. solution of phenylhydrazine in glacial acetic acid and then washed thoroughly with dilute acetic acid before treating with the silver solution.—A. S.

Lactic acid in sisal; Occurrence of ——. W. McGeorge. J. Amer. Chem. Soc., 1912, **34**, 1625—1627.

The acidity of the juice expressed during the decortication of sisal (*Agave sisalana*) is found to be due to the presence of lactic acid, which is normally developed by the plant. —F. Sodn.

Sulphite cellulose; Determination of the quality of ——. G. von Zweigbergk. Papierfabrikant, 1912, **10**, 1247 1250, 1278—1280.

For the determination of moisture, a range of temperature from 90° to 105° C. and a duration of 8—10 hours seem to give the most concordant results for technical purposes. The maximum temperature should not be reached until after a preliminary period at the lower temperature, but it should be maintained over most of the time of drying. Schwalbe's petroleum distillation method may be used, employing a copper retort and 40—50 grms. of the sample. The distillation lasts about 20 minutes and the separation of the water requires another 15 minutes. Towards the end of the distillation, the burner should be removed for a moment, then replaced and arranged so that a wave of petroleum passes over suddenly, washing down the tube of the condenser and carrying over any residual drops of water which may be adherent. For the determination of the resin, a fresh, air-dry sample which has not been heated must be taken. The Soxhlet apparatus should have ground-glass joints. Extraction with ether yields a different product from extraction with alcohol, and the latter solvent will give higher results, sometimes 50 per cent. more than by extraction with ether, partly because of its higher boiling point. The ether extract is generally clear, yellow and fluid; the alcohol extract is dark brown, cloudy and thick. Other solvents extract various amounts from the same pulp, so that it is always necessary to specify the solvent employed. Incineration for the determination of ash should be performed at a moderate temperature to avoid volatilisation of the chlorides; the use of ammonium nitrate or hydrogen peroxide is permissible. The determination of the degree of digestion and the bleaching properties of the pulp is based on the estimation of the residual lignin. It must be borne in mind however that two pulps may contain the same amount of lignin and yet differ materially in quality, according to the strength of digestion liquor, time and temperature employed. With cautious interpretation, Klemm's "Malachite Green" test may afford useful indications. Klason's colourimetric test is probably the best rapid method for estimating the degree of digestion, but it is better to use, instead of pure 96 per cent. sulphuric acid, a mixture of 4 parts by weight of this acid with 1 part of water. The sample should be reduced to fine fibre by means of a grater, and 50 mgrms. of well boiled pulp or 25 mgrms. of so-called "strong" pulp are weighed out, treated in stoppered tubes with 20—25 c.c. of acid, shaken until dissolved and then compared colourimetrically with a standard pulp similarly treated. Of the direct quantitative methods of analysis, Cross and Bevan's chlorine gas method is preferred, but the usual preliminary boiling with alkali should be omitted and the removal of the chlorinated lignin should be effected by boiling with sodium sulphite alone without alkali. Care is required to avoid attack of the cellulose by the chlorine; the final bleaching of the product is effected by dilute permanganate. The nitric acid method is more rapid but yields lower results.—J. F. B.

Sulphite cellulose; Acidity and sizing of ——. E. Richter. Wochenbl. Papierfab., 1912, 43, 4517—4520.

The majority of samples of sulphite wood pulp show a marked acid reaction which may be determined quantitatively in the following manner: 5 grms. of pulp are reduced to fibre and vigorously shaken in a hard-glass or silica vessel with 100—150 c.c. of water at 60°—80° C. The liquid is strained off through a small plug of cotton-wool, the residue is washed a few times with hot water, the filtrate being titrated with $N/100$ alkali. The acidity is expressed as grms. of sulphuric acid per 1000 grms. of pulp. The acid values found for a series of commercial sulphite pulps ranged from 0·02 to 0·39, though it only rarely exceeds 0·20. In exceptional cases pulps are found giving a perfectly neutral extract, whilst still more rarely the extract shows an alkaline reaction. One of the latter type of pulps was more closely examined by the author; the aqueous extract on titration showed a relatively strong basicity, neutralising 0·098 grm. of sulphuric acid per 100 grms. of pulp. At the same time its cupric-reducing power was high, the copper value by Schwalbe's method (this J., 1907, 548; 1910, 689) being 4·85. In the paper mill considerable difficulty was experienced in sizing this pulp and only a moderate degree of "hardness" was attained with double the normal quantity of size; difficulty was also experienced in dyeing the pulp with a red acid dyestuff. The abnormal characters of this pulp are attributed to over-digestion, with corresponding formation of hydrocellulose or oxycellulose. On determining the copper values before and after hydrolysis with dilute sulphuric acid (Schwalbe's method), the difference may be regarded as a measure of the tendency to hydrolysis or in other words the state of hydration of the cellulose, since hydrated celluloses are especially susceptible to hydrolysis; the state of hydration likewise determines the affinity for dyestuffs. In making such tests, the pulp should previously be extracted successively with ether, alcohol and water, because the resins and other impurities of the pulp have a direct cupric-reducing power of their own. The copper value of the cellulose and the hydrolysis-difference [hydration] value stand in some relationship to the manner of digestion, and this relationship likewise extends to the degree of acidity of the product.—J. F. B.

Paper pulp. Increase in weight of —— *on heating for the determination of moisture.* F. Zweigler. Papierfabrikant, 1912, 10, 1364—1365.

The increase of weight which takes place on drying various cellulose materials by heat in presence of air has been studied by the author at a temperature of 110° C. In the changes which take place the pulp itself and the residual impurities present are both concerned. Fats, resins and gums, which are present in practically all technical pulps, are prone to decomposition and oxidation at high temperatures. Pulps which have been prepared from lignocelluloses by chemical treatment show a notable tendency to increase in weight owing to the oxidation of residues of lignin. Pure cellulose, hydrocellulose, oxycellulose and hydrated cellulose do not appear to suffer any appreciable oxidation at 110° C. The technical products may, however, contain residues of absorbed and dried alkalis, etc., which in conjunction with air set up appreciable oxidation. If such products be washed with acidulated water before heating, the tendency to increase in weight disappears. Atmospheric oxygen is the primary cause of all these changes and if hygroscopic moisture is to be determined by simple loss of weight, complete exclusion of oxygen is essential. For this reason it is preferable to absorb or collect the water driven off and make the determination a direct one. Schwalbe's method of distilling off the water in an indifferent medium, such as petroleum, possesses the advantage of being a direct method, rapid in execution. The author further points out that constancy of weight, even when attained, affords no assurance that all moisture has been expelled, since the errors may counterbalance one another. On the other hand, for technical purposes, the errors introduced by oxidation on drying at the temperatures usually employed are negligible. When heated for 5 hours at 110° C., the increase in weight of cotton and linen half-stuffs ranged from 0·03 to 0·06 per cent.; unbleached soda wood pulp gained 0·07 per cent., sulphite pulp 0·03—0·04 per cent., mechanical pulp 0·11, brown mechanical 0·17, and bleached straw cellulose 0·08 per cent.—J. F. B.

Patents.

Electric charges formed on textiles, fibres, paper and like materials during the working processes; Methods of neutralising ——. Siemens Bros. and Co., Ltd., London. From Siemens und Halske, A.-G., Berlin. Eng. Pat. 1555, Jan. 19, 1912.

The electrified material is exposed to the action of a medium, preferably air or gas, which is artificially rendered conductive by means of a radio-active substance. An earthed electrode (a plate or wire netting) is arranged below the material to be discharged and a radio-active substance is placed on the electrode; or else the material may be surrounded by a box or tubular electrode which is coated, preferably inside, with the radio-active substance. Those radio-active substances are most suitable which mainly emit α-rays, *e.g.*, pitchblende, chalcolite, carnotite, autunite, monazite, etc., or the salts of uranium, thorium, and actinium derived from these minerals. Alternatively the material may itself be brought in contact with the radio-active substance disposed on a roller, or air ionised in a separate machine may be conducted to the material.
—J. F. B.

Fibrous materials; Process of treating ——. V. del Prato, neé V. Viscardi, G., V., C. and M. del Prato. Fr. Pat. 445,180, Apr. 15, 1912.

For the treatment of hemp and flax, the bundles of fibres are boiled for a quarter of an hour in a dilute solution of sodium bicarbonate containing about 8 parts per 1000. The softened fibres are then passed between rollers being washed with warm water, whereby the ligneous particles are loosened and the gummy impurities washed away. Lastly the fibres are immersed for one minute in a boiling solution of calcium chloride at a strength of 2 per 1000. In the case of wool the material is treated in a solution of sodium bicarbonate at 8 per 1000, the temperature of which, after boiling, has been reduced to 50°—60° C.; for silk the same bath is used at the boiling temperature.
—J. F. B.

Cellulose; Preparation of solvents for ——, *and cellulose solutions.* E. Knecht, Marple, A. Perl and P. Spence and Sons, Ltd., Manchester. Eng. Pats. 25,532 and 25,533, Nov. 16, 1911.

(1) Copper is precipitated in a state of extremely fine division by treating a 20 per cent. solution of copper sulphate with slightly more than the theoretical quantity of a 20 per cent. solution of titanous sulphate. The

precipitated metal is filtered off, washed and then dissolved in a strong solution of ammonia with the assistance of a current of air. (2) Cellulose is reduced to a state of fine division and impregnated with copper sulphate, either in the form of a solution or fine powder. The mixture is then treated with sufficient titanous sulphate to precipitate the whole of the copper in the metallic state. The material is washed and drained and then exposed to the action of ammonia and air until the cellulose is dissolved. The titanic sulphate produced in these reactions may be recovered and reduced to titanous sulphate by electrolysis or other means.—J. F. B.

Textile and other fibres, films and fabrics; Production of metallised ——. E. Knecht, Marple, A. Perl and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 25,534, Nov. 16, 1911.

Fibres or films produced in the ordinary manner from cuprammonium solutions of cellulose are immersed in an acid solution of titanous sulphate which effects the reduction to the metallic state of the copper compounds contained in them. Alternatively the cuprammonium solution of cellulose may be coagulated in the form of threads or films by injection into an acid solution of titanous sulphate, which then serves as a combined coagulating and reducing agent. Fabrics, fibres or yarns also may be coated, either locally by printing or entirely, with a cuprammonium solution of cellulose and the metallic copper deposited as described. The precipitated copper in any of the above cases may then serve as a basis on which other metals, such as silver or gold, may be deposited by electrolysis or otherwise. The metallic deposit may be burnished by friction or pressure.—J. F. B.

Threads from cellulose solutions; Apparatus for spinning lustrous ——. A. Boisson. Second Addition, dated Aug. 26, 1911, to Fr. Pat. 436,556, Jan. 24, 1911 (this J., 1912, 428, 1119).

The spinneret, consisting of a simple perforated disc, is held in a removable cap which is clamped to the delivery pipe by means of a stirrup, the lugs of which slide on helicoidal ridges on the edge of the cap, forming a bayonet joint.—J. F. B.

Wood, straw and the like elastic material; Charging boilers with ——. Pokorny und Wittekind Maschinenbau-A.-G., Frankfort-on-Maine, Germany. Eng. Pat. 10,548, May 3, 1912. Under Int. Conv., March 14, 1912.

In charging boilers with elastic material by stamping, the elastic after-effect of the material, which considerably influences the efficiency, is diminished by effecting the stamping at such a speed that the material has not sufficient time to expand again and follow the back-stroke of the pneumatic stamping tool. The capacity of the boiler is increased, and more rapid and uniform boiling of the material is possible.—B. N.

Threads, filaments, strips, or films of cellulose; Manufacture of ——. S. S. Napper, Coventry, Assignor to S. Courtauld and Co., Ltd., London. U.S. Pat. 1,045,731, Nov. 26, 1912.

See Eng. Pat. 406 of 1911; this J., 1911, 1308.—T. F. B.

Cellulose-ester solution. O. Schmidt, T. Eichler, Mannheim, and G. Lutz, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,045,895, Dec. 3, 1912.

See Fr. Pat. 440,733 of 1912; this J., 1912, 828.—T. F. B.

Acetylcellulose compound and method of making same. W. G. Lindsay, New York, Assignor to The Celluloid Co. U.S. Pat. 1,045,990, Dec. 3, 1912.

See Fr. Pat. 415,518 of 1910; this J., 1910, 1299.—T. F. B.

Formylcellulose; Process of producing ——. E. Bronnert, Niedermorschweiler, Assignor to Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. U.S. Pat. 1,046,729, Dec. 10, 1912.

See Eng. Pat. 15,700 of 1910; this J., 1910, 1199.—T. F. B.

Sodium bicarbonate; Process of making —— and organic substances from soda-pulp waste liquor. E. L. Rinman, Harnäs, Sweden. U.S. Pat. 1,045,889, Dec. 3, 1912.

See Ger. Pat. 244,941 of 1911; this J., 1912, 532.—T. F. B.

Caustic liquor resulting from digestion of wood; Process of treating the residual ——. J. M. Neil, Toronto. U.S. Pat. 1,047,132, Dec. 10, 1912.

See Fr. Pat. 442,850 of 1912; this J., 1912, 1027.—T. F. B.

Chemical solutions for various purposes, especially for rendering fabrics, fibres, paper, etc., impervious to water. Fr. Pat. 445,175. *See* VII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Cotton; Shrinkage of —— on treatment with caustic soda lye. P. Krais. Z. angew. Chem., 1912, 25, 2649—2651.

The author has determined the shrinkage of skeins of cotton yarn of various qualities when treated loose with mercerising caustic soda lyes of densities ranging from 15° to 35° B. (sp. gr. 1·116—1·320) at temperatures of 0°, 10° and 20° C. The skeins were measured before and after, under a tension of 1 kilo. The shrinkages, expressed as percentages, are summarised in the following table:—

Density of lye.	15° B. (sp. gr. 1·116)				20° B. (sp. gr. 1·162)				25° B. (sp. gr. 1·210)				30° B. (sp. gr. 1·263)				35° B. (sp. gr. 1·320)			
Yarn.	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
Temp.																				
*0° C.	9·7	12·3	13·3	14·6	17·9	23·9	21·9	20·9	16·5	21·6	23·5	26·0	23·9	22·3	28·2	30·0	26·0	24·6	26·6	30·0
10° C.	8·2	7·0	10·0	6·3	20·0	20·0	17·1	16·7	21·7	24·7	31·3	18·8	22·4	23·0	28·2	29·2	23·9	24·6	31·3	29·2
20° C.	6·8	0·8	3·9	2·0	14·0	12·3	15·7	8·4	16·5	20·0	24·3	18·8	16·5	20·8	26·6	25·0	22·4	21·6	28·2	24·0

* 5 c.c. of alcohol added per 250 of lye to assist the wetting of the yarn.

a = Water Louisiana *Ia*, Xls, 20s. b = Louisiana a a a, 2 ply 40s. c = Maco C. 2 ply 40s. d = Knitting yarn 6 ply 2s.

Celluloid and similar compositions: Manufacture of ——. H. Dreyfus, Basle, Switzerland. Eng. Pat. 20,975, Sept. 22, 1911. Under Int. Conv., July 15, 1911.

See Fr. Pat. 432,264 of 1911; this J., 1912, 24.—T. F. B.

Dyed cellulose esters; Process of producing ——. B. Borzykowski, Charlottenburg, Germany. Eng. Pat. 12,995, June 3, 1912.

See U.S. Pat. 1,041,587 of 1912; this J., 1912, 1075.—T. F. B.

Thus, under favourable conditions as to quality of yarn, concentration of lye and temperature, a maximum shrinkage of 31·3 per cent. is recorded, which is higher than has been quoted by other authorities. Experiments with single and two-ply yarns of the same quality, under similar conditions, showed that the difference in shrinkage of the two sorts was very small, but generally in favour of the single yarn. This is of interest in the mercerising of piece-goods, where the single weft yarn is generally thrown up on the top side. Further experiments were made with the addition of various substances to the mercerising lye. None of the substances added increased the shrinkage; alcohols, salts, glycerin, dextrin, sodium carbonate, etc., all had the effect of reducing the shrinkage, which shows the importance of a constant control of the purity of mercerising lyes in continuous use.—J. F. B.

Indigo on cotton yarn; Dyeing artificial ——. M. Ducat. Rev. Gen. Mat. Col., 1912, **16**, 313—315.

A serious drawback to the use of the hydrosulphite vat for dyeing indigo on yarn is that the amount of caustic soda required for the production of deep shades is so great as to be very injurious to the workmen's hands. The author surmounts this difficulty by reducing the amount of caustic soda and adding common salt to the vat. A typical vat is prepared as follows:—To 1000 litres of cold water are added 1·5 litres of caustic soda of 40° B. (sp. gr. 1·383), 1·5 kilos. of Hydrosulphite Conc. B.A.S.F., 4 kilos. of Monopol soap, 4 kilos. of common salt, and 20 kilos. of 20 per cent. Indigo solution B.A.S.F. for cotton. The mixture is gently stirred. After 20 minutes it should have a greenish yellow colour. The prepared hanks are worked in this vat for 25—30 minutes, then squeezed off or hydro-extracted, afterwards allowed to oxidise and finally washed and dried.—P. F. C.

Prussiate Aniline Black. H. Sunder. Z. Farben-Ind., 1912, **11**, 221—222.

The author has adapted the process of Zeidler and Wengraf for printing Aniline Black on a naphthol ground, to the printing of unprepared goods. He prepares his printing colour from 120 parts of aniline, 5 parts of Taramin extra (B.A.S.F.), 80 parts of acetic acid (7° B., sp. gr. 1·052), 65 parts of hydrochloric acid (20° B., sp. gr. 1·162), 20 parts of lactic acid (80 per cent.), 595 parts of neutral thickening, 30—35 parts of sodium chlorate, 20 parts of potassium ferrocyanide, and 60 parts of potassium ferricyanide. The printed goods are developed by a short steaming.—P. F. C.

PATENTS.

Two-shade dyeing in one operation on fabrics of pure wool. A. E. F. Delmasure. Fr. Pat. 444,971, May 4, 1912, and First Addition thereto, dated June 4, 1912.

It has been proposed to change the colour of part of the uniforms of the French army from a mixture of white and indigo to a bronze and green. This can be effected by dyeing the material with a suitable dyestuff such as Anthracene Yellow BNL in combination with acetic acid and potassium bichromate.—P. F. C.

Resists; Recovery of materials used as —— in printing upon cotton textile fabrics. R. Ashton, Marple, Chester, and The Calico Printers' Association, Ltd., Manchester. Eng. Pat. 23,324, Oct. 23, 1911.

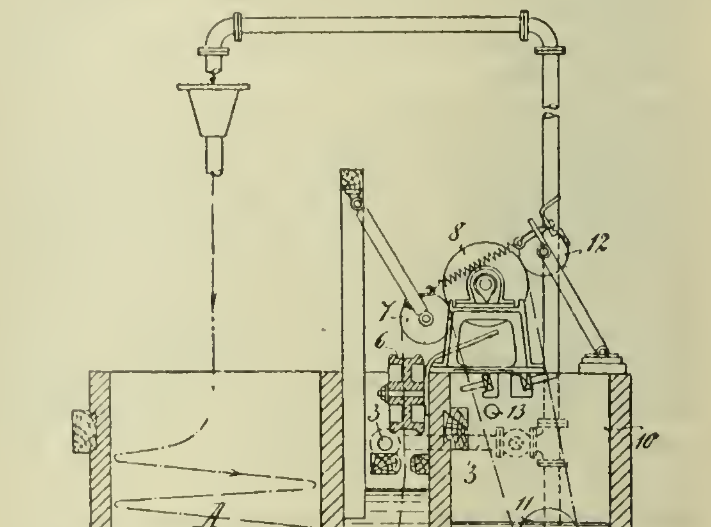
Resists of a fatty, waxy or resinous nature are recovered from cotton fabrics by subjecting the latter to the action of a solvent heavier than water arranged beneath a water seal, and the saturated solvent is subsequently treated for obtaining relatively pure resist and solvent. Instead of water, solutions ordinarily employed for dunging may be employed as the seal, and the operations of recovery of resists and dunging may thus be carried out simultaneously.—B. N.

Extracting moisture from piece goods in the open width; Machine for ——. P. Bailey, Dewsbury. Eng. Pat. 25,731, Nov. 18, 1911.

This is a machine of the type in which the fabric passes in the open width over a longitudinal slot which is connected by a pipe with a pump. In order to help to maintain the vacuum, which is readily broken if the fabric is of a light or porous nature, a number of laps of woven porous material are fastened to a bar in such a way that they rest over that part of the fabric which is passing over the slot.—P. F. C.

Bleaching; Process and apparatus for treating fabric with liquids and particularly for ——. W. Mathesius and M. Freiberger, Charlottenburg, Germany. Eng. Pat. 28,485, Dec. 18, 1911. Under Int. Conv., Dec. 22, 1910.

A wooden box, 1, is divided into two compartments, A, B, by a partition, 2, having an inclined part, 2a, at its lower end. The fabric is plaited down in rope form in the compartment, A, and at the same time bleaching liquor is run into the box. In order to prevent compression of the fabric at the bottom of the compartment, A, bleaching liquor is also pumped through a pipe, 3, down the compartment, B, up the compartment, A, through overflow openings into a pipe, 61, and back to a reservoir, 64. The fabric is drawn down the compartment, A, up the compartment, B, between rollers, 6, through squeezing rollers, 7 and 8, then down into a rinsing tank, 10, over a roller, 11, upwards and around the pressure roller, 8, the fabric being wound a few times round the rollers, 8, 11, in the usual manner. The cloth is next sprayed on its way into the tank, 10, by jets from a water-pipe, 13, the excess water being afterwards expressed between the rollers, 8 and 12. By working two such machines as this together, the fabric can be treated with sodium or calcium hypochlorite in the first machine and then, after rinsing in the tank, 10, with an acid solution in the second machine. By this means the small quantity of hypochlorites still present in the fabric after rinsing is decomposed and the hypochlorous acid is set free. In this way the fabric is successively subjected to an alkaline and acid bleach. Means are provided for heating the bleaching liquor if desired. —P. F. C.



Waterproofing process. G. M. Anderson, and Anderson, Anderson, and Anderson, Ltd., London. Eng. Pat. 26,622, Nov. 28, 1911.

See Fr. Pat. 445,884 of 1912; this J., 1912, 1177.—T. F. B.

Preparation of diastatic substances. Eng. Pat. 26,068. *See* XVIII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Lead-chamber walls; The construction of ——. Awe. Z. angew. Chem., 1912, 25, 2523—2524.

The structural properties of sheet lead are very poor and great care is required in designing, to ensure that the lead is subject only to simple stresses of small magnitude. In constructing lead chamber walls the author recommends a horizontal suspension of the sheets. The carriers consist of horizontal angle-irons over which is laid a lead angle or the bent-over edge of the lead sheet. This is clamped to the angle-iron by means of a strip of flat-iron with bolts, and the joint made by soldering in the usual manner. Assuming that the thickness of the lead is 3 mm. and that the horizontal angle-irons are 1·5 m. apart, the lead having a specific gravity of 11·3, then the tensional stresses in the lead are only about 2 kilos. per sq. cm. No other stresses occur, since the attachment to the angle-irons is uniform. The distance between the vertical supports of the angle-irons may be fixed at will, the only condition being the absence of sagging. With light angle-irons the supports may be 3·75—4·25 m. apart and thus a space of approximately 6 sq. m. is left clear for repairs. On the other hand the use of vertical carriers for the lead sheets sets up large and not readily calculated stresses, the carriers must be set closely together to counteract the tendency for the lead to give way at the seams and this allows little space for repairs. When repairing, it is necessary to undo one of the vertical attachments which increases the stresses and easily leads to deformations. The trouble is magnified when the upper ends of the carriers are attached to the roof-girders or other vibrating portions of the structure.—J. F. B.

Perchloric acid; Preparation of ——. H. H. Willard J. Amer. Chem. Soc., 1912, 34, 1480—1485.

The method consists in the conversion of ammonium perchlorate into perchloric acid by oxidation with *aqua regia*; it is as follows:—A solution made by diluting 105 grms. of 37 per cent. hydrochloric acid to 400—500 c.c. is introduced through a long-stemmed dropping funnel into a vigorously boiling mixture of 500 grms. of ammonium perchlorate, 600 c.c. of water, and 410 grms. of 68—70 per cent. nitric acid, contained in a 2 litre flask. Water is added to replace that lost by evaporation, the volume being kept constant for about an hour after the acid has been added, and the solution is then rapidly boiled down, until the fumes of perchloric acid appear. When the acid fumes copiously, its composition is approximately that of the dihydrate, $HClO_4,2H_2O$, a theoretical yield being obtained. The principal gaseous products of the reaction are nitrous oxide and chlorine. Purification is effected by distilling under 200 mm. pressure, a convenient apparatus for the purpose being described, and the distillate is rendered free from chlorine and its oxides by a current of air passed through the gently warmed acid. The hydrated acid is stable and non-poisonous. In addition to its other applications, it may be used as a substitute for sulphuric acid in acidimetry and in permanganate titrations, sparingly soluble basic salts not being formed when ferric choride is evaporated with perchloric acid.—F. Sodn.

Inorganic ferments. VI. Catalytic decomposition of formic acid by rhodium. G. Bredig and T. Blackadder. Z. physik. Chem., 1912, 81, 385—415.

The catalytic decomposition of formic acid by rhodium has been studied qualitatively and quantitatively. For the preparation of rhodium black of lasting catalytic activity, the presence of sulphur compounds is essential. The sulphur absorbed by the rhodium is slowly eliminated as hydrogen sulphide whilst the rhodium slowly becomes inactive. An active rhodium black containing sulphur is obtained on reducing rhodium sesquisulphide with formic acid. Inactive rhodium becomes catalytically active for a short time on absorbing oxygen. The gases resulting from the decomposition of formic acid are a mixture in equal volumes of hydrogen and carbon dioxide. The reaction is not a mass action change of the first degree, since the velocity constant increases with decreasing amounts of formic acid. The temperature-coefficient of the change is above 2 for a rise of temperature of 10° C. Stirring has very little influence on the rate of change. The addition of sodium formate increases the rate of change, but there is no decomposition in alkaline solution. The addition of formic acid decreases the rate of decomposition of sodium formate. Dilution of the formic acid with water increases the rate of change: this is decreased, however, on adding hydrochloric acid.—E. F. A.

Vanadic acid; Volatilisation of —— with halogens. E. B. Auerbach and K. Lange. Z. angew. Chem., 1912, 25, 2522—2523.

It has been shown by various authors that vanadic acid is somewhat volatile when heated with halogen acids or salts, *e.g.*, hydrochloric acid, hydrofluoric acid and fluorides, free halogen being also formed. When 2 grms. of dry sodium chloride are fused with 1 grm. of vanadium pentoxide, the loss of weight of the mixture amounts to 22·4 per cent. in 4 hours, and the loss of the original vanadium pentoxide is 2·9 per cent.; free chlorine may be recognised by the smell. The authors have examined the course of the reaction quantitatively in the case of a mixture of 1 grm. of vanadium pentoxide and 3 grms. of anhydrous barium chloride. The loss of weight was 9·64 per cent. after the first hour, but the increments of loss for each succeeding hour of fusion decreased progressively, being 0·39 per cent. in the seventh hour. When analysed at the end of this time, it was found that the loss of vanadium pentoxide was only 0·7 per cent., whilst 69 per cent. of the original chlorine had been volatilised. The restriction of the loss of vanadium is attributed to the decomposition of the volatile vanadium-halogen compound by the moisture of the air and the combination of the vanadic acid with the increasingly alkaline residue. Sodium or barium vanadate does not react when fused with sodium chloride. The volatile vanadium-halogen compounds may be collected by performing the fusion in a closed retort in an atmosphere of dry carbon dioxide. A brownish oily liquid is condensed, which is decomposed by water into hydrochloric acid and vanadic acid. The above results explain the loss of vanadium experienced on roasting vanadium ores with salt. In the analysis of vanadium ores by precipitation with mercurous nitrate, if chlorides be present, a considerable loss of vanadium occurs when the precipitate is ignited. For instance, when a solution of 0·25 grm. of vanadium pentoxide and 0·25 grm. of hydrochloric acid was precipitated with mercurous nitrate, 20 per cent. of the vanadium was lost on incineration.—J. F. B.

Lead thiosulphate; Precipitation of ——, and its behaviour on boiling with water. W. H. Perkins and A. T. King. Chem. Soc. Proc., 1912, 28, 315—316.

The addition of sodium thiosulphate to a solution of lead acetate produces a precipitate the composition of which varies with the dilution of the solutions, and with the proportions in which they are mixed. From concentrated solutions, especially those containing excess of the lead salt, the precipitate consists of the double salt, $Pb(C_2H_3O_2)_2,2PbS_2O_3$, whilst from dilute solutions or with excess of thiosulphate it has a composition corresponding with PbS_2O_3. It is therefore advisable when pure lead thiosulphate is required to obtain it from lead nitrate. The well-known blackening of this salt on warming takes place most readily in the presence of excess of sodium thiosulphat according to the equation: $PbS_2O_3+3Na_2S_2O_3=PbS+4S+3Na_2SO_4$. Without the sodium salt the reaction is slower and more complex, but it still proceeds mainly according to the equation:—

$$4PbS_2O_3 = PbS+4S+3PbSO_4.$$

The authors' results are in conflict with those of Fogh (Ann. Chim. Phys., 1890, [vi.], **21**, 56) who prepared his thiosulphate from moderately concentrated lead acetate solution, and represented its decomposition on boiling by the equation: $2PbS_2O_3 = PbS+PbS_3O_6$.

Titanium tetrachloride: Action of the silent electric discharge on a mixture of hydrogen and the vapour of ——. F. Böck and L. Moser. Monats. Chem., 1912, **33**, 1407—1429.

THE authors bubbled perfectly dry hydrogen through liquid titanium tetrachloride and subjected the resulting gaseous mixture to the silent electric discharge. At ordinary temperatures the product is a brown solid which is extremely sensitive to moisture, and a powerful reducing agent, igniting spontaneously in air. The reactions of its solution correspond with those of titanium trichloride, but analysis gives too high a percentage of chlorine. On heating to 100° C. *in vacuo*, an almost colourless distillate of titanium tetrachloride is obtained. The residue while preserving its original appearance and properties now corresponds exactly, on analysis, with the trichloride. On heating to about 200° C. its colour changes to violet, and it is apparently crystalline. Variations in the experimental conditions gave widely varying ratios of tri- and tetrachloride in the original product. The authors believe the brown substance to be a labile modification of titanium trichloride which on account of its porous nature retains appreciable quantities of the tetrachloride. By suitably modifying the apparatus and the use of mica-coated porcelain tubes, the authors have carried out the reaction at 200° C., at which temperature the product is a violet crystalline powder with all the properties of titanium trichloride. It is suggested that this method of preparation may prove simpler than those at present in use for obtaining titanous compounds.—W. H. P.

Chromic oxide and other substances; Glowing of —— on heating. L. Wöhler. Z. Chem. Ind. Kolloide, 1912, **11**, 241—242.

WHEN wet precipitated chromic oxide is heated, at about 540° C., after the water is expelled, evolution of considerable heat takes place (the temperature rises suddenly 50° or 100°) and the substance glows. A similar change takes place with precipitated ferric oxide (also at 540° C.) and with zirconia, oxides of noble metals, and other hydrogels. The glowing takes place in indifferent gases, and is independent of the source of the precipitated oxide, with the exception that conditions favourable to the production of hydrosols during the precipitation promote the subsequent glowing of the precipitate. It has been found that the glowing is accompanied by a marked diminution of surface as measured by adsorptive power. By prolonged heating below the temperature at which "glowing" takes place, the surface diminishes gradually instead of suddenly, and the capacity of glowing is finally lost. It is concluded that the glowing is the result of the sudden loss of surface energy, this being the final stage of a series of changes each involving diminution of surface, viz., flocculation of the hydrosol, conversion of the hydrogel into the anhydrous gel-pseudomorph, and conversion of the latter into the ignited oxide, which has practically no adsorptive power.—A. S.

Silica; The various forms of —— and their mutual relations. C. N. Fenner. J. Wash. Acad. Sci., 1912, **2**, 471—480.

QUARTZ, tridymite and cristobalite were investigated with regard to their mutual relations. It was found that the velocity of transformation is extremely small at most temperatures, and also, in accord with Ostwald's principles of successive reactions, that a given form, when subjected to conditions under which it is unstable, will frequently pass first into some less unstable condition before being converted into the most stable form. It was frequently necessary to employ a catalytic agent, such as sodium tungstate, to assist the reaction to completion. Besides these slow and difficult inversions, which are characterised by a complete change in the outer form of the mineral, there is a second class which takes place almost instantaneously. The outer form of the mineral is retained, only the internal structure being modified, and the method of investigating these inversions is that of heat-curves, which was also used for defining a fourth mineralogical phase of silica in chalcedony. The various inversions of silica are recapitulated as follows. At some unknown, but probably low temperature, chalcedony passes into α-quartz, (tetartohedral hexagonal). At 575° C., a point on the geological thermometer which is unchanged by this investigation, α-quartz $\rightleftharpoons$ β-quartz (hemihedral hexagonal). At 870° C., β-quartz $\rightleftharpoons$ β-tridymite (holohedral hexagonal). At 1470° C., β-tridymite $\rightleftharpoons$ β-cristobalite (isometric). These are all stable forms, but on cooling, meta-stable α-forms result from β-tridymite and cristobalite at 115°—120° and 180°—270° C. respectively. There are thus at least seven distinct crystalline forms of silica, and with rising temperature each form passes successively into one possessing a higher grade of crystallographic symmetry. The effect of pressure is to raise the quartz-tridymite inversion point 1° per 9·5 atmospheres, or roughly 90° for a column of rock two miles in depth.
—H. H. S.

Carbon subsulphide, C_3S_2. A. Stock and P. Praetorius. Ber., 1912, **45**, 3568—3578.

IN the preparation of carbon bitelluride by the method previously described (this J., 1911, 954) a compound of sulphur and carbon was invariably obtained as an impurity. This has been identified as carbon subsulphide, C_3S_2, which was first described by von Lengyel (Ber., 1893, **26**, 2960), who termed it "tricarbonium disulphide." The best yields of this compound were obtained from carbon bisulphide at low temperatures in the presence of metals capable of reducing carbon bisulphide with the formation of sulphides, and for this purpose the electrodes for the arc were made of a mixture of antimony with 7 per cent. of graphite. During the passage of the current a slow stream of carbon dioxide was passed through the flask, and after about three hours the liquid was filtered from the black antimony sludge, and the filtrate shaken for an hour with 200 grms. of mercury and some phosphorus pentoxide and concentrated on the water-bath to 100 c.c. It then contained about 1 per cent. of carbon subsulphide and could be kept for a week in the dark without decomposition. By further concentration and distillation *in vacuo*, the carbon subsulphide was separated as a solid yellowish-red substance at a temperature of about —40° C., the receiver having been cooled with liquid ammonia. It melted at —0·5° C., forming a sparkling red, strongly refractive liquid which had a sp. gr. of 1·319 at 15° C. and a molecular weight of 106·3 (theory=100·1). It was soluble in carbon bisulphide and benzene in all proportions, and reacted with aniline to form thiomalonanilide in accordance with the equation:

$$C_3S_2+2C_6H_5.NH_2=CH_2(CS.NH.C_6H_5)_2.$$

At the ordinary temperature it became turbid in a few hours and was spontaneously polymerised into a black carbon-like non-volatile mass, which was not affected by water, sodium hydroxide solution, hydrochloric acid or chlorine water. When heated *in vacuo* the polymerised product was decomposed mainly into carbon bisulphide and a carbonaceous residue containing a large proportion of sulphur. In this respect its behaviour corresponded with that of the polymerisation product of carbon suboxide described by Diels and Meyerheim (this J., 1907, 169).—C. A. M.

Boron hydrides. A. Stock and C. Massenez. Ber., 1912, **45**, 3539—3568.

PREVIOUS attempts to isolate definite hydrides of boron have been unsuccessful, mainly on account of the instability of these compounds especially in the presence of water. In the authors' experiments magnesium boride was made to drop, little by little, into hydrochloric acid (strength 2, 4 or 8*N*) at a temperature of 50° to 80° C. In this way the formation of an alkaline reaction in the vicinity of the boride was prevented. The evolved gases were condensed in a series of U-tubes chilled by means of liquid air, and the condensed portion was subsequently fractionated by replacing the liquid air first by a mixture of acetone and solid carbon dioxide (—82° C. to —75° C.), then by liquid ammonia (—45° C. to —35° C.), and finally by ice. By these means the following compounds were separated: (1) Silicon hydride, SiH_4; (2) carbon dioxide; (3) silicon hydride, Si_2H_6; (4) a boron hydride, B_4H_{10}, boiling at +16° C.; (5) a boron hydride, B_6H_{12}, boiling at a higher temperature and having a tension of 10 mm. at 0° C.; and (6) a small still less volatile residue containing other boron and silicon hydrides. The hydride, B_4H_{10}, melted at about —112° C. and readily decomposed into a series of other boron hydrides. On treatment with water it was completely decomposed in 48 hours at the ordinary temperature in accordance with the equation:—

$$B_4H_{10}+12H_2O=4B(OH)_3+11H_2,$$

whilst in the presence of alkali a similar reaction took place, the final stage being represented by:

$$B_4H_{10}+4NaOH+4H_2O=4NaBO_2+11H_2.$$

The density of the gas (H=1) was (1) 26·9, (2) 27·1 (theory =26·8). The only impurity in the fractionated product was found to be a trace of the less volatile boron hydride, B_6H_{12}. In air or in oxygen it took fire (with dangerous explosions in vessels with narrow openings). Dilute hydrochloric acid acted upon it like water, whilst concentrated nitric acid caused it to take fire with explosive violence. Gaseous ammonia combined with it to form a light brown compound, insoluble but slowly decomposed by water, and apparently containing 2 mols. of NH_3 to 1 mol. of B_4H_{10}. Benzene absorbed the hydride forming a stable solution possessing the characteristic repulsive odour of the gas. The other hydride, B_6H_{12}, the formula of which was not established with the same certainty as that of B_4H_{10}, was a colourless liquid igniting spontaneously in the air and having a very repulsive odour. At the ordinary pressure it boiled at about 100° C. It was still more sensitive to the action of water than its companion, and on treatment with alkali solutions yielded hydrogen immediately. To prevent violent explosions all vessels containing traces of this hydride should be washed with sodium hydroxide solution before admitting air.—C. A. M.

Oxidations effected by osmium tetroxide and its use in rendering chlorate solutions active. Hofmann. *See* XX.

Some basic copper sulphates. G. Fowles. *See* Manchester Section, p. 9.

Patents.

Sulphurous gases (e.g., gases from the roasting of lead ores); Process for the utilisation of dilute —— for the manufacture of sulphuric acid in lead chambers. A.-G. für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westfalen. Ger. Pat. 253,493, June 10, 1911.

The dilute sulphurous gases are mixed with hot burner gases after the latter have passed through the Glover tower, and the mixed gases are led into the chambers.—A. S.

Hydrofluoric acid; Manufacture of ——. H. B. Bishop. Fr. Pat. 445,749, July 3, 1912.

The process consists in agitating a heated mixture of calcium or other fluoride and a suitable acid, such as sulphuric acid, preferably after a preliminary mixing or agitation without heating. For example, 68 kilos. of finely crushed fluorspar are added, with constant stirring, to 90 kilos. of 99 per cent. sulphuric acid, at a temperature of about 27° C. or less. Suitable apparatus comprises a mixing agitator, connected by a pipe with a rotary reaction vessel (*e.g.*, a cast iron cylinder), which is heated externally by fuel gases, and means for securing a proper circulation of the heating gases, so as to ensure a higher temperature near the discharge end of the reaction vessel than at the other end (the temperature of the interior of the cylinder near the discharge end being maintained at about 315° C. and that near the charging end at 115°—127° C.), thus causing a uniform evolution of hydrogen fluoride throughout the cylinder. The process, which is continuous, is said to be rapid and economical and to give a good yield, besides which it is characterised by comfort in working, owing to the apparatus being gas-tight, and the production of a non-adherent calcium sulphate residue.—F. Sodn.

Ammonia; Continuous process for the manufacture of —— by direct reaction between water and potassium cyanide. P. Wéber. Fr. Pat. 445,506, June 27, 1912. Under Int. Conv., July 1, 1911.

Excess of steam is made to react with a volatile cyanide, such as potassium cyanide, at its temperature of formation, by injection into a mixture of coke or other combustible carbonaceous material and an appropriate reducible salt such as potassium carbonate, which is undergoing combustion in the presence of air. The products are ammonia and a formate, which latter is separated from the combustion gases by filtration or deposition and is used again in the process. The combustion is effected in a shaft furnace having tuyères below the boshes, for the supply of heated air, and, above these, rows of pipes for injecting steam into the reaction zone. A charging arrangement depends into the furnace in such a manner as to maintain the material at constant level and at the same time to bring about partial deposition of the formate, which is returned to the charge. The heated gases pass out at the upper part of the furnace to a dust chamber of relatively large dimensions, in which the reaction between steam and cyanide is completed and in which a further deposition of formate takes place, and they are then cooled in regenerative cooling apparatus, and the contained ammonia is absorbed in known manner, after which the residual gases may be burnt.—F. Sodn.

Ammonia; Process for the recovery and manufacture of ——. K. Burkheiser. Fr. Pat. 445,556, June 28, 1912. Under Int. Conv., Sept. 12 and 26, 1911.

Thiocyanates are treated in solution with oxidising or reducing substances, in process of formation, or, at a high temperature, in the fused state, with hydrogen or steam, or with substances, other than alkalis, which yield hydrogen or steam at such temperatures. The process may be applied to the treatment of thiocyanates obtained from the cyanogen compounds produced in gas manufacture, the ammonia formed being recovered in the usual way, along with that previously present in the gas; the thiocyanates are advantageously added to a charge of the coal before submitting this to destructive distillation. —F. Sodn.

Ammonia; Catalyst for the oxidation of ——. A. de Montlaur. Fr. Pat. 445,857. Sept. 15, 1911.

The catalyst consists of a lustrous and adherent deposit of metallic platinum on some inert material such as mica, glass, porcelain, etc.; it is obtained by coating the supporting surface with a solution of platinum tetrachloride in an essential oil, preferably blue chamomile oil, and effecting reduction at a red heat, or by the decomposition, at a bright red heat, of polysulphide ["thiosulfurés"] compounds of platinum.—F. Sodn.

Dicyandiamide; Manufacture of a substance consisting essentially of ——. Oesterreichischer Verein für Chem. und Metall. Produktion. Ger. Pat. 252,273, Sept. 13. 1910.

Nitrolim (crude calcium cyanamide) is extracted with water, the aqueous extract is treated with a quantity of ammonia equivalent to one-half of the cyanamide present, the lime is precipitated by means of carbonic acid, and after separation of the calcium carbonate, the solution is concentrated to the crystallising point or evaporated to dryness. Instead of adding ammonia and then precipitating with carbonic acid, precipitation may be effected with ammonium carbonate.—A. S.

Hydrogen cyanide and cyanogen compounds; Production of —— by catalytic combination of gaseous or volatile carbon compounds with gaseous or volatile nitrogen compounds. C. Beindl. Ger. Pat. 254,068, Feb. 15, 1912.

A MIXTURE containing not more than 7 vols. of the carbon compound to 1 vol. of the nitrogen compound is used, with a contact material consisting of a metallic oxide or a mixture of metallic oxides. It is stated that oxides of metals of the iron group have the property of inducing the rapid formation of hydrogen cyanide at relatively low temperatures from dry mixtures of gaseous or volatile carbon compounds and nitrogen compounds.—A. S.

Ferrous sulphate liquors; Process of treating waste ——. J. McFetridge, Vandergrift, Pa., Assignor to American Sheet and Tin Plate Co. Pittsburgh, Pa. U.S. Pat. 1,045,723, Nov. 26, 1912.

THE liquor is filtered and evaporated, and the ferrous sulphate thus separated is mixed with 0·5—1 per cent. of fine carbon and furnaced at a dull red heat, sulphur-containing material being burnt in the furnace, and the heat evolved therefrom utilised to maintain the heat of the furnace. As a result of this operation a mixture of sulphur dioxide and trioxide escapes from the furnace, and a residue consisting of ferric oxide mixed with ferric sulphate is left. This residue is treated with "liquid," whereby the ferric sulphate is dissolved and removed, leaving the ferric oxide in the form of a pigment (rouge). —A. S.

Chemical solutions for various purposes, especially for rendering fabrics, fibres, paper, etc., before or after manufacture, impervious to water, whilst preserving intact their porosity as regards air. C. Bourlet. Fr. Pat. 445,175, Feb. 24, 1912.

CLAIM is made for all products obtained in accordance with the equations:

$$Al_2(SO_4)_3+3Pb(C_2H_3O_2)_2=3PbSO_4+Al_2(C_2H_3O_2)_6,$$

and $Al_2(C_2H_3O_2)_6+nH_2O=Al_2(C_2H_3O_2)_4$. 2, 4, or $5H_2O+2C_2H_4O_2$ (especially for products serving to replace white lead), and for all applications of these reactions. —F. SODN.

Perborate mother-liquors; Process for rendering stable the oxygen present in ——. Chem. Fabr. Grünau, Landshoff und Meyer A.-G., E. Franke, and R. May. Ger. Pat. 253,169, April 29, 1911.

A QUANTITY of a fatty acid (stearic, palmitic, or oleic acid) is added to the mother liquor equivalent to the free caustic soda contained therein, and substances which will promote the formation of an emulsion, *e.g.*, ammonium salts, guaiacol sulphonates, or resins, are also added. —A. S.

Sulphur, Separation of —— from hydrogen sulphide and gases containing the same. P. Fritzsche, Recklinghausen, Germany. Eng. Pat. 25,454, Nov. 15, 1911.

SULPHUR dioxide and hydrogen sulphide are treated, simultaneously or in succession, with a liquid in which aluminium hydroxide or an aluminium compound of similar action, such as basic aluminium sulphite, is suspended or dissolved. Soluble acid sulphites of low vapour tension are formed and, reacting with the hydrogen sulphide, give a precipitate of sulphur and basic sulphite, which latter is dissolved by further treatment with sulphur dioxide, thus regenerating the liquor and yielding fairly pure sulphur. The process is carried out, preferably, at 60°—70° C., and the aluminium sulphite solution should not be very concentrated, nor should it be brought into contact with iron vessels or tubes. By treating the sulphite solution simultaneously or successively with gases containing hydrogen sulphide and ammonia, the ammonia may be recovered as sulphite or sulphate, in the latter case the solution of ammonium sulphite being treated with hot air or oxygen in the presence of the aluminium compounds, which favour the oxidation, the ammonium sulphate solution being separated and concentrated as desired. In the case of gases produced by the distillation of coal, the process may be carried out as follows:—The gas, free from tar, is washed with a solution of aluminium sulphate, and the liquor treated with sulphur dioxide until the precipitated aluminium hydroxide is dissolved; the solution is then employed, in considerable excess, in the purifying apparatus in which hydrogen sulphide is removed and passes thence into oxidising apparatus, in which it is treated with air until the conversion of sulphite into sulphate is complete, after which the suspended sulphur is removed and the solution is used again, liquor being removed and concentrated for the recovery of ammonium sulphate as desired.—F. SODN.

Air enriched in oxygen; Apparatus for the manufacture of ——. O. Rast. Ger. Pat. 253,494, Dec. 29, 1911.

THE cylindrical vessel containing the absorbing liquid, *e.g.*, water, is divided into compartments by concentric cylindrical partitions projecting upwards from the bottom. In the upper part of the chamber a piston works and from this a second series of concentric cylindrical partitions project downwards in between those projecting upwards from the bottom. On the upward stroke of the piston air is drawn into the outermost compartment through a non-return valve, and passes, in a circuitous path through each compartment in turn; bubbling through the water or other liquid therein. Shortly before the piston reaches the lowest position on the downward stoke, suitably loaded "blow-off" valves open, through which the unabsorbed gas, rich in nitrogen, escapes. The absorbed gas, rich in oxygen, which is evolved from the water in the innermost compartment during the upward stroke of the piston escapes through a valved pipe provided for the purpose.—A. S.

Hydrogen peroxide; Process for the manufacture of ——. A. Hempel. Fr. Pat. 445,096, Aug. 25, 1911.

SOLUTIONS containing persulphuric acid, or a mixture of this acid and Caro's acid, are distilled in flat shallow vessels or coils, heated externally (preferably by electrical means) and provided with tubulures which allow of the ready escape of the hydrogen peroxide vapours as formed, other tubulures serving for the entry and exit of the reacting liquor which is introduced in the atomised state or in a thin stream or film. Hydrogen peroxide of 50 per cent. strength or over may be obtained, almost without loss, pure sulphuric acid being recovered.—F. SODN.

Ammonia from distillation gases; Recovery of ——. W. Mueller, Essen on Ruhr, Germany. U.S. Pat. 1,045,590, Nov. 26, 1912.

SEE Eng. Pat. 15,034 of 1911; this J., 1911, 1201.—T. F. B.

Alkali aluminates; Manufacture of ——. D. A. Peniakoff, Brussels. U.S. Pat. 1,045,097, Nov. 19, 1912.

SEE Eng. Pat. 30,324 of 1909; this J., 1910, 1454.—T. F. B.

Sulphates; Process for the reduction of ——. V. Bollo and E. Cadenaccio, Genoa, Italy. U.S. Pat. 1,045,769, Nov. 26, 1912.

SEE Fr. Pat. 423,228 of 1910 and Addition thereto; this J., 1911, 620, 747.—T. F. B.

Reducing chemical compounds [preparation of boron]; Method and apparatus for ——. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,046,043, Dec. 3, 1912.

SEE Fr. Pat. 421,831 of 1910; this J., 1911, 488.—T. F. B.

Barium oxide; Process for the manufacture of ——. W. Kirchner, Assignor to Chem. Fabr. Grünau, Landshoff und Meyer A.-G., Grünau, Germany. U.S. Pat. 1,047,077, Dec. 10, 1912.

SEE Fr. Pat. 441,565 of 1912; this J., 1912, 922.—T. F. B

Treatment of sulphide ores or metals-bearing solutions and production of ammonia or ammonium salts or other nitrogenous compounds. Eng. Pat. 25,506. *See* X.

VIII.—GLASS; CERAMICS.

Soda-barium and soda-lime glasses; Relation of the refractive index of —— to their chemical composition. E. W. Tillotson, jun. J. Ind. Eng. Chem., 1912, 4, 882—885.

The author determined the refractive powers of four series of soda-barium glasses, the composition of which varied from:—(1) $Na_2O,3SiO_2$ to BaO,SiO_2; (2) $Na_2O,3{\cdot}5SiO_2$ to BaO,SiO_2; (3) $Na_2O,5SiO_2$ to BaO,SiO_2; and (4) $Na_2O,3SiO_2$ to $BaO,2SiO_2$. The results are given in tables and curves, together with those obtained previously for some soda-lime glasses (this J., 1912, 433). The existence of compounds of the type, $Na_2O,BaO,xSiO_2$ and $2Na_2O,3CaO,xSiO_2$, is indicated on the curves. The specific refractive powers of the glasses computed with the aid of the calculated densities (this J., 1912, 28, 1127) are additive from the pure sodium silicate up to the double silicate, and from the double silicate up to the barium or calcium silicate. For glasses varying in composition from the pure sodium silicate up to the double silicate, and thus including nearly all the typical commercial soda-lime and soda-barium glasses, the specific refractive power may be calculated (using Gladstone and Dale's formula) from the percentages by volume of the constituent oxides, the specific refractive powers of the oxides in the glasses being taken as SiO_2, 0·1995; BaO, 0·0500; CaO, 0·2410; Na_2O, 0·2360.—A. S.

Various forms of silica and their mutual relations. Fenner. *See* VII.

Patents.

Glass; Preparation of a quality-testing table for —— G. R. Fischer. Ger. Pat. 252,733, April 12, 1912.

The glass is subjected to the action of high-pressure steam in an autoclave, and is then photographed. By the action of the steam, the alkali of the glass separates comparatively rapidly, and the extent of the separation can be registered photographically. Photographic reproductions of test-pieces of different glasses may be arranged in a table according to the amounts of alkali separated.—A. S.

IX.—BUILDING MATERIALS.

Various forms of silica and their mutual relations. Fenner. *See* VII.

Patents.

Viscous, stringy, adhesive substance, more particularly for use in the asphalt industry; Process for making a ——. J. Göpper and O. Geiger, Obertürkheim, Germany. Eng. Pat. 6019, March 11, 1912. Under Int. Conv., Sept. 6, 1911.

See Fr. Pat. 434,065 of 1911; this J., 1912, 232.—T. F. B.

Wood; Preservation of —— E. Kuhn, Brussels. Eng. Pat. 14,496, June 20, 1912.

See Fr. Pat. 445,244 of 1912; this J., 1912, 1182.—T. F. B.

Cement, mortar, and concrete; Method of rendering —— waterproof. R. A. Plumb, Detroit, U.S.A. Eng. Pat. 17,070, July 22, 1912.

See U.S. Pat. 1,036,898 of 1912; this J., 1912, 926.—T.F.B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Charcoal iron; Effect of high carbon content on the quality of ——. J. E. Johnson, jun. Met. and Chem. Eng., 1912, 10, 777—788.

An account is given of an investigation of the reason for the great difference in price between the charcoal irons of Lake Superior and those of the Southern and Eastern regions. Irons were found to have different characters quite independent of their composition, and although silicon controls the condition of the carbon, phosphorus the fluidity, and manganese the chilling qualities, yet the presence or absence of these elements alone does not account for the differences familiar to those who use high-grade iron for special purposes. Details are given of the analysis and microscopical examination at various depths in a pig with a white chilled spot in the centre, known as "spotted iron," and which is useless for the manufacture of chilled car wheels. It is shown that the white chilled spot consisted of the eutectic containing 4·30 per cent. of carbon the existence of which is discussed with reference to the iron-carbon equilibrium diagram. It is concluded that:—(1) Spotted irons are the result of carbon segregation. (2) This segregation may occur in irons containing more or less carbon than the eutectic ratio, and is less marked the further the carbon is below this ratio. (3) When the fracture of an iron shows high cleavage at the edge it is most likely to be either at or above the eutectic ratio and to be a weak iron. (4) Close-grained spots not associated with cleavage may occur in irons of good quality especially where the silicon content is comparatively high. (5) There appears to be some further unknown factor which produces strength and high chill with a given silicon content in the same way as low carbon induces weakness and low chill with a given silicon content. The paper is illustrated by nineteen microphotographs which are discussed.—A. H. C.

[Iron.] Titanium in malleable castings; Further notes on the use of ——. C. H. Gale. Trans. Amer. Foundrymen's Assoc., 1912, 353—355. (See also this J., 1911, 958.)

Further results are given showing the effect of titanium upon the tensile strength and elongation of open-hearth malleable iron. The ferrotitanium employed contained Fe 70·18, Ti 20·66, Al 7·46, C 0·84, and Si 0·83 per cent. In the first series of experiments, in which from 0·25 to 0·35 per cent. of the alloy was added to the metal in the hand ladles, the quality of the product was found to be inferior to that of the untreated iron, this result being mainly attributed to the aluminium content of the alloy. In another series from 0·15 to 0·20 per cent. of the alloy was added to the metal in the bath or in the large receiving ladle and a distinct improvement in the mechanical qualities of the metal was observed. The iron employed in the investigation was of so good a quality, however, that the effect of the titanium was generally inconspicuous, the results indicating mainly that treatment of good metal with deoxidising alloys is unnecessary.—W. E. F. P.

Mild steel; Influence of arsenic on the properties of ——. J. Liedgens. Stahl u. Eisen, 1912, 32, 2109—2115.

Using a mild steel containing 0·08 per cent. C., 0·435 Mn, 0·020 P, 0·050 Si, 0·050 S, 0·177 Cu, 0·032 As, sixteen alloys were prepared ranging from 0·123 to 3·515 per cent. As, their complete compositions being given. Up to 2·8 per cent. cold-shortness rose rapidly in alloys containing from 0·4 per cent. or more but red-shortness was unaffected. The mechanical tests of bars welded both by the oxyhydrogen flame and electrically are tabulated and show a continually decreasing strength. The critical points of the alloys were lowered by addition of arsenic. All the alloys showed good rolling properties up to the highest arsenic content, and it was possible to make cylindrical articles containing up to 1·5 per cent. of arsenic, while the enamelling, tinning, and galvanising capability were unaffected. Tables and curves of the electrical and magnetic properties are given and it is shown that with a rising arsenic content the specific gravity and specific resistance are increased, the total watt-loss is lowered, the permeability, hysteresis, and coerciveness are advantageously influenced with a high arsenic content, the remanence and magnetisation remaining about the same, while the effect of ageing (estimated by measuring the total watt loss before and after heating for 240 hours at 110° C.) is stronger. It appears from the results that arsenic is not a dangerous constituent of mild steel accompany iron in practice, but that any changes of a favourable nature due to its presence are not so considerable as to warrant its introduction or use. The paper is illustrated by fourteen tables and sixteen curves.—A. H. C.

Undercooled solid solutions: Theory of ——, with an investigation of austenite and martensite. H. Hanemann. Int. Zeits. Metallogr., 1912, **3**, 127—140.

AFTER discussing the general theory of undercooled solid solutions and its applications, the author shows that in hypereutectoid steels austenite and martensite are distinct phases. This conclusion is reached because on heating to 650° C. (at which temperature they are both resolved into ferrite and cementite) the martensite needles are observed microscopically to yield much less cementite than the austenite. The martensite also is not decomposed at such a low temperature as the austenite. As martensite is formed from austenite in liquid air, the author has studied the volume changes associated with the transformation and finds there is always a considerable diminution in the specific gravity. These results were obtained by the immersion of specimens which had previously been quenched from about 1100° C. The same volume change is noticed even after annealing for 45 minutes at temperatures up to 260° C. If the annealing temperature is above 270° C., there is no change in volume on immersing in liquid air, showing that at 270° C. austenite is readily decomposed. This conclusion has been confirmed by microscopic investigation.—W. H. P.

Sulphur in pig-iron and steel; New method for the determination of ——. A. Vita and C. Massenez. Stahl u. Eisen, 1912, **32**, 2089—2090.

FROM 4—8 grms. of pig-iron, or 8 grms. of steel, are dissolved in hydrochloric acid in the usual manner and the hydrogen sulphide evolved is absorbed by an ammoniacal solution of cadmium sulphate prepared by dissolving 50 grms. of cadmium sulphate in 1 litre of concentrated ammonia and 9 litres of water. To minimise the amount of hydrochloric acid in the distillate, the top of the reaction flask is fitted with a special trap which is illustrated. If the distillate becomes too acid, ammonia is added from time to time. The solution containing the precipitated cadmium sulphide is boiled (in the case of pig-iron for 30 min.) in order to drive off the hydrocarbons and then diluted in another beaker with 600 c.c. of water containing 25 c.c. of sulphuric acid (1 : 1) and which has been made just red with standard potassium permanganate. It is now titrated slowly with constant stirring until the cadmium sulphide has disappeared and the solution remains pink for one minute. The value for the sulphur is one-eighth of the iron value of the potassium permanganate and the results of fifteen tabulated analyses show close agreement with gravimetric methods.—A. H. C.

Steel: Determination of chromium and vanadium in ——. D. J. Demorest. J. Ind. Eng. Chem., 1912, **4**, 895.

THE method described previously (this J., 1912, 436) for the determination of vanadium has been modified so that chromium may be determined as well in the same sample. Two grms. of the steel are dissolved, by heating, in a mixture of 12 c.c. of strong sulphuric acid and 50 c.c. of water, and when solution is complete, 25 c.c. of nitric acid (sp. gr. 1·42) are added. The solution is heated to boiling to expel nitrous fumes and oxidised with sodium bismuthate until the permanganate colour (produced by oxidation of the manganese) does not disappear on shaking. It is then diluted to 200 c.c., and, after addition of a little more sodium bismuthate, boiled for 20 minutes to decompose the permanganic acid. After cooling by adding 50 c.c. of water, the manganese dioxide is removed by filtering through asbestos, the filtrate is made up to 300 c.c., cooled, treated with 5 c.c. of syrupy phosphoric acid, and titrated with $N/100$ ferrous sulphate, using ferricyanide as external indicator. The solution now contains trivalent chromium and quadrivalent vanadium, and the latter is oxidised by titrating with $N/100$ permanganate, a slight excess of the latter being added and titrated back with ferrous sulphate: the c.c. of total ferrous sulphate minus the c.c. of permanganate × 0·0001733 represents the chromium. Excess of ferrous sulphate is now added and then 1 grm. of manganese dioxide, and after shaking until all ferrous iron is oxidised, the solution is filtered through asbestos (using suction) and the vanadium titrated with permanganate.—A. S.

Copper-slag formation; Rôle of alumina in ——. J. Buchanan and F. E. Lee. Met. and Chem. Eng., 1912, **10**, 795.

ON the assumption that the lime combines with the requisite amount of alumina to form a calcium silicate and aluminium, $Al_2O_3,3CaO,6SiO_2$, the alumina acting as a base and any excess over the amount required by this formula acting as an acid, an average monthly slag gave the figures shown in the following table:—

	Per cent.	Oxygen units.	
		Acid.	Base.
SiO_2	44·0	23·47	—
Al_2O_3	17·4	2·68	5·49
CaO	19·2	—	5·49
FeO	16·1	—	3·57
MgO	2·5	—	1·00
	99·2	26·15	15·55

This gives a base to acid ratio of 1·0 : 1·68, a good economic slag. It is stated that the addition or subtraction of lime to or from the charge beyond certain narrow limits proves from experience that the amount of alumina acting as a base is determined by the amount of lime present in the slag.—A. H. C.

Copper-cuprous oxide; Investigation of the dissociation pressures and melting points of the system ——. R. E. Slade and F. D. Farrow. Proc. Roy. Soc., 1912, A, **87**, 524—534.

THE melting points of mixtures of copper and cuprous oxide ranging from pure metal to 88·24 per cent. of copper having

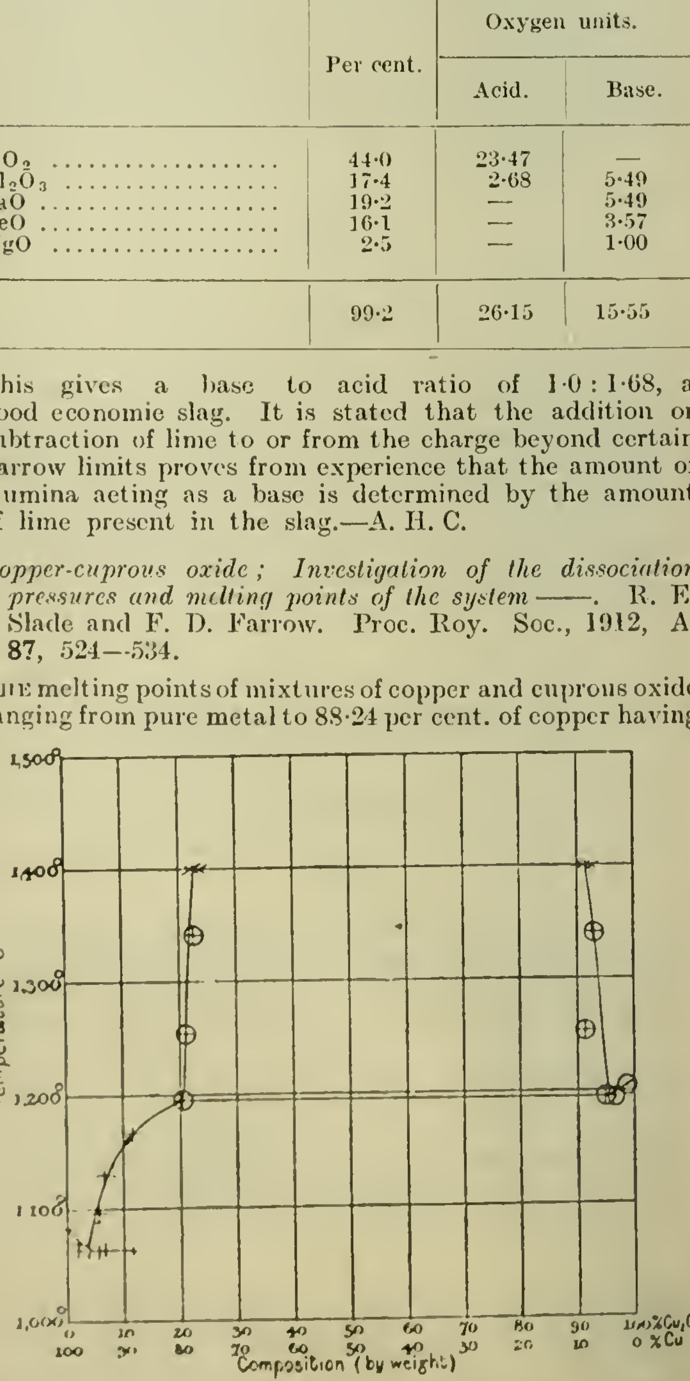


FIG. 1

been determined by Heyn (Z. anorg. Chem., 39, 11; this J., 1901, 996), the present investigation was confined to the remaining portion of the melting point diagram.

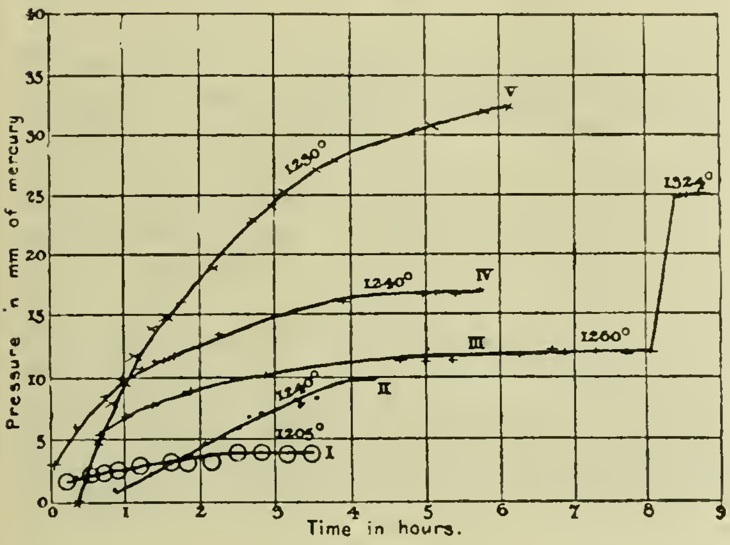


FIG. 2.

As shown in the diagram (Fig. 1)—in which the points marked + indicate the results obtained by Heyn—the system was found to be similar to that of phenol and water. At temperatures above 1195° C. mixtures containing between 20 and 95 per cent. of cuprous oxide were found to separate into two layers (the upper rich in cuprous oxide and the lower rich in copper): by increasing the temperature up to 1400° C. the solubility of one liquid phase in the other was found to be slightly increased—but the authors consider it possible that the quenching of the charges may not have been sufficiently rapid and that in all the experiments the equilibrium obtained was approximately that at 1195° C. The m. pt. of pure cuprous oxide is about 1210° C. For the determination of the dissociation pressures, the furnace described on page 31 was employed, with the addition that to the glass exit-tube projecting through the base was sealed a U-tube connected with the vacuum gauge and Töpler pump; during the experiments this U-tube was immersed in liquid air for the purpose of condensing any sulphur dioxide and carbon dioxide evolved from the magnesia boats employed as containers for the charges. The pressure of the system was too small, and equilibrium obtained too slowly, for any determinations to be made at temperatures below 1200° C.; but at 1205°, 1240°, 1260° and 1324° C. the pressures obtained were respectively 4, 10, 12 and 25 mm. of mercury. The results are shown in Fig. 2; curves I. to IV. are dissociation curves of the system, liquid (1)—liquid (2)—gas: curve V. is that of the di-variant system, liquid—gas at 1230° C., and in this case, owing to the absence of sufficient copper to form two liquid phases, no equilibrium was reached. As the result of an experiment to determine the influence of a small piece of platinum upon the dissociation pressure at 1240° C. it was found (curve IV.) that the latter was raised from 10 to 16 mm. In the course of the investigation it was found that cuprous oxide volatilises *per se* and not only by dissociation and subsequent re-combination of its constituents; at 1300° C. a small piece of cuprous oxide was completely volatilised in air from a strip of platinum.—W. E. F. P.

Copper and brass; Electric melting of ——. G. H. Clamer. Trans. Amer. Inst. Metals, 1912. [Advance copy.]

THE author suggests that the advantage to be derived from the use of the electric furnace will not so much reside in a reduction of the melting costs as in a diminished loss of metal and the avoidance of sulphur absorption from the furnace gases. It is stated that, even in a closed crucible, brass absorbs 0·02 to 0·05 per cent. of sulphur during melting in a coke furnace.—R. W. N

Brass melting; The electric furnace for ——. G. H. Clamer and C. Hering. Trans. Amer. Inst. Metals, 1912. [Advance copy.]

THE cost of electric energy is not necessarily the most important factor to be considered. To be cheaper than fuel heat, electric heating must possess other advantages, such as the greater heat-efficiency of the electric than of the fuel furnace. As many of the objectionable features of fuel heating do not appear below high temperatures, probably an advantageous method will be to preheat with fuel, developing higher temperatures by electricity. By casting direct from tilting furnaces, the necessity for overheating is abolished, and by the electric furnace the metal may be melted entirely in a non-oxidising or even a reducing atmosphere. This greatly reduces volatilisation losses. The abolition of crucibles constitutes another point in favour of the electric furnace, which also presents advantages as regards cleanliness, convenience and comfort. To melt and superheat to casting temperature, say 1000° C., 100 lb. of ordinary brass requires about 6·9 kilowatt-hours, assuming cold metal at the start and no loss of heat. It is shown that the saving due to the decrease in loss of metal with electric heating considerably exceeds the total cost of electric energy required. After outlining the various types of electric furnaces, the authors advocate the adoption of a resistance furnace in which agitation of the bath is obtained by the "pinch" effect. Figures are given for the electrical and fuel consumption in metal-melting work; these are compiled from various sources, and are put forward as approximately correct.
—R. W. N.

Tin concentrate; Notes on the valuation of Nigerian —— R. T. Hancock. Inst. Min. and Met., Dec. 19, 1912 [Advance proof.]

IN the "field" methods adopted, the tin concentrate is valued on the basis of its specific gravity. The clean concentrate consists essentially of cassiterite and "black sand" (magnetite, ilmenite, rutile and zircon) with a small quantity of monazite. Since all the constituents of the "black sand" (in which ilmenite largely predominates) have practically the same sp. gr., this material may be regarded as homogeneous within a wide range of composition. The sp. gr. of monazite is between those of "black sand" (about 4·5) and cassiterite (about 7), but as this constituent is rarely present in quantity, the proportion of cassiterite present in a concentrate of known sp. gr. may be calculated, it is stated, with a fairly close approximation to the truth. The concentrate is purchased in the dry state by measure, the current local unit being the "cash bowl"; the cash value of a "bowl" of concentrate is ascertained by means of the formula :—

$$\begin{array}{c}\text{Cash value}\\ \text{per bowl}\end{array} = \begin{array}{c}\text{Weight}\\ \text{per bowl}\end{array} \times \left(\begin{array}{c}\text{Weight}\\ \text{per bowl}\end{array} - \begin{array}{c}\text{Weight of}\\ \text{“zero” bowl}\end{array}\right) \times \frac{\text{Cash value of “standard” bowl}}{\text{Weight of “standard” bowl}}$$

the terms "zero" and "standard" indicating respectively barren "black sand," etc. and concentrate of known market value.—W. E. F. P.

Tin; Notes on the direct volumetric determination of ——. H. J. B. Rawlins. Inst. Min. and Met., Dec. 19, 1912. [Advance proof.]

IN an investigation to ascertain the degree of accuracy attainable by technical methods in the direct determination of tin in the commercial metal, the following processes were employed :—(1) Titration with excess of ferric chloride and working back with a dilute solution of titanium chloride (method of Knecht and Hibbert; compare this J., 1905, 1192), (2) titration with ferric chloride, employing starch and cuprous iodide as indicator, (3) titration with iodine. The procedure adopted in the second and third methods consisted in oxidising the bulk of the stannous chloride by the addition of a definite volume of a strong solution of ferric chloride or iodine from an automatic burette, and completing the titration with a corresponding weak solution. It was found that by treating 1 grm. of the metal (thinly rolled or in the form of filings) with 30 c.c. of cold or slightly warm concentrated hydrochloric acid in a flask through which a current of carbon dioxide was maintained and into which a small piece of marble had been previously placed, solution was effected in from 45 to 90 minutes, the whole of the tin being retained in the stannous condition. In determinations made by the three methods upon commercial tin containing only traces of antimony, the maximum differences obtained (in terms of tin) were 0·14 per cent. by the first, 0·15 by the second and 0·10 by the third process. Copper in small quantity was found to be practically without influence on the titanium chloride titration; it is generally known, however, that finely divided antimony is dissolved by solutions of ferric chloride and iodine, but since this constituent is present in only the smallest quantity in many brands of commercial tin—and when present may be determined and allowed for—the author considers that the results for tin obtainable by the direct methods indicated are not only sufficiently accurate for technical purposes, but in many cases more correct than those obtainable by the "difference" method involving rapid technical determinations of the impurities.—W. E. F. P.

Nickel; Detection of minute quantities of ——. V. Fortini. Chem.-Zeit., 1912, **36**, 1461.

The author has found Bianchi and Di Nola's modification of the dimethylglyoxime test (Boll. Chim. Farm., 1910, **49**, 517) very satisfactory, but troublesome, and has modified it as follows, especially for use with metallic articles containing nickel:—0·5 grm. of dimethylglyoxime is dissolved in 5 c.c. of 98 per cent. alcohol, and 5 c.c. of concentrated ammonia are added. The clear, pale yellowish solution obtained keeps for a long while in glass-stoppered bottles. The surface of the metal to be tested is cleaned with ether, and a drop of the reagent is brought upon it: traces of nickel oxide show as red specks in a few seconds before any copper present can dissolve and turn the reagent blue. With fresh and unoxidised surfaces it is advisable to heat a small spot with a small oxidising flame, and apply the reagent after cooling. The test is extremely delicate, and leaves no permanent traces even on a polished surface.—J. T. D.

Copper-cadmium-antimony alloys; The ternary system ——. A. Schleicher. Int. Zeits. Metallogr., 1912, 3, 102—126.

The various binary mixtures in this system include the following compounds, Cu_2Cd, Cu_2Cd_3, Sb_2Cd_3, SbCd, $SbCu_2$, $SbCu_3$. The author's scheme for the investigation of the equilibrium diagram includes the survey of the various sections between these compounds. He has already been able to show that the sections, $SbCu_2$—SbCd, Cu_2Cd_3—Sb_2Cd_3, and Cu_2Cd—$SbCu_3$ are practically binary in type; in the mixtures of these three series the only compounds which crystallise are those which correspond to the end-points of the respective series. It is probable also that $SbCu_2$ forms similar systems with Cu_2Cd_3 and Sb_2Cd_3. That portion of the total system represented by $SbCu_2$-Sb-SbCd has also been more closely studied. The various binary eutectic curves in space meet at a ternary eutectic point (400° C., 18·5 atomic per cent. of copper, 47·5 of antimony and 34 of cadmium). In the system Sb-Cd, the initial crystallisation does not yield the compound, SbCd, but Sb_2Cd_3 is first formed at a lower temperature and SbCd is subsequently formed from this with evolution of heat. To get true cooling curves therefore it is necessary to inoculate with SbCd. The same phenomena occur in the ternary system, so that a metastable ternary system $SbCu_2$-Sb-Sb_2Cd_3 is formed.—W. H. P.

Magnesium, zinc, and cadmium; Ternary alloys of ——. G. Bruni and C. Sandonnini. Z. anorg. Chem., 1912, **78**, 273—297.

In this and a previous paper (Z. anorg. Chem. 1910, 73) the authors give the results of a complete thermal and micrographic investigation of the ternary alloys of magnesium, zinc and cadmium. The binary zinc-cadmium alloy show a eutectic point at 262° C. with 26·5 atomic per cent. of zinc. The cadmium holds about 2 atomic per cent. of zinc in solid solution. Magnesium and zinc form a compound, $MgZn_2$ (m. pt. 589° C.) and two eutectics containing respectively 7·5 atomic per cent. of magnesium (m.p. 363° C.) and 72 atomic per cent. of magnesium (m.p. 340° C.). Magnesium and cadmium give a compound, MgCd (m.p. 424° C.) which forms an unbroken series of solid solutions with both components. The compound, MgCd, exists in two forms, the transition temperature being 248° C. The ternary system has only one true triple eutectic point (250° C., 73 atomic per cent. Cd, 25 Zn, and 2 Mg) and may be divided as regards primary crystallisation into three areas. The largest range of alloys covering over two-thirds of the triangular diagram is that which gives the compound, $MgZn_2$. A narrow strip covering about one-fifteenth of the triangle corresponds to primary zinc separation, while the remainder is a region in which a solid solution is the first product to separate. The number of alloys studied has been nearly 200 and the paper is illustrated by 40 photomicrographs which are described and discussed.
—W. H. P.

Cobalt-chromium alloys. E. Haynes. Met. and Chem. Eng., 1912, 10, 804—806.

In continuation of previous work on cobalt-chromium alloys (this J., 1910, 1253) an account is given of some further alloys with tungsten and molybdenum. Tungsten alloys readily with chromium and cobalt in all proportions, having little influence in small quantities; above 3 per cent. the alloy becomes harder and more elastic especially in the presence of small quantities of carbon, boron, or silicon. Keeping the chromium at 15 per cent. a forgeable alloy suitable for cold chisels and wood-working tools is obtained when the tungsten reaches ten per cent. As the tungsten content rises to 20 per cent. the forgeability decreases, and at 25 per cent. a very hard alloy results which cannot be forged to any extent, but can be cast into bars and ground to a suitable form for lathe tools and these are very strong and retain their hardness at speeds which instantly destroy the cutting edge of steel tools. An alloy containing 40 per cent. of tungsten readily scratches quartz and in the lathe will turn up 49 cast-iron wheels without losing its edge; in the same time a steel tool will do only 26 wheels and requires to be ground fifty times during the operation. Alloys having similar properties are produced by the addition of molybdenum to a similar cobalt-chromium alloy, a smaller quantity of molybdenum than of tungsten being required to produce the same increase in hardness.—A. H. C.

Alloys; Test-bars for non-ferrous ——. G. H. Clamer. Trans. Amer. Inst. Metals, 1912. [Advance copy.]

This brief report of the Committee of the American Institute of Metals which, in conjunction with the U.S. Bureau of Standards, has fixed a programme for the investigations, indicates that suitable equipment is being installed at Pittsburgh. It has been decided to work on one alloy at a time, and the well-known alloy containing 88 per cent. of copper, 10 per cent. of tin, and 2 per cent. of zinc has been selected for the first investigations. The subjects considered include: dimensions; methods of casting and gating; conditions of casting; relationship between chill and sand cast alloys; and the amount of shrinkage on a 12 in. bar.—R. W. N.

Metals; Vaporisation of ——. J. W. Richards. Trans. Amer. Inst. Metals, 1912. [Advance copy.]

Metals have vapour tension curves similar to that of water. Like ice, metals have some vapour tension in the solid state. Zinc, boiling at 920° C., has an appreciable vapour tension at 289° C., which is 130° C. below its melting point. Silver can evaporate from solid ingots if heated in a flame, the gases carrying off some silver vapour. Heating in closed vessels is an effective way of checking such volatilisation losses, especially the use of the electric furnace.—R. W. N.

Copper-tin alloys; Electric conductivity of ——. Ledoux. Comptes rend., 1912, **155**, 1249. (See also this J., 1912, 728.)

A correction of certain figures given previously (*loc. cit.*).

Patents.

Pyrites and other iron sulphides; Metallurgical treatment of ——. L. T. Wright, San Francisco, U.S.A. Eng. Pat. 26,128, Nov. 22, 1911.

In a process for the manufacture of iron and the extraction of sulphur from pyrites, etc., the latter is heated in an electric furnace suitably enclosed for the recovery of the sulphur by distillation.—W. E. F. P.

Steel reheating furnaces and the like; Method of reducing the smoke from ——. V. Stobie, Sheffield. Eng. Pat. 2597, Feb. 1, 1912.

In the usual method of reheating, the smoky flame from the fire employed is conducted into the reheating chamber to protect the steel from oxidation and violent heating. According to the present invention, the same purpose is served—with a minimum discharge of black smoke—by conducting the operation in a closed muffle into which small quantities of coal, tar, etc., are periodically introduced, the muffle being heated by means of a smokeless fire.—W. E. F. P.

Iron; Bath for the electrolysis of ——. G. Tischenko, St. Petersburg. Eng. Pat. 5853, March 8, 1912.

The bottom of the bath is provided with projections in the middle and at the sides for supporting the anode and cathode. The walls and the bottom are formed of a mixture of cement and coarse sand, reinforced if necessary with iron bands, and the internal surfaces of the bath are dressed with a mixture of cement and finer sand.—B. N.

Iron; Electrolytic production of malleable ——. H. Plauson and G. Tischtschenko. Ger. Pat. 252,875, June 15, 1911.

Electrolysis is conducted at temperatures between 50° and 70° C. in an electrolyte containing a double ferrous salt, acidified by acids with simple or complex anions, or by acid salts of the alkali metals, or by acid salts with complex anions. The double ferrous salts of the type, $FeNaCl_3$ or Fe_2MgCl_6, may be obtained by one of the three following methods:—(1) Electrolysis is effected between iron anodes and iron cathodes in a solution of an acid and of the salt which is to form a component of the double salt, acid being added continuously during the process, and an inert gas (carbon dioxide when alkali salts are employed or hydrogen when alkaline-earth salts are used) being passed through the electrolyte. (2) A ferric salt is mixed with a "conducting salt," the mixture is melted *in vacuo* or in an atmosphere of hydrogen, and the requisite quantity of an alkali or alkaline-earth metal is added. (3) A solution of a ferrous salt and another salt is heated to boiling *in vacuo* or with exclusion of air, and a ferrous salt is added, whilst the solution is kept boiling under non-oxidising conditions.—A. S.

Iron or other metals; Manufacture of alloys of ——. L. Weiss. Ger. Pat. 250,891, Jan. 18, 1910.

For the production of alloys from metals which are partly in the form of fine powder and partly in the form of coarser particles, these are intimately mixed with a suitable binding material, the melting point of which is equal to or higher than that of the alloying metals. The mixture is formed into briquettes, which are then smelted. A suitable binding material is water-glass (or chlorides in certain cases), to which is added an oxide of a metal forming one of the constituents of the alloy, and also, if necessary, borax in order to lower the melting point. The process may be applied to the production of cast iron from cuttings of steel and ingot iron, the latter being broken up, mixed with powdered wood charcoal and ferrosilicon, fine sand, and a binding agent (water-glass mixed with manganese dioxide, magnesia, or levigated chalk), formed into briquettes, and smelted either alone or together with pig iron.—A. S.

Iron and steel in open-hearth furnaces; Process for separating slag from ——. K. O. Friedrich and Oberschlesische Eisenindustrie, A.-G. für Bergbau und Hüttenbetrieb. Ger. Pat. 250,996, Dec. 9, 1911.

A ladle or other similar device, operated mechanically or by hand, is introduced into the furnace, and immersed in the charge close under the molten slag, so that the latter flows into the ladle, unaccompanied by any considerable quantity of the molten metal. The ladle is protected by a coating of refractory acid or basic material, and is preferably constructed with one side considerably higher than the other, the projecting portion being provided with an opening through which any molten metal, carried over with the slag, can be run off before discharging the latter.—A. S.

Steel or ingot iron; Process for the addition of ferromanganese, ferrosilicon, ferrochrome or the like to molten ——. M. Daelen. Ger. Pat. 250,997, Oct. 5, 1911.

The ferromanganese or the like is added in the form of pieces around which cast iron or mild steel has been cast, and if desired with the inclusion also of suitable substances capable of developing heat.—A. S.

Steel; Process for the manufacture of refined ——. Dellwik-Fleischer Wassergas-Ges. m. b. H. Ger. Pat. 250,999, Nov. 1, 1911.

The vessel containing the molten steel is heated to the desired degree and then placed in a receptacle in which a vacuum is maintained.—A. S.

Siemens-Martin furnace. Gutehoffnungshütte, Aktienverein für Bergbau und Hüttenbetrieb. Ger. Pat. 252,503, Nov. 15, 1911.

The heating gases pass into the furnace from the gas chambers through passages in the fire-bridge, so that the crown of the furnace contains only the air-admission channels.—A. S.

Iron; Process for dephosphorising —— *in Bessemer converters by means of ferric oxide and lime.* A. F. dit A. Pasquier. Ger. Pat. 252,504, Dec. 1, 1911.

A mixture of iron oxide and lime is introduced by means of the blast and the slag produced is tapped off periodically during the process, whereby, it is claimed, the whole of the phosphorus is removed in the slag as calcium phosphate, and the usual after-blow and recarburisation of the metal are rendered unnecessary.—A. S.

Ferromanganese low in phosphorus; Production of —— *from manganese ores or ferromanganese containing phosphorus.* G. Lang. Ger. Pat. 252,166, Feb. 7, 1911.

The ferromanganese containing phosphorus is subjected to an oxidation process at about 1200° C., using manganese dioxide as oxidising agent, whereby the phosphorus is removed without notable loss of manganese. In the treatment of ore, this is first worked up into ferromanganese containing phosphorus, and the latter is then dephosphorised, if necessary after cooling. Both stages of the process are carried out in the same furnace, preferably in an electric furnace.—A. S.

Sulphide ores or metal-bearing solutions; Treatment of ——, *and the production of ammonia or ammonium salts or other nitrogenous compounds.* E. A. Ashcroft, Balestrand, Norway, and London. Eng. Pat. 25,506, Nov. 15, 1911.

A solution containing zinc is heated, with or without pressure, with a metallic cyanide or cyanamide, so as to obtain the zinc in the form of insoluble oxide, hydroxide, or carbonate, and the nitrogen either as ammonia or as cyanogen compounds, such as hydrogen cyanide, dicyandiamide, etc. Two examples are given: (1) A mixed sulphide ore, after removal of lead, silver, etc., is treated by means of chlorine so as to obtain a solution of the remaining metals, as described in Eng Pats. 19,257 of 1911 (this J., 1912, 931), 24,170 of 1911, 6670, 7329, and 7444 of 1910 (this J., 1911, 493, 552), and the solution, containing zinc, etc., as chlorides, is mixed with commercial calcium cyanamide, the requisite amount being deduced from the equation,

$$CaCN_2 + ZnCl_2 + 4H_2O = Zn(OH)_2 + 2NH_3 + CaCl_2 + CO_2.$$

The emulsion is then treated with steam under pressure at about 150°—300° C., so as to drive off the ammonia, which is made to react with the sulphur gases from the zinc ore treatment, so as to give ammonium sulphate, or is utilised in other manner, and the calcium chloride solution resulting from the reaction is separated by filtration from the residue, which constitutes a valuable zinc smelting ore, containing lime and a considerable proportion of graphitic carbon; or, the zinc solution is employed so concentrated that on adding the cyanamide a stiff paste is produced which is subsequently heated to 200°—500° C. and finally to about 600° C., whereby water, ammonia, and (ultimately) carbon dioxide are expelled. Steam, with or without superheating, may be admitted during this operation, and the residue, after washing out the soluble chloride, is smelted for zinc. (2) Zinc solutions obtained as in (1) are treated with sodium cyanide or barium cyanide, and the mixture is heated as above described. Hydrogen cyanide is formed and is employed for the production of cyanides, preferably by absorption in the secondary electrolyte employed in the process described in Eng. Pat. 228 of 1910 (see Fr. Pat. 421,851 of 1910; this J., 1911, 422). The solution of sodium chloride or barium chloride obtained by filtration may be utilised for producing, by electrolysis, the chlorine required in the zinc ore treatment, cyanides or hydroxides being simultaneously produced. The residues from treating calcium cyanamide with water and steam under pressure, for the production of ammonia, may be advantageously employed in the process, with or without a cyanide or cyanamide, and the operations of producing dicyandiamide, etc., from calcium cyanamide and a zinc-smelting product from zinc chloride solution may be combined, by treating commercial calcium cyanamide, for example, with water and using the clear solution for the production of dicyandiamide, etc., whilst the insoluble residue is utilised in treating the zinc solution, all or part being added, so as to introduce more or less carbon, according to the requirements of the smelting operation.
—F. Sodn.

Metallic salts; Deposition of —— from solutions containing them. H. J. Rees, Llansamlet, Glamorgan, and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 25,919, Nov. 20, 1911.

In the process described in Eng. Pat. 7222 of 1911 (see Fr. Pat. 433,477 of 1911; this J., 1912, 230), for the extraction of zinc from complex sulphide ores, these are first roasted and then treated with sulphur dioxide in the presence of water to form zinc bisulphite and sulphate. The monosulphite and a portion of the sulphate are removed from the solution, by passing the liquid in a continuously moving thin film over a heated surface or in cascade over a number of heated surfaces, the films being subjected to the action of hot gases from a coke fire. A portion of the liquor after this treatment is removed, and the remainder is made up to the original bulk with water for further use in the extraction. The separated portion is evaporated to crystallise out the zinc sulphate, and the latter, together with the bisulphite, then heated in a reverberatory furnace by a neutral or reducing flame to a temperature of 800° to 950° C., so as to produce zinc oxide.—B. N.

Furnaces; Metallurgical ——. V. Stobie, Sheffield. Eng. Pat. 26,184, Nov. 23, 1911.

Claim is made for the combination, with an ordinary electric steel melting or refining furnace, of apparatus for auxiliary firing by means of oil or illuminating gas.
—W. E. F. P.

Metal mixers, open hearth furnaces, and the like. B. W. Head, London. Eng. Pat. 26,240, Nov. 23, 1911.

The port block or burner is mounted on a carriage provided with wheels capable of running on rails, arranged parallel to the centre line of the furnace and supported on an under carriage. The latter is also provided with wheels capable of running on rails, arranged at right angles to the centre line of the furnace. In this way the burner may be moved away from the furnace, either sideways or endways.—W. H. C.

[Crucible] furnaces for melting, smelting, refining and other like purposes. S. W. Price, London. Eng. Pat. 4989, Feb. 28, 1912.

For use with crucible and other furnaces of rectangular shape, claim is made for a removable, sectional cover, each section of which is placed transversely of the furnace and consists of two or more refractory bricks of "stock" size, held together by an iron frame provided with a handle or ring for lifting.—W. E. F. P.

Furnace. A. W. Ekstrom, Los Angeles, Cal. U.S. Pat. 1,044,763, Nov. 19, 1912.

A reducing furnace is provided with a number of horizontal reducing chambers or muffles arranged vertically one above the other within an outer heating chamber. A liquid reducing agent is injected into the upper muffle where it vaporises, and the vapour then passes successively through the lower reducing chambers which progressively increase in temperature. The hot gases resulting from the reaction are burnt and utilised for heating the furnace. The material to be reduced passes through all the muffles in turn, being successively discharged through downwardly flaring shoots.—H. H.

Aluminium or its alloys; Treatment of surfaces of —— for the [electrolytic] deposition of metals thereon. Q. Marino, London. U.S. Pat. 1,045,718, Nov. 26, 1912.

The surfaces of aluminium or its alloys are prepared for the electrolytic deposition of metals thereon by treating them with a solution containing a metallic fluoride, *e.g.*, tin fluoride, and a tartrate, *e.g.*, potassium tartrate.—A. S.

Iron or steel; Process of coating —— with copper or alloys of copper. W. S. Rockey and H. Eldridge, New York. Eng. Pat. 21,661, Oct. 2, 1911.

See Fr. Pat. 434,971 of 1911; this J., 1912, 342.—T. F. B.

Iron articles which will withstand the action of acids and heating; Alloy for use in the manufacture of ——. H. Sefton-Jones, London. From Grohmann und Co., G.m.b.H., Cologne, Germany. Eng. Pat. 27,151, Dec. 4, 1911.

See Fr. Pat. 437,144 of 1911; this J., 1912, 439.—T. F. B.

Metals; Processes for extracting —— from ores. H. S. Mackay, Riverside, Cal., U.S.A. Eng. Pats. 27,343 and 27,344, Dec. 6, 1911.

See Fr. Pats. 437,481 and 437,841 of 1911; this J., 1912, 542.—T. F. B.

Atomising metals, minerals, and the like; Process of and apparatus for ——. J. M. Neil, New York. Eng. Pat. 1350, Jan. 17, 1912.

See U.S. Pat. 1,036,689 of 1912; this J., 1912, 932.—T.F.B.

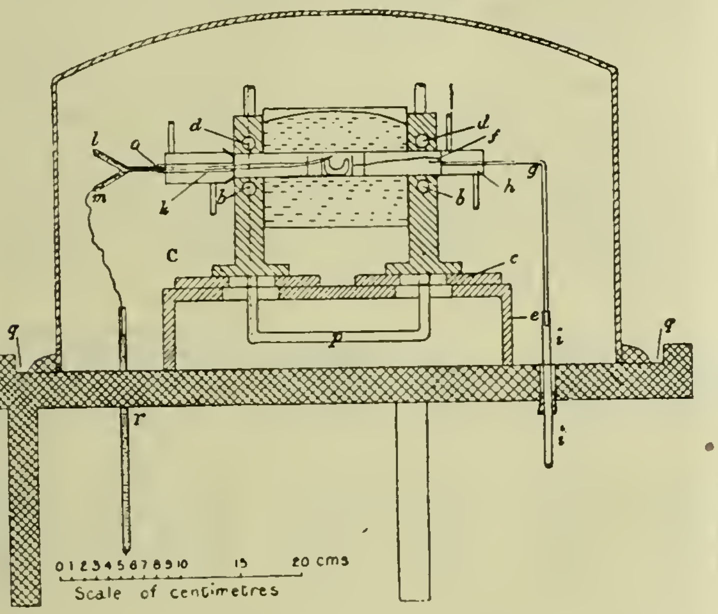
Roasting furnaces; Mechanical ——. G. G. M. Hardingham, London. From Metallbank und Metallurgische Ges. A.-G., Frankfort-on-Maine, Germany. Eng. Pat. 16,346, July 12, 1912.

See Fr. Pat. 445,527 of 1912; this J., 1912, 1186.—T.F.B.

XI.—ELECTRO-CHEMISTRY.

Electric furnace for experiments in vacuo at temperatures up to 1500° C. R. E. Slade. Proc. Roy. Soc., 1912, A, **87**, 519—524.

The furnace (see fig.) consists of a horizontal platinum tube, 2 cm. in diameter, 17·5 cm. long and with walls 1 mm. thick, mounted at each end in a water-cooled brass terminal and enclosed—between the terminals—in an asbestos box filled with magnesia. The lower parts of the terminals are screwed to the wooden bases, *c,c*, each of the latter having a central opening through which passes a brass tube conveying water to the cooling channel, *b*; the brass tubes of both terminals are connected by a rubber tube, *p*. One of the wooden bases, *c*, is fixed to the wooden bridge, *e*, the other being free to take up the expansion of the platinum tube on heating. One end of the platinum tube is closed by a soldered silver plate, *f*, into an opening in which a bent silver capillary tube, *g*, is soldered; the other end is closed by a ground-in stopper or plate of silver into a central opening in which a horizontal silver tube, *k*, is soldered. The fittings at either end of the platinum tube are prevented from becoming hot by means of the cooling chambers, *h,h*, through which cold water is circulated. The lower end of the capillary tube, *g*, fits easily into the thick-walled glass tube, *i*, the joint being made gas-tight by means of a hard wax of low m. pt. The ground joint at the opposite end of the platinum tube is made gas-tight (after the introduction of the charge) by means of a soft wax which does not harden on cooling; into the horizontal silver tube, *k*, at this end of the apparatus a glass Y-piece (through which the thermo-couple is sealed at *l* and *m*) is fitted, the joint, *o*, being made permanently gas-tight by means of the hard wax. The boat containing the charge is placed in the middle of the platinum tube and is protected from radiation to the cool ends by means of two discs of platinum at each side. To prevent collapse of the tube when the interior is exhausted, the furnace is mounted upon a cast iron base and covered with an iron dome, the space thus enclosed being in communication with two Bunsen filter-pumps and a pressure gauge. The necessary connections to the furnace (leads for the current, etc.) are made through holes bored in the cast iron base, the holes being fitted with rubber stoppers through which the respective connections pass; a manometer and Töpler pump are sealed to the glass tube, *i*, projecting through the base. The two ends of the thermo-couple dip into glass tubes (one of which, *r*, is shown in the figure) containing mercury; each of these tubes has a platinum wire sealed through the bottom and projects into a wider tube containing mercury into which dip the wires leading to the measuring instrument. The current required to heat the furnace to 1400° C. is about 350 amp. at 3 volts when the enclosure is exhausted, the power necessary to maintain a given temperature being greater as the pressure is increased. —W. E. F. P.



Apparatus for testing water by measurement of its electrical conductivity. Archbutt. *See* XIXb.

Patents.

Cathodic reduction; Preventing ——. A. Pietzsch and G. Adolph, Munich, Germany. Eng. Pat. 22,028, Sept. 27, 1912. Under Int. Conv., Oct. 7, 1911.

A porous non-conducting thread, capable of resisting chemical attack, is wound tightly round the cathode so that the whole surface is covered, and so that the hydrogen escapes between the turns of the thread into the anode compartment.—B. N.

Insulation of electrical coils or the like. J. E. Pollak, London. From Specialfabrik für Aluminium-Spulen und Leitungen G. m. b. H., Berlin. Eng. Pat. 25,672, Nov. 17, 1911.

The conductor or coil to be insulated is coated with any known adhesive or binding agent, and disintegrated flaky insulating materials, such as mica flakes, are applied without the use of pressure, so that the binding agent is not forced into the spaces or cavities between the flakes of insulating substance. The air, which is thus entrapped, increases the insulating effect. The flaky substance may be applied by sprinkling, blowing, or by dipping the coil in the material. In an alternative method, the coil and the flaky substance are placed in a closed vessel whilst the binding agent is still sufficiently moist, the coil or the vessel being then moved, or the insulating flakes agitated, so as to bring about intimate contact between the binding medium and the flakes, with uniform distribution of the latter.—B. N.

Cryolite-rutile [*insulating*] *composition.* E. Kraus, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,045,985, Dec. 3, 1912.

See Eng. Pat. 28,869 of 1911; this J., 1912, 995.—T. F. B.

Electrode of secondary batteries. H. Garde and A. J. Adams, London. U.S. Pat. 1,046,288, Dec. 3, 1912.

See Eng. Pat. 9066 of 1909; this J., 1910, 1317.—T.F.B.

XII.—FATS; OILS; WAXES.

Earthnut [*arachis*] *oil in olive oil; Detection of —— by the Franz-Adler method.* H. Lüers. Z. Unters. Nahr. Genussm., 1912, **24**, 683—684.

Two samples of olive oil examined by the author yielded a considerable amount of precipitate at 16° C. when submitted to the test described by Franz and Adler for the detection of arachis oil (this J., 1912, 691), but this oil was proved to be absent by means of the lead-soap method of Tortelli and Ruggeri (this J., 1898, 876). Further investigation showed that the two oils in question contained abnormally high proportions of myristin and that the precipitate obtained in the Franz-Adler test consisted of the acid potassium salt of myristic acid ($KC_{14}H_{27}O_2{\cdot}C_{14}H_{28}O_2$). The production of a turbidity or precipitate in the course of the test, owing to the formation of this salt, may be prevented by adding 3 drops of glacial acetic acid (in addition to the usual quantity of dilute acetic acid) to the saponified oil. If preferred, the test may be carried out as described originally, and the additional quantity of acetic acid added only in those cases where a turbidity is obtained, the mixture being warmed until clear and then cooled.—W. P. S.

Cotton-seed foots; Investigation of the methods for the determination of total fatty acids in ——. F. N. Smalley. J. Ind. Eng. Chem., 1912, 4, 893—895.

The author has examined a number of proposed modifications of, and substitutes for, the official method of the Interstate Crushers' Association (U.S.A.) (see this J., 1911, 906). He concludes that the most accurate results are obtained by the official method modified as follows:—

The crude fatty acids on the filter-paper are transferred to the original beaker and dissolved by the addition of 100 c.c. of gasoline (b. pt. not above 75° C.), the mixture being boiled for a few minutes on a hot plate. The solution is filtered through a dry paper and the residue treated with successive small portions of gasoline until the fat is completely dissolved. In case only two such extractions are given, it is recommended that the filter-paper and residue be extracted in a Soxhlet apparatus.
—A. S.

Sesamé oil-cake; Examination of ——. A. Grégoire and E. Carpiaux. Bull. Soc. Chim. Belg., 1912, **26**, 479—485.

Samples of reputed linseed oil-cake were found on microscopic examination to contain sesamé oil-cake. To obtain data for a chemical determination of the adulterant, 19 samples of sesamé oil-cake of different origin were examined with the following results:—

	Organic matter.	Crude ash.	Pure ash.	Earth.	Fat.	Acidity of fat as oleic acid	Oxalic acid anhydride (C_2O_3)	Calcium oxide.	Calcium oxide in pure ash.	In dry substance less fat and earth. C_2O_3	In dry substance less fat and earth. CaO	Ratio $\frac{CaO}{C_2O_3}$
Sesamé oil-cake	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Maxima	83·11	12·43	9·94	3·22	23·40	123	2·38	3·41	39·8	2·96	4·66	2·70
Minima ..	78·01	8·16	6·03	0·44	7·39	13	1·07	2·16	28·4	1·44	3·20	1·43
Mean	79·97	10·71	8·55	1·86	13·65	58	1·50	2·93	34·5	1·99	3·92	2·03
Sesamé seed	92·31	3·28	3·19	0·09	58·87	9	0·86	1·09	34·2	2·35	2·98	1·27

According to Kellner (*Principes Fondamentaux de Alimentation de Bétail*) sesamé oil-cake contains 2·56 per cent. of calcium oxide, whilst linseed oil cake contains only 0·43 per cent. In Wolff's tables the only plants with seeds whose ash contains more than 30 per cent. of calcium oxide are sainfoin, carrot, chicory, poppy, and *Alnus glutinosa*. With regard to the oxalic acid in sesamé seed Hebebrand (*Landw. Vers. Stat.*, 1899, 69) found 2·71 per cent. in white East Indian seed, 2·12 per cent. in black East Indian seed, and only 0·48 per cent. in Levant yellow seed. The authors point out, however, that Levant seed is not very common in commerce, and that the seeds met with in the ordinary refineries are those of *Sesamum indicum* and *S. radiatum*. The ratio between the oxalic acid and calcium oxide in calcium oxalate is 0·78, so that sesamé seed contains a large proportion of calcium salts other than oxalate. It is therefore necessary to base a valuation of the proportion of sesamé oil-cake in a mixture upon the average of the two results. For example, the adulterated oil-cake mentioned above was calculated from the amount of lime to contain 30 per cent. of sesamé oil-cake, and from the amount of oxalic acid 20 per cent. Hence the conclusion was drawn that it contained approximately 25 per cent. of sesamé oil-cake.
—C. A. M.

Wood oil; Examination of Chinese and Japanese ——. A. C. Chapman. Analyst, 1912, **37**, 543—552.

In determining the purity of a sample of wood oil, the analytical values which are of the most importance are the specific gravity, the iodine value, the refractive index, the viscosity, and the manner in which the oil polymerises when heated. Seventeen samples of the oil, obtained from Hankow, yielded the following results:—

	Sp. gr. 15°/15° C.	Iodine value (Wijs).	Saponif. value.	Refractive index 20° C.	Viscosity.
Minimum	0·9406	166·4	192·0	1·5170	1636
Maximum	0·9440	176·2	196·6	1·5207	2178
Average	0·9425	170·6	194·2	1·5179	1850

The viscosity is expressed as the time of efflux in seconds as determined in a standard Redwood viscometer at 15·5° C.; the values appear to vary within somewhat wide limits. As regards the heat polymerisation test the author attaches more importance to the hardness of the jelly obtained under standard conditions than to the time required for bringing about polymerisation; the following procedure is recommended as being capable of yielding definite and concordant results: About 5 c.c. of the oil are introduced into each of two test tubes, which are then immersed in a bath containing melted paraffin wax at a temperature of about 100° C.; the temperature is raised to, and maintained at, 250° C. At the end of 39 minutes, one of the tubes is withdrawn, allowed to cool, then broken, and the jelly is examined. The other tube is kept in the bath at 250° C. for a further 30 minutes, then withdrawn, cooled, and the hardness of the jelly observed. Chinese wood oil of good quality should give at the end of 30 minutes heating a fairly firm jelly, which, at the end of one hour, should become quite hard. The latter, when cut with a knife or broken across, should exhibit a cut or fractured surface which is free from stickiness, and small pieces when rubbed in the hand should break down completely into a soft crumbly mass. An American method described recently for carrying out this test (see this J., 1912, 997) is considered by the author to be an unsatisfactory one owing to the shallowness of the containing vessel and the large cooling surface, etc. It may be mentioned that two specimens of the oil extracted from the seeds by the author himself were markedly inferior in their polymerising properties to any sample of genuine commercial oil examined. Differences in treatment during the manufacture of the oil, botanical and geographical origin, climatic variations, conditions of storage, etc., unquestionably affect the properties of the oil, and it is not advisable to adopt any single method in determining its purity. Tests other than those mentioned above comprise the drying test at 105° C., the iodine (solidification) test, the bromine thermal value, and the hexabromide test; these may be employed as supplementary tests in the analysis of the oil. Although Japanese wood oil is often regarded as being practically identical with Chinese wood oil, and both are referred to under the common designation "tung oil," the former oil is obtained from a different tree, namely, the *Paulownia imperialis*, and there is a considerable difference in the properties of the two oils. Three samples of the Japanese oil yielded the following results on analysis:—Sp. gr. at 15° C., 0·9349 to 0·9400; iodine value, 149·0 to 158·0; saponification value, 193·4 to 196·3; refractive index, 1·5034 to 1·5083; viscosity, 1230 to 1620 secs. In the heat polymerisation test the Japanese oil remains quite liquid under conditions which suffice to convert the Chinese oil into a very hard jelly. Even after two hours heating at 250° C., the oil does not always form a jelly, but remains in a viscous condition.—W. P. S.

Fish oils; Studies on ——. *III. Properties of fish and vegetable oil mixtures.* G. F. White and A. Thomas. J. Ind. Eng. Chem., 1912, **4**, 878—882. (See this J., 1912, 239, 442.)

The authors examined dogfish (*Mustelus canis*) liver oil, soya bean oil, linseed oil and Chinese wood oil, and mixtures of the vegetable oils with the fish oil, determinations being made of the viscosity, density, index of refraction, saponification value, acid value, and iodine value. As shown previously for certain fish oils, it was found that the fluidities of dogfish liver, linseed and soya bean oils, and of mixtures of them, were nearly linear functions of the temperature (between 30° and 90° C.) and the curves for the pure oils had nearly the same slope. Chinese wood oil behaves differently, and is changed on heating. its viscosity at 35° C. being 1·589 and 1·946 respectively before and after being heated to 90° C. It has a much higher viscosity than the other oils, and this property may be used as a criterion of purity. At 50° C. the viscosities of the oils were : dog-fish liver oil, 0·2112 ; linseed oil, 0·1757 ; soya bean oil, 0·2063 ; Chinese wood oil, 0·7801. The index of refraction is of no value for detecting addition of dog-fish liver oil to linseed and soya bean oils, but may be useful in the case of Chinese wood oil, which has a much higher index of refraction (1·5560 at 25° C.) than the other oils.—A. S.

Wool fat distillates. J. Marcusson and A. v. Skopnik Z. angew. Chem., 1912, **25,** 2577—2580.

Wool fat oleines obtained by expressing the distillate from wool fat contain unsaponifiable matter with 40 to 60 per cent. of liquid fatty acids. The unsaponifiable matter (43 to 52 per cent. in crude wool fat) undergoes decomposition in the distillation and in the oleine consists mainly of unsaturated hydrocarbons, with iodine values of 51 to 79, and sp. gr. at 15° C., 0·9000 to 0·917. The colour reactions and optical properties have been previously described (this J., 1904, 1001). These hydrocarbons can be distilled *in vacuo* without decomposition. yielding distillates which show an increasing dextro-rotation with the rise in temperature, whilst the iodine values do not show any pronounced alteration. None of the distillates examined showed a lævo-rotation. which would have indicated unaltered cholesterol. The fatty acids separated from the saponifiable part contained only traces of solid acids. They had a sp. gr. of 0·913 at 15° C., iodine value, 52·7, and saponification value, 208·5. Apparently they consisted of oleic acid and saturated liquid fatty acids of lower molecular weight. Semi-solid distillates are obtained by allowing the distillate between 300° and 310° C. to crystallise, and draining off the oleine. The resulting product solidifies below 45° C., and consists of a white or yellowish lard-like mass, composed of free fatty acids with 16 to 33 per cent. of unsaponifiable matter, similar to that in the wool fat oleines, though frequently showing a lower optical rotation ($\alpha_D = +20°$ to $+12·5°$), and a somewhat higher proportion of paraffin wax. The iodine value fluctuates from 60 to 74. The fatty acids in two samples of French and one of English origin consisted of 41 to 59·7 per cent. of solid fatty acids (m.pt. 44° to 47° C.) with a molecular weight of 258 to 267 ; and 18·6 to 25·4 per cent. of liquid fatty acids with iodine value 43 to 48 and molecular weight 270 to 302. The detection of mineral oil, rosin oil or rosin is effected in the same way as in the case of wool fat oleine (this J., 1904, 1001) ; but the lower optical rotation of the unsaponifiable matter must be borne in mind, as also the influence of the solid fatty acids on the solubility in methyl alcohol test. Solid distillates (Wool fat stearines) :—These are obtained by expressing the portions distilling (steam distillation) above 310° C., at a pressure of about 200 atmospheres, and melting and pouring the residue into moulds. The product consists of a dark yellow mass melting above 45° C., and consisting of variable proportions of unsaponifiable matter and fatty acids. The iodine value of the unsaponifiable matter is somewhat lower than in the case of the oleines and semi-solid distillates, but, on the other hand, the optical rotation is high (+23·6° to +30·5°). The fatty acids have a high m.pt. (60° to 67° C.), an iodine value of about 10, and a molecular weight of 320 to 380. No cholesterol could be detected by the digitonin test of Windaus in any of the distillates. Wool fat stearine is used as a lubricant in the leather and harness industries, and for greasing cartridges, etc. It is unsuitable for making candles, and may be distinguished from true "stearine" by the absence of crystalline structure and by the colour reactions (this J., *loc. cit.*)—C. A. M.

α-β-Diglycerides ; Preparation of mixed ——. A. Grün and B. Schreyer. Ber., 1912, **45,** 3420—3426.

Mixed α-β-diglycerides have not hitherto been synthetically prepared. The following method of preparing α-myristo-β-stearin,

$$CH_2(OH).CH(O.CO.C_{17}H_{35}).CH_2.O.CO.C_{13}H_{27},$$

was devised, and is applicable to the synthesis of all glycerides of this type. Glycerol-α-monochlorhydrin was first converted by the action of myristyl chloride into the monomyristic acid ester. This, on treatment with stearyl chloride yielded myristo-stearo-chlorhydrin, from which on substitution of the atom of chlorine by hydroxyl (by treatment with silver nitrite). α-myristo-β-stearin was obtained. This glyceride melted at 58° C., whilst the isomeric α-myristo-α-stearin melts at 52°—53° C.—C. A. M.

Kambara earth. A decolourising material for mineral oils, etc. Kobayashi *See* IIa.

Rapid control method for the determination of oil in grains. Harding and Nye. *See* XIXa.

Patents.

Oil presses and the like. F. H. Smulders, and Utrechtsche Machinefabriek opgericht door F. Smulders, Utrecht, Holland. Eng. Pat. 13,705, June 11, 1912.

The wall of the cylindrical press-chamber is provided with annular grooves within which is arranged a heating tube, which after leaving each groove passes vertically into the next groove and then turns in the opposite direction. The necessary bends in the tube are contained in the wall of the chamber, the grooves in which are covered by clamping rings.—C. A. M.

Oleaginous material and the like ; Machine for expressing ——. E. Zander, Stettin, Germany. U.S. Pat. 1,045,355, Nov. 26, 1912.

See Eng. Pat. 11,932 of 1912 ; this J., 1912, 885.—T. F. B.

Emulsions in combination with solid substances ; Process for obtaining ——. W. Jeroch. Aschersleben, Germany. U.S. Pat. 1,045,982, Dec. 3, 1912.

See Fr. Pat. 425,838 of 1911 ; this J., 1911, 966.—T. F. B.

Process for rendering stable the oxygen present in perborate mother-liquors. Ger. Pat. 253,169. *See* VII.

Cod liver oil preparations. Eng. Pat. 20,928. *See* XX.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Red lead ; Study of the variations of the physical and chemical properties of ——. O. W. Brown and A. R. Nees. J. Ind. Eng. Chem., 1912, 4, 867–876.

The authors prepared red lead from litharge, lead hydroxide, white lead, lead sponge, metallic lead, and lead tartrate, and studied the effect of temperature upon the rate of oxidation of the different raw materials and also the physical and chemical properties of the red lead formed under different conditions. The paper is illustrated by curves and 21 photomicrographs. It was found that the red lead produced, and also commercial specimens of red lead, may be either amorphous or crystalline ; in the latter case the crystals appear to retain the form of the substance from which they have been produced. The specific gravity of the red lead varies from 8·32 to 9·16 according to the temperature used in effecting oxidation, the time of heating, the chemical composition, and the physical nature of the raw material ; the variations in specific gravity are considered to be due directly to variations in the degree of polymerisation of the product. The sample with the lowest specific gravity (8·32) was prepared from lead sponge obtained by electrolysing a hot saturated solution of litharge in caustic soda ; it was slightly crystalline. In general, amorphous samples have a specific gravity between 8·66 and 8·9, whilst crystalline specimens give higher values, but exceptions are met with ; the specific gravity appears to be lower the nearer the composition approximates to Pb_3O_4. The apparent density depends mainly upon the fineness of the particles of the red lead, decreasing as the fineness increases up to a certain point. The most suitable temperature for the formation of red lead is 425°—430° C. from white lead, 450°—470° C. from litharge and lead sponge, and about 450° C. from lead hydroxide and metallic lead. At 525°—530° C. red lead is reduced rapidly and completely to litharge. Litharge is oxidised much less readily after it has been treated with water, and hence should be graded by a current of air rather than by levigation. Litharge which has not been fused during the process of manufacture also appears to be oxidised less readily. Amorphous red lead forms a tough plastic mass when mixed with water, whilst a paste made with the crystalline modification is much less plastic and shows a tendency to harden and crumble. (See also Milbauer, this J., 1909, 612, 1049; 1910, 282; 1911, 37.)

—A. S.

Oil of turpentine; The thermoterebenthometer of Tortelli and the detection of petroleum in ——, from Pinus Pinaster. R. Massy. J. Pharm. Chim., 1912, 6, 484—491.

In connection with the application of the Maumené (thermo-sulphuric acid) test to the examination of oil of turpentine, Tortelli has stated (Rev. Chim. ind., 1912, **23**, 203) that the direct test (*i.e.*, as applied to the oil without preliminary rectification) affords a reliable means of establishing the purity or otherwise of the sample, the thermo-sulphuric index of genuine oil of turpentine of good commercial quality being 100°—105° C. The test is conducted in a "thermoterebenthometer" consisting of a Dewar flask of about 50 c.c. capacity provided with a thermometer-stirrer; to 10 c.c. of the sample placed in the flask, 10 c.c. of sulphuric acid (sp. gr. 1·722 at 15° C.) are added, the mixture stirred and the maximum temperature noted, the difference between the latter and the initial temperature of the oil (in °C.) being the thermo-sulphuric index or "thermoterebenthic degree" of the sample. By repeating Tortelli's experiments with oils of turpentine derived from *P. Pinaster* (officinal in France), it was found that, as determined by the direct test, the thermo-sulphuric indices of eleven merchantable samples varied from 93·2° to 106·0°, that of one sample which had been stored for eleven years being 115·7° C.; in the latter case the rise of temperature was rapid, accompanied by abundant evolution of sulphur dioxide and by blackening and thickening of the acid mixture—as previously observed by Tortelli in the examination of genuine oils aged by storage. To determine the effect of adulterants, experiments were made with mixtures of a genuine oil with 10 per cent. by weight of various impurities, the adulterants chiefly considered being the petroleum products usually employed (burning oil, rectified mineral oil, "white spirit" and ligroïn) although in one series of tests benzol, carbon tetrachloride, rosin oil and colophony were also used. In every case the presence of the adulterant caused a lowering of the thermo-sulphuric index, the greatest effect (14° C.) being produced by burning oil and the least (3° C.) by colophony; of the petroleum adulterants "white spirit" was found to be the most difficult of detection by the direct test. It is pointed out that, owing to the abnormally high thermo-sulphuric indices of aged oils of turpentine, judicious adulteration of the latter with a petroleum would probably escape detection by the direct test. A preliminary rectification of all samples is therefore regarded as essential; the oil should be distilled, 4/5 of the original volume collected and the test applied to the distillate. The values obtained by testing, in this manner, 15 samples of genuine oil of turpentine from *P. Pinaster* (some of good, and others of indifferent, commercial quality) varied between 96·2° and 100·6° C.; the thermo-sulphuric indices of the distillates from adulterated samples containing 10 per cent. of burning oil, rectified mineral oil, ligroïn and "white spirit" respectively, were 91·3°, 84·6°, 82·2° and 88·3° C. respectively, that of the oil from which these adulterated samples were prepared being 98·8° C. It is stated that the presence of 1 per cent. of "white spirit" (the most usual adulterant) may be readily detected by this means.

—W. E. F. P.

Oleo-resin of Pinus Pinea L. L. Reutter. J. Pharm. Chim., 1912, 6, 494—497.

The oleo-resin was of yellow or brownish-red colour, and had an aromatic and balsamic odour and taste; the m.pt. was 85° C., acid value 101·7—102·5, saponification value 269·27—270·1, and ester value 167·54—167·6. It was slightly soluble in petroleum ether, $\frac{2}{3}$rds soluble in ether, $\frac{3}{4}$ths in chloroform and alcohol, $\frac{4}{5}$ths in carbon bisulphide, and $\frac{1}{4}$th in oil of turpentine and benzol, the solutions being generally pink or rose-coloured; it was largely soluble in alkalis and in warm ammonia, forming brownish or brownish-red solutions. In the analysis, 20 grms. of the material were extracted with ether; the solution was agitated successively with aqueous solutions (each of 1 per cent. strength) of ammonium carbonate, sodium carbonate and potassium hydroxide; the insoluble portion was treated with petroleum ether and then with alcohol, by which means complete solution was effected except for the vegetable debris (wood chips, etc.). From the ammonium carbonate solution of the ether extract *pineic acid*, $C_7H_{14}O_4$ (m.pt. 99°—99·5° C.) was isolated; *pineolic acid*, $C_{18}H_{28}O_3$ (m.pt. 86° C.) was obtained from the sodium carbonate solution, but no satisfactory result was obtained from the potassium hydroxide solution. The portion of the oleo-resin insoluble in ether yielded, on steam distillation and subsequent treatment of the distillate with petroleum ether, a yellowish-rose coloured essential oil from which white crystals (m.pt. 204° C.) having an odour like that of borneol were deposited. From the alcoholic extract of the residue, *pinea resin*, $C_9H_{13}O_4$ (m.pt. 85° C.) was obtained by crystallisation. The percentage results of the analysis were:—Pineic acid 18, acids extracted by sodium carbonate 37, pinea resin 18, essential oil 12, vegetable debris 15.

—W. E. F. P.

Oleo-resin of Pinus Halepensis Mill., from Montpellier. Reutter. J. Pharm. Chim., 1912, 6, 497—500.

The oleo-resin had: m.pt. 83°—85° C., acid value 180·75—182·74, saponification value 196·5—199·3, ester value 15·7—16·5 and gave reactions characteristic of cholesterol. It was $\frac{4}{5}$ths soluble in ether and benzol, slightly soluble in carbon bisulphide, and very soluble in alcohol, chloroform, acetone, oil of turpentine and petroleum ether; it was also dissolved by cold alkalis. The analysis was made upon 50 grms. of the material on the lines indicated in the preceding abstract. From the ammonium carbonate extract, *helepinic acid*, $C_{21}H_{40}O_4$ or $C_{20}H_{40}O_4$ (m.pt. 73·5°—74·5° C., was isolated; from the sodium carbonate extract *helepinolic acid*, $C_{40}H_{56}O_5$ (m.pt. 144·2°—145·5° C.), *a-helepinolic acid*, $C_{34}H_{50}O_4$ (m.pt. 80·5°—81·5° C.), acid value 188·69—189·14), *β-helepinolic acid*, $C_{18}H_{28}O_4$ (m.pt. 80·5°—82·0° C.) acid value 185·33—186·45) and *heleponic acid*, $C_{18}H_{28}O_2$ or $C_{37}H_{58}O_4$ (m.pt. 156°—157° C.) were obtained. The percentage results of the analysis were:—Acids extracted by ammonium carbonate 19, ditto by sodium carbonate 53, essential oil 14·4, resin 6·6, vegetable débris 7.

—W. E. F. P.

Patents.

Bottle-seals and bottle-sealing composition; Manufacture of ——. C. Wagishauser, Mannheim, Germany. Eng. Pat. 10,222, Apr. 30, 1912.

The bottles are dipped in a cold lacquer of the following (or analogous) composition:—nitrocellulose, 40; methylated spirit, 100; benzol, 50; ethyl chloride, 8; and methyl alcohol free from acetone and water, 650 parts. Petroleum benzine may be used instead of benzol, and castor oil, metallic bronze powders, or colouring matters may be added to the lacquer. The seal may be removed from the bottle in the form of a film, if it be first soaked in water.—E. W. L.

Linseed oil or oil varnish; Process of obtaining a substitute for ——. W. Kaempfe. Fr. Pat. 445,565, June 29, 1912.

A marine animal oil, such as whale oil, is heated for a short time at 235°—240° C., at ordinary pressure or under diminished pressure, and steam superheated to 375°—

400° C., is then blown through the mass for 25—30 hours; the temperature of the oil itself is not allowed to exceed 250°—260° C. The distillation with steam may be effected *in vacuo*, in which case the temperature of the oil may be allowed to rise to 270°—285° C. The effect of the process is to expel the saturated fatty acids or their glycerides, and to polymerise the residual unsaturated acids. When the greater portion of the saturated fatty acids has been expelled, linolic or other unsaturated acids, or their esters, may be added to the residue in the still; or the distillation may be interrupted before the saturated fatty acids have been completely expelled, and the residue, after the addition of unsaturated fatty acids, or their esters, heated for a time to about 315° C. The residual product is stated to form a satisfactory substitute for boiled linseed oil.—A. S.

Varnish; New ——, and its application. L. E. Nottelle and R. E. E. Héraud. Fr. Pat. 445,638, Sept. 9, 1911.

The varnish consists of a mixture of cellulose esters, oils or fats, modified or not, and gums, gum-resins, or other similar substances, the whole being dissolved in a suitable solvent or suspended therein in the form of an emulsion. Examples given are mixtures of: (1) nitrocellulose or cellulose acetate, oils and gums or resins, acetone and amyl acetate; (2) cellulose thiocarbonate, resins and oils, caustic alkali solution, and carbon bisulphide; (3) nitrated (oxidised) oil (rubber substitute), resins or gums, nitrocellulose or cellulose acetate, alcohol and ether; (4), cellulose hydrate, resins or gums and oils, and Schweitzer's reagent (cuprammonium solution). After the varnish has dried, the coating may be vulcanised by a solution of sulphur chloride, to which is also preferably added, a substance capable of retarding the evaporation of the sulphur chloride.—A. S.

Condensation products from phenols and formaldehyde; Process for manufacturing soluble ——. K. Albert and L. Berend, Amöneberg, Germany. Eng. Pat. 1269, Jan. 16, 1912.

See Fr. Pat. 441,547 of 1912; this J., 1912, 886.—T. F. B.

Phenolic condensation products. J. W. Aylsworth, East Orange, N.J., U.S.A. Eng. Pat. 26,029, Nov. 21, 1911. Under Int. Conv., March 11, 1911.

See Fr. Pat. 441,017 of 1912; this J., 1912, 828.—T. F. B.

Plastic phenolic condensation product. J. W. Aylsworth, East Orange, N.J. U.S. Pat. 1,046,137, Dec. 3, 1912.

See Fr. Pat. 429,292 of 1911; this J., 1911, 1267.—T. F. B.

Plastic [phenolic] composition and method of preparing the same. J. W. Aylsworth, East Orange, Assignor to F. L. Dyer, Montclair, N.J. U.S. Pat. 1,046,420, Dec. 3, 1912.

See Eng. Pat. 3947 of 1911; this J., 1912, 347.—T. F. B.

Converting indanthrene and its derivatives into a form suitable for their use as pigment colours. Ger. Pat. 253,240. *See* IV.

Process of treating waste ferrous sulphate liquors. U.S. Pat. 1,045,723. *See* VII.

Chemical solutions for various purposes. Fr. Pat. 445,175. *See* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Gutta-percha; Alterations in the softening-point of ——, effected by various additions. R. Ditmar. Gummi-Zeit., 1912, **27**, 384—385.

In the manufacture of gutta-percha capsules for explosives it is often necessary to employ a gutta-percha which will soften at a definite temperature. From this point of view the author has studied the effect of the addition of various proportions of a number of substances upon the softening-point. The gutta-percha employed had been obtained from *Gulai secunda*—and had a resin content of 55·39 per cent. All the mixings were worked for 25 minutes on laboratory rolls heated to 100° C. and were left to cool off overnight in a press. Strips measuring 58 × 16 × 2 mm. were then prepared and tested in the author's softening-point apparatus (see this J., 1912, 547), under a load of 2·4 grms. The softening-point of the original gutta-percha was 38° C. and the effect of the admixtures is shown in the following table. Whereas kieselguhr and barytes mixtures show a maximum softening point, the former for 100 per cent., the latter for 70 per cent. addition of the mineral, the softening point of the magnesia mixture progressively increases until at additions of 145—150 per cent., the strip no longer softens but remains hard and brittle at 100° C.

Table of Softening Points.

Nature of ingredient.	Percentage of ingredient added.												
	10	20	30	40	50	60	70	80	90	100	120	140	150
Kieselguhr	40	42	43	45·5	48	49	50	50	50	55	52	52	52
Barytes	41	41	42	42	42	42	44	42	40	39	39	40	40
Magnesia	40	42	42	43	47	47	47	52	57	65	67	84	—
Tjipetir gutta percha softening point 59° C.	41	49	51	53	53	54	55	55	55	56	57	58	58
Tar—dropping point 34° C.	38	38	37	34	—	—	—	—	—	—	—	—	—

—E. W. L.

Influence of light on the rapidity of polymerisation of phenylbutadiene. Stobbe and Reuss. *See* XX.

Patents.

India rubber; Process for coagulating and curing —— and apparatus to be used for the purpose. F. A. Byrne, Birmingham. Eng. Pats. 27,665, Dec. 9, 1911 and 292, Jan. 4, 1912.

Three forms of apparatus, identical in principle, are described. In each form of apparatus wood tar, pyroligneous acid or other product or products of the destructive distillation of wood, wood waste, or the like, is allowed to run slowly from a container (or is sprayed under pressure from such container) on to the inner heated surface of a gasifying chamber or retort, where it is rapidly volatilised. The vapours are conducted from the retort to the shed or chamber in which they are to be used for "curing" coagulated (sheet) rubber, or into vessels containing the latex. The retort may be heated by solid fuel or by means of oil-firing. The exit pipe from the retort is made of small diameter to ensure that the exit gases may leave the retort under pressure.—E. W. L.

Caoutchouc-like substance; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8065, April 3, 1912.

Kondakow (J. prakt. Chem., 64, 109—110) has described a white caoutchouc-like polymerisation product obtained by autopolymerisation of β-γ-dimethylerythrene, which is totally different from the caoutchouc-substance obtained by heating β-γ-dimethylerythrene. 100 parts of this white polymerisation product and 300 parts of freshly prepared β-γ-dimethylerythrene are put into a vessel which is then closed and kept in the dark for 3—4 weeks. After this time the hydrocarbon is totally converted into the caoutchouc-like substance.—E. W. L.

[Plastic] material or composition or mouldable substance and process of manufacturing same. L. Grote and A. W. H. Vivian, London. Eng. Pat. 18,503, Aug. 16, 1911.

Eight parts by weight of starch flour are dissolved in 55 parts of water, and 3 parts of caustic potash (35° Bé., sp. gr. 1·32) are added. The resulting mass is treated with 2 parts of nitric acid. A solution of 4 parts of gelatin in 30 parts of water is added and thoroughly mixed in, and the mixture is heated. To this is added a solution of 30 parts of powdered resin in 30 parts of phenol, treated with 40 parts of formaldehyde, and the mixture is heated until the mass separates from the contained water and begins to rise to the surface. The mass is then cooled and begins to thicken. It is kneaded and washed between rollers in a stream of cold water until the excess of free acid has been removed. The mass obtained serves for the production of artificial hard-rubber, ebonite, etc., and may be mixed with suitable ingredients, and rolled, pressed, shaped or otherwise finished. For harder articles the lighter hydrocarbons and water in the mass are removed by heating and the mass is moulded while still hot.—E.W.L.

Plastic compositions; Process of manufacture of ——. L. Lilienfeld. First Additoin, dated June 28, 1912 (under Int. Conv., July 18, 1911), to Fr. Pat. 417,392, June 23, 1910 (this J., 1911, 36).

The plastic substances manufactured according to the process described in the chief patent are treated with formaldehyde in the gaseous condition or in solution, or the formaldehyde is added during the process of manufacture. The treatment with formaldehyde is stated to raise the melting point and increase the hardness and elasticity of the products.—A. S.

Plastic masses; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 252,193, Dec. 18, 1910.

Unsaturated fatty acids which contain more than one double linkage or alcoholic hydroxyl group, are treated with sulphur or its equivalent, with or without addition of a condensing agent or solvent. The plastic masses obtained in this way do not swell so much, when treated with ether or hydrocarbons, as analogous known products. —T. F. B.

Caoutchouc-like products; Process for preparing ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pats. 252,705, 253,517, 253,518 and 253,519, July 6 and Aug. 7, 1910.

(1) Oxidised oils, such as blown linseed, castor, sesamé, or olive oil, are treated with formaldehyde or its equivalent in presence of a condensing agent. (2) In place of the oxidised oils, mixtures of oxidised oils and phenols may be used, so long as the weight of phenol does not exceed that of the oil. Indifferent substances or filling materials may be added to the reaction-mixture. (3) The formaldehyde may be replaced by other aldehydes or by aldehydic carbohydrates, such as starch, dextrose, or levulose. The reaction in this case is slower, but the products are very tough and elastic. (4) A vegetable or animal albuminous substance is added to the mixture before condensation.—T. F. B.

Rubber goods; Process for preserving the elasticity of ——. C. Beyer, Köln on Rhine, Germany. Eng. Pat. 8876, April 15, 1912. Under Int. Conv., April 19, 1911.

See Ger. Pat. 243,218 of 1911; this J., 1912, 291.—T. F. B.

Rubber; Process for making products similar to ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger First Addition, dated July 29, 1911, to Fr. Pat. 444,026, July 28, 1911. Under Int. Conv., Aug. 6, 1910.

See Ger. Pat. 251,371 of 1910; this J., 1912, 1085.—T.F.B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin. K. Feist. Arch. Pharm., 1912, 250, 668—683. (See this J., 1912, 652 and 1044.)

In order to obtain glucogallic acid, powdered Turkish galls were extracted in a Soxhlet, first with pure chloroform and then with benzene. This was followed by a prolonged extraction with ether purified over sodium. The extracted material was dissolved in a little acetone and exposed to the vapour of chloroform. By repeating this process glucogallic acid was obtained in a crystalline form. Commercial tannin prepared from Turkish galls yields glucogallic acid when treated in the same way. The acid melts at 233° C. with decomposition, and when pure it does not give the precipitation reactions characteristic of tannin. It has $[\alpha]_D = +10{\cdot}6°$ in acetone at 17° C. The acid is monobasic and on hydrolysis with dilute sulphuric acid yields 40 per cent. of gallic acid and 35·5 per cent. of dextrose. After drying in a vacuum over sulphuric acid, it has the composition $C_{13}H_{14}O_9$. There is no action upon Fehling's solution at the ordinary temperature. The residue left after extracting Turkish galls as above with ether consists of tannin. This was obtained by extraction with acetone. When hydrolysed with dilute sulphuric acid, 10 grms. yielded 8·07 grms. of gallic acid and 0·91 grm. of dextrose. Tannin from Turkish galls has $[\alpha]_D = 28{\cdot}6$ in acetone or ethyl acetate. The molecular weight as determined by the elevation of the boiling point of acetone lies between 521·8 and 746·3 for Turkish tannin, and between 899 and 1045 for tannin obtained from Chinese galls.—F. Shdn.

Dressing East India-tanned kips and skins for box and willow leathers. G. E. Townsend. Leather World, 1912, 4, 852—853.

Selected kips are soaked and split or shaved to the required thickness. They are then stripped in the drum, using $1\frac{1}{4}$ lb. of borax in 10 gallons of warm water for every 100 lb. of leather. The goods are run for an hour, the liquor is strengthened by adding another $\frac{1}{4}$ lb. of borax for each 100 lb. of leather, drumming is continued another half-hour and the goods then rinsed well with warm water. Re-tanning is then carried out as follows, the quantities given being for 100 lb. of leather in every case. The goods are drummed for half an hour in 12 galls. of water at 60° C., in which 12 lb. of salt have been dissolved, $\frac{1}{4}$ per cent. of sulphuric acid diluted in 2 galls. of water is then added, and after running another hour, $5\frac{1}{2}$—6 lb. of potassium bichromate in 5—6 galls. of water is added gradually and the drumming continued another three hours. The free acid in the goods is then neutralised by running in $\frac{1}{2}$ per cent. solution of borax, and sorting for black and colour work is carried out. For dyeing blacks, $\frac{1}{2}$ lb. of Hematin crystals, $\frac{1}{8}$ pint. of fustic extract, $4\frac{1}{2}$ oz. of Nigrosine B., and $4\frac{1}{2}$ oz. of Chrome Leather Black are dissolved in 10—12 galls. of water at 60° C. This is added to the goods while in motion and run for 25 minutes and then $\frac{1}{4}$ lb. of potassium bichromate is added and the treatment continued for a further 10 minutes. The goods are then rinsed with warm water for 15 minutes and fat-liquored. 1 lb. of soft soap is dissolved in 10 galls. of hot water to which 2 oz. of borax are added, the solution is raised to boiling temperature and $1\frac{1}{2}$ pints of cod-oil and $\frac{1}{4}$ lb. of egg-yolk added and well emulsified. This fat liquor is added to the goods while in motion, run for 30 minutes, and the goods are then lightly rinsed and horsed up to drain. They are afterwards set out, oiled lightly on the grain with a mixture of linseed oil and sperm oil in equal parts, sammed, lightly set over again and dried. For obtaining a good medium brown shade, the goods, after neutralising, are mordanted with 1¼ pints of fustic extract and 1¼ pints of palmetto in 12 galls. of water at 60° C., in which they are drummed for ½ hour. They are then dyed by running ¼ hour in a solution of ½ lb. of Indian Yellow in 10 galls. of water at 140° F. (60° C.), after which time 2 oz. of Havana Brown, 2 oz. of Acid Anthracene Brown and ¾ oz. of Soluble Blue dissolved in 2 galls. of water are added and run for a further 20 minutes and the colour developed by running 10 minutes after adding 2 oz. of acetic acid. After rinsing the goods are fat-liquored with 1 lb. of Castile soap, 1½ pints of neatsfoot or castor oil and ½ lb. of egg-yolk in 10 galls. of water for 20 minutes. After rinsing again and horsing up they are set out and sammed, lightly set over and dried out in a slow-drying stove. After lying a few days to temper, they are damped back in sawdust, staked out, aired off, staked over at a light pressure and fluffed. Before seasoning, a fuller colour is produced in the finished leather by brushing over with weak lactic acid. A finish for blacks consists of 4 oz. of ruby shellac, 2 oz. of ammonia, 2 oz. of Hematin, 6 oz. of Nigrosine, 3 oz. of Chrome Leather Black and 2 oz. of glycerin in 10 gallons of water ; when dissolved 2½—3 pints of defibrinated bullocks' blood is added, and the whole stirred till cold. Two coats of the finish are given and the goods glazed after each, after which they can be grained, and sorted. A waterproof dull finish is made as follows :—8 oz. of paraffin wax, 4 oz. of soft soap and 2 oz. of tallow are melted together, 2 oz. of gum dragon are dissolved and added and the whole made up to 10 galls. with hot water. A little of the black dyestuff is added and the finish applied to the goods, after which they are dried out and afterwards given a second coat of 2 oz. of neatsfoot oil and 1 oz. of tallow in 2 galls. of water. For colours the following finish is used :—4 oz. of egg albumin, 4 oz. of blood albumin in 8 galls. of water, tinted with a little of the dyestuff and treated in the same way as for black.—D. J. L.

Sulphonated oils and mineral oils used in the leather industry ; The analysis of ——. C. R. Oberfell. Report of Committee of Amer. Leather Chem. Assoc. J. Amer. Leather Chem. Assoc., 1912, **7**, 656—664.

Sulphonated oils. The identification of the fatty oil from which the product is obtained is too difficult a problem for immediate solution. The important constituent to estimate is the amount of original oil present and whether or not it has been adulterated with mineral oil. The proximate analysis includes the estimation of (*a*) water and volatile matter, (*b*) ash, (*c*) unsaponifiable matter, and (*d*) fatty oils. (*a*) *Water.* The method of drying at 95°—100° C. for 16 hours is no more efficient than the method of drying over a flame until tiny puffs of smoke appear. (*c*) Unsaponifiable matter is estimated in the usual way by saponification with alcoholic potash and subsequent extraction with ether. *Mineral oils.* Estimation of volatile constituents by evaporation methods proved unreliable. Viscosity determinations by means of pipettes were also discordant. Flash test by the following simple method gave good results. A porcelain crucible is set in a sand bath so that the top is below the rim of the bath. The crucible is filled within ¼ in. of the top, and heat applied so that the temperature registered on a thermometer in the liquid, rises 8° C. per minute. A jet flame is passed across the crucible about ½ in. above the oil. —J. R. B.

Sugars in leather ; Determination of ——. F. P. Veitch and J. S. Rogers. Report of Committee of Amer. Leather Chem. Assoc. J. Amer. Leather Chem. Assoc., 1912, **7**, 645—656.

In the detannisation of the water-soluble extracts from leather for the estimation of sugars, both normal and basic lead acetates are used. It has been consistently found that basic lead acetate gives lower results for the glucose than does the normal salt. Parker and Blockey (this J., 1912, 268) conclude that this is due to the fact that gallic acid and kindred substances which reduce Fehling's solution, are not removed completely by normal lead acetate in presence of free acid such as acetic acid. In the collaborative work here detailed, experiments were carried out on water-soluble extracts from leather, containing known quantities of dextrose. When normal lead acetate was used, the results obtained showed very close agreement with the calculated results, but with the basic acetate the percentages of dextrose were consistently low. The average error in a leather containing 8 per cent. of dextrose was —0·07 with normal, and —1·43 with basic lead acetate. The method recommended as the official one is as follows :—*Fehling's solution.* (*a*) 34·639 grms. of crystallised copper sulphate per 500 c.c. (*b*) 173 grms. of Rochelle salt and 50 grms. of sodium hydroxide per 500 c.c. *Determination.* 200 c.c. of water-soluble extract are treated in a 500 c.c. flask, with 25 c.c. of a saturated solution of normal lead acetate, shaken frequently for 10 minutes and filtered. Excess of solid potassium oxalate is added to the filtrate to precipitate the excess of lead, and after mixing frequently for 15 minutes, the solution is filtered. 150 c.c. of the filtrate are transferred to a 600 c.c. Erlenmeyer flask, treated with 5 c.c. of concentrated hydrochloric acid, and boiled under a reflux condenser for 2 hours. After cooling and neutralising with anhydrous sodium carbonate, the solution is transferred to a 200 c.c. flask, made up to volume, and filtered through a double filter. The dextrose in the solution is determined immediately by adding 50 c.c. to 25 c.c. of the copper sulphate solution and 25 of the alkaline tartrate solution in a 400 c.c. beaker, heating to boiling in exactly 4 minutes, boiling for 2 minutes, and filtering immediately without diluting, through asbestos. The cuprous oxide is washed with hot water, alcohol and finally with ether, dried for half an hour in a water oven and weighed. The amount of dextrose is calculated by the aid of Munson and Walker's table.—J. R. B.

Gelatin ; Chemistry and quantitative determination of ——. M. Berrár. Biochem. Zeits., 1912, **47**, 189—214. (Cp. this J., 1911, 1174.)

The solubility of purified gelatin in cold water is 0·56, 0·60 and 0·62 per cent. at temperatures of 17°, 18° and 21° C. respectively. These concentrations are not very different from the lowest required for the formation of a jelly ; for example, a 0·7 per cent. solution in hot water sets to a thin jelly on cooling. If a saturated solution, formed in the cold, remains in contact with pieces of gelatin, a partial separation of the dissolved substance occurs on further cooling, but there is no formation of jelly. Neither alcohol nor metaphosphoric acid precipitates gelatin completely from aqueous solutions. The same is true of picric acid at the ordinary temperature, but at 8° C. complete precipitation may be effected by adding an equal volume of a saturated aqueous solution of picric acid. When gelatin is completely precipitated by acid reagents, *e.g.*, by a solution containing picric acid and potassium mercuric iodide (the precipitate may in this case be safely washed with water), the gelatin combines with acid in a definite proportion, viz., one molecular equivalent of acid to a quantity of gelatin containing ten atoms of nitrogen. Assuming that one molecular equivalent of acid unites with one molecule of gelatin, the molecular weight of the latter must be 823 (Paal found 900). The nitrogen content of picric acid, or of precipitates containing this compound and proteins or gelatin, may be determined accurately by a modification of Kjeldahl's method. The material is treated in a Kjeldahl flask, with 0·5—1 grm. of iron filings, 5 c.c. of glacial acetic acid, 20 c.c. of concentrated sulphuric acid and some copper sulphate ; the mixture is heated in the ordinary way, and the subsequent operations carried out as usual. In aqueous solutions gelatin may be completely separated from proteins, albumoses, peptones, mucin and casein, by adding about 2 volumes of a mixture of 1 part of a saturated aqueous solution of picric acid with 4 parts of 96 per cent. alcohol. The gelatin alone remains in solution, and after filtration it may be quantitatively precipitated by adding about 1½ volumes of a saturated aqueous solution of picric acid and allowing the mixture to stand for 12 hours at 10° C. By this means the author accurately determined quantities of gelatin admixed with milk and egg albumin. The gelatin-picric acid precipitate was washed with a solution of potassium mercuric iodide until the washings were no longer yellow in colour ; the quantity of gelatin in the residue was found by determination of the nitrogen-content. The method described above may be applied to the qualitative detection of gelatin in presence of proteins. After precipitating the latter by the alcoholic-aqueous picric acid solution, and filtering, the presence of gelatin in the filtrate, even at a concentration of 1 in 100,000, is indicated by a yellowish white opalescence formed on addition of an aqueous solution of picric acid. The opalescence is best detected by a "ring-test."—J. H. L.

Patents.

Chrome leather; Process for impregnating ——. J. Winther, Roskilde, Denmark. Eng. Pat. 17,228, July 24, 1912.

The leather, immediately after the completion of the tanning process, and before it is dry, is treated with a sugar solution, and then after drying, is dipped in a solution consisting of 10 to 20 parts of resin, 5 to 12 parts of Japan wax, ½ to 6 parts of Venetian turpentine, ½ to 6 parts of tallow, and 4 to 10 parts of paraffin wax, kept at a temperature of 30°—60° C.—E. W. L.

Chrome tanning; Process of —— for the production of sole leather. P. Castiau. First Addition, dated June 19, 1912, to Fr. Pat. 440,736, Feb. 28, 1912 (this J., 1912, 830).

Instead of subjecting the chrome-tanned skins to a light vegetable tannage, the two processes may be combined, the skins being treated in a bath containing both a chromium salt and a vegetable tanning material. The colour of the leather may be improved, if the skins after withdrawal from the bath of paraffin and resin described in the principal patent (*loc. cit.*), and whilst still hot, be worked vigorously in hot water (50°—80° C.) and the surface rubbed with a sponge or the like saturated with hot water; or the leather, after cooling, may be immersed for a few seconds in benzene, and its surface rubbed with a dry fabric.—A. S.

Patent-leather, etc.; Apparatus for baking or curing ——. W. R. Smith, Assignor to Buffalo Leather Co., Buffalo, N.Y. U.S. Pat. 1,045,623, Nov. 26, 1912.

See Eng. Pat. 1464 of 1912; this J., 1912, 694.—T. F. B.

XVI.—SOILS; FERTILISERS.

Farming with dynamite. W. Cullen. J. Chem., Met. and Min. Soc., S. Africa, 1912, **13**, 139—148.

An illustrated account of the use of explosives for preparing the ground for farming operations. For cracking up the ground at depth or sub-soiling, a very slow explosive is required which evolves a large volume of gas slowly on detonation. For making holes in which to plant trees, a quicker explosive is used. The operation of sub-soiling is specially useful in S. Africa where about 8—9 in. below the surface a stratum, called "hardpan," impervious alike to water and air, is formed. The explosives are of a powdery consistence made up in cartridges about 1⅛ in. in diameter and 4 in. long. The distance between the holes is regulated by the nature of the soil: with holes 6 feet apart the cost is about £14 per acre. (See also this J., 1911, 1078.)—E. F. A.

Manganese; Agricultural study of ——. P. Nottin. Comptes rend., 1912, **155**, 1167—1169.

Arable soil, on contact with water containing dissolved salts of manganese, precipitates and retains the latter. Neither sand nor humus plays any part in this fixation. Calcium carbonate (not however in all states) slowly precipitates manganese from solutions of its salts, and an equivalent quantity of calcium passes into solution. Natural clays, apart from the presence of any calcium carbonate, also possess the power of fixing manganese. When soils containing manganese are washed with water, very little of the metal is extracted, even if the water is slightly acidified.—J. H. L.

Patents.

[*Nitrolim*] *Calcium cyanamide; Process of obtaining crude —— in the form of granules, which can be applied as a fertiliser without risk of injury to the skin.* A. Renault. Fr. Pat. 444,933, June 13, 1912.

The finely powdered and sifted nitrolim (about 100 kilos.) is mixed intimately with molasses (20—25 kilos.) for a sufficient time to ensure complete hydration of the calcium cyanamide (*e.g.*, for at least 30 minutes). The mixture is then compressed into cakes, sheets or granules of a thickness not exceeding 1 cm. (0·4 in.), dried at about 30° C., and the dried material, if in the form of cakes or sheets, is broken into granules.—A. S.

Manure from leather; Manufacture of nitrogen ——. G. Feldmann, Taganrog, Russia. Eng. Pat. 27,266, Dec. 5, 1911.

See Fr. Pat. 437,628 of 1911; this J. 1912, 549.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Reducing sugars; Presence of —— in the fresh beetroot: Influence of reducing sugars on the direct determination of sucrose in the beetroot. Origin of the reducing sugars that certain beet sugar factory product contain. H. Pellet. Bull. Assoc. Chim. Sucr., 1912, 30, 239—253.

Experiments with roots grown in France, which were in full vegetation in November, and which had been pulled, washed, rasped, and pressed in the shortest possible time, namely from half an hour to an hour, depending upon the distance at which the fields were situated from the factory, have shown that reducing sugars are always present in the ripe root, though in small and variable amount, the extreme differences found being 0·05 to 0·27 grm. per 100 c.c. of expressed juice. These figures relate to good roots of high sucrose content; but for low quality roots, likewise freshly picked, the reducing sugars may be as high as from 2—2·5 grms. per 100 c.c. of juice. In the case of sound roots preserved in silos, either in full contact with air or covered with earth, the sucrose content gradually diminishes, but the reducing sugars generally remain within the limits of 0·15 and 0·25 grm. per 100 c.c. of juice. For injured or altered roots these figures do not hold, and in these the reducing sugar content may rise to 0·50, whereas originally it may have been 0·16 grm. per 100 c.c. of juice. In determining small amounts of reducing sugars in the beet, certain precautions must be taken, the most important of them being not to use basic lead acetate solution or Herles' reagent (lead nitrate and sodium hydroxide) for defecation, but only normal lead acetate solution, otherwise a certain amount of the reducing sugars, consisting principally of lævulose, will be precipitated. As to the influence of the reducing sugars on the determination of sucrose by direct polarisation in the beet, it is shown that in the case of small amounts such as 0·10—0·20 per cent. on the juice, the result is not affected. When, however, 0·30—0·60 per cent. is the quantity present, the polarisation may be influenced, owing to the modification of the rotatory power of the reducing sugars by the basic lead acetate, the true sucrose content then only being obtainable by the double polarisation method, preferably using the new method of procedure described by the author (this J., 1912, 85). Lastly, the author discusses the formation of reducing sugars during the process of manufacture, and points out that neither during extraction by diffusion, nor during carbonatation, provided these be conducted normally, are reducing sugars formed. After defecation by lime, reducing sugars are no longer present in the juice, and sometimes during subsequent operations no reducing sugars may be formed, so that the molasses is free from them. In general, however, according to the author, with the modern method of sulphiting at different stages, traces of reducing sugars are formed in each, and accumulate in the last products, the final molasses, it is stated, often containing as much as 0·30—0·50 per cent., even with careful working.—J. P. O.

Thermophilic bacteria; Occurrence of —— in [beet] sugar juices. A. Kossowicz. Deutsche Zuckerind., 1912, **37**, 1019.

Nutrient solutions of broth, beet juice, wort, and milk were inoculated with 1 c.c. of a beet juice causing gas formation in the diffusers, and incubated at 80°—85° C., when at the end of 5 days it was found that there was no evolution of gas or any other sign of bacterial life. These cultures were next maintained at 15°—20° C. for 2—3 days, and then a distinct formation of gas, acid, and sediment was observed, microscopical examination indicating the presence of various spore-forming organisms. In other experiments 300 c.c. of the beet juice forming gas during diffusion were kept at 70° C. for 2 days, after which the previous experiment was repeated, using the solution thus heated. Neither in these cultures, nor in others prepared directly from the unwashed roots from which the defective juice had originated, was there any sign of vitality at high temperatures. It is concluded by the author that thermophilic bacteria capable of developing at 80°—85° C. are not to be found in diffusion juices, and that another explanation of the phenomenon of gas formation in the diffusers must be sought.—J. P. O.

[Beet] diffusion and press juices; Determination of the loss of polarisation caused by the action of lime on ——. Verein d. Zuckerindustrie in Böhmen. Z. Zuckerind. Böhm., 1912, **36**, 663—669. (Compare also this J., 1908, 1168; and 1911, 1325.)

Among the uniform methods of analysis of beet sugar factory products compiled by a special commission at the instigation of the Verein der Zuckerindustrie in Böhmen, the following process is given for the determination of the loss of polarisation during defecation. Into a 100 c.c. flask 75 grms. of diffusion juice are weighed, 10 c.c. of basic lead acetate added, and the liquid made up to bulk, mixed, filtered, and polarised. Into a 100·6 c.c. flask another 75 grms. of diffusion juice are weighed, 1 grm. of calcium oxide in the form of milk of lime is added, and the mixture heated in a boiling water-bath for a quarter of an hour. At the end of this time, phenolphthalein is added, and whilst shaking, a current of carbon dioxide is led against the surface of the liquid until the colour is just discharged. After cooling, and adding a drop of acetic acid and 5 c.c. of basic lead acetate, the liquid is made up to 100·6 c.c., filtered, and polarised. The loss of polarisation thus caused, as compared with the polarisation of the unlimed juice, is calculated as a percentage of the sucrose content of the sample.—J. P. O.

Sugar of any composition to its equivalent in standard muscovado; Table for the convenient calculation of ——. H. C. Prinsen Geerligs. Archief Suikerind. Nederl.-Indië, 1912, **20**, 1590. Intern. Sugar J., 1912, **14**, 663—664.

In a previous article (this J., 1912, 550) the author gave tables for the calculation of the available sugar, available crystal sugar, and the crystal content of cane sugar of different composition. Another table in extension of these is now presented by which it is possible to ascertain immediately with how much standard muscovado any quantity of sugar of some other kind corresponds. If, for example, it be desired to know with how much standard muscovado a rendement of 9·75 of sugar of 98·9 polarisation, and 0·2 per cent. of water, corresponds, the number 9·75 is multiplied by the number 1·0352 read from the table, when the result, 10·09, is obtained.

Geerligs' Table for the Equivalent in Standard Muscovado for One Part of Sugar of any Polarisation between 96·1 and 99·9, and for any Water Content between 0 and 1·5 per cent.

Polarisation.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1·0	1·1	1·2	1·3	1·4	1·5
	WATER CONTENT.															
99·9	1·0499	1·0505	—	—	—	—	—	—	—	—	—	—	—	—	—	—
99·8	1·0484	1·0489	1·0494	—	—	—	—	—	—	—	—	—	—	—	—	—
99·7	1·0468	1·0473	1·0478	1·0484	—	—	—	—	—	—	—	—	—	—	—	—
99·6	1·0452	1·0457	1·0462	1·0468	1·0473	—	—	—	—	—	—	—	—	—	—	—
99·5	1·0436	1·0441	1·0446	1·0452	1·0457	1·0462	—	—	—	—	—	—	—	—	—	—
99·4	1·0420	1·0425	1·0430	1·0436	1·0441	1·0446	1·0452	—	—	—	—	—	—	—	—	—
99·3	1·0405	1·0410	1·0415	1·0420	1·0425	1·0430	1·0436	1·0441	—	—	—	—	—	—	—	—
99·2	1·0389	1·0394	1·0399	1·0405	1·0410	1·0415	1·0420	1·0425	1·0430	—	—	—	—	—	—	—
99·1	1·0374	1·0379	1·0384	1·0389	1·0394	1·0399	1·0405	1·0410	1·0415	1·0420	—	—	—	—	—	—
99·0	1·0358	1·0363	1·0368	1·0374	1·0379	1·0384	1·0389	1·0394	1·0399	1·0405	1·0410	—	—	—	—	—
98·9	1·0342	1·0347	1·0352	1·0358	1·0363	1·0368	1·0374	1·0379	1·0384	1·0389	1·0394	1·0399	—	—	—	—
98·8	1·0326	1·0331	1·0336	1·0342	1·0347	1·0352	1·0358	1·0363	1·0368	1·0374	1·0379	1·0384	1·0389	—	—	—
98·7	1·0310	1·0315	1·0320	1·0326	1·0331	1·0336	1·0342	1·0347	1·0352	1·0358	1·0363	1·0368	1·0374	1·0379	—	—
98·6	1·0294	1·0299	1·0304	1·0310	1·0315	1·0320	1·0326	1·0331	1·0336	1·0342	1·0347	1·0352	1·0358	1·0363	1·0368	—
98·5	1·0279	1·0284	1·0289	1·0294	1·0299	1·0304	1·0310	1·0315	1·0320	1·0326	1·0331	1·0336	1·0342	1·0347	1·0352	1·0358
98·4	1·0263	1·0268	1·0273	1·0279	1·0284	1·0289	1·0294	1·0299	1·0304	1·0310	1·0315	1·0320	1·0326	1·0331	1·0336	1·0342
98·3	1·0247	1·0252	1·0257	1·0263	1·0268	1·0273	1·0279	1·0284	1·0289	1·0294	1·0299	1·0304	1·0310	1·0315	1·0320	1·0326
98·2	1·0232	1·0237	1·0242	1·0247	1·0252	1·0257	1·0263	1·0268	1·0273	1·0279	1·0284	1·0289	1·0294	1·0299	1·0304	1·0310
98·1	1·0216	1·0221	1·0226	1·0232	1·0237	1·0242	1·0247	1·0252	1·0257	1·0263	1·0268	1·0273	1·0279	1·0284	1·0289	1·0294
98·0	1·0200	1·0205	1·0210	1·0216	1·0221	1·0226	1·0232	1·0237	1·0242	1·0247	1·0252	1·0257	1·0263	1·0268	1·0273	1·0279
97·9	1·0184	1·0189	1·0194	1·0200	1·0205	1·0210	1·0216	1·0221	1·0226	1·0232	1·0237	1·0242	1·0247	1·0252	1·0257	1·0263
97·8	1·0168	1·0173	1·0178	1·0184	1·0189	1·0194	1·0200	1·0205	1·0210	1·0216	1·0221	1·0226	1·0232	1·0237	1·0242	1·0247
97·7	1·0152	1·0157	1·0162	1·0168	1·0173	1·0178	1·0184	1·0189	1·0194	1·0200	1·0205	1·0210	1·0216	1·0221	1·0226	1·0232
97·6	1·0136	1·0141	1·0146	1·0152	1·0157	1·0162	1·0168	1·0173	1·0178	1·0184	1·0189	1·0194	1·0200	1·0205	1·0210	1·0216
97·5	1·0121	1·0126	1·0131	1·0136	1·0141	1·0146	1·0152	1·0157	1·0162	1·0168	1·0173	1·0178	1·0184	1·0189	1·0194	1·0200
97·4	1·0105	1·0110	1·0115	1·0121	1·0126	1·0131	1·0136	1·0141	1·0146	1·0152	1·0157	1·0162	1·0168	1·0173	1·0178	1·0184
97·3	1·0089	1·0094	1·0099	1·0105	1·0110	1·0115	1·0121	1·0126	1·0131	1·0136	1·0141	1·0146	1·0152	1·0157	1·0162	1·0168
97·2	1·0074	1·0079	1·0084	1·0089	1·0094	1·0099	1·0105	1·0110	1·0115	1·0121	1·0126	1·0131	1·0136	1·0141	1·0146	1·0152
97·1	1·0058	1·0063	1·0068	1·0074	1·0079	1·0084	1·0089	1·0094	1·0099	1·0105	1·0110	1·0115	1·0121	1·0126	1·0131	1·0136
97·0	1·0042	1·0047	1·0052	1·0058	1·0063	1·0068	1·0074	1·0079	1·0084	1·0089	1·0094	1·0099	1·0105	1·0110	1·0115	1·0121
96·9	1·0026	1·0031	1·0036	1·0042	1·0047	1·0052	1·0058	1·0063	1·0068	1·0074	1·0079	1·0084	1·0089	1·0094	1·0099	1·0105
96·8	1·0010	1·0015	1·0020	1·0026	1·0031	1·0036	1·0042	1·0047	1·0052	1·0058	1·0063	1·0068	1·0074	1·0079	1·0084	1·0089
96·7	0·9995	1·000	1·0005	1·0010	1·0015	1·0020	1·0026	1·0031	1·0036	1·0042	1·0047	1·0052	1·0058	1·0063	1·0068	1·0074
96·6	0·9979	0·9984	0·9990	0·9995	1·0000	1·0005	1·0010	1·0015	1·0020	1·0026	1·0031	1·0036	1·0042	1·0047	1·0052	1·0058
96·5	—	0·9968	0·9974	0·9979	0·9984	0·9990	0·9995	0·0000	1·0005	1·0010	1·0015	1·0020	1·0026	1·0031	1·0036	1·0042
96·4	—	—	0·9958	0·9963	0·9968	0·9974	0·9979	0·9984	0·9990	0·9995	1·0000	1·0005	1·0010	1·0015	1·0020	1·0026
96·3	—	—	—	0·9947	0·9952	0·9958	0·9963	0·9968	0·9974	0·9979	0·9984	0·9990	0·9995	1·0000	1·0005	1·0010
96·2	—	—	—	—	0·9936	0·9942	0·9947	0·9952	0·9958	0·9963	0·9968	0·9974	0·9979	0·9984	0·9990	0·9995
96·1	—	—	—	—	—	0·9926	0·9931	0·9936	0·9942	0·9947	0·9952	0·9958	0·9963	0·9968	0·9974	0·9979

—J. P. O.

Light filter cell; Use of a —— in polarising high-grade sugars. A. H. Bryan. Intern. Sugar J., 1912, **14**, 630—633.

On the recommendation of the author, the following resolution was adopted by the 7th meeting of the International Commission for Uniform Method of Sugar Analysis held in New York on September 12th, 1912: That where white light is used in polarisations, it shall be filtered through a potassium bichromate solution of such a strength that the percentage composition multiplied by the length of the column in cm. is 9.—J. P. O.

Sucrose; Study of the different methods of determining —— in cane molasses. Complete analysis of a cane molasses. C. Fribourg. Intern. Sugar J., 1912, **14**, 702—712.

Using a Brazilian molasses containing 15·25 per cent. of reducing sugars and 6·36 per cent. of ash, the author has made a comparative study of the various optical and chemical methods of determining the sucrose, the following results were obtained: Direct polarisation (the so-called "apparent"-determination), defecating with basic lead acetate, gave 35·88; defecating with chloride of lime and normal lead acetate, 33·85. Double polarisation, using for the direct reading a solution defecated with basic lead acetate, gave 42·58 per cent. sucrose; double polarisation, using for the direct reading a solution defecated with chloride of lime and normal lead acetate, 41·86; double polarisation, using for the direct reading a solution containing hydrochloric acid and urea, 41·52; double polarisation, using for the direct reading a solution containing sulphurous acid, 41·62; after destruction of the reducing sugars by the Pellet-Lemeland method (this J., 1910, 1220, and 1911, 1400), and direct polarisation of the liquid obtained, 41·65 per cent. sucrose was obtained; after destruction of the reducing sugars by the Pellet-Lemeland method, and double polarisation of the liquid obtained, 41·57; after destruction of the reducing sugars by the Pellet-Lemeland method, and the determination by the gravimetric process of the reducing substances before and after inversion in the liquid obtained, 41·32; gravimetrically, by the Pellet procedure, using an undefecated solution, and determining the reducing sugars before and after inversion, 41·44; by the invertase double polarisation method (this J., 1911, 62), 41·36 per cent. On averaging the different double polarisation determinations of sucrose (excepting the figures obtained by means of solutions defecated with basic lead acetate, which are known to be incorrect), the result is 41·54, as compared with 41·36, the figure obtained by the invertase process. Finally, the so-called "apparent" analysis (where the solid matter is taken from the direct reading on the Brix saccharometer and the sucrose from the direct polarisation reading) and the "true" analysis of the molasses were made, and the results obtained lead the author to emphasise the importance of employing the more correct methods of determining the sucrose, reducing sugars, and dry substance values.
—J. P. O.

Photolysis of various classes of sugars by ultra-violet rays. D. Berthelot and H. Gaudechon. Comptes rend., 1912, **155**, 1153—1156. (See also this J., 1910, 904, 1080, 1081; 1912, 847.)

The photolysis of ketoses may be effected with rays of longer wave-length than 0·3 μ; for aldoses the upper limit is 0·3—0·25 μ; for open-chain polyhydric alcohols the upper limit is 0·25—0·2 μ, whilst cyclic polyhydric alcohols are only decomposed by the extreme ultra-violet rays, of wave-length less than 0·2 μ. When these classes of compounds are submitted to the action of rays of the longest wave-length which will effect photolysis, the decomposition proceeds in a simple fashion. From ketoses, only carbon monoxide is evolved; from aldoses, 2 vols. of carbon monoxide and 1 vol. of hydrogen, and from polyhydric alcohols, equal volumes of these two gases. There is no formation of acid nor of substances capable of reducing Fehling's solution in the cold. When, however, rays of shorter wave-length are employed, the product develops acidity and capacity for reducing cold Fehling's solution. At the same time there is an increased production of hydrogen, and more or less carbon dioxide is formed. Very advanced decomposition is accompanied by the production of methane. Sunlight decomposes ketoses fairly readily (see this J., 1912, 847), but aldoses to only a slight extent. Solutions of erythritol and mannitol, exposed by the authors to sunlight for six months, evolved no gas, but acquired slight reducing properties. Carbon monoxide and hydrogen, which are primarily formed in simple proportions by the photolysis of carbohydrates, have previously been shown to combine under the influence of ultraviolet light to produce formaldehyde (this J., 1910, 904), the starting point in the natural synthesis of carbohydrates. The photolysis and photosynthesis of formaldehyde are probably reversible processes, and the same appears to be true in the case of the sugars generally.—J. H. L.

Starch granules; Researches on the gelatinising temperature of ——. M. Nyman. Z. Unters. Nahr. Genussm., 1912, **24**, 673—676.

Rye, barley, and wheat starches were found to gelatinise at slightly different temperatures, the actual results obtained being:—Rye starch, 57° C., barley starch, 58° C., and wheat starch, 59° C. The determinations were made by placing the starches in water heated to suitable temperature, and, as the temperature rose, removing drops of the mixtures every 30 seconds for examination under the micropolariscope. The point at which the granules ceased to show interference crosses was taken as the gelatinising temperature. Other experiments showed that the larger starch granules gelatinised more quickly than the smaller. Although the difference in the gelatinising temperatures does not afford a means of identifying two starches in a mixture of the same, the rate of gelatinisation may be of some use for the purpose. For instance, if a mixture of rye and wheat meals is maintained at a temperature of 53° C., the rye starch is gelatinised in 6 minutes, whilst the wheat starch requires 24 minutes; any ungelatinised grains observable in such a mixture after 7 minutes heating indicate the probable presence of wheat meal.
—W. P. S.

Purification of waste waters [of a beet sugar factory, a refinery, a brewery, and a malthouse] by lime, "humin," and clay. Roubinek. *See* XIXb.

Patents.

Sacchariferous plants; Extraction of the juice of ——. C. Steffen, Vienna. Eng. Pat. 1540, Jan. 19, 1912.

Dilute juice, obtained as described below from partially extracted sacchariferous material such as beet slices, is heated, preferably to 92° C., and mixed with 20—25 per cent. of its weight of cold fresh slices. The slices are then removed from the liquid, which is re-heated and mixed with a further portion of fresh slices, the cycle being repeated until the liquid attains the same concentration and purity as the juice expressed from the fresh slices. The slices that have been soaked in this way and thereby heated to a temperature above 60° C., are expressed, yielding a juice of high concentration and purity. The residue is repeatedly soaked with hot dilute juice in a series of troughs and expressed in presses situated between the troughs; the liquid from one press serves to soak the material to be treated in the preceding press, and before the final pressing the residue is soaked in hot water.—L. E.

Sugar juices; Sulphitation of ——, and apparatus therefor. E. L. Illingworth, Batstone, Natal. Eng. Pat. 8218, April 4, 1912.

The apparatus includes a vertical column, the lower part of which is immersed in, but does not quite extend to the bottom of, a tank for the reception of the sulphited juice. This tank is provided with an overflow. A feed pipe connects a sulphur burner with the upper end of the column, and an air compressor, feeding the sulphur burner, causes the sulphitation gas to be delivered at such a pressure that the residual gas is forced through the juice in the tank; the ascending arm of the feed pipe is fitted with an expansion chamber in order that any unburnt particles of sulphur may be returned to the burner. The juice to be treated is pumped through a supply pipe attached to the column at such a distance above the end of the latter, that the juice absorbs all the sulphur dioxide; this supply pipe is attached to the column at such an angle that it remains full of juice between the strokes of the pump. A perforated transverse plate in the column causes the juice to descend in the form of spray. Near its lower end, the column is fitted with a number of horizontal perforated pipes for the distribution of the sulphitated juice throughout the tank.—L. E.

Starch; Process for the purification of ——. W. H. Uhland Ges.m.b.H. Ger. Pat. 251,907, May 31, 1911.

In this process for the purification of starch, especially potato starch, a vessel provided with superposed filter-partitions is filled with the water carrying the starch, etc., in suspension, and the solids are allowed to settle in the order of their specific gravity, the water being drawn through the filters by suction. The process is repeated as often as is necessary, the vessel being completely filled each time. It is stated that the starch finally obtained does not need to be centrifuged before drying.—A. S.

Dextrin; Continuous process for the manufacture of non-hygroscopic ——. H. Th. Böhme A.-G. Ger. Pat. 252,827, Aug. 26, 1909.

The air-dried starch is mixed intimately with the necessary quantity of acid, in as concentrated a condition as possible, and the mixture is introduced continuously into a relatively large quantity of a similar mixture in which the dextrin-formation is complete and which is at the temperature necessary for the formation of dextrin. The dextrin produced is withdrawn at a speed corresponding with that at which the mixture of starch and acid is introduced.—A. S.

XVIII.—FERMENTATION INDUSTRIES.

Diastase; Action of hydrochloric acid gas on ——. *I.* T. Panzer. Z. physiol. Chem., 1912, **82**, 276—325.

Diastase, dried *in vacuo* over sulphuric acid, absorbs dry hydrochloric acid without undergoing much darkening. From specimens of commercial diastase, some of which had been further purified, the author obtained preparations containing 6—17 per cent. of hydrochloric acid. After solution in water and neutralisation, these preparations were found to have lost their saccharifying power completely. When kept in a vacuum over sulphuric acid and soda-lime, hydrochloric acid was withdrawn from them fairly rapidly during the first few days, and afterwards more slowly, but even after several weeks their content of hydrochloric acid was only reduced by about one-half. This partial withdrawal of acid was associated with a partial recovery of saccharifying power. The author discusses fully the possible explanations of these facts, and concludes that the activity of diastase depends on the presence of one or more atomic groups capable of combining chemically with hydrochloric acid, not by virtue of basic properties nor in consequence of ionic reactions, but in some other manner. The activity lost in consequence of combination of these groups with the acid, is restored again when the latter is withdrawn, *e.g.*, by prolonged treatment in a vacuum. If the active groups simply combined with the acid owing to a slightly basic character, they should be set free again on neutralising a solution of the enzyme with alkali, whereas in fact neutralisation produces no restoration of activity.—J. H. L.

Invertase; Action of hydrochloric acid on ——. T. Panzer. Z. physiol. Chem., 1912, **82**, 377—390. (Cp. preceding abstract.)

A dried invertase preparation absorbed 20—25 per cent. of dry hydrochloric acid, and thereby completely lost its activity. After 3 weeks *in vacuo* over sulphuric acid and soda-lime, less than half the acid was withdrawn, and the invertase remained inactive. The author concludes that the loss of activity on absorption of hydrochloric acid is due to other causes than those operative in the case of diastase, and that the chemical constitution of the active atomic grouping is not the same in the two enzymes. —J. H. L.

Enzyme action and the influence of neutral salts thereon. II. E. Starkenstein. Biochem. Zeits., 1912, **47**, 300—319. (See also this J., 1910, 507.)

The quantity of sodium chloride required to confer the maximum activity on diastase which has been rendered inactive by dialysis, is proportional to the quantity of enzyme present (*loc. cit.*). The author has applied this fact to the comparison of the diastase-content of corresponding organs of various classes of animals.—J. H. L.

Fermentation by yeast; Influence of organic acids on ——. F. Johannessohn. Biochem. Zeits., 1912, **47**, 97—117.

Sufficiently dilute solutions of formic acid and its homologues (up to valeric acid) accelerate fermentation, and the maximum accelerating influence is exerted by the different acids at equimolecular concentrations. With increase in the concentration the acids exert a more and more marked inhibitive action. The minimum quantities of the acids required to arrest fermentation completely do not kill the yeast cells. The degree of inhibition exerted on a given quantity of yeast depends on the concentration of acid and not on the absolute amount. The relation between the quantity of yeast present (x), and the minimum concentration of acid (y) required to arrest fermentation completely, is represented by the parabolic equation, $y^2=kx$, in which k is a constant. The inhibitive action is due chiefly to undissociated molecules of acid and not to ions. This last conclusion is based on the fact that the inhibitive influence of formic acid was found to be undiminished by addition of sodium formate, except in one case where the molecular proportion of salt to acid was 20 : 1. In the case of acetic acid, the addition of sodium acetate certainly diminished the inhibitive action, but not to an extent corresponding to the diminution in the degree of ionisation of the acid. —J. H. L.

Aluminium; Resistance of —— *to alcohol.* Rüdiger and A. Karpinski. Z. Spiritusind., 1912, **35**, 660—661.

A piece of aluminium, weighing about 50 grms. and of about 116 sq. cm. area, was found to lose 0·349 per cent. in weight when left in contact with fermented potato mashes, during distillation for 85 working days: afterwards however, it gained in weight owing to the deposition of a tenacious coating of iron compounds. A piece of the same metal was corroded to a much less degree when left in the rectifying column for the same period, and it also subsequently gained in weight slightly. Further experiments showed that both pure and crude alcohol attack aluminium fairly readily and are rendered turbid thereby. It is concluded that the metal is very suitable for the construction of stills, but not for the construction of vessels in which alcohol is to be stored.—L. E.

Caramel in vinegar; Detection of ——. L. Ronnet. Ann. Falsif., 1912, **5**, 517—518.

Fifty c.c. of the vinegar are mixed with an excess of calcium carbonate and evaporated to dryness. The mass is then extracted with 20 c.c. of ether, the ethereal solution is filtered, and the filtrate is received in a test-tube containing 10 c.c. of resorcinol reagent (1 grm. of resorcinol dissolved in 100 c.c. of hydrochloric acid of sp. gr. 1·125). Should caramel be present in the vinegar, a red zone is obtained at the junction of the two liquids. Methods which depend on heating the vinegar with albumin, and extracting the evaporated solution with ether are untrustworthy, as traces of furfural compounds (the presence of which leads to the colouration with the resorcinol reagent) may be formed during the evaporation should the vinegar contain sugars.—W. P. S.

Purification of waste waters [of a beet sugar factory, a refinery, a brewery, and a malt-house] by lime, "humin" and clay. Roubínek. *See* XIXb.

PATENTS.

Ferment; Process of producing digestive ——. H. Yenjo, Tokyo. Eng. Pat. 25,879, Nov. 20, 1911. Under Int. Conv., Dec. 5, 1910.

This process is an improvement on that claimed in Fr. Pat. 376,373 of 1907 (this J., 1907, 1025) in that wheat or rice bran (30 bushels) is moistened, not with water, but with the liquid (17 gallons) obtained by boiling equal parts of powdered soya beans, sodium phosphate, potassium nitrate, and magnesium sulphate with water for 2 hours under an absolute pressure of 2—3 atmospheres. The moistened bran is steamed for 1½ hours, cooled and used for cultivating a mixture of 4 parts of an orange monilia (a hitherto unknown species first found in rice bran) and 6 parts of *Aspergillus oryzae*. The "koji" fungus thus obtained, which possesses very high proteolytic and diastatic power, is mixed with the product formed by steaming a mixture of the bran of farinaceous substances (30 bushels), powdered soya beans (1 bushel), and the above-mentioned liquid (17 gallons). The "koji" obtained thereby is sprayed with a liquid such as dilute alcohol or glycerin, left for 23 hours at 20°—30° C., and then expressed and filtered. The filtrate may be used for spraying a second portion of "koji," the filtrate finally obtained (40 gallons) being mixed with powdered germinated soya beans (1 bushel), stirred for 10 hours, and filtered. The filtrate is treated with 35—40 per cent. alcohol, decanted from precipitated impurities, and then treated with 90 per cent. alcohol. The precipitated ferment is washed with alcohol and ether, and dried over sulphuric acid.—L. E.

Diastatic substances; Preparation of ——. W. Acton, Tollcross, Lanark. Eng. Pat. 26,068, Nov. 22, 1911.

A mixture of 7 parts of wheaten or other bran and 1 part of ground peas or rice is moistened with an equal weight of an aqueous solution of say, 1 per cent. of acid potassium phosphate or an equivalent quantity of acid calcium phosphate and 0·5 per cent. of potassium nitrate. The whole is steamed, cooled to about 86° F. (30° C.) and thoroughly mixed with say, 0·01—1·0 per cent. of the spores or growth of an amylomyces fungus such as *A. rouxii*, or preferably, that species originally obtained from a sample of East India opium. The inoculated material is then spread in thin layers and kept at 90°—100° F. (32°—38° C.). When, in the course of 3—5 days, the growth has acquired a maximum diastatic activity, the material is extracted with a suitable solvent such as water. The extract acts on starch paste forming dextrin and only a very small proportion of sugars, and is especially suitable for use in laundry work; if desired, it may be evaporated *in vacuo* to a syrup or to dryness, or mixed with other substances such as dihydrogen potassium phosphate to insure better keeping qualities.—L. E.

Beverages; Manufacture of ——. W. Charnley, Fulwood, Lancs. Eng. Pat. 3899, Feb. 16, 1912.

The residue left on extracting the oil from soya beans is cleansed, ground, and heated to a temperature not exceeding 600° F. (316° C.), though, in some cases, this last operation may be omitted. The raw or cooked material is mixed with a small quantity of malt and treated in a converter or autoclave for about an hour at a pressure not exceeding 10 lb. The product is transferred to the mash tun in quantity equivalent to 12—25 per cent. of the malt or similar material. To prevent difficulty in fining, the wort must be thoroughly boiled; the beer obtained therefrom is characterised by great brilliancy, a strong head, and low alcohol-content. The above-described product is also used in the manufacture of spirits; in the case of whisky, the usual distilling materials are mixed with about 20 per cent. of the product. —L. E.

Wines and like beverages; Process and apparatus for the manufacture and treatment of effervescent ——. A. Porte, Geneva. Eng. Pat. 16,482, July 15, 1912.

See Fr. Pat. 432,664 of 1911; this J., 1912, 147.—T. F. B.

Beverages; Process of clarifying ——. H. Zwick, Neustadt, Germany. U.S. Pat. 1,045,245, Nov. 26, 1912.

See Fr. Pat. 422,281 of 1911; this J., 1911, 567.—T. F. B.

Beer-yeast; Process of cleaning ——. G. Erdmann, Berlin. U.S. Pat. 1,045,689, Nov. 26, 1912.

See Eng. Pat. 11,424 of 1911; this J., 1912, 507.—T. F. B.

XIXa.—FOODS.

Oil in grains; Rapid control method for the determination of ——. E. P. Harding and L. L. Nye. J. Ind. Eng. Chem., 1912, **4**, 895—897.

The authors find that carbon tetrachloride extracts the oil completely from air-dried or oven-dried grains (cereals) in a comparatively short time and that the extracted oil has a higher iodine value than that obtained by use of petroleum ether or ether. Their method, which occupies only 2½ hours, is briefly as follows:—The sample is boiled with carbon tetrachloride for 1 hour under a reflux condenser, cooled, and the whole mixed with alcohol, water, and petroleum ether and whirled in a centrifuge. The petroleum ether layer is then "blown off" through a filter into a tared flask, and the operations of adding alcohol, water, and petroleum ether, whirling in a centrifuge, and "blowing off" the petroleum ether layer are repeated twice more. The filter is washed with petroleum ether, and then the petroleum ether is distilled off from the solution, and the tared flask containing the residue dried in a casserole water-bath till of constant weight.—A.S.

Cottonseed meal; Organic phosphoric acid of ——. R. J. Anderson. J. Biol. Chem., 1912, **13**, 311—323.

The organic phosphoric acid present in cottonseed meal has been isolated and identified as phytin or some closely allied substance. It is uncertain whether the toxicity of the meal is due to phytin; the experiments at present made do not support this idea.—E. F. A.

Caffeol [from coffee]; Origin of ——. V. Grafe. Monats. Chem., 1912, **33**, 1389—1406.

The roasting of coffee beans results in the formation of substances (among which is the substance responsible for the specific aroma of the beverage) which are very soluble in water, and are presumed to have an important physiological action on the heart; they are collectively called caffeol. The composition of caffeol is usually about 50 per cent. of furfuryl alcohol and 38 per cent. of valeric and acetic acids, the remainder being phenolic substances with a creosote odour and a nitrogenous substance allied to pyridine which is the aromatic principle. The author has conducted an investigation into the origin of caffeol using three types of coffee:—(1) Ordinary coffee. (2) Caffeine-free coffee, prepared by "opening" the unroasted coffee with superheated steam and extracting the caffeine with the purest benzene. In this way mechanical impurities, fats and wax are also removed. (3) Coffee purified by Thum's method (this J., 1911, 340) which consists in brushing the coffee in warm water. The removal of surface wax and any remaining portions of the seed coating is thus achieved, but the crude fibre of the bean itself is not disturbed. Coffee (2) yielded a much smaller percentage of caffeol and particularly of furfuryl alcohol than coffee (1). This appears to be due to the much smaller content of crude fibre in coffee (2), a large amount being removed by the processes to which it had been submitted. The author therefore concludes that the crude fibre is the source of the caffeol. This conclusion is supported by the fact that coffee (3) gives as much caffeol as (1), and by the fact that the percentage of crude fibre is greatly diminished on roasting. Examination of the refuse from the processes used in producing coffees (2) and (3), shows that the former contains large quantities of carbohydrates, while the latter contains only traces. The origin of the carbohydrates is obviously the cellulose and other polysaccharides of the crude fibre, which would otherwise have given rise to caffeol on roasting. It also appears probable that the “ opening ” with superheated steam destroys some of the chlorogenic and coffalic acids, with which the caffeine is originally combined, thus rendering the caffeine much more easy of extraction. —W. H. P.

Gelatinising temperature of starch grains. Nyman. *See* XVII.

Patents.

Corn ; Process for separating the germ or germ and hull from —— and the product of such process. H. Wulkan, Assignor to Dextrin Automat Ges. m. b. H., Vienna. U.S. Pat. 1,045,490, Nov. 26, 1912.

The corn is soaked in a dilute acid, *e.g.*, hydrochloric acid, until it is sufficiently softened, and is then subjected to a pressure sufficient to separate the germ and hull without materially disintegrating the starchy kernel. —A. S.

Decorticated pulses ; Process of preserving the aroma of ——. E. J. Lourdel, Rheims, France. U.S. Pat. 1,046,314, Dec. 3, 1912.

See Eng. Pat. 5413 of 1912 ; this J., 1912, 1049.—T. F. B.

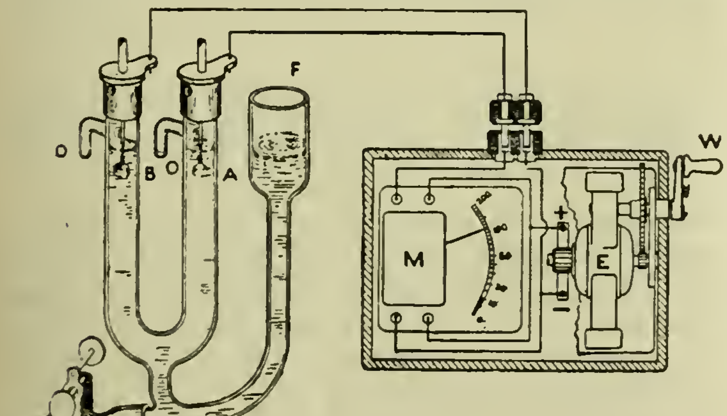
Fish ; Process of preserving ——. A. Danilevsky, St. Petersburg. U.S. Pat. 1,046,991, Dec. 10, 1912.

See Eng. Pat. 18,365 of 1911 ; this J., 1912, 1197.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

Water ; Apparatus for testing —— by measurement of its electrical conductivity. L. Archbutt. Analyst, 1912, **37**, 538—542.

The apparatus shown in the illustration is known as the “ Dionic ” water-tester and was designed primarily for detecting leakage in surface condensers ; its value depends upon its extreme sensitiveness in detecting the presence of mere traces of dissolved electrolytes in the water. The water to be tested is poured into the funnel, *F*, and rises into the two arms of the U-tube to the level fixed by the overflows, *O*, *O* ; the electrodes, *A* and *B*, are short tubes of platinum foil and the current is supplied by the hand-driven dynamo, *E*, fitted with a constant-speed friction clutch which maintains a constant E.M.F. of 100 volts when the handle, *W*, is turned at a rate faster than that at which the clutch is designed to slip. The current passing through the water is measured by the direct-reading conductivity meter, *M*, and the temperature is taken by a thermometer immersed in the funnel. The standard temperature for testing is 20° C., but a scale of corrections supplied with the instrument saves the trouble of adjusting the temperature of the water provided that it is between 10° and 40° C. Unboiled distilled water shows a conductivity of 2·7 ; the same after boiling to remove carbon dioxide, 1·0 to 1·5 ; water saturated with carbon dioxide, 44·0 ; Glasgow (Loch Katrine) water, 34 ; spring water with a hardness of 18·4° and containing 25 grains of total solids per gall., 552. On diluting the latter water with boiled distilled water so that the mixture contained 0·15 grain of total solids per gall., the conductivity fell to 4·2 ; the amount of chloride in this mixture could scarcely be detected by means of silver nitrate. The conductivities exhibited by various acid, alkaline, and saline solutions are given, and it is shown that, in the case of boiler water, the instrument is a more rapid indicator of the amount of saline matters in solution than is a determination of the chlorine ; the conductivity is fairly proportional to the non-volatile solids whilst the chlorine is not. In discussion, the author remarked that there might be circumstances in which the apparatus would be useful in connection with water-softening operations, but conditions could easily be imagined under which it would be practically useless. In the case of a mixed water supply derived from different sources it might be possible to determine approximately to what extent the various kinds of water were present, but here again there would be limitations.—W. P. S.



Water ; Determination of nitrites in ——. Duyk. Ann. Chim. analyt., 1912, **17**, 445—447.

In order that there shall be no danger of oxygen combining with nitric oxide and rendering the latter capable of liberating further quantities of iodine from potassium iodide, it is recommended that Winkler's method of carrying out the iodometric determination of nitrites be adopted. In this method 100 c.c. of the water under examination are acidified with 20 c.c. of 10 per cent. hydrochloric acid, 3 c.c. of starch solution are added, and 4 grms. of potassium bicarbonate are introduced in small quantities at a time. A crystal of potassium iodide is now added, then a further quantity of 1 grm. of the bicarbonate, and the liberated iodine is titrated with thiosulphate solution. The liquid ought to remain colourless for 10 minutes after the completion of the titration ; if the blue colouration reappears, it indicates that the oxygen was not expelled completely by the carbon dioxide. —W. P. S.

Waste waters ; Purification of the —— [of a beet sugar factory, a refinery, a brewery, and a malt-house] by lime, “ humin,” and clay. J. Roubínek. Z. Zuckerind. Böhm., 1912, **37**, 128—131. (Cf. also this J., 1912, 505).

After unsuccessfully endeavouring to purify the waste waters coming from a beet sugar factory, a refinery, a brewery, and a malt house by means of lime alone, the author obtained satisfactory results by the addition of both “ humin ” and lime. It was found that the “ humin ” had the effect of readily carrying down the colloidal substances, yielding a clear and odourless liquid. That the water had thus been considerably purified is shown by the following figures, expressing mgrms. per litre, (a) before and (b) after the treatment : total solid matter, (a) 3457, (b) 1740 ; mineral matter, (a) 2183, (b) 1395 ; organic matter, (a) 1274, (b) 345 ; suspended matter (a) 1328, (b) 40 ; and oxygen absorption, potassium permanganate required, (a) 602, (b) 219. Since, however, “ humin ” is comparatively costly, experiments were made, with the object of replacing it either in whole or in part by a clay of suitable character (compare Rohland, this J., 1911, 150). On mixing the clay with the waste water, and adding milk of lime, the suspended impurities were precipitated apparently as effectually as when “ humin ” and lime had been used, although it was observable that the smell was not so readily removed. Comparative figures, also expressing mgrms. per litre, (a) before treatment, (b) after treatment with “ humin ” and lime, and (c) after treatment with the clay and lime, obtained by the author in experiments on the large scale are as follows: total solid matter, (a) 3087, (b), 1062, (c) 1164; mineral matter, (a) 2187, (b) 769, (c) 792; organic matter, (a) 900, (b) 293, (c) 372; suspended matter, (a) 1077, (b) 47, (c) 46; oxygen absorption, potassium permanganate required, (a) 542, (b) 199, (c) 203; and alkalinity, (a) neutral, (b) 23, (c) 28. It would appear that the bad smell of the water originated from substances of a colloidal nature, which were only incompletely precipitated by "humin." Laboratory experiments showed that in the case of the waste water with which the investigations had been conducted, both suspended and colloidal substances could be completely precipitated, and the unpleasant odour entirely removed, by the use of a mixture of 90 per cent. of the clay and 10 per cent. of "humin," an appreciable economy in the working of the process as compared with the use of "humin" and lime thus being effected.—J. P. O.

Separation of suspended solids from percolator effluents. L. Clement. *See* Manchester Section, p. 4.

PATENT.

Carcases, slaughter-house waste, and the like; Apparatus for the treatment of ——. A. Sommermeyer, Assignor to R. A. Hartmann Maschinenfabrik, Berlin. U.S. Pat. 1,046,402. Dec. 3, 1912.

SEE Eng. Pat. 8898 of 1911; this J., 1912, 200.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine determinations according to the German Pharmacopœia and the volumetric determination of quinine by means of picric acid. E. Richter. Apoth.-Zeit., 1912, **27**, 949—950, and 960—961.

THE method described in the German Pharmacopœia, 5th Edn., for the determination of quinine in cinchona bark does not give concordant results, and is unsatisfactory in other respects. A preliminary treatment of the bark with hydrochloric acid is of great importance. Where the alkaloid solution is titrated, Poirrier's blue and lacmoid are better than hæmatoxylin, the indicator officially recommended. The author recommends a modification of the method proposed by Kleinstück (this J., 1912, 896), the alkaloid being precipitated in acid solution of known concentration with excess of picric acid, and then the total excess of acid titrated back. 3·75 grms. of the powdered bark are warmed on the water-bath with 2·5 c.c. of 25 per cent. hydrochloric acid and 20 grms. of distilled water for 15 minutes. When cold, 30 grms. of chloroform and 60 grms. of ether are added and the whole shaken. This is followed by the addition of 10 c.c. of 10 per cent. sodium hydroxide solution and a further shaking of 15 minutes duration. About 1 grm. of powdered tragacanth is added to clear the chloroform solution, followed by the addition of 0·5 grm. of ignited magnesia. 60 grms. of the chloroform-ether solution are filtered off and shaken out with 20, 20, and 10 c.c. of $N/10$ hydrochloric acid, and finally with 10 c.c. of water. The organic solvents are driven off and the aqueous portion made up to 250 c.c. 100 c.c. of this solution are treated with 20 c.c. of water and 30 c.c. of $N/10$ picric acid solution. When the precipitate has settled, the liquid is filtered and 50 c.c. are titrated with $N/10$ potassium hydroxide solution, using phenolphthalein as indicator.—F. SHDN.

Opium extract; Preparation of ——. Debourdeaux. J. Pharm. Chim., 1912, **6**, 542—544.

It is pointed out that in preparing solid extracts of opium to contain 20 per cent. of morphine as required by the French Codex, determination should be made of the morphine extracted by water and not the total morphine in the opium (see this J., 1911, 305). A portion of the morphine always remains behind in the marc. Dry powdery extracts are stated to be more satisfactory than the solid extract of the Codex.—F. SHDN.

Laudanum of Sydenham; Preparation and storage of ——. Debourdeaux. J. Pharm. Chim., 1912, **6**, 544—551.

THE laudanum of Sydenham is preferably made by lixiviation rather than by maceration. The percentage of soluble morphine in the opium is determined, and the latter lixiviated with its own weight of 30 per cent. alcohol. The alcohol is drawn off and used to lixiviate the saffron. This operation is repeated with fresh quantities of alcohol till the weight of laudanum obtained is 100 times that of the soluble morphine originally present. The morphine insoluble in the alcohol suffers some change during the lixiviation, for the marc is found to contain very much smaller quantities than could be expected from determinations of the total morphine in the original material. On keeping, the laudanum forms a deposit and the morphine content is lowered. This action is hastened by exposure to air.—F. SHDN.

Digitalis assay. W. H. Martindale. Pharm. J., 1912, **35**, 745—748, 778—780.

A COMPARISON has been made between the physiological method of assaying digitalis and the approximate simple chemical method described below. By means of the chemical method it can be readily ascertained whether a tincture is up to the physiological test requirements. 10 c.c. of the tincture are mixed with 10 c.c. of water and precipitated with 3 c.c. of 10 per cent. normal lead acetate solution, a little kieselguhr being added. After standing for 15 minutes the precipitate is filtered off and washed. The lead is removed from the filtrate by the addition of 2 c.c. of 10 per cent. sodium phosphate solution. The filtrate is evaporated to dryness after the addition of 0·2 grm. of calcium carbonate. The residue is mixed with sand and extracted 5 times with chloroform, using 10 c.c. on each occasion. The extract is evaporated and the residue extracted with warm water on the water-bath using 10 c.c. and 5 c.c. and again employing sand. The filtrate is evaporated to dryness and extracted three or four times with chloroform, 5 c.c. each time, the residue being mixed with sand and thoroughly triturated. The chloroformic liquors are evaporated and the residue dissolved in 4 c.c. of glacial acetic acid. 0·1 c.c. of the acetic acid solution is mixed with 1 c.c. of "sulphuric ammonium molybdate solution" in a 5×1 cm. test tube, and the depth of colour produced after 5 minutes is compared with a standard. The colouration indicates the content of combined "active water soluble" glucosides. —F. SHDN.

Aluminium; Action of amalgamated —— *on extracts containing alkaloids. Its use in toxicology.* E. Kohn-Abrest. Comptes rend., 1912, **155**, 1179—1181. (See this J., 1911, 836; 1912, 689.)

EXPERIMENTS are described relating to the application of amalgamated aluminium to the decolourisation of alcoholic extracts of viscera obtained in toxicological investigations. To determine whether alkaloids present in such extracts would be precipitated by the alumina formed, the following tests were carried out:—0·1 grm. of alkaloid was dissolved, together with 1 grm. of tartaric acid, in a mixture of 80 c.c. of alcohol and 20 c.c. of water. The solution was left for 24 hours in contact with 3—4 grms. of aluminium foil which had been previously immersed for 3 minutes in a 1 per cent. solution of mercuric chloride and afterwards washed. In the tests with morphine, narcotine, brucine, narceine and antipyrine, no appreciable precipitation of alkaloid occurred, for 95 per cent. or more of the amount used remained dissolved in the alcoholic liquid. The corresponding percentages in the case of other alkaloids were: atropine 94, codeine 92·5, héroine 90, caffeine 85, veratrine 80, strychnine 60, codeine and cocaine 50, and nicotine only traces. In operating on actual extracts of viscera, 10—12 grms. of amalgamated foil are used per litre of extract, and allowed to act for 24 hours, during which time the liquid should remain acid. Usually this treatment reduces the colour of the extract to a straw yellow tint, but sometimes it is necessary to add a further quantity of freshly amalgamated foil. After distilling off the alcohol, the extraction of the alkaloid is carried out as usual. By applying this procedure to the extraction of morphine and strychnine from viscera, the author invariably obtained satisfactory results, even when the quantity of alkaloid present did not exceed 0·0015 per cent. Any loss of alkaloid owing to fixation by the alumina is compensated by the greater purity of the product actually isolated.—J. H. L.

Dihydrobrucinonic acid and isobrucinolone. Strychnine alkaloids, XVI. H. Leuchs and G. Peirce. Ber., 1912, **45**, 3412—3420.

When warmed with acetic anhydride and sodium acetate, dihydrobrucinonic acid (Ber., 1912, **45**, 202) forms an acetyl derivative, $C_{25}H_{28}O_9N_2$, melting at 235°—238° C. If on the other hand, the acid be boiled with acetic anhydride, a neutral product, $C_{29}H_{30}O_{10}N_2$, is produced, which melts at 280°—282° C. with decomposition. Brucinonic acid was warmed with acetic anhydride and sodium acetate, with the production of a substance $(C_{13}H_{14}O_4N)^x$, which crystallises from alcohol and melts at 125°—127° C. with decomposition. Upon treating *iso*-brucinolone in the same way, an acetyl derivative is produced which has the composition, $C_{23}H_{24}O_6N_2$, and melts at 281°—283° C. with decomposition. *Iso*-brucinolone hydrate was prepared by heating *iso*-brucinolone with concentrated hydrochloric acid on the water-bath. After drying at 100° C. it has the composition, $C_{21}H_{24}O_6N_2$, melts with frothing at 205°—208° C., and on further heating solidifies and finally melts and decomposes at 310°—315° C. The sulphate of this basic substance melts with vigorous decomposition at 238° C. The hydrate by carefully heating to 215°—225° C. loses water and is converted into *iso*-brucinolone (melting at 308°—312° C. with decomposition). *Iso*-brucinolone was treated with ice-cold nitric acid of sp. gr. 1·4, with the formation of nitro-*bis*-apomethyldihydro-*iso*-brucinolone, $C_{19}H_{15}O_7N_3$. This can be reduced by the action of sulphur dioxide to nitro-*bis*-apomethyl-*iso*-quinolone, $C_{19}H_{17}O_7N_3$. The nitro-quinol of brucinolone when treated in the same way with sulphur dioxide yields nitro-*bis*-apomethylbrucinolone, $C_{19}H_{17}O_7N_3$.—F. Shdn.

Ipuranol and some related compounds; The formula of ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Proc., 1912, **28**, 317—318.

In a paper published some time ago (this J., 1908, 1828), Power and Rogerson described the isolation from *Ipomœa purpurea* of a substance which was designated ipuranol, and since then the same compound has repeatedly been obtained from a variety of plants. The analysis of the ipuranol, and of its acetyl derivative, appeared to indicate that the substance in question was a dihydric alcohol possessing the formula $C_{23}H_{38}O_2(OH)_2$. It has since been observed, however, that the analytical results agree equally well for a higher formula, $C_{29}H_{47}O_2(OH)_3$. The present authors have recently analysed benzoylipuranol, when figures were obtained not in harmony with the formula $C_{23}H_{38}O_4(CO{\cdot}C_6H_5)_3$, but in exact agreement with those theoretically required for the tribenzoyl derivative of a substance possessing the higher formula mentioned above.

A molecular-weight determination of the acetyl derivative was subsequently made, when the value 607 was obtained, compared with 604 required for $C_{29}H_{47}O_5(CO{\cdot}CH_3)_3$ and 464 required for $C_{23}H_{38}O_4(CO{\cdot}CH_3)_2$. It is thus evident that ipuranol is a trihydric alcohol, possessing the formula $C_{29}H_{47}O_2(OH)_3$.

Similarly, it has been ascertained that cluytianol possesses the formula $C_{29}H_{46}O(OH)_4$, and not $C_{23}H_{37}O(OH)_3$, as recently stated (this J., 1912, 1146). Power and Moore (this J., 1910, 271) described the isolation from colocynth of a new alcohol, designated as citrullol, which appeared to possess the formula $C_{22}H_{36}O_2(OH)_2$, thus being a lower homologue of ipuranol. A small quantity of this substance being available, it has now been re-investigated, with the result that it has been ascertained that citrullol should be represented by the formula $C_{28}H_{45}O_2(OH)_3$, a conclusion which is quite in harmony with the analytical results obtained by Power and Moore.

Benzoylcitrullol has not previously been described. It forms colourless needles, melting at 179°—180° C.

Lemon oil; Terpeneless ——. J. C. Umney. Perfumery and Essent. Oil Rec., 1912, 3, 317.

Much of the terpeneless lemon oil now being offered on the London and other markets contains only from 36 to 40 per cent. of citral, whilst formerly the quantity of this constituent was from 46 to 48 per cent. It has been assumed by some that the odour value of this oil is lower than that of the oil sold formerly, but tests which the author has made do not appear to indicate any very great difference in the two oils; at the same time it is important that the matter should be investigated thoroughly so that manufacturers may, if it be necessary, select oils of high citral content as the starting-point for the manufacture of terpeneless oils. Although the oils in question contain a low proportion of citral, there is present in them the normal percentage of total oxygenated substances, and the author, for this and other reasons, is not inclined to lay too much stress for the moment upon the aldehyde-content of terpeneless lemon oil.—W. P. S.

Marjoram oil. E. M. Holmes. Perfumery and Essent. Oil. Rec., 1912, 3, 322—324.

An oil distilled from *Calamintha nepeta* (lesser calamint) has been sold in France for many years and has been used as "marjolaine" or marjoram oil; true marjoram oil is, however, obtained from the plant *Origanum majorana* (sweet, knotted, or garden marjoram). The two plants are quite distinct, and the author points out the difference in their characters and appearance. As regards the oils themselves, that obtained from *Calamintha nepeta* has so distinct a pennyroyal flavour that it could not knowingly be used in place of marjoram oil, although it might possibly be mistaken for an inferior quality of pennyroyal oil. The physical and chemical characters of the two oils are as follows:—*Marjoram oil:* Sp. gr. 0·89 to 0·91; optical rotation, + 5° to + 18°; saponification value, 21·5. It contains a terpinene hydrate, a terpene, $C_{10}H_{16}$, 80 per cent. of a mixture of borneol and camphor, and a sesquiterpene hydrate, $C_{15}H_{24}H_2O$, but the substance which gives the peculiar odour to the oil has not been ascertained; the oil dissolves in two parts of 80 per cent. alcohol to form a clear solution. *Calamintha nepeta oil:* Sp. gr. 0·922 to 0·9249; optical rotation, +14° to +17·5°; it yields 4·4 per cent. of esters (as menthyl acetate) from 14 to 18 per cent. of alcohols (as menthol), and from 10·8 to 20 per cent. of ketones (probably pulegone).
—W. P. S.

Phenyl-butadiene; Influence of light on the rapidity of polymerisation of ——. H. Stobbe and F. Reuss. Ber., 1912, **45**, 3496—3498.

The phenyl-butadiene employed was prepared by the method of Von der Heide (Ber., 1904, **37**, 2103), and boiled at 96° C. under 18 mm. pressure. The authors point out that they found the vapour of their preparation strongly attacked the mucous membrane of the throat and eyes. Samples of the hydrocarbon were sealed up in two glass tubes of about ¾ cm. diameter, the air in which was first displaced by carbon dioxide. One tube was exposed to a south light, and the second was protected from light but kept close to the first. The refractive indices of the two samples were determined at intervals of 1½, 2½ and finally 7 months, and the results, which are given in a table, indicate that in 7 months the phenyl-butadiene is almost completely polymerised into *bis*-phenylbutadiene. Assuming that the degree of polymerisation is proportional to the refractive index, it was found that in 2½ months 75—76 per cent. of the phenyl-butadiene had been polymerised in the sample exposed to light, but only 12—13 per cent. in the sample which had been kept in the dark.—E. W. L.

Chlorinated hydrocarbons of importance as solvents; Physical constants of some ——. W. Herz and W. Rathmann. Chem.-Zeit., 1912, **36**, 1417—1418.

The authors determined some of the physical characters of chloroform ($CHCl_3$), carbon tetrachloride (CCl_4), trichloroethylene ($CHCl:CCl_2$), tetrachloroethylene (C_2Cl_4), *symm.*-tetrachloroethane ($C_2H_2Cl_4$) and pentachloroethane (C_2HCl_5). The densities at 15°/4° C. and 25°/4° C. respectively, and formulæ for calculating the densities at other temperatures are: chloroform, 1·4963, 1·4791; $d=1·5255—0·00186t$; carbon tetrachloride, 1·6011, 1·5835, $d=1·6309—0·0018943t$; trichloroethylene, 1·4660 (at 17·6°/4° C.), 1·4542, $d=1·49486—0·001641t$; tetrachloroethylene, 1·6239, 1·6080, $d=1·64861—0·0016246t$; *symm.*-tetrachloroethane, 1·6015, 1·5881, $d=1·6257—0·0015073t$; pentachloroethane, 1·6846, 1·6712, $d=1·7074—0·0014492t$. The vapour pressures at different temperatures are given in the following table:—

$CHCl_3$		CCl_4.		$CHCl:CCl_2$.		C_2Cl_4.		$C_2H_2Cl_4$.		C_2HCl_5.	
p.	t.	p.	t.	p.	t.	p.	t.	p.	t.	p.	t.
mm.	° C.	mm.	° C.	mm.	° C.	mm.	° C.	mm.	° C.	mm.	° C.
755	61·0	743	76·1	760	87·15	751	118·5	751	144·7	734	157·8
684	56·0	663	71	562	77·0	669	114·5	594	136·0	563	147·0
616	53·8	559	65	385	65·0	457	101·6	502	130·0	479	140·8
[illegible]	50·5	443	58·5	234	51·0	407	98·0	372	120·5	406	135·1
481	47·0	328	50·0	183	45·0	280	86·0	313	115·0	327	128·2
416	42·8	282	46·3	177	44·15	161	72·0	252	108·0	247	119·0
342	38·0	236	42·0	139	38·20	102	60·0	132	90·0	172	108·2
287	33·0	143	31·0	92	30·0	51	44·3	89	80·0	103	93·6
223	27·0	116	25·0	73	25·0	30	33·2	45	62·0	37	69·0

—A. S.

Osmium tetroxide: Oxidations effected by —— and its use in rendering chlorate solutions active. K. A. Hofmann. Ber., 1912, **45**, 3329—3336.

On heating oxidisable liquids containing a trace (0·01 grm. per 200 c.c.) of osmium tetroxide with oxygen in a steel bomb under a pressure of 10 atmos. at 50° to 100° C., rapid oxidation is frequently effected. For example 40 per cent. alcohol was thus oxidised in 3 to 4 hours to acetic acid and acetal, whilst dilute methyl alcohol was oxidised to formaldehyde and formic acid. Aldehydes, however, were oxidised only slowly or not at all by osmium tetroxide, and the simple acids (formic, acetic, oxalic acids, etc.), were also very resistant to its action. Anthracene in acetic acid solution was oxidised to anthraquinone. On treating a mixture of 15 grms. of arsenic and 10 grms. of potassium chlorate with 50 c.c. of water, no reaction takes place, even on the addition of 1 c.c. of dilute sulphuric acid, but after the introduction of 1 c.c. of osmium tetroxide solution (1·5 grm. in 100 c.c.), the temperature immediately rises and the arsenic is rapidly oxidised to arsenic acid. Still more violent is the oxidation of hypophosphoric acid. In like manner hydrazine sulphate is quantitatively oxidised, and by measuring the liberated nitrogen the reaction may be used for the determination of hydrazine sulphate. Quinol was thus oxidised to quinhydrone, and aniline to Emeraldine. In the latter reaction the effect of osmium tetroxide was far superior to that of the cerium salts hitherto used for the purpose, and was also better than vanadic acid. Benzidine yielded a dark blue precipitate with a copper-red lustre, apparently identical with Willstätter's diphenoquinonedi-imide (this J., 1896, 1086). Coloured salts were also given by *p*-leucaniline and the leuco-compound of Malachite Green. Pyrocatechol yielded a red brown; tannin, a dark green; and resorcinol a brown red colouration. Anthracene on treatment with 12 per cent. sodium chlorate solution and 1 or 2 c.c. of the osmium solution was immediately oxidised to anthraquinone, whilst the chlorate was reduced to chloride. An addition of glacial acetic acid was required for obtaining the best yield. The osmium tetroxide had the same catalytic effects whether added to a neutral or slightly acid solution of an alkali chlorate. Pure benzene from tar gives no darkening with osmium tetroxide, but in the presence of traces of impurities, probably thiophen, a black discolouration is speedily obtained. Pure pentane and hexane, unlike the commercial preparations, are also not blackened; and the same remark applies to pure benzoic acid, bromobenzoic acid and naphthalene. Saturated ketones, like aldehydes, offer great resistance to the reagent, although "pure" commercial acetone is darkened, owing to the presence of some impurity.—C. A. M.

Hydrogenation of unsaturated substances; Catalytic ——. VII. Preparation and application of colloidal platinum metals. VIII. Hydrogenation of aldehydes and ketones and of aromatic and heterocyclic substances in colloidal solutions. A. Skita and W. A. Meyer. Ber., 1912, **45**, 3379—3395.

It has been shown previously that on leading hydrogen into aqueous alcoholic solutions of unsaturated aldehydes or ketones containing small quantities of palladious chloride and gum arabic, a stable colloidal palladium solution is formed, and on continuing the passage of hydrogen, the C : C double linkage is quantitatively hydrogenised, the more rapidly the nearer it is to the carbonyl group. With substances other than aldehydes or ketones, the palladium is, as a rule, precipitated in a granular form, and with such a solution hydrogenation cannot be effected at all of aromatic double linkages, and only slowly of non-aromatic unsaturated groups (camphene, phenylvinyl acetate).

The authors have now found that the hydrogenation of unsaturated substances other than aldehydes and ketones can be readily effected, if to the solution prepared as indicated above, a trace of a previously prepared colloidal platinum or palladium solution be added before passing in the hydrogen: the reduced palladium (or platinum) then separates in the colloidal instead of the granular form. The colloidal metal solutions may be prepared by Paal's method (this J., 1904, 208), using, however, gum arabic as protective colloid: or by passing hydrogen into a previously warmed solution of platinum chloride or palladious chloride and gum arabic. Or, by adding sodium carbonate to a solution of palladious chloride (or platinum chloride) containing gum arabic, and heating, the colloidal hydroxide of the metal is produced: the solution is dialysed, and evaporated to dryness *in vacuo*, yielding the solid colloidal hydroxide, which dissolves in water in presence of a trace of acid or alkali, and is reduced to the corresponding colloidal metal by hydrogen. Reversible metallic colloids, soluble in water, may be prepared in a similar manner, by dialysing colloidal platinum or palladium solutions and then evaporating to dryness *in vacuo*, and these are suitable for effecting hydrogenation in acid, alkaline, or neutral solution. These colloidal metal solutions are not decomposed even on boiling with acetic acid, and based on this fact a method of hydrogenation of aldehydes and ketones and aromatic and heterocyclic substances has been devised which is more rapid than that of Willstätter (this J., 1912, 634). A small quantity of a colloidal platinum or palladium solution (prepared by adding a few drops of formaldehyde and caustic soda to a few c.c. of a dilute solution of platinum chloride and gum arabic, or by passing hydrogen into a hot solution of palladious chloride and gum arabic) is added to a homogeneous solution in acetic acid of the substance to be reduced, platinum chloride (H_2PtCl_6) and gum arabic, and the whole is shaken with hydrogen until the theoretical quantity of the gas is absorbed. Examples are given of the reduction of dihydroisophorone to *trans*-dihydroisophorol, of heptylaldehyde (œnanthic aldehyde) to heptyl alcohol, of benzene to hexahydrobenzene, of toluene to hexahydrotoluene, of benzoic acid to hexahydrobenzoic acid, of naphthalene, of pyridine to piperidine, and of quinoline to decahydroquinoline and to tetrahydroquinoline respectively. Hydrogenation is effected in a thick-walled glass-bottle, provided with a ground-in gas-inlet tube, held in position by a clamp. The gas-inlet tube is connected with the gas-holder by means of a copper capillary. The gas-holder consists of a tall brass cylinder provided with a manometer and an external water-gauge. After introducing the solution into the bottle, this is exhausted, then connected with the supply of hydrogen and placed on a shaking machine.—A. S.

Patents.

Cod-liver oil preparations. R. Weiss, London. Eng. Pat. 20,928 of 1911, dated Jan. 13, 1912.

Cod-liver oil is made nearly neutral or slightly alkaline with dilute sodium hydroxide solution and emulsified with water, and with this is emulsified a solution of a suitable quantity of a salt of lecithin. For example, the sodium salt from 1 lb. of lecithin may be combined with the emulsion from 24 lb. of cod-liver oil.—T. F. B.

β-Iminazolylethylamine ; Process for obtaining —— from fermented histidine, or from fermented albumin-hydrolysates rich in histidine, or from vegetable extracts. F. Hoffmann-La Roche und Co. Ger. Pat. 252,874, Oct. 29, 1911.

The mixture containing β-iminazolylethylamine is made alkaline and extracted with chloroform, and the base is recovered from the extract by means of dilute acid (see Ger. Pats. 252,872 and 252,873 ; this J., 1912, 1201).
—T. F. B.

Arseno-compounds ; Process for preparing unsymmetrical ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,226, Oct. 10, 1911. Addition to Ger. Pat. 251,104, April 16, 1911.

To prepare arseno-compounds containing an aliphatic radicle on one side, the process of the principal patent (see Eng. Pat. 11,709 of 1911 ; this J., 1912, 256) is varied by replacing one of the aromatic arsinic acids or arsenoxides by an aliphatic arsinic acid or arsenoxide, and using an aromatic arsenic compound containing at least one salt-forming (hydroxy or amino) group.—T. F. B.

Nitrohydroxy- and aminohydroxyarylarsinic acids containing sulphur ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,757, Dec. 17, 1910.

When nitrohydroxy- or aminohydroxyarylarsinic acids are treated with hydrogen sulphide, new compounds are formed, which have a more powerful parasiticidal action than the original substances.—T. F. B.

Tricalcium phosphate-albumin compounds ; Process for preparing —— soluble in alkali. Dr. W. Wolff und Co. Ger. Pat. 253,839, Aug. 4, 1911.

Albuminoids, albumoses, peptones, or their halogen substitution products or their compounds with metaphosphoric acid, are treated in aqueous alkaline solution with alkali phosphates and soluble calcium salts ; it is necessary to avoid large excess of alkali and high concentration of the solutions. The products are insoluble in water and in organic solvents, but soluble in alkali solutions. They may be used for therapeutic purposes, or for the preparation of plastic masses or agglutinants.—T. F. B.

Hydrocarbons ; Manufacture of partially hydrogenised monocyclic ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5429, March 4, 1912.

See Fr. Pat. 441,203 of 1912 ; this J., 1912, 843.—T. F. B.

Sulphuretted hydrocarbons [thiophen, etc.] from acetylene ; Process for manufacturing ——. W. Steinkopf, Karlsruhe, Germany, and G. Kirchhoff, Zürich, Switzerland. Eng. Pat. 16,810, July 18, 1912. Under Int. Conv., July 19, 1911.

See Ger. Pat. 252,375 of 1911 ; this J., 1912, 1201.—T. F. B.

Diaminodi[hydr]oxyarsenobenzene ; Manufacture of derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 8219, April 4, 1912. Under Int. Conv., March 1, 1912. Addition to Eng. Pat. 7865 of 1912, dated May 17, 1911.

See Fr. Pat. 441,882 of 1912 ; this J., 1912, 900.—T. F. B.

Chlorinated hydrocarbons ; Process of making ——. O. Graul, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,045,139, Nov. 26, 1912.

See Fr. Pat. 433,309 of 1911 ; this J., 1912, 153.—T. F. B.

Methyl and ethyl esters of 8-methoxy-2-phenylquinoline-4-carboxylic acid and of 6-methyl-2-phenylquinoline-4-carboxylic acid. M. Dohrn, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pats. 1,045,377, 1,045,378, 1,045,379, and 1,045,759, Nov. 26, 1912.

See Eng. Pat. 12,053 of 1912 ; this J., 1912, 702.—T. F. B.

Compounds containing hydrogen peroxide ; Process of making solid stable ——. V. Stanek, Prague, Assignor to Chem. Fabr. Gedeon Richter, Budapest. U.S. Pat. 1,045,451, Nov. 26, 1912.

See Eng. Pat. 26,960 of 1911 ; this J., 1912, 557.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Sulphide-toning of silver images ; Process for the ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 252,337, Dec. 13, 1911.

Silver prints are treated with a solution of a sulphide and then with an oxidising agent. By this process, in which the toning is effected by nascent sulphur, it is possible to produce prints of black or brown tones by varying the dilution of the solutions or the duration of the treatment.—T. F. B.

Light-filter which absorbs ultra-violet rays. Kopp und Joseph. Ger. Pat. 253,334, Feb. 9, 1911.

The derivatives of coumarin, which do not possess glucoside-characters, and which contain hydroxyl, amino-, carboxyl-, or other suitable groups, are capable of strongly absorbing ultra-violet light, and may be used in the production of light-filters.—T. F. B.

Photographic images ; Process for producing coloured ——. R. Fischer. Ger. Pat. 253,335, Feb. 7, 1912.

Developers for use with silver halide emulsions are prepared with the addition of a substance which will combine with the oxidation product of the developing agent, to form a sparingly soluble, coloured substance. For example, the developing agent may consist of *p*-phenylenediamine or its homologues or derivatives, and phenol, naphthols, or their derivatives may be added to the developer. Again, using a *p*-diamine or *p*-aminophenol or a derivative as developer, an aliphatic or aromatic methylene compound of acidic character may be added to the solution. Variations of these examples can be made to give images of a large variety of tones. The phenol, amine, or methylene compound may be incorporated with the emulsion, or the leuco-dyestuff (indophenol, azomethine compound, etc.) may be used as the developing agent.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Determination of the degree of bleaching of cotton. Piest. *See* V.

Farming with dynamite. Cullen. *See* XVI.

Oxycellulose and its reactions. Harrison. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Platinum as sulphide; Determination of ——. R. Gaze. Apoth.-Zeit., 1912, **27**, 959—960.

In determining platinum as sulphide, the precipitate frequently filters badly and there is difficulty in getting complete precipitation. This may be avoided by the addition of mercuric chloride solution to the platinum solution, warming to 80°—90° C., saturating with hydrogen sulphide and again warming. The precipitation is complete in a short time, and the filtration can be performed without difficulty. The amount of mercuric chloride present should be from 5 to 10 per cent. The mercuric sulphide disappears during the subsequent ignition.—F. Sodn.

Zinc; Determination of —— *by electro-analysis.* E. B. Spear and S. G. Strahan. J. Ind. Eng. Chem., 1912, **4**, 889—891.

The authors find that the method proposed by Kemmerer (this J., 1910, 1208) for the electrolytic determination of zinc in alkaline solution is very satisfactory when slightly modified. The chief modifications consist in (1) cooling the solution to below 25° C., with ice if necessary, 5—6 mins. before removing the electrodes; and (2) using a smaller quantity of potassium hydroxide, viz., 10—25 grms. for 125 c.c. of solution. It is best to use a rotating nickel gauze cathode, completely immersed in the electrolyte, and a stationary platinum plate or spiral anode placed above the cathode. The solution should be free from nitrates and ammonium salts.—A. S.

Manganese; Determination of —— *by the bismuthate method.* H. F. V. Little. Analyst, 1912, **37**, 554—557.

As the result of a number of experiments the author is convinced that the bismuthate method yields accurate results both for small and large quantities of manganese when the theoretical factor is employed (see this J., 1911, 836). He uses *N*/10 solutions in the process and prefers to dilute the oxidised solution, before filtration, with an equal volume of 3 per cent. nitric acid.—W. P. S.

Testing the liability to spontaneous ignition of coal. Dennstedt and Schaper. *See* IIa.

Hydrosulphites in volumetric analysis [*of dyestuffs*]. Siegmund. *See* IV.

Determination of the degree of bleaching of cotton. Piest. *See* V.

Determination of the quality of sulphite cellulose. Von Zweigbergk. *See* V.

Increase in weight of paper pulp on heating for the determination of moisture. Zweigler. *See* V.

Volatilisation of vanadic acid with halogens. Auerbach and Lange. *See* VII.

Determination of sulphur in pig iron and steel. Vita and Massenez. *See* X.

Determination of chromium and vanadium in steel. Demorest. *See* X.

Volumetric determination of tin. Rawlins. *See* X.

Detection of minute quantities of nickel. Fortini. *See* X.

Detection of earthnut [*arachis*] *oil in olive oil.* Lüers. *See* XII.

Determination of total fatty acids in cottonseed foots. Smalley. *See* XII.

Examination of Chinese and Japanese wood oil. Chapman. *See* XII.

The thermoterebenthometer of Tortelli, and the detection of petroleum in oil of turpentine from Pinus Pinaster. Massy. *See* XIII.

Analysis of sulphonated oils and mineral oils used in the leather industry. Oberfell. *See* XV.

Determination of sugars in leather. Veitch and Rogers. *See* XV.

Chemistry and quantitative determination of gelatin. Berrár. *See* XV.

Determination of the loss of polarisation caused by the action of lime on [*beet sugar*] *diffusion and press juices.* *See* XVII.

Use of sulphurous acid in making the acid reading in the double polarisation method of determining sucrose. Ogilvie. *See* XVII.

Different methods of determining sucrose in cane molasses. Complete analysis of cane molasses. Fribourg. *See* XVII.

Gelatinising temperature of starch grains. Nyman. *See* XVII.

Detection of caramel in vinegar. Ronnet. *See* XVIII.

Rapid control method for the determination of oil in grains. Harding and Nye. *See* XIXa.

Apparatus for testing water by measurement of its electrical conductivity. Archbutt. *See* XIXb.

Determination of nitrites in water. Duyk. *See* XIXb.

Quinine determinations according to the German Pharmacopœia and volumetric determination of quinine by means of picric acid. Richter. *See* XX.

Digitalis assay. Martindale. See XX.

Action of amalgamated aluminium on extracts containing alkaloids. Its use in toxicology. Kohn-Abrest. *See* XX.

Oxidations effected by osmium tetroxide and its use in rendering chlorate solutions active. Hofmann. *See* XX.

A simple form of gas generator. F. Shedden. *See* Birmingham Section, p. 3.

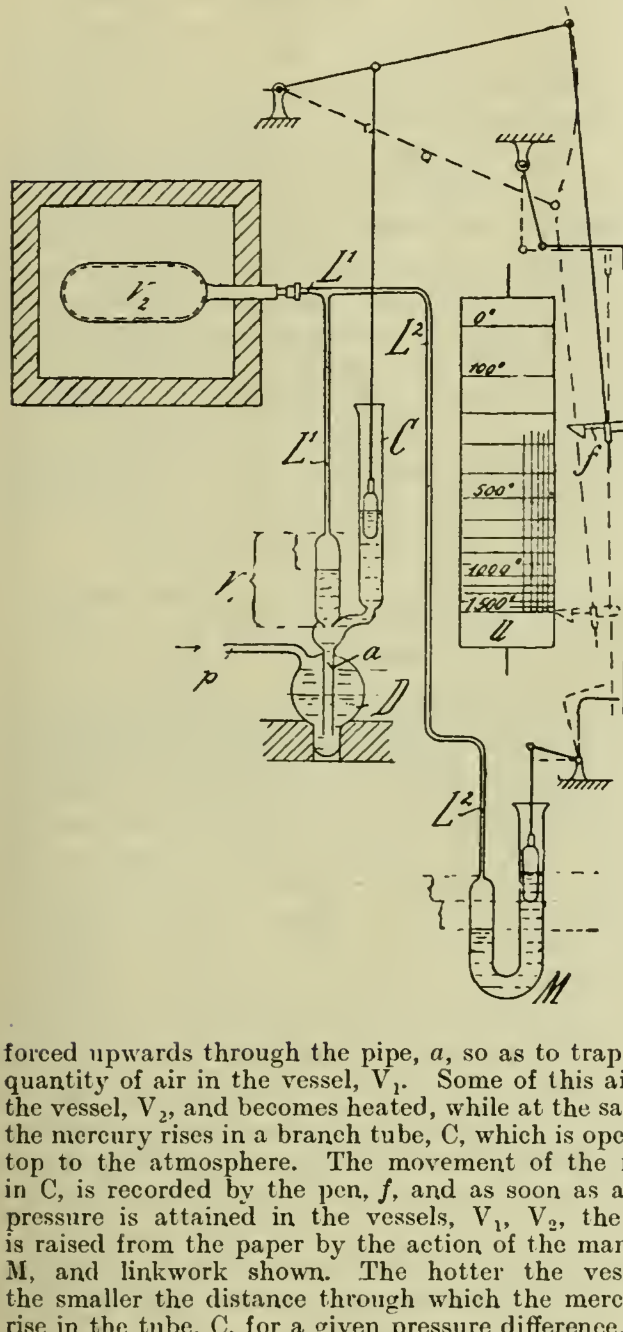
Separation of iron and manganese. F. H. Campbell. *See* Birmingham Section, p. 3.

A Hempel double pipette, modified to facilitate filling. A. C. Cumming. *See* Scottish Section, p. 9.

Patents.

Air or gases; Recording devices for use in instruments and apparatus for measuring the volume of ——. M. Arndt, Aachen, Germany. Eng. Pat. 28,630, Dec. 19, 1911.

The figure shows the recording device applied to an air pyrometer. At the commencement of a measurement the air in the heated vessel, V_2, and in the pipes, L^1L^2, leading respectively to the air chamber, V_1, and manometer, M, is open to the atmosphere through the tube, C, and the pen, *f*, is at the bottom of the recording drum, *u*. Air or other fluid under pressure is then admitted through a pipe, *p*, to a vessel, D, containing mercury, which is forced upwards through the pipe, *a*, so as to trap a given quantity of air in the vessel, V_1. Some of this air enters the vessel, V_2, and becomes heated, while at the same time the mercury rises in a branch tube, C, which is open at the top to the atmosphere. The movement of the mercury in C, is recorded by the pen, *f*, and as soon as a certain pressure is attained in the vessels, V_1, V_2, the pen, *f*, is raised from the paper by the action of the manometer, M, and linkwork shown. The hotter the vessel, V_2, the smaller the distance through which the mercury will rise in the tube, C, for a given pressure difference, so that the record of these movements can be utilised as a record of the temperatures of the vessel, V_2.—H. H.



Measuring a definite quantity of air or gas in instruments or apparatus (pyrometers, gas analysis apparatus, etc.) acting under air or gas pressure; Apparatus for ——. M. Arndt. Fr. Pat. 445,566, June 29. 1912.

See Eng. Pat. 28,630 of 1911; preceding.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Photochemical lecture experiment. O. Baudisch and R. Fürst. Ber., 1912, **45**, 3426—3428.

The change produced by light on the ammonium salt of *a*-nitrosonaphthylhydroxylamine (this J., 1911, 1249) is due to the action of violet and blue rays of comparatively long wave length which will pass through glass and other substances. If a piece of stout filter-paper be treated with the above salt, steamed, and exposed to the rays from a quartz mercury vapour lamp with a glass plate covering half of the sheet, it is found that the paper is uniformly reddened. The same result is obtained by using a gelatin plate or a solution of starch or albumin as filter. If, however, the filter-paper is treated with a solution containing potassium nitrate, potassium iodide, and starch, and illuminated in the same way, it will be found to turn blue only where it is not protected by the filter. The rays which cause the evolution of oxygen from potassium nitrate are of short wave length and are absorbed by various filters. It is suggested that the colloids of plant cells can exercise a similar differentiating influence on the radiation which they receive. From the above ammonium salt free *a*-nitrosonaphthylhydroxylamine can easily be obtained by precipitation with metaphosphoric acid. It is soluble in chloroform but the solution gradually changes owing to the reducing action of the chloroform, which forms *a*-diazonaphthalene chloride.—W. H. P.

Trehalose, vanillin and d-sorbitol; Occurrence of ——. E. O. von Lippmann. Ber., 1912, 45. 3431—3434.

After a short July frost of unusual severity, small nodules, of the size of hemp-seeds, were observed hanging from the flowers of some sedges (*Carex brunescens*) growing above the village of Davos (Switzerland). These nodules, resembling in appearance frozen drops of exuded matter, were white in colour, crisp when bitten, and of sweet taste. They were found to contain trehalose. The occurrence of sugars in *Carex brunescens* has not hitherto been observed. Neither trehalose nor the trehalum (of Scheibler and Mittelmeier), could be extracted from the plant itself, but considerable quantities of mannitol were present. On the heights above Davos an orchid, *Gymnadenia altida*, was found, the flowers of which were intensely fragrant owing to the presence of vanillin. As a rule the flowers of this plant possess a scarcely perceptible odour. After a period of wet summer weather during which fungoid growth had been conspicuously abundant, some fungi of the species *Boletus bovinus* were observed lying on a sandy path near Kissingen (Bavaria). They were shrunken, and had apparently been gathered the day before and afterwards thrown away. Their heads were covered with a glistening network of crystals of *d*-sorbitol.—J. H. L.

Aspergillus niger; Comparative influence of potassium, rubidium, and cæsium on the development and sporulation of ——. B. Sauton. Comptes rend., 1912, 155. 1181—1183.

When *Aspergillus niger* is cultivated in Raulin's nutrient solution, the substitution of rubidium for potassium in the liquid, leads to a diminution of 50 per cent. in the weight of the crop. If cæsium is substituted, practically no growth takes place. The presence of potassium is necessary for sporulation, but rubidium and cæsium are without influence.—J. H. L.

Books Received.

The Problem of the Gasworks Pitch Industries and Cancer. The John Howard McFadden Researches. John Murray, Albemarle Street, London, W. 1912. Price 6d. net.

Pamphlet form measuring 8½ by 5½ ins., and containing 48 pages of subject matter, with two illustrations. The entire contents are divided into two parts:—I. The problem of the gasworks pitch industries and cancer. H. C. Ross and J. W. Cropper. With some observations by W. J. A. Butterfield. II. Epithelial cell proliferation induced by the injection of gasworks tar. H. Bayon, M.D.

Digitalis Assay. By W. Harrison Martindale, Ph.D. A communication to the Pharmaceutical Society of Gt. Britain at an Evening Meeting in London, December 10th, 1912. H. K. Lewis, 136, Gower Street, London, W.C. 1913. Price 2s. net.

Demy 8vo volume, 8¾ by 5¾ ins. It contains 47 pages of subject matter with one coloured illustration, and consists essentially of a "comparison between physiological and chemical results, with an approximate simple chemical assay method" (see p. 44).

SPRECHSAAL-KALENDAR, 1913, für die Keramischen, Glas- und Verwandten Industrien. Herausgegeben von Dr. J. KOERNER. Verlag von Müller und Schmidt, Coburg. 1913. V. Jahrgang. Price M. 2.50.

POCKET-BOOK size, measuring 6½ by 4¼ ins., and containing 184 pages of subject matter. Bound in waterproof linen. It contains a calendar with blank pages subdivided for each day of the year, and 46 blank pages for additional notes. The 184 pages of subject matter ("Technischer Teil"). are devoted to scientific data and tables, followed by carefully arranged tabulated and other matter relating to fuels, clays, etc., and likely to be of service to those engaged in the ceramic, glass, pottery and earthenware industries.

UNTERSUCHUNG UND NACHWEIS ORGANISCHER FARBSTOFFE AUF SPEKTROSKOPISCHEM WEGE. Von JAROSLAV FORMÁNEK. Professor an der k. k. böhmischen tech. Hochschule in Prag, unter Mitwirkung von Dr. Eugen Grandmougin, Professor an der Höheren Chemieschule in Mülhausen i. E. Zweiter Teil. 2. Lieferung. Julius Springer's Verlag. Berlin. 1913. Price M. 14.

VOLUME measuring 9½ by 6½ ins., and containing 207 pages of subject matter, inclusive of six tables of absorption spectra at the end. This part is devoted to blue and red dyestuffs, and their reactions, properties, etc., given in tabulated form. An alphabetical index is given at the end of the blue and violet dyestuffs, and another at the close of the matter on the red dyestuffs. A small section is also devoted to green dyestuffs, with an index.

AUSFÜHRUNG QUALITATIVER ANALYSEN. Von WILHELM BILTZ. Akademische Verlagsgesellschaft m. b. H. Leipzig. 1913. Price M. 5. Bound in cloth M. 6.

VOLUME measuring 9¾ by 6¾ ins., and containing 129 pages with one photolithographic table and 13 illustrations. There is also an alphabetical index. The subject matter is classified as follows:—I. Preparation of sample, and analysis by the dry method. II. Analysis by the wet method. III. Testing for acids. IV. Some analytical inconsistencies.

A HISTORY OF CHEMISTRY. FROM THE EARLIEST TIMES TILL THE PRESENT DAY. By the late JAMES CAMPBELL BROWN, D.Sc., LL.D., Professor of Chemistry in the University of Liverpool. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 10s. 6d. net.

VOLUME measuring 9 by 6 ins., and containing, as frontispiece, portrait of Dr. Campbell Brown, 538 pages of subject matter with 106 illustrations, and an alphabetical index. The subject matter is classified as follows:—Biographical note and list of publications by Dr. Campbell Brown. Part I. Ancient History. Part II. Modern History.

CHEMIKER KALENDAR, 1913. Ein Hilfsbuch für Chemiken, Physiker, Mineralogen, Industrielle, Pharmzeuten, Huttenmänner, u.s.w. Von Dr. RUDOLF BIEDERMANN. In zwei Bänden. Vierunddreissigster Jahrgang. Julius Springer's Verlag, Monbijouplatz 3, Berlin, 1913. Price M. 4.40. Bound in leather, M. 5.40.

PART I. (6¼ ins. by 4 ins. wide). Arranged as a pocket-book and strongly bound in waterproof cloth or in leather. It contains an almanack for 1913, together with a table of the frequently used atomic weights and their multiples. The general text refers principally to matters of purely chemical interest. I. Atomic and molecular weights. II. Different properties of chemical substances. III. Gas and vapour densities. Specific gravities. (i) Alkalis. (ii) Acids. (iii) Salts. (iv) Alcohols, etc. IV. Solubilities. V. Analysis. VI. Volumetric analysis. VII. Electrochemical analysis. VIII. Gas analysis. IX. Spectrum analysis. The matter in these various groups is chiefly arranged in tables described as "Hilfstabellen." A note-book calendar with blank pages for notes, is arranged for the different days of the year. The subject matter, exclusive of the calendar and the blank pages for notes, fills 402 pages. A tabular arrangement of the relative coinage values of the world now follows. One side of the external cover of the little volume is utilised as a centimetre scale measure.

PART II. (6½ ins by 4 ins. wide). Supplementary volume, in size similar to the pocket-book, and similarly bound, accompanies PART I., and is more directly concerned with chemical technology. It contains tables relating to:—I. Physics and physical-chemistry. II. Mineralogy. III. Technical chemical analysis and investigation. IV. Special items, recipes, etc. Besides the tabulated matter, however, there are concise descriptive paragraphs of introductory character, with descriptions of analytical methods. The subdivisions are as follows:—(1) Water. (2) Assaying. (3) Fuels. (4) Sulphuric acid. (5) Alkali. (6) Bleaching powder. (7) Nitre and explosives. (8) Ceramics. (9) Glass. (10) Mortar and cement. (11) Illuminants. (12) Starch and sugar. (13) Fermentation industries. (14) Fats and oils. (15) Essential oils and perfumery. (16) Tanning agents. (17) Textile fibres and paper. (18) Photography. (19) Dyestuffs and colours. (20) Physiological chemical analysis. (21) Appendix with (*a*) Various recipes; (*b*) Pure mercury; (*c*) Recipes for electroplating. The subject matter occupies 661 pages.

THE SCIENTISTS' REFERENCE BOOK AND DIARY FOR 1913. Published by James Woolley, Sons and Co., Ltd., Victoria Bridge, Manchester, 1913. Price 2s.

ARRANGED also as a pocket-book and note-book. (5¾ ins. by 3 ins. wide). It is divided into two parts, Part I. containing lists of Associations, Institutes, International Congresses, Victoria University, Scientific Societies, Data as to First Aid, and in poisoning cases. Notable facts of the World. Astronomy, Meteorology. British Weights and Measures, and Tables. Specific gravities. Specific gravities of Pure Oils. Hydrometers, etc. Chemical terms, Synonyms etc. International Atomic Weight Tables. Physical Constants of the Elements. Formulæ and Solubility in Water (Table), etc. Factors for use in Volumetric Analysis. Factors for Chemical Analysis. Classified list of "Dangerous Inflammable Substances." Alloys. Microscopy, etc. Human Physiology and Hygiene. Chemical Composition of Food. Thermometry. Mineralogy. Back to back with the preceding, comes Part II. as a duplicate pocket-book, and forming the "Scientists' Reference Book" with a Calendar, and "Daily Wants Dictionary," etc., etc. Tables of Weights and Measures. Chief Officers of State, etc. Foreign Moneys. National Debt. Antidotes for Poisons. Direction signals of the Meteorological Office and a series of blank pages for memoranda, etc., telephone numbers, and diary. Following this, ruled blank spaces for addresses, and for general notes.

LECTURE ON THORIUM AND ITS COMPOUNDS. By EDMUND WHITE, F.I.C., 30, Bloomsbury Square, London, W.C. 1912.

THIS lecture (pamphlet 8⅝ ins. by 5½ ins.) was delivered before the INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND, at Finsbury Technical College, London, on November 1st, 1912. Pamphlet containing 228 pages of subject matter, including list of exhibits, and three illustrations. In the contents. I. The history, occurrence, and commercial sources, etc., are dealt with. Also II, the Chemical processes employed in extraction, and III, the yield and relation of cost of extraction. Uses of thorium compounds, etc.

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* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Pöschl.* Thdr., u. Karl v. *Terzaghi:* Berechnung v. Behältern nach neueren analytischen u. graphischen Methoden. Für Studierende u. Ingenieure zum Gebrauche

im Konstruktionsbureau bearb. (IV, 80 S. m. 34 Fig.). gr. 8°. Berlin, J. Springer. 1913. M. 3.

IIa. *Bartel*, F.: Torfkraft. Untersuchungen üb. den Wert des Torfes als Energiequelle u. Vorschläge f. seine Nutzg. f. Grosskraftwerke. (VIII, 164 S. m. 109 Abbildgn.). gr. 8°. Berlin, J. Springer. 1913. Cloth M. 6.80.

Escard, J.: L'utilisation industrielle de la tourbe, in 4°. Paris. 1912. 1 fr. Dunod et Pinat.

Burns, D.: Safety in Coal Mines. 12mo., pp. 158. Blackie. London, 1912. Net 2s. 6d.

Dilworth, J. B.: Die Kohlenfelder der Philippinen. Uebers. u. ergänzt v. A. Gerke. [Aus. "Berg- u. hüttenmänn. Rundschau"] (19 S. m. 1 eingedr. Kartenskizze.) gr. 8°. Kattowitz. Gebr. Böhm. 1912. M. 1.

O'Connor, H.: Petrol Air-Gas. A Practical Handbook. 2nd ed. Thoroughly revised and enlarged. Cr. 8vo., pp. 106. C. Lockwood. London, 1912. Net 1s. 6d.

Tower, W. S., and *Roberts*, J.: Petroleum, the Motive Power of the Future. Illust. 8vo., pp. 254. Hodder and Stoughton. London. 1912. Net 6s.

IIb. *Bloch*, L.: The Science of Illumination. An outline of the Principles of Artificial Lighting. 8vo, pp. 180. J. Murray. London. 1912. Net 6s.

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V. *Textil-Industrie;* Die deutsche, im Besitze v. Aktien-Gesellschaften. Statistisches Jahrbuch üb. die Vermögensverhältnisse u. Geschäftsergebnisse derselben im Betriebsj. 1911–1912. 16. vollständig umgearb. Aufl. 16. Jahrg. (XII, 275 S.). gr. 8°. Berlin, Verlag f. Börsen- u. Finanzliteratur. 1913. Cloth M. 6.

VI. *Mundorf*, E.: Die Appretur der Woll- u. Halbwollwaren. Kl. Ausg. Bibliothek der gesamten Technik. Leipzig, Dr. M. Jänecke. (VIII, 82 S. m. Abbildgn.). gr. 8°. 1912. geb. in Leinw. M. 2.80.

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London Section.

Meeting held at Burlington House, on Monday, December 2nd, 1912.

MR. G. T. HOLLOWAY IN THE CHAIR.

THE SLATE-BED TREATMENT OF SEWAGE.

BY W. J. DIBDIN, F.I.C.

Introductory.

In a paper on March 31st, 1904, I had the honour to bring before the Members of this Society certain proposals to facilitate the reduction of sewage solids to an inoffensive condition by the use of a coarse contact bed filled with a structure of plates and blocks. The essential action was stated to be the same as that in ordinary contact beds and in land treatment, viz., decomposition by the agency of aerobic organisms. The specific advantages claimed for the plate bed were :—The provision of increased water capacity ; maintenance of drainage ; the avoidance of choking ; permanence of structure and the maintenance of capacity on account of the non-breaking down or settling together of the material.

In a later paper, on the 15th May, 1906. I submitted the results of experience including an account of the process at Devizes where the results, so far, justified the original suggestions.

Since that time the system has been fairly widely adopted and has received recognition as a sound undertaking. In the present paper I desire to submit an account of the success in recent years.

It is to be noted that the introduction of this process marks the utilisation of one waste product, slate debris, to effect the conversion of offensive organic waste into an inoffensive earthy form which has some manurial value.

The Process.

The action of the beds has been outlined previously and may be summarised as follows :—The solid matters in the sewage are allowed to settle on shelves of slate supported by slate blocks at a distance of about two inches, these being superposed to a depth of one to five or six feet, as required. In consequence of the alternate filling and emptying and resting empty the deposit becomes the home of many types of organisms that digest the matters and render them inoffensive in like manner to the action by which earthworms produce a humus from organic debris and throw it to the surface in the form of worm-casts. In the slate bed the deposit of earthy matter thus formed on the surface of the layer of mud on the slates is washed off by the receding effluent when the bed is emptied and forms a black slurry, consisting of mineral and indigestible matter with numerous organisms from the bed. This slurry is then placed on a suitable drainage bed for the water to drain off and to allow time for the full digestion of any crude material that may have come from the bed, and, finally, to allow the host of infusoria gradually to extinguish themselves by the natural process of the "survival of the fittest."

The organisms taking part in the action include such red worms as are possible under the conditions, infusoria and aerobic bacteria. The predominating type in any installation depends on the nature of the organic matter and the presence or absence of any inhibiting substance. For instance, in the deposit from sewage containing large quantities of waste yeast anguillulae were counted and estimated to the extent of one million per square inch of surface deposit.

"Humus" or "Sludge."

As a result of very careful experiments during a period of 18 months carried out by Mr. T. J. Rushbrooke, the Borough Engineer of High Wycombe, the following facts are available, by his kind permission, as to the quantity of sewage treated and humus obtained from the slate beds, from which data the quantities per million gallons of normal sewage are deduced, after allowing for the percentage of moisture.

Quantity obtained.

Gallons of sewage treated.	Residue from slate beds.		Tons per million gallons of a 45 gallon per head sewage.	Moisture per cent.	Tons dry.	Tons 50% moisture.
	cube yards.	tons.				
8,874,000	10·0	7·5	0·84	72·0	0·23	0·46
Corrected to a normal flow of 30 gallons per head per day these figures become :—						
5,916,000	10·0	7·5	1·26	72·0	0·34	0·68

or 3·4 tons of 90 per cent. moisture per million gallons against 6·5 tons of 90 per cent. moisture per million gallons from a septic tank, according to the Royal Commission Report.

Cost of disposal.

Sludging and lagooning in connection with the old open septic tanks.	Slate bed residue from drainage bed.
850,000 gallons of a 45 gallon per head sewage per day. Equal to :— 570,000 gallons of a 30 gallon per head sewage per day. Actual cost :— £40 per annum labour £360 per annum cartage, etc.	The disposal of an inoffensive manurial earth will require little land
Corrected to 1 million gallons daily of a 30 gallon per head sewage :— £70 per annum labour	$\frac{3{\cdot}4 \times 70}{6{\cdot}5}$ £36 pr. an.
£635 per annum cartage, etc. Against Royal Commission estimate of £73 per annum £(?) cost of land for digging in, etc.	

The difference between £70 and £36, or £34, represents the saving on handling only, and to this should be added, on the assumption that farmers will remove the air dried humus at their own cost, £635 in regard to sludge removal and disposal, making £669 as the annual economy per million gallons daily. This sum capitalised at 3½ per cent. equals £19,114, which is far more than sufficient to repay the whole cost of the slate beds. There is the further advantage that the whole of the nuisance of sludge disposal is abolished.

It will be noticed that no credit is taken for the value of the "manurial earth" as the amount of this is a debatable point.

How far, however, the above assumption that farmers will remove the humus free of cost is warranted may be judged from the fact that, from actual experiments made by Messrs. Barr and Sons, of Taplow, on a ten ton sample of air-dried humus, they report that it is evident that while it possesses undoubted manurial properties it has a very beneficial mechanical advantage in lightening heavy soils. To obtain best results the material should be stacked until it has attained a friable condition. Once it has attained this condition, it would, in their opinion, be an excellent medium for mixing with potting soils for general purposes, in addition to being a good manurial agent to dig into the soil.

Section of Slate Bed being filled with slates supported on blocks.

Taken in conjunction with the fact that the Corporation of Manchester is making and selling at 25s. per ton a good manure made from the washings of the clinker contact beds, which are of the same character as that from the slate beds, this evidence of the utility of the only residue from sewage treated by the aerobic method in slate beds more than fully justifies the belief, without entering into any question of possible profit from its sale, that, when once farmers realise the difference between this residue and ordinary "sewage sludge," they will readily remove it free of cost and thus save all expense in connection with its disposal.

The following comparison of the above-mentioned Manchester manure with weathered humus obtained from the slate beds at Devizes, as analysed by Dr. J. Gilbert Fowler, will be of interest :—

	Manchester. Dried sewage manure.*	Devizes. Dried weathered humus.†
	per cent.	per cent.
Moisture..................	10 to 12	0·0
Organic matter	35 to 45	40·1 to 45·0
Containing nitrogen	1·25 to 2·0	1·83 to 1·99

ROYAL COMMISSION ON SEWAGE TREATMENT.

The Officers of the Royal Commission have made a report dated October, 1911, stating the following conclusions and observations, some of which are remarkable when placed in juxtaposition.

In their Fifth Report, p. 67, the Commission made the following statement with regard to slate beds :—"As the result of our inspection of the beds at Devizes, we came to the tentative conclusion that primary beds containing large slabs of slate must be regarded more as preliminary settling or septic tanks than as contact beds.

"As regards the effluent which results from the treatment of sewage in slate beds, this conclusion has been borne out by the observations which have since been made. The effluent from a slate bed is, for practical purposes, indistinguishable from a tank effluent. It contains about the same amount of suspended matter and requires subsequent treatment similar to that which would be necessary for a tank effluent from the same sewage.

"The capacity of a slate bed is about 85 to 90 per cent. of the capacity of the empty tank.

"From the measurement of the capacity of the slate beds at the three places under observation, it is clear that the greater part of this capacity can be maintained permanently.

"Owing to the difficulty of making accurate measurements of sludge at the works under observation, it is impossible to give any precise estimate of the digestion of sludge which takes place in slate beds.

"From the data which have been obtained with regard to Devizes however, the digestion, or, more correctly, the diminution of solids, which takes place in the slate beds there would appear to be very small. The actual figure obtained was only 1 per cent. of the total suspended solids.

"Provided that the sewage is not allowed to remain too long in the slate beds, the slate bed sludge differs from ordinary sewage or septic tank sludge in that it possesses only a slight odour, resembling that of sea-weed, and that it is full of minute forms of animal life. When examined under the microscope, the number of actively motile vibrios is a striking feature. Numbers of small worms are also to be found in the sludge as it lies on the slates.

"Investigations by Dr. G. J. Fowler and others, go to show that the organic matter of the sludge (apart from the worms and other small animals present) is in an active process of inoffensive decomposition, as it lies on the slates.

"Compared with other preliminary processes of sewage purification slate beds will probably be found to be expensive as regards capital outlay : but on account of the sludge being comparatively odourless, we think that the claims of the process deserve consideration in cases where the reduction of smell at a sewage installation is of primary importance.

"We consider it undesirable to treat settled sewage in slate beds since this defeats one of the main objects of the process.

"This sludge possesses a strong sea-weed, but not offensive, odour.

"On two occasions when a slate bed was opened no offensive odour could be detected in the bed, even when standing at the bottom of it on a hot day. In fact, it smelt no worse than an ordinary damp cellar."

It is unfortunate that three main sources of information were overlooked by the Commission's Officers in regard to the diminution of solids, viz. —

1. The above High Wycombe results.

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* Ogden. Proceedings Asso. Manager Sewage Disposal, Works. 1910, p 106.

† Dibdin, Disposition and Analyses of Sewage Débris. Socy. Public Analysts. Mch. 1907.

2. The annual expenditure at Devizes, which shows a reduction in the working expenses from £700 to £200 per annum, the difference being mainly due to the absence of the sludge that required handling before the slate beds were installed.

3. The figures as to the quantity of sludge before the installation was at work, viz., some 680 tons of pressed sludge per annum.

It will be of great interest if the Officers of the Royal Commission will explain how a process in which the effective action takes place without nuisance and the contents of 'the beds, even on a hot day, have only an odour comparable with that of a damp cellar, can possibly be the same as that of a septic tank.

Experience at Philadelphia, U.S.A.

The following extracts from the Report of the Bureau of Survey upon the purification of the sewage of Philadelphia, 1910, may be usefully referred to, as entirely independent evidence :—

"Between sedimentation and contact processes may be classed the Dibdin Slate Bed No. 16.—The best results were accomplished when this bed was filled twice a day or at the rate of two million gallons per acre per day. Crude sewage applied deposited three-fourths of the suspended solids; the effluent was slightly nitrified and rendered partially stable.—The result was obtained aerobically and the bacterial work is undoubtedly largely supplemented by worms and other lower forms of animal life.—As the results accomplished by this bed are more than mere sedimentation, including oxidation of the applied sewage, it has been considered in two ways; first, as a sedimentation tank in which the resulting sludge has been digested and concentrated, second, as a contact bed producing partially a stable effluent. If looked upon as a sedimentation process it would consist of nineteen superimposed quiescent basins, each about three inches deep. The bed should be filled at such a rate that the velocity is not high enough to disturb the deposit on the slates, and then the bed be allowed to remain quiescent for, say, one hour.—Before the bed is again filled the worms and other animals and the bacteria have attacked the organic matter of this deposit and are ready for the next thin layer of food, when the bed is subsequently filled. If considered as a contact bed, its large void space as compared with a contact bed filled with ordinary media, is of great aerating value, also due to the construction in horizontal layers, one slate resting upon another; on the under side of many slates a large, flat bubble of air must be entrained, which would tend to oxygenate the sewage whilst in the bed. The deposit upon the slates was inodorous mud, even gritty when rubbed between the fingers, and the microscopic examination revealed large amounts of sandy matter. When heated in a dish to obtain the dry residue, the worms came to the surface and their activity showed the aptness of the term 'living earth.'"

As an instance of one of the many varying conditions under which slate beds are working satisfactorily the installation at the Kazan Railroad Station at Moscow may be mentioned. This plant deals with 20,000 gallons per day, and the Engineers responsible for its construction, Messrs. Simin and Co., of the Neptune Co., Moscow, report that the Kazan Railroad Board of Managers were so satisfied that they decided to use the system in other cases.

Special Points for Consideration in New Designs.

Although in many instances the albuminous solids in solution are reduced in a slate bed to the extent sometimes of fifty per cent., a slate bed effluent is not and has not been claimed as a final effluent. Some slate bed effluents are good enough to discharge into tidal waters but, in general, some further treatment is required. It is necessary to point this out again, because in many quarters one meets with the idea that finality is claimed for the single contact in such beds. It was hoped that in the earlier papers it had been made clear that these beds were designed as sludge digesters.

Duration of the beds.—The permanence of the slate has a distinct bearing on the question of the period for which loans could be granted. For land treatment 60 years are allowed for repayment. For artificial systems 30 years only are allowed. In view of the indestructibility and permanent character of the slate beds it is worth considering whether the rate might not be lessened by the extension of the period for repayment and part of the cost laid on the next generation who will profit by the installation as in the case of land, and a period of sixty years allowed for the repayment.

Causes of Failure of the Slate Beds.

There are two remarkable instances of misuse and consequent "failure" of slate bed installations. In one, at Malden, in Surrey, the Local Authority made a trial bed and experimented for twelve months. They then filled one of the precipitation tanks with slate and worked it for twelve months. They then filled a second tank, but unfortunately the outlet valves of these two tanks were originally placed at the shallow end, so that the effluent in the deeper end was not run off, the result being that septic action took place in the lower layer. Further, the sewage was often retained for twelve or more hours in the "tank sewer" before being pumped on to the beds. Finally, the mineral matter, ashes, etc., and septic solids which accumulated on the floor of the tank sewer were pumped into the slate beds periodically. If there had been a deliberate intention to choke the beds and at the same time to destroy the aerobic conditions in them no more ready means could have been devised.

In the second case, at Trowbridge, the sewage was treated to anaerobic action in large septic tanks and the foul liquor was passed into the slate beds, which admittedly were not worked according to instructions. This treatment, even according to the officers of the Royal Commission, "defeats one of the main objects of the process." In addition to this misuse of the primary method only one-half of the plant necessary for the secondary treatment was provided and *none* for the tertiary treatment which was specifically arranged for in the original scheme in consequence of the peculiar character of this sewage.

Precautions.

In new installations more perfect means are provided for trapping the humus on its escape from the slate beds and so reducing the suspended matter passing to the secondary treatment. With land treatment immediately following the slate beds of course no humus trapping is necessary.

In building the slates the supporting blocks must be placed one over another so that the weight of the upper layers is not borne by the centre of any slates lower down which would result in the breaking of some of the slates.

The floor of the beds should have a good fall in order to ensure the carrying of the humus to the outlet; otherwise it will remain behind and choke the lower layers and render flushing necessary.

It is wise to provide shafts for flushing purposes, especially as these involve no cost. There is an advantage in these being against the walls of the upper end of the tank so that the flush of water will be from the highest point of the floor.

Hitherto flushing has been necessary in only one case, where the floors of the tanks were practically level because they were old sedimentation tanks converted for experiment.

The following are the results of analyses of the deposit on the slate layers at Devizes and High Wycombe (Soc. Pub. Analysts, March, 1907):—

Sewage mud from slate beds at Devizes, November 13th, 1906.

—	Surface of deposit on slates.	Half-depth of deposit on slates.	Bottom layer of deposit on slates.	Average.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	80·00	80·50	79·70	80·07
Mineral matter	9·05	8·76	8·53	8·78
Organic matter	10·95	10·74	11·77	11·15
	100·00	100·00	100·00	100·00
On dried mud.				
Mineral matter	45·25	45·00	42·00	44·08
Organic matter	54·75	55·00	58·00	55·92
CO_2	5·8	7·0	4·0	5·6
Ether extract (fat, etc.)	9·62	5·9	7·7	7·41
Organic carbon	20·19	20·09	17·86	19·38
Organic nitrogen	5·98	3·12	3·71	4·30
Ratio N : C	1 : 3·4	1 : 6·4	1 : 4·7	1 : 4·83
Nitrogen on dry organic matter	10·8	5·65	4·70	7·05
On wet mud.				
Free ammonia	0·028	0·013	0·023	0·021
Albuminoid ammonia	0·112	0·135	0·045	0·098
Bacteria, per gram	725,000,000	495,000,000	240,000,000	480,000,000

Microscopical Examination.—Large numbers of worms, monadina and other infusoria, anguillulæ, bacteria, both free and in the zooglœa condition, and usual sewage debris.

In each case the deposits were *without offensive odour*, such as would have been evolved from an ordinary sewage sludge. In the bulk the odour was described by Dr. G. J. Fowler and others as slightly resembling that of seaweed. It is most important to notice that when kept for a time in closed bottles an extremely offensive odour was evolved, due to the decomposition of the organisms which freely flourished under normal aerobic conditions. When the deposits were exposed to the air and allowed to "weather," as it is generally termed, the mass became friable and odourless.

Sewage mud from slate beds at High Wycombe, September 28th, 1906.

—	Surface of deposit on slates.	Half-depth of deposit on slates.	Bottom layer of deposit on slates.	Average.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	83·68	84·31	84·86	84·28
Mineral matter	7·95	7·75	7·46	7·72
Organic matter	8·37	7·94	7·68	8·00
	100·00	100·00	100·00	100·00
On dried mud.				
Mineral matter	48·66	49·40	49·27	49·11
Organic matter	51·34	50·60	50·73	50·89
CO_2	1·84	3·88	3·24	2·97
Ether extract (fat, etc.)	5·13	7·12	6·89	6·38
Organic carbon	17·31	25·07	23·15	21·88
Organic nitrogen	3·46	4·64	3·73	3·9
Ratio N : C	1 : 5·0	1 : 5·4	1 : 6·2	1 : 5·5
Nitrogen on dried organic matter	6·6	9·2	7·3	7·7
On wet mud.				
Free ammonia	0·065	0·065	0·060	0·063
Albuminoid ammonia	0·270	0·250	0·235	0·252
Bacteria, per gram	160,000,000	190,000,000	50,000,000	133,000,000

Microscopical Examination.—Usual sewage debris, with large numbers of small worms, monadina and other infusoria, anguillulæ, bacteria, both free and in the zooglœa conditions.

The following results are by Dr. Gilbert J. Fowler, as given in the same paper:—

Samples of unweathered and weathered deposit from the experimental slate beds at Devizes—Collected July 8th, 1905.

—	Unweathered 1 mm.	Weathered 1 mm.	Unweathered ¼ mm.	Weathered ¼ mm.
	Per cent.	Per cent.	Per cent.	Per cent.
Organic matter	56·5	45·0	57·0	40·1
Carbon in dried substance, 100 deg.	29·10	17·14	30·05	24·21
" " " "	29·32	16·86	30·19	23·96
Average	29·21	17·00	30·07	24·07
Hydrogen in dried substance 100 deg.	4·03	2·47	4·26	2·37
" " " "	4·13	2·52	4·22	2·52
Average	4·08	2·50	4·24	2·44
Nitrogen in dried substance, 100 deg.	3·80	1·99	3·31	1·83
Carbon on organic matter	51·7	37·7	52·7	60·2
Hydrogen on organic matter	7·2	5·5	7·4	6·1
Nitrogen " "	6·7	4·4	5·8	4·5
Ratio N : C	1 : 7·7	1 : 8·5	1 : 9·0	1 : 13·0

Description.	Loss on ignition.	Ether extract.		Oxidation test.
		On dry material.	On loss on ignition.	
Sample scraped from middle layer of deposit on slates. Devizes, November 21st, 1906	54·52	6·00	11·0	1 gram dry material = 24·6 c.c. $\frac{N}{10}$ oxalic = 108·4 mgms. CO_2 = 198·4 mgms. CO_2 on organic matter
Sample scraped from bottom layer of deposit next slates. Devizes, November 21st, 1906	43·65	8·75	20·0	1 gram dry material = 7·7 c.c. $\frac{N}{10}$ oxalic = 33·8 mgms. CO_2 = 77·4 mgms. CO_2 on organic matter
Sample taken from drying beds thoroughly weathered. Devizes, November 21st, 1906	37·09	2·16	5·8	1 gram dry material = = 0·1 c.c. $\frac{N}{10}$ oxalic = 0·044 mgm. CO_2 = 1·14 mgms. CO_2 on organic matter

Discussion.

Mr. Tyndale said he was satisfied that the process was an aerobic one. His experience was that when the mud had been formed on the plates the capacity was not 80 per cent. but about 66 per cent. The slate beds at the Curragh Camp had now been in use four years, and although the amount of sewage coming from the camp had very largely increased, they had entirely met the increase of volume and there was room for more ; so much so, that the secondary beds would have to be multiplied to meet that extra volume with which the slate beds were dealing. In one of the beds which had been put up four years, he had found about an inch of muddy film at the bottom. To his mind, for the preparation of effluent for land, nothing could be more satisfactory than treatment by a slate bed. Choking had only occurred in two cases, in dealing with barrack sewage some sludging-up of the bottom having taken place. They had, he believed, got over the difficulty by screening. The oldest bed he had seen was of seven years' duration, and he had not noticed any subsidence of the surface owing to breakage occurring in the beds. The humus, as it had been called, was so distinct from the sludge from septic tanks that some misconception originally had occurred as to the necessity for dealing with it as it came away from the slate beds. In some places it was found that the top layers of the contact beds were congested with the humus. To get over that difficulty, at one installation, they had constructed three shallow beds of fine ash, which were worked in series and alternated daily, and from those, humus was daily taken away. It was deposited in a heap close to the beds, and there it aerated and dried, and within the space of a week or two, without any offence having occurred during the whole while, it had become practically garden earth. There was no doubt that the aerobic action went on in breaking down and purification during the stacking.

Dr. J. A. Voelcker said he could speak with some personal experience of what went on at Devizes. In his opinion, injustice had been done to Mr. Dibdin in the Report of the Royal Commission by describing his tank as being similar to a septic tank. It was nothing of the sort. At Devizes and elsewhere, Mr. Dibdin had done that which was not an easy thing, he had satisfied his clients ! At Devizes, more particularly, one of the most difficult materials—dairy refuse—had to be dealt with. He was indeed surprised to see the great readiness with which the refuse from milk factories and slaughter-houses was dealt with by the process. There was an entire absence of nuisance. It seemed to him that the great advantage of the process was that the activity of purification was spread over an enormous area and went on at a number of different centres. There was life of all kinds present, each one doing its own particular work and all tending to the same satisfactory end.

Mr. J. W. Barr said that he had tried the slate bed humus with several plants, some of which were of a very delicate kind. Its effects, so far as could be judged, were beneficial rather than otherwise. It certainly did no harm in any case, but he thought the use of the humus was rather to improve the physical character of the soil than as a fertiliser. He thought that it would be found desirable to allow the humus to dry somewhat rather than to apply it in its original moist condition.

Mr. H. Percy Boulnois said he was surprised to see the very small amount of humus which the author said he got from the slate beds at High Wycombe, because he (the speaker) had been accustomed to hear of 21 to 60 tons of sludge from a million gallons. At Manchester, Salford, and Chorley, the amount of sludge was far in excess of that Mr. Dibdin had got with slate beds. Did not Mr. Dibdin think some sort of sedimentation tank in front of his slate beds would be an advantage either to equalise the sewage and also the temperature to some extent, or to equalise its character as it came down hour by hour ?

Mr. Martin said he had seen the Trowbridge installation, and believed that the Local Authority, in consequence of Mr. Dibdin's representations, had put in a direct bypass channel, to do away with the condition to which Mr. Dibdin objected, namely, the detention of the sewage in the septic tank. He did not think that Mr. Dibdin had represented the officers of the Royal Commission quite fairly. As he had read their Report, they did not refer to the *modus operandi* of the slate bed treatment, but to its results ; they said merely, "The effluent from a slate bed is, for practical purposes, indistinguishable from a tank effluent. It contains about the same amount of suspended matter, and requires subsequent treatment, similar to that which would be necessary for a tank effluent from the same sewage." The annual cost of dealing with sludge took no account of the amount of solid matter which was deposited in the interstices of the beds, and he was informed that at Devizes the fine beds had sludged up to a very serious extent. In the author's comparative estimate there appeared an item of £635 per annum for cartage of the sludge from the septic tank ; if that heavy expenditure were to be incurred simply as an aid to disposal, one would say that it would be necessary only in those cases where no land was available at the sewage works. In referring to the difference between the humus from slate beds and that obtained by other processes, it seemed to him that the author was comparing the best result from a slate bed with the worst result from a septic tank. A number of observers of world-wide reputation had testified to the inodorous and inoffensive character of the digested residuum from a septic tank.

Mr. Dibdin's desideratum for a slate bed was that it should be worked on aerobic lines ; that there should be a sufficient period of submersion to allow the solids to be deposited on the layers of slate, and no more. Unfortunately, owing to the conditions under which sewage arrived at the outfall, it was impossible to secure those conditions over the whole twenty-four hours. A bed filled according to the rate of flow—at night very slowly and in the daytime more quickly. It was kept full the proper time, and then had to be emptied. In many cases the beds had been emptied very slowly, with the object of getting the effluent as free as possible from suspended matter, with the result that the lower layers of the beds were charged with liquid for many hours. Consequently the condition in the bottom of the bed was very different from that aimed at by Mr. Dibdin, with a corresponding difference in the character of the residuum. The humus which he saw lying on the draining beds at Devizes was indistinguishable from that obtained by a thorough digestion in a septic tank. Sludge digestion was no doubt important, but it was secondary to the condition of the effluent, and he would be glad of some figures as regards the quantity of suspended matter in the effluent of a bed worked in the ordinary way. He thought the heart of the slate bed question was the avoidance of nuisance, and they had the testimony of the Royal Commission, and of a number of engineers and others that the slate bed was a very valuable means of avoiding nuisance in dealing with an offensive sewage. They must not, however, expect too much from it, because of the slow flow of sewage to the works, particularly at night. Even at Devizes, for instance, he found that the effluent from the slate beds which had come down during the night and was passing off during the morning, after being many hours in the bed, had a distinctly offensive smell indistinguishable from that of the effluent from a septic tank.

Mr. A. H. Dewar said that from the standpoint of the Local Authority the question was that of cost. A very good idea of the cost of conversion of the sewage into inodorous humus had been given them, but Mr. Dibdin had not told them of the cost afterwards of converting the effluent into one which was fit to be discharged into tidal waters, and more particularly into rivers. That was a matter of very great importance to all in inland towns. Another point was, how did Mr. Dibdin's process compare with sprinklers over beds of gravel or coke, and what was the capacity of his slate beds, of the same depth, as compared with these sprinkler beds from which, of course, the effluent was clean enough to be passed off into tidal waters or even rivers?

Dr. S. Rideal said the analyses of the different sections of material did not seem to warrant Mr. Dibdin in drawing any conclusion as to any difference between them. One characteristic about the deposit which proved the aerobic nature of the change taking place, was the constant presence in the deposits of a considerable quantity of fat. It seemed to him that Mr. Dibdin had removed a portion of the sewage solids in the slate bed, but that a great deal of them must go forward and remain either in the secondary catch pit or be in the filters or on the land. Not a single analysis had been put forward to show what sort of effluent was obtained. Mr. Dibdin had said that under certain conditions it might be discharged into tidal waters, but it was certainly an effluent that required further purification in the two vital characteristics, viz., a removal of a good deal of the remainder of the suspended solids, and an oxidising process.

Mr. L. A. Dibdin said he had seen the by-pass mentioned by Mr. Martin which was at Trowbridge. The sewage went direct from the septic tank to two out of the four slate beds and was by-passed to only two of the slate beds, and unfortunately the by-pass was not regularly used. The sewage had been seen passing direct through the septic tank to all the slate beds after the by-pass had been installed, so that the benefit did not follow. The difficulty of the slow filling of slate beds at night and the consequent prolonged hours under which the lower slates were kept under water, was overcome in many cases by having a number of small beds and diverting the sewage from one bed to another by the use of automatic syphons or valves, so that only one bed filled at a time, after it had had two hours quiescent contact the water was then drawn off as quickly as possible, provided that in draining the effluent and humus out of the bed they did not scour undigested sewage. In most works where properly erected humus drainage beds were provided, the effluent was discharged as quickly as possible, provided that the undigested sewage was not brought out. The time that would take, varied with the size of the bed and the depth, but might be about an hour for a three-foot depth of water. Experiments had been made by using a floating arm outlet in drawing the water from the bed. There was a large field yet for experimental work as to the best means of emptying the slate bed. It might be feasible sometimes to empty the beds from several points; but he thought it would always be found advisable to do it from the bottom of the bed, although the rate might be regulated by a floating arm.

Mr. H. C. H. Shenton wrote as follows:—The slate bed and the coarse contact bed are identical in working, and the results are similar when the coarse bed is formed of such a material and drained in such a manner that it can discharge its humus. In a paper I read before the Society of Engineers 13 years ago, the following statements were made:—"Possibly a very coarse bed of durable material, very well drained, would produce the result of a more or less sludgy effluent from the first bed. The object is that the first beds should not sludge up. What is needed to perfect the bacteria bed system is some way of preventing the sludging up of the first beds. Were it not for the sludging up of the first beds, the tank treatment would be unnecessary. It" (sludge) "can be more easily removed from among the very coarse material than from among the very fine, with which it will form one mass." From that time to the present I have had considerable experience with coarse contact beds, dealing sometimes with crude sewage and sometimes with sewage which has passed through a tank, and I am ready to endorse to the fullest degree Mr. Dibdin's contention as to the merits of slate beds. I have found that where even a bed of clinker is provided with a false bottom, and with special draining channels for the full depth of the bed, that a result is obtained comparable to that from the slate bed, but the construction of such beds is more expensive than that of slate beds, which are certainly superior, but even clinker beds constructed in this way are capable of discharging their humus and do not become clogged, provided that they have proper emptying arrangements. They will at certain times discharge their humus in large quantities, and this can be intercepted, and as Mr. Dibdin has demonstrated, it has a considerable manurial value. Another statement made in a paper I read in the year 1904 was as follows:—"It would be a good thing to make provision for washing out the first contact beds to some extent occasionally, *e.g.*, by opening a large valve when the bed is full, so as to create a good rush out. The humus washed out might be caught in channels on the second beds, or it would probably remain on the surface, where it could be cleaned off, or it might be well to have a settling pool or channel to catch it between the first and second beds." I have constructed contact beds in a great many places upon the principles advocated by Mr. Dibdin, and where his teachings have been *properly* carried out, the result has always been successful. The first beds, whether of slate or constructed on the slate bed principle, have unloaded their humus and have not required to be cleaned out. Further, the humus has been of an absolutely unobjectionable nature, and above all, the clients have been well satisfied with the results. The same results have not attended the construction of settling tanks, the effluent from which is apt to become foul from various causes and the sludge from which is objectionable in quality.

Mr. Dibdin, in reply, said that Mr. Boulnois was correct in the suggestion that slates were first proposed to be used at Festiniog in connection with the old style of contact beds. As to the small amount of humus, he expressly stated in the paper that those were the results obtained by Mr. Rushbrooke, the Borough Engineer of High Wycombe, who had made very careful experiments for 18 months. They had been working at Devizes now for about 7 or 8 years, and he was informed that with the exception of a few barrow loads that were taken away for growing some cucumbers, none of the humus had been removed from those works. Before that, they had stacks of pressed cake steaming and causing a nuisance. Now only the black mould was to be found. The Royal Commission had said that it was very difficult to ascertain the amount, but they made some measurements and concluded that only about 1 per cent. was destroyed. If he had claimed to have reduced ordinary suspended matter in sewage to the inoffensive condition he had shown them with a loss of only 1 per cent., he would have had to meet some very severe criticisms. By retaining the fine humus in the "humus beds" before the effluent went on to the fine beds, the capacity and life of the latter was undoubtedly increased. Mr. Martin had mentioned the by-pass at Trowbridge. He was informed that they let the sewage run through the slate beds, the outlet and inlet being open at the same time. As to not treating the Royal Commission fairly, he had merely quoted what they had said. His only observation was in a few lines, viz.: Reference to the High Wycombe results. "The annual expenditure at Devizes might be taken into account." He thought that was fair. A saving of £500 a year on a total of £700 ought to be taken into account. Then he had said, "The figures as to the quantity of sludge before the installation was at work, namely, some 680 tons of pressed sludge per annum." They did not now get 680 tons of pressed sludge per annum. That was all his criticism, beyond asking for an explanation of an obvious contradiction. Then as to the fine beds, in a paper which he had read before the West of England Branch of the Society of Medical Officers of Health, at Devizes, on March 19th, 1908, he had fully explained that when those beds were constructed, by an oversight the contractor put in a lot of very fine ashes such as ought to have been, according to the specification, sifted out and rejected. The clinker, obtained from the adjoining iron works at Westbury, contained a considerable quantity of iron, so that it rusted and made an iron cement, which was dug out in solid masses. When it was taken out, the capacity of the beds was increased, and he was informed by the Borough Surveyor that they were perfectly satisfied, and had given no more trouble. As to the difference between digging the humus in land at a distance and at the works, his point was that it was not necessary to dig it in. For 7 or 8 years at Devizes, he did not think they had put a spade in the ground to get rid of it. He had stated, from the time of the first experiments which had been made at Barking, on a one acre bed, worked jointly by himself and the engineers for years, that within reason, the faster the bed could be emptied the better would be the result. That principle applied to every class of contact bed. They did not want the lower layers to be under water longer than could be helped. The bottom bed wanted the maximum aeration to prevent the anærobic action, and on that point he had just made an improvement. He had increased the size of the air trap by putting a ring round the slate. It reduced the capacity of the bed somewhat, but only to a very small extent, and it increased the period of aeration. With regard to the figures as to the suspended matter, he referred Mr. Martin to his previous papers. As to the difference in the number of bacteria in different layers, they might make different experiments, and get different results according to the difference in the sewage and the number of fillings and so on. Those particulars were given mainly to show what an enormous development of microbic life had taken place in those beds, and whether it was only half an inch skimmed off the top or a portion from underneath, he thought he had got really remarkably good results. He had pointed out the necessity for secondary treatment of slate bed effluents again and again; these were not to be considered as final effluents, and must be subjected to a further treatment under normal conditions. Under exceptional conditions of suitable land or tidal water, it might not be essential.

Dr. Rideal had mentioned fat. Fat did disappear, and in the paper which he had read before the Society of Public Analysts in 1907, they would see the same results, particularly those given in connection with the paper by Dr. Gilbert Fowler, in which the reduction of the fat was distinctly shown. That was also very definitely demonstrated in a series of experiments submitted to the Association of Managers of Sewage Disposal Works in March, 1911.

Meeting held at Burlington House on Monday, January 6th, 1913.

DR. W. R. E. HODGKINSON IN THE CHAIR.

THE ESTIMATION OF GLYCERYL ACETATE IN ESSENTIAL OILS.

BY S. GODFREY HALL AND A. J. HARVEY.

In the October issue of the "Perfumery and Essential Oil Record" there appears an article by M. S. Salaman and W. M. Seaber (see this J., 1912, 1052) in which the authors point out the necessity of a sensitive method for the detection and estimation of glyceryl acetate, and examine at some length the merits of two different methods. The first depends roughly upon the assumption that the glyceryl acetate, or at least such proportion of it as remains behind in the non-volatile residue when the oil is heated on the water bath, raises the saponification value above that of a normal oil. The second method was devised by Messrs. Schimmel & Co., of Leipzig, and is described in detail in the issue dated April, 1911, of their report. It depends upon the solubility of glyceryl acetate in 5 per cent. alcohol and its consequent elimination from the oil on washing.

The conclusion that Messrs. Salaman and Seaber come to is that the first method is unreliable, but that Schimmel's could reasonably detect 2 per cent. glyceryl acetate. At about the time of the publication of the above paper, it became necessary for us to determine the nature of the esters in some samples of bergamot and lavender oils; it appeared to us, however, that a more convenient and perhaps more reliable method even than Schimmel's might be found; and after some preliminary investigations we determined upon the following, which roughly is dependent upon the separation and estimation of the glycerol as such.

A quantity, if possible, not less than 10 grms., of the oil to be examined is mixed with about 50 c.c. of 0·830 alcohol and saponified with $N/2$ alcoholic potash; it is then digested on the water bath for one hour; the solution is now neutralised by means of $N/2$ hydrochloric acid and evaporated to dryness on the water bath in order to remove the alcohol; about 20 c.c. of water are added, and the oily portion extracted by methylated ether, the water solution being run into a 6-oz. round bottomed flask: the ether extract is again washed with a further quantity of about 10 c.c. of water, which is then added to that already in the flask and the whole evaporated to a syrupy condition. This residue now contains the glycerol originally present as glyceryl acetate, which is estimated in the usual way by the triacetin method, as follows:—To this residue 3 grms. of fused sodium acetate is added together with 8 c.c. of acetic anhydride and the whole refluxed for one hour at a gentle heat, then cooled and 50 c.c. of boiled, distilled water added. The contents of the flask are now raised to a temperature of 80° C., again cooled, filtered and washed into a 30 oz. flask. A few drops of phenolphthalein are added and a sufficiency of caustic soda solution of about normal strength, to just neutralize the excess acetic acid, care being taken to insure thorough mixing. A known excess of $N/2$ sodium hydroxide is now added and the whole gently boiled under a plain tube reflux for 15 minutes, then cooled and titrated with $N/2$ hydrochloric acid. The consumption of sodium hydroxide measures the quantity of glycerol present and consequently the glyceryl acetate using the following factors:—1 c.c. NaOH (semi-normal) = 0·01535 glycerol = 0·03641 glyceryl acetate. It is advisable always to do a blank test using only the acetic anhydride and sodium acetate and boiled with 5 c.c. $N/2$ sodium hydroxide.

Glyceryl acetate in bergamot and lavender oils.

Bergamot.

	Ester value.			
	Weight.	c.c. $N/2$ alc. potash.	Per cent. Lin acet	Sap val
Original oil	2·288	7·65	32·77	93·8
,, ,, + 2 per cent. glyceryl acetate	2·136	9·35	37·60	107·7
Original oil + 5 per cent glyceryl acetate	7·789	35·80	45·04	128·9

	Glycerol content.			
	Weight.	c.c N/2NaOH less correct.	Per cent. Glycerol.	Per cent. Gly. ace.
Blank	—	—0·03 p. c.c.	—	—
Original oil	5·000	—	—	—
,, ,, + 2 per cent. glyceryl acetate	15·780	9·65	—·938	2·22
Original oil + 5 per cent. glyceryl acetate	7·789	10·25	2·020	4·79

Lavender.

	Ester value.			
	Weight.	c.c. N/2 alc. potash.	Per cent. Lin. acet.	Sap. val.
Original oil	3·299	9·65	28·66	82·1
,, ,, + 5 per cent. glyceryl acetate	3·902	16·50	41·44	118·6

	Glycerol content.			
	Weight.	c.c. N/2NaOH less correct.	Per cent. Glycerol.	Per cent. Gly. ace.
Original oil	9·802	—	—	—
,, ,, + 5 per cent. glyceryl acetate	5·970	7·8	2·00	4·75

THE DETERMINATION OF MOISTURE.

BY G. N. HUNTLY AND J. H. COSTE.

The amount of moisture in commercial products frequently enters into contracts for sale and purchase, the price paid in some cases being regulated by a sliding scale according to the amount of water present. The moisture is determined in the laboratory, and its estimation, from its apparent simplicity, has received less attention than its importance and difficulty merit. A Sub-Committee of the Eighth International Congress of Applied Chemistry has recently reported on the determination of water in coal, and in considering the general question we would call attention to the report of this Sub-Committee which was issued by the President (Mr. G. T. Holloway) and one of us as Vice-President.[*] The Committee included the following active members: E. R. Andrews, C. O. Bannister, H. Bancke, W. T. Burgess, F. Clowes, Staff of Messrs. Schneider & Co., Le Creusot, E. J. Constam, J. H. Coste, H. F. Hills, W. R. Hodgkinson, G. N. Huntly, M. Huybrechts, A. McArthur Johnston, L. L. de Koninck, G. Lacombe, R. Lessing, C. Nicolardot, W. Pollard, W. E. F. Powney, W. Rosenhain, C. A. Seyler, and J. E. Stead, several of whom co-operated in the examination of a series of samples of coal sent out by the President. We shall frequently refer to, and quote from, this report.

The water bath with a large door, unventilated, and the single walled metal air-bath are to be found in most laboratories, and analysts are frequently satisfied to determine moisture by drying in open vessels at temperatures which may vary from 84° C. to 98° C. in the water bath, and between still wider limits in the air bath, the loss of weight under these conditions being set down as moisture. It is well known that any substances which contain volatile constituents other than water or are liable to absorb oxygen from the air cannot be dealt with by simply taking the loss of weight, and no one, for instance, would attempt to determine water in a crude fuel oil by mere loss of weight. Many substances, however, which absorb appreciable amounts of oxygen at or near 100° C., and which do not lose all their moisture at this temperature, are still commonly examined by the mere indirect method.

The methods used for the determination of water may be classified as direct and indirect, with an intermediate class in which, although the water contained in a substance is not directly weighed or measured as such, a gas such as acetylene, hydrogen or methane, evolved by the interaction of water and an added substance in amount directly proportional to the quantity of water present, is measured. We briefly mention some of these various methods.

A. *Direct Methods.*

I. Water driven off by ignition, condensed in part of ignition tube and weighed directly. (Penfield).

II. Substance heated in a current of dry gas, or in a vacuum, water vapour collected in calcium chloride or sulphuric acid and weighed.

III. Substance mixed with an excess of a volatile nonmiscible liquid such as xylene, distilled, and the water measured under the hydrocarbon layer, with or without corrections for the mutual solubilities of the water and liquid used for its removal.

IV. The material directly heated to 130° C. by a vapour jacket (high pressure steam), the steam given off condensed and measured.

B. *Gasometric Methods.*

V. The substance is mixed with calcium carbide, acetylene measured.

VI. The substance is mixed with magnesium methyl halide in presence of a suitable dry solvent. Methane measured.

VII. The substance is treated with sodium. Hydrogen measured.

C. *Indirect Methods.*

VIII. Determination of the loss of weight by heating to a definite or indefinite temperature. The usual method.

IX. Prolonged exposure in a vacuum in presence of strong sulphuric acid, either at ordinary or at higher temperature.

By one or other of these methods most of the water determinations required in practice can be carried out with fair accuracy, but there are a few outstanding cases to which no one of these is applicable, for example, the water present in hydrated silicates in coal.

I. Penfield's elegant method (suggested in its original form by Brush) is specially designed for the analysis of rocks. It gives accurate results in presence of carbonates or where ferrous salts are present in the rock, but can obviously not be applied if the substance to be dried is organic.

II. Driving off the water in a stream of gas and catching and weighing the water evolved in a calcium chloride or sulphuric acid tube, subject to certain conditions, is an accurate and widely applicable method. If the volume of gas is large the amount of water not absorbed by calcium chloride is quite appreciable. In this respect sulphuric acid is preferable, but the liquid is more awkward to handle than a solid. If the statement of F. M. G. Johnson[*] is confirmed, that alumina (dried by heat, in a stream of dry air at the temperature of a smoky flame) absorbs water vapour as completely as sulphuric acid, then alumina will be an ideal substance for the purpose, as it does not attack rubber or corks, and will not require saturating with carbon dioxide like calcium chloride: neither is it liable to absorb hydrocarbons like sulphuric acid. Air is not a safe gas to use, as with coal at 100° C. oxidation is marked and water is one of the products. This is pointed out by W. F. Hillebrand and W. L. Badger remarking on the experiments of Archibald and Lawrence (J. Ind. Eng, Chem., 4, 258, 1912) in a paper before the Eighth International Congress of Applied Chemistry, carbon dioxide or nitrogen, preferably the latter, must therefore be used in this method, and this destroys the practical value of the process. Subject to the further conditions that all the water is proved to be given off at the temperature chosen, and that no products capable of being absorbed by the hygroscopic reagent used are also given off at this temperature, this is one of the best standard primary methods, by means of which the everyday process can be checked.

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[*] Dr R. Lessing attended the Congress and presented the Report.

[*] Jour. Amer. Chem. Soc., 1912, 911.

On this process the reporters of the International Committee say :—

"4b. The method of drying at 104°—107° in a current of gas free from oxygen (see below *) appears to possess a considerable advantage over any other process of drying at an elevated temperature, in that the necessary compromise between the desire to dry completely on the one hand and the fear of oxidation on the other is reduced to a minimum. It may be said, at any rate, when 'fixed gases' such as hydrogen, nitrogen or carbon dioxide are used, that the only reasonable possibility of error is the loss of something other than water due to the elevated temperature adopted. That this is small, at least for some coals, has been shown by Mahler (Comptes rendus, 1910, 1521, 2). The use of coal gas unless carefully purified would seem to be very risky, as is shown by the results marked VIII. It is, perhaps, not unreasonable to suppose that dry coal may possess a certain power of ad- or absorbing some of the constituents of coal gas. This possibility is suggested by Dr. Lessing, whose figures seem to confirm this view; Mr. Hills, who uses a direct method, *i.e.*, actually weighs the water in calcium chloride tubes, informs us that since the amount of CO_2 in coal gas has become considerable, owing to the abandonment of purification with lime, he has found it necessary to take special precautions for the removal of this gas (CO_2), since calcium chloride usually contains sufficient free lime for it to absorb CO_2 readily. His two results by this positive method and those of Drs. Constam and Pollard, are particularly interesting, as they show that at least the amount of water indicated is actually given off from the coal, since calcium chloride, unlike sulphuric acid, is not an absorbent of olefines. It is worthy of note that in four coals out of six sent out, the highest result obtained by any method was by this method."

III. Distillation with a non-miscible liquid, such as xylene, and measurement of the liquid water carried over is a very promising method, and deserves a careful comparative study against Nos. 2 or 8. It lends itself to substances difficult to handle by the ordinary method, such as oils, butter, tar, and coal.

"Dr. Constam," working with the International Committee, "gives some results obtained by his colleague Dr. Schläpfer with a modification, not hitherto published, of a method described by Marcusson for the estimation of water in oils, fats, soaps, and resins. 40—50 grams of coal (100 grams of coal of low water content) are weighed into an Erlenmeyer flask of 500 c.c. capacity, 200 c.c. of xylene are added, and 150 c.c. of this are distilled over, the flask being heated on a sand bath, into a measuring cylinder, the lower part of which is divided to 1/20 c.c. The measuring vessel is then hung in a cylinder with warm water. Any drops of water which hang about the shoulder of the measuring vessel are detached and allowed to fall to the narrow part by means of a glass rod. After 1 hour standing, the volume of water distilled over with the xylene and which has separated under it, is measured, due correction being made for the meniscus. The results obtained agreed well with those of standard methods. The method is ingenious and, in the opinion of the reporters, has many advantages, and might well be made the subject of further trial by other workers."

Allen and Jacobs (VIII. Inter. Cong. Applied Chem. 1912, Sec. Ve. Original communication, 10, 17—23. This Journal, 31, 863) have used a similar method for the determination of water in petroleum and its products. They describe the process as accurate to 0·033 grams of water per 100 c.c. of distillate.

The process has the drawback of requiring close attention during the distillation, and hence is not suitable for dealing with large numbers of samples simultaneously, and is not free from danger of fire.

IV. Crosfield (Journal Franklin Inst. 1911, 172, 495) has designed an apparatus called by him the "moisture determinator" for the direct estimation of water in coal. It consists of a jacketed tube provided with a screw plug at each end. Steam at 230° F. is passed through the jacket, and the water from 1 lb. of coal is condensed with suitable precautions. (This Journal, 30, 1911, 1366). It has the advantage of requiring a large sample, of giving a direct rapid reading and requiring only a rough balance, since an error of 2 grams in a kilogram would only alter say 10 per cent. of water to 10·05 per cent. It does not require skilled handling and is eminently suitable for use in a power station, where results are required in the shortest possible time. It has the disadvantage, from a laboratory point of view, of requiring high pressure steam, but if the accuracy claimed by the author is confirmed, it should take its place as a standard method for coal.

A somewhat similar method has been used by Allen and Jacobs (*loc. cit.*) for the determination of water in petroleum and its products. 200 grams of the oil are distilled in the ordinary way, and the water in the fractions between 100° and 150° is separated and weighed. The method is exact to within 0·03 per cent. It is difficult to see how water is prevented from coming over below 100°. Probably the authors collect all below 150° and from this separate the water.

V., VI., and VII. Three gasometric methods have been proposed, based on the evolution of acetylene from calcium carbide, of hydrogen by means of sodium, and on the production of methane from magnesium methyl halide. The latter reaction is quantitative, but the time and skill required for the preparation of the reagent and solvent and also the fact that all hydroxyl groups and many other organic groups react rule this out as a working laboratory method. The use of calcium carbide was first suggested by Dupré. (For other references cf. F. H. Campbell. (paper read to-night)). Cordite, wool, butter, cocoa, coffee and coal are substances to which this method has been applied. The reaction assumed here is

$$CaC_2 + H_2O = C_2H_2 + CaO.$$

When tested with known amounts of water, however, there is always a deficiency of about 6 per cent. of acetylene, and this necessitates working empirically. Possibly some calcium hydroxide is formed from the oxide as a secondary reaction. The use of this method will probably remain restricted to substances to which the ordinary methods are inapplicable.

Treatment with sodium has been used, as well as treatment with calcium carbide, by Allen and Jacobs (*loc. cit.*) for the determination of water in petroleum and its products. They describe the method as very accurate since hydrogen is insoluble in oil. 2 grams of finely cut sodium, are used for 1 gram of water supposed to be present, and the apparatus used for the evolution and measurement of the hydrogen evolved by the interaction of the sodium and water is similar to that for the carbide method.

The method, although clearly of rather limited application, appears to be sound within those limits. The use of rubber joints or stoppers should be avoided as far as may be in the apparatus since hydrogen is a gas which diffuses very readily.

VIII. This is the method in general use, and is likely to remain so. The errors to which it is liable require careful consideration, and it is proposed to devote some space to them. Correct results will be obtained if—

1. The temperature of the oven and period of drying is sufficient to drive off all the moisture.

2. No moisture is reabsorbed before weighing.

3. No volatile substance other than water vapour is evolved.

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* This requirement should be taken literally. The presence of a small percentage of oxygen may lead to the absorption of this gas.

4. No oxidation takes place.

5. No absorption of carbon dioxide takes place.

6. No internal chemical change is induced which may lead to the formation of water in the substance to be dried by heating it to the chosen temperature. This error is seldom considerable at 100° C.

1. The ordinary water oven, with water at the bottom, and steam on three sides does not give a uniform inside temperature of 100° C. The copper door exerts a cooling effect, as is shown by the following figures :—

Temperature of the boiling water	100·0
Temperature of the centre of the oven	98·0
Temperature 1" from the door	96·8
Difference observed in the oven	1·9

These figures are for an ordinary unventilated oven. With a shutter ventilator of the usual type in the centre of the door, these differences are increased, a temperature of 94° was observed 1 inch from the door, and the mercury thermometer in the centre of the oven was steady at 97·0. Data obtained with such an oven cannot be put down as "loss at 100° C."[*] An additional loss of efficiency with this oven is due to the fact that the air in the oven soon becomes saturated, and the substance to be dried ceases to lose moisture. Two simple improvements have been suggested for this type of oven, the door is jacketed with a non-conducting substance (uralite, asbestos) and air is introduced at the back after passing through a tube of sufficient length to raise it to the temperature of the boiling liquid. If this air is forced in under a slight positive pressure, it can be dried previous to entering the oven; but this, although very desirable, is rather too complicated for ordinary use. An oven with a stout "uralite" door, and fitted with a preheater ventilating tube, showed 109·0° when used as a toluene oven, and exploration with a copper-eureka thermocouple showed differences in various parts of the oven of 0·1 to 0·2° C. only. The water oven may occasionally be too hot; thus with an oven with a badly fitting door, heated by a rather large flame, some of the combustion gases found their way into the oven, and temperature reading of 103° was obtained in the neighbourhood of the door.

As showing the drying effect of a few degrees rise of temperature the following table is instructive :—

Temperature.	Vapour pressure.	Relative pressure.
	mm.	
80°	355	1·0
90°	526	1·48
95°	634	1·79
100°	760	2·14
105°	906	2·55
110°	1075	3·63

As might be expected the temperature irregularities are much greater in the case of the ordinary single walled air oven. Such an oven heated by a single bunsen burner showed a steady temperature on a mercury thermometer of 110° C. Fluctuating temperature differences of 2° to 5° C. between two porcelain crucibles placed side by side in the centre of the oven were found with a thermocouple, and an exploration of the inside of the oven with the couple showed a maximum difference of 27° C. The substitution of a spreader burner with 25 small flames for the bunsen did not reduce this maximum difference, although the differences in the centre of the oven were reduced to 5° C. It is obvious that such an oven cannot be used when the temperature of drying enters into a specification. Some form of constant temperature jacket must be used, and for temperatures of 106°—109° either toluene (B.P. 111° vapour and liquid at same temperature) or a mixture of glycerol and water[†] (liquid used for jacket) appear equally suitable.

The following figures taken from the report of the International Sub-Committee will illustrate the effect of a rise of 8° or 9° above the water oven in the temperature of drying.

Percentage lost by coal when dried in water ov

	I.	II.	III.	IV.	V.	VI.
Maximum ..	3·12	9·78	7·36	5·50	7·31	7·66
Minimum ..	2·70	9·42	6·80	5·25	6·72	6·95
Average ..	2·89	9·65	7·14	5·34	6·96	7·25

Percentage lost by coal when heated at 104°—107° C.

	I.	II.	III.	IV.	V.	VI.
Maximum ..	3·24	10·25	8·00	6·42	7·63	8·16
Minimum ..	2·72	9·48	6·52	5·10	6·22	6·92
Average ..	2·96	9·84	7·33	5·84	7·20	7·48

Similar differences are observed with such vegetable products as linseed, cotton seed and soya bean cakes and meal.

2. It is well known that many, if not most, dried powders are hygroscopic. This property of powders appears to be more marked when they are very finely ground and to be independent of ordinary chemical affinity for water, since it has been noted in such a substance as ignited quartz (cf. Hillebrand, Analysis of Silicate and Carbonate Rocks, U.S. Geol. Survey, Bull. 422). This increase is almost certainly due to the increased ratio of surface to weight caused by grinding, and the consequent greater adsorptive power of the powder. It must, however, be remembered that whereas the water content of a substance which is in equilibrium with the atmosphere (of the balance case) or nearly so will not vary, or will vary very slowly, the tendency to change, *i.e.*, to absorb water will be much more marked when the substance is dry and the air of the balance case not entirely so. We may consider the case of an ordinary determination of moisture in, say, a feeding stuff such as linseed cake. It has been weighed in a glass or porcelain vessel, usually open, dried in an ordinary water oven, and then taken out and allowed to cool in a desiccator. This vessel often has a wide opening to the air, and a small absorbing surface of calcium chloride or sulphuric acid. The desiccant is not often changed. During its sojourn in this appliance, the dried material cools and tends to assume a state of equilibrium with the air around it. This has probably not had time to dry, and equally probably will part with its moisture more readily to the dry powder than to the "desiccant" provided. Consequently some gain of water occurs in the desiccator which will be further increased in the balance case. Dr. Pollard in the International Report illustrates the absorptive power of a coal (No. 2) after it is dried, as follows :—"Air was sucked over 5 grammes of dried coal and then through a sulphuric acid tube for 6 hours. The coal gained 0·121 grams and the U tube only 0·008 grams, so the coal had nearly dried the air.

On the question of suitable drying vessels the International reporters say :—"It cannot be contended that an ordinary crucible, either of porcelain or platinum, is a vessel of suitable shape for use in such a determination as that of moisture in any substance; more particularly one so liable to oxidation as coal, which should therefore be dried as quickly as possible. The American Committee, in indicating that platinum crucibles, which are usually of a tall form, give on the whole lower results than porcelain, have hit on a weak point in the method recommended by them. . . ." A crucible is perhaps the worst shaped open vessel for this purpose.

It is well known that substances left over-night in ordinary desiccators frequently gain in weight.

It is, therefore, important—

(1) To weigh substances for moisture determination in vessels which, whilst exposing a large area of substance, can be closed satisfactorily during the period of weighing.

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[*] An example is given by one of us in the International Report in which differences of temperature of 16° were observed in a large ventilated oven.

[†] Specific gravity 1·19 at 15°. About 73 per cent. by weight glycerine. This strength must of course be maintained by using reflux condenser. This mixture is obviously much safer than toluene.

(2) To use a good desiccator, which will expose a large surface of strong sulphuric acid ; and

(3) To allow the vessel to cool open in the desiccator since, *e.g.*, a weighing bottle of 15 c.c. capacity would hold at 15° about 18 milligrammes of air, and at 100° only 14 milligrammes, which would be the amount weighed after cooling if the bottle were kept stoppered.

The International reporters describe various forms of weighing bottle used by members, and mention that well fitting watch glasses are very simple and are apparently quite satisfactory. (One of us uses small shallow tins, such as vaseline is sold in, which appear to possess many advantages.) We may remark that there was considerable evidence showing that covered crucibles are not satisfactory. Apart from the looseness of their covers, we consider their shape very unsuitable.*

The subject of desiccators can be more conveniently considered in connection with the vacuum method.

3. The possibility that a substance may evolve some other volatile matter than water introduces an element of uncertainty in the indirect method, which must be eliminated or shown to be negligible. Fertilisers of such an alkaline character as Peruvian or fish guano and many other products will evolve ammonia or amines as well as water when heated. Ammonium salts are not above suspicion in this respect. Salts of weak and volatile acids may absorb CO_2 and evolve the acids. Many vegetable substances, *e.g.*, spices, seeds, etc., give off essential oils as well as water when heated. Soaps, or similar materials, containing "carbolic acid," creosote, naphthalene, or petroleum will lose matters other than water when heated. It is well known that many substances char slightly when heated even at 100° for a time.

The evolution of traces of hydrocarbon gases by coal has been shown by Mahler (*vide supra*) to be negligible, and, therefore, so far as this source of error is concerned, the method is applicable to coal.

The water in very heavy hydrocarbon oils such as are used for lubricating purposes can probably be determined with some accuracy by the indirect method, but it is not applicable to the class of relatively heavy oils which are used for fuel. It may be said with safety that for any oil having a flash point below, or not very much above, 100° C., this method should not be used. It is inapplicable for creosote or tar oils generally.

4. The action of the oxygen of the air on substances to be dried is in many cases not to be neglected. It is not always of a simple kind, since frequently the sign and magnitude of the error caused are both uncertain.

The simplest possible case is to be found in the drying of minerals containing ferrous salts. The only satisfactory way to determine the moisture in these by means of an indirect method is to correct for the difference in the content of ferrous iron before and after ignition when it is desired to ascertain the total water. Hillebrand has shown that grinding such materials decreases the amount of iron found in the ferrous condition, and it is therefore fairly certain that the determination of "moisture" should be corrected in the same manner. Dr. Pollard (cf. International Report) found that ferrous sulphate dried in an "air vacuum" was invariably oxidised, but not so in a "hydrogen vacuum."

Drying oils and substances containing them present difficulties which are frequently ignored. It is well known that an increase of weight occurs when films of drying oil are exposed to the air ; this increase also occurs at elevated temperatures, but to a less extent. This does not appear to be due to a reduced oxidation at the higher temperature, but rather to the protective action of the film which is formed, and to the circumstance that oxygen is not simply added, but that carbon dioxide, water, and possibly other volatile substances, are given off.

Such substances as linseed cake, if dried slowly at temperatures below 100° C., reach a minimum weight and then slowly gain. It does not follow that any weighing which may be made will represent the point of minimum weight, although the rate of gain is usually so low that the probable error on this account is small. It is certain, however, that in such a case the minimum point does not furnish a sure means of determining the amount of water originally present in the substance.

Coal is another substance which in the finely ground state is very sensitive to the action of oxygen, especially at high temperatures. Here again the sign of the error affecting indirect determination is uncertain. Not only is the organic matter of coal easily attacked by oxygen, but the sulphur of pyrites contained in it also presents a vulnerable point. It was shown by the International Committee that the results obtained by drying at a temperature above the boiling point of water, but not above that of toluene, were higher than those obtained in the water oven and corresponded more nearly to those obtained by drying in a current of inert gas. For these reasons we feel that the use of a water oven is indefensible for this material, and agree with the conclusions stated below of the International reporters on this matter.

Other organic materials, such as sugar and vegetable products, generally are affected by the oxygen of the air when they are dried. The approximate magnitude of errors in moisture determinations in all cases should be carefully considered, and where the sign is also uncertain the indirect method should not be used unless it is certain that the sum of any such errors can by suitable means be reduced to an insignificant amount. We may incidentally remark that where it is decided to dry in a current of oxygen-free gas it is wise to ascertain that the gas chosen is actually free from oxygen, and not to rely on its name as implying this freedom. For instance, coal gas may contain 1 per cent. of oxygen. This is equal to about 14 milligrammes per litre.

5. Mortar, soap, or any product containing free alkali or alkaline earth, may absorb CO_2 if dried in a current of air.

IX. Prolonged exposure in a vacuum to the action of a drying agent is the last method to be considered. The apparatus may be arranged to measure the gain of weight of the drying agent or the loss of weight of the substance to be dried, the latter being more usual. The presence of substances, other than water, volatile in a vacuum, obviously renders the results inaccurate, but when working at the ordinary temperature, even with this restriction, this process is applicable to a large number of substances. Owing to the low temperature and the absence of oxygen (the latter condition being effectively secured if after the first exhaustion an indifferent gas is admitted and again pumped out) oxidation is completely excluded. The method has its limitations like all the rest, *e.g.*, crystallised copper sulphate is not completely dehydrated in this way, but direct comparison with heating at 105° C. shows that the vacuum process usually gives the higher, and therefore more probably correct results. It is, however, necessary to see that the sulphuric acid used to absorb the water is concentrated (1·84), has a large effective surface, 25 to 30 square inches, and that the vacuum is as high as possible. Before removing the samples from the desiccator the vacuum should be broken by the admission of dry air (see remarks of Dr. Pollard on the hygroscopic properties of dry coal). The point as to the necessity for a good vacuum appears to have been missed by some workers. The vapour pressure of water at the ordinary temperature is of the order of 10 mm. to 20 mm., and a water pump gives about this figure. The water on the surface of a fine powder has a lower effective vapour pressure than this, and hence the rate of drying of a powder in a water pump vacuum over sulphuric acid is practically the same as in a desiccator at the ordinary pressure. There is no difficulty in a pump of the Fleuss type in getting the pressure down to 1 mm., and in keeping the pressure at least under 2 mm. for an indefinite period. The length of time required for the exposure is difficult to settle. Out of six coals examined by one of us, two gave identical results with 15 and 24 hours exposure, and the others showed an additional loss for the extra 9 hours of 0·15 per cent., 0·25 per cent., 0·40 per cent., and 0·55 per cent. Mr. Burgess (Report of International Sub-Committee) obtained an additional loss for the second 24 hours of exposure of 0·06 per cent. on the average (extremes 0·01 and 0·17 per cent.). On the other hand, W. F. Hillebrand and W. L. Badger, in the paper already mentioned, show a steady loss of weight up to 8 days; no details are given of the vacuum, and it is possible from these figures that the pressure was greater than 1 to 2 mm. In this connection it may be mentioned that an ordinary vacuum gauge as purchased cannot be relied upon without examination. It should be connected (preferably fused) to a good Töpler mercury pump and tested, it will usually be found to require boiling out in a vacuum before use.

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* In some cases it might be desirable to use counterpoises of similar form, volume and surface to the weighing vessels. This is not necessary for any ordinary work.

The vacuum method has been officially adopted by the International Committee on Glycerine Analysis: a vacuum of 1 mm. is specified, and drying has been found to be complete in 48 hours.

The following comparison is of interest in connection with the question of time necessary for exposure:—

Coal No.	1	2	3	4	5	6
"IV."	2·50	10·14	7·28	5·86	7·30	7·46
G.N.H.	3·66	10·37	7·83	6·05	7·68	8·36
Highest	2·90	10·33	7·76	6·07	7·80	7·99

In this table the line "IV." represents the loss in a vacuum (unspecified) over sulphuric acid after 8 days, taken from the paper already mentioned by Hillebrand and Badger. The series "IV." was considered by them as best representing the moisture condition of the samples as received. The second line contains the loss over sulphuric acid (1·84), (30 sq. inches surface) in 24 hours, vacuum 1 mm. for first 15 hours, dropped to 3 mm. during the following nine hours. (Shallow bottles, weighed stoppered). The third line contains the highest figure recorded for 8 days exposure to the vacuum over sulphuric acid by Hillebrand and Badger.

Excluding sample 1, it is clear that the differences are small, and in fact are much less than the differences between different observers all using the loss for 1 hour in a toluene oven, cf. VIII. 1. Except in coal No. 5, the 24 hours loss is always greater than the 8 days loss, a result possibly due to the area of sulphuric acid exposed and the high vacuum. There is no certainty that the whole of the moisture is lost in this way, but it is worthy of note that the losses shown in the second line are consistently higher than those found in the ordinary way in the toluene oven, and the higher figures here appear to be more probable. It would be a matter of great interest to try to reduce the time of exposure necessary for using a higher vacuum. Pressures of 0·01 mm. and under can be readily reached and maintained by a double oil pump of the Fleuss pattern working in series: with this and an arrangement for circulating the sulphuric acid, the time required for a vacuum moisture determination might possibly be reduced to 1 or 2 hours. There is no practical reason why the double pump should not be used with a Hempel desiccator containing strong sulphuric acid above and below the substance to be dried.

The International reporters arrived at the following conclusions and recommendations:—

"1. It does not appear that, at present any means exists for distinguishing by analysis between added water "moisture" (which term we take to signify water of adsorption, *i.e.*, that due to a concentration of water on the surface of the particles) and water of crystallisation or of combination, whatever the latter somewhat indefinite term may be supposed to mean.

2. It is probable that the distinction between moisture and water of combination is of little moment in the case of coal, since the losses of water: (*a*) at ordinary temperature under greatly reduced pressure, and in the presence of suitable means for reducing the tension of aqueous vapour to an inappreciable quantity (desiccants), and (*b*) at temperatures a few degrees above the boiling point of water, do not differ seriously.

3. Coal is a substance which very readily undergoes oxidation, and the best results in the determination of water are only to be obtained when the coal is treated in an atmosphere containing no oxygen.

4. Coal is a very hygroscopic substance and before being dried, must be properly protected in the laboratory from the effects of changes of temperature or of atmospheric conditions. When dry, it must be protected from any contact with moist air or with moisture in any form until the determination is finished.

5. Unless the initial rate of drying is known to be very rapid, the drying should be divided into two periods of which the latter is much longer than the former. Unless this is done, it is probable that an almost constant small loss, continued over a very long period, may be mistaken for an inappreciable loss.

A consideration of the curve on page 124 of Report will illustrate this point, which obviously applies with very great force to the "vacuum method."

6. When the initial rate of drying is very rapid, *e.g.*, at 105° or thereabouts, the gain of weight by oxidation may *very soon* become greater than any loss due to a very slow rate of drying over a long period.

7. There is no advantage to be obtained by drying coal at temperatures above that of the atmosphere but below, say, 105° C. Those who have read the body of the Report or who have, even, carefully read the above conclusions will not need to be informed that the accurate determination of water in a small sample of coal is a matter of difficulty and requires grave consideration. In the case of large samples of relatively coarse coal, the matter is of even greater difficulty. We put forward the following recommendations believing them to be sound, and having due regard to the requirements of both the industrial and the research chemist, but we do not suggest that they are final. We do, however, ask that workers shall give them serious consideration with a view to their adoption.

We recommend that:—

1. Whenever possible, especially in the case of very moist coals, the water in the original sample should be determined after it has been subjected to a minimum amount of preliminary mechanical treatment (*e.g.*, thorough mixing with rapid crushing of lumps), by either of the following methods:—

(*a*) A carefully weighed portion of from 100 to 500 grams of coal is spread out in a metal tray and exposed for at least 24 hours to the atmosphere of the sampling room. The tray containing the coal is then reweighed and the percentage change of weight is calculated. The coal is then coarsely ground in a mill (a ball grinder is best), and the water determined in the ground portion by one of the methods given in recommendations 2, 3 or 4. The water on the original sample can then be calculated,

or

(*b*) The xylene method used by Dr. Constam and given in recommendation 5, all results to be calculated back to the original coal.

2. *For ordinary technical work*, coal should be dried in an oven with a good air circulation for a period not exceeding one hour at a temperature not below 104° nor above 111° C. It is advised that two portions of 1 gram should be weighed between pairs of accurately fitting watch glasses or in a shallow weighing bottle which has been heated to the temperature of drying and cooled in a good desiccator, and be dried for periods of ½ hour and 1 hour respectively, the upper glass or the lid of the bottle being removed during the period of drying, at the end of which it should be replaced loosely and the covered vessels placed in the desiccator to cool. At the end of the period of cooling, which should be equal to that allowed for the heated *empty* glasses or bottles, they should be reweighed and the percentage loss calculated. The higher result shall be considered as the percentage of water in the coal. The required temperature can be obtained by the vapour of boiling toluene (111° C. at 760 mm.), by steam at a pressure of 906—1100 mm. or by an electrically heated thermostatic arrangement. We advise that a long oven with a door in the small end should be used. A toluene oven with a preheating arrangement for the air current, as described by Siaw (Jour. Soc. Chem. Ind., 1911, 61) or other similar device* is, in our opinion, a practical arrangement. We strongly condemn air ovens and all devices in which the temperature of the walls of the drying chamber is variable. We believe that a fairly uniform

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* A simple oven with preheater has been described by one of us (this Jour. XXXI., 1912, 471).

temperature in the whole of the interior of an oven is only to be obtained when the heated walls have an area very large relative to the cubical contents of the interior and are themselves at a uniform temperature. A pre-heated supply of air is to be desired. Mere heating without a proper air current is unreliable.

3. Whenever it is suspected that a coal is specially liable to oxidation or the ½ hour and 1 hour results differ materially drying at 104°—111° in a current of nitrogen or carbon dioxide is to be preferred to drying in an oven through which a current of air is passing. Either the direct or indirect method of estimating water may be used. If the former is chosen, care must be taken to prove the dryness of the stream of gas which is passed over the coal. The percentage of free oxygen in this gas must be inappreciable. This method of drying in a current of inert gas is to be preferred for all very exact work.

4. Drying to constant or minimum weight in a vacuum in the presence of sulphuric acid (or other desiccant) possesses no advantage over the last mentioned method. It is very much slower, and, unless the vacuum is very high, it is better to fill the desiccator with carbon dioxide (or other inert gas before exhausting). If this method is preferred, a Hempel desiccator, or any other form in which a large surface of sulphuric acid is exposed both above and below the coal, should be used; the coal should be weighed in watch glasses or shallow weighing bottles and the loss after, say, 24 hours, 72 hours and 144 hours should be taken.*

With such prolonged periods of drying, the results obtained by this method are practically identical with those by method 3. The air admitted into the vacuous space should always be dried by passing slowly through or over sulphuric acid.

5. The method of drying off water from coal by heating in boiling xylene and measuring the water which distils over with the hydrocarbon, is a variant of the method of drying in an inert atmosphere at an elevated temperature. It is worthy of serious consideration, and although we cannot, in view of the limited information at our disposal, recommend it unconditionally, we consider that it is most promising and appears to be particularly suitable for industrial purposes.

6. Coal should always be weighed in closed vessels with well fitting lids or stoppers. Deep vessels such as crucibles are unsuitable for water determinations. Porcelain or metal boats which can be weighed in stoppered or well fitted sliding tubes may be used.

7. Desiccators with the strongest sulphuric acid which is *frequently* renewed are recommended. If calcium chloride is used it must be ignited before it is put in the desiccator. If phosphoric anhydride is used it must frequently be stirred. These substances are not nearly as convenient or reliable as sulphuric acid.

George T. Holloway, *President.*
J. H. Coste, *Vice-President.*

These recommendations, of course, refer more particularly to coal, but as this presents most of the difficulties which are found with other substances, most of the conclusions may be considered as of general application. Some of the methods to which we have referred were not examined by any member of the Committee, such as the ignition method (obviously inapplicable to substances containing organic matter or ammonium salts), the "water determinator" method, and the gasometric methods. These are applicable to coal and to many organic materials. We do not suppose that either the direct or the vacuum method will be adopted to any great extent notwithstanding their undoubted merits, nor that the ordinary water or steam oven will cease to be a prominent feature in most laboratories. It is, moreover, provided in various statutory rules and regulations (*e.g.*, under the Fertilisers and Feeding Stuffs Act, 1906), that water shall be determined by drying at 100° C. We strongly urge that those who either choose or are obliged to work at temperatures not exceeding 100° C. should use such appliances as will ensure the attainment of a temperature throughout the oven within a very few degrees of the boiling point of water, and which will allow a steady current of hot air to pass over the substance to be dried. It does not appear that for general work temperatures below 100° are nearly as satisfactory as those a few degrees above. Both on the grounds of accuracy and of speed the higher temperatures are to be recommended. It would be advisable in many cases to state the method used when returning results which are at all likely to be the subject of dispute. It must be remembered that frequently the analysis of the dry matter is dependent on the exact determination of the moisture, and that the presence of at least some of the "water of combination" or "organic matter" is very often due to an under-estimation of the amount of moisture in the sample examined.

The analyst should therefore make the same careful choice of a method for this determination as he would for that of any other constituent.

In conclusion, we wish to thank our colleagues on the International Sub-Committee for the mass of analytical work and of information which have been incorporated in the Report, only a small portion of which has been mentioned in any detail in this paper, and especially to thank the President of the Sub-Committee (now the Chairman of this Section) for the suggestion that this paper introducing its work should be presented to the Society.

THE DETERMINATION OF MOISTURE IN ORGANIC SUBSTANCES.

BY F. H. CAMPBELL, M.SC.

It is well known that the estimation of moisture as ordinarily carried out leads to unreliable results in the case of materials which undergo change when heated, but of the magnitude and sign of these errors little is known. The dissatisfaction with this state of affairs is shown by publications such as the results of determinations carried out by various methods on sorghum, meat extracts, etc., at the instance of the A. O. C.,* on which the conclusion is made that drying the sample over concentrated sulphuric acid in a vacuum leads to the most satisfactory results; and the work on coals by Archibald and Laurence† shows that the results obtained by heating coal in air and taking the loss in weight as moisture differ considerably from those obtained by weighing the moisture absorbed by calcium chloride.

The work, the results of which are communicated in the present paper, was commenced with a view of testing the efficacy of a new form of apparatus involving the use of calcium carbide. As it was found that the results obtained by this method, though consistent among themselves, differed in most cases from the equally consistent values obtained by various recognised methods involving heating, a series of tests in a vacuum desiccator was carried out. The results obtained by drying the various materials *in vacuo* without heat agree remarkably well with those obtained by the carbide method, so that it may be claimed for the latter that it is superior to the ordinary methods, not only in convenience and rapidity but in accuracy as well.

It will be seen on reference to the results detailed below, that the values obtained by heating the substances examined in air or *in vacuo* are lower that those obtained in the vacuum desiccator and by the carbide method; this is no doubt owing to oxidation, and were it not that most of the substances lose volatile constituents other than water the discrepancies would be still greater. The method described below gives values near the true moisture content, because the substance when heated at all is heated for a short time only and then in an atmosphere consisting mainly or wholly of acetylene, and because owing to its shape the upper part of the apparatus remains cold throughout and serves as a condenser for volatile substances.

The use of calcium carbide in the estimation of moisture was first suggested in 1900 by Danne,‡ and since that time

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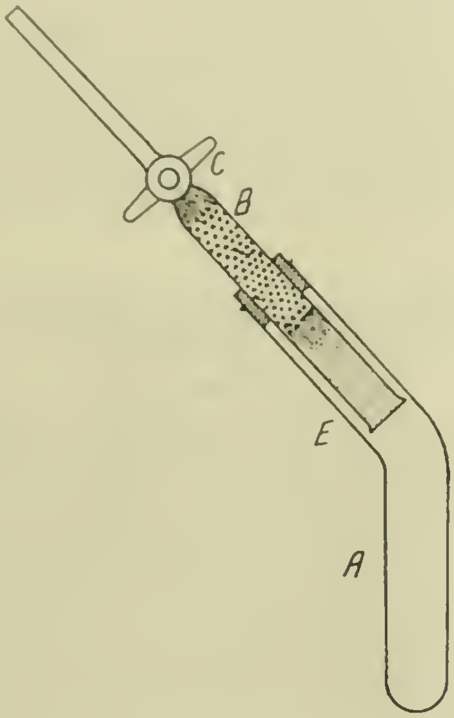
* Pressure not greater than 1 mm. to 2 mm.

* U.S. Dept. Agr., Bureau of Chemistry, Bull 132, pp 150–3.
† J. Ind. Eng. Chem. 4 (1912), 258—262.
‡ Proc. Soc. Chem. Ind. of Victoria, 1900.

Dupré,* Roberts and Fraser,† Cripps and Brown,‡ Orme Masson,§ and I. O. Masson,‖ have described apparatus of various forms designed for the estimation of moisture by the measurement of acetylene gas evolved when the moist sample is brought into contact with calcium carbide. I. O. Masson has also discussed the general applicability of the method in analytical work.¶ The fact that the measurement of gases involves the use of somewhat complex apparatus is probably the reason that none of the methods suggested has been widely adopted. Rivett** has lately published a description of a method which differs from those cited above in that the amount of acetylene evolved is determined gravimetrically by difference. The method used by the author depends on the same principle, but the apparatus is of a new form.



As shown in the diagram the apparatus consists of a tube, A, of thin glass, bent midway at an angle of 45°; for most purposes it may conveniently be about 12 cm. long and 1·5 cm. in diameter, and of a tube, B, about 7 cm. long and 1 cm. in diameter, to the end of which a light glass tap, C, is sealed. B passes through a hole in a rubber stopper which fits into A.

The method of experiment is as follows: The upper part of B is filled with finely granular carbide, held in position by plugs of glass wool, the open lower end is gently warmed and dipped into low melting point paraffin wax, after the solidification of which the lower part of B is filled with powdered carbide, which is then protected from further contact with moist air by placing a warm microscope cover-slip upon the wax, which, when it solidifies forms an air-tight and sufficiently permanent joint.

An actual determination is carried out by placing a weighed quantity of the substance in the lower end of A after the apparatus has been tared; B is put into position, C is connected with a wash bottle containing concentrated sulphuric acid and then opened, A is gently warmed at the point, E, until the wax is melted and the coverslip detached, which allows the carbide being shaken down upon and subsequently thoroughly mixed with the sample. The rate of admixture is regulated so that not more than 60 to 90 bubbles of gas escape per minute, as apparently the acetylene is not completely dried during its passage through the granular carbide if moving very rapidly. When the evolution of gas becomes slow the lower end of A is placed in an air-oven maintained at 100° C. provided with holes of a suitable size in the top, the mixture is thoroughly shaken occasionally and the heating continued until no more gas is evolved. The tube is now cooled by immersion in mercury, attached to a three-way tap and alternately evacuated and filled with pure dry air two or three times. If a water pump is used a bottle containing concentrated sulphuric acid is interposed between it and the apparatus; the air is drawn through a train of wash bottles containing concentrated potash solution and sulphuric acid respectively. Finally the apparatus is weighed and the moisture content of the sample calculated with the help of a factor obtained from blank experiments with pure water. When the operator is not familiar with the peculiarities of any given material it is advisable to repeat the heating, but a further loss of weight will seldom be found to have occurred, and a short experience of the method will render the precaution unnecessary.

After half a dozen determinations have been carried out it is advisable to renew the granular carbide in the upper part of B as fine powder is gradually drawn through it, the loss of which will give rise to faulty results.

The weight of the apparatus as described is about 30 grms.

The time required for a determination varies according to the nature of the sample treated, in many cases 30 minutes is sufficient, and while in others a longer time is required, 60 minutes is about the maximum. The amount of sample taken was as a rule from 1 to 2 grms.

The amount of water equivalent to 1 grm. of acetylene was determined by mixing a known weight of water with about 5 grms. of dry ignited sand, and regulating the admixture of the carbide in such a way that the gas was steadily evolved at a rate of some 60 bubbles per minute.

In Table I the results of experiments with two samples of carbide are given. Sample A was used in all subsequent experiments, sample B was of a much lighter colour than is usual with commercial carbide.

TABLE I.

Sample of carbide.	Wt. water.	Wt. acetylene evolved.	Wt. water eqvt. to 1 grm. C_2H_2.
	grm.	grm.	grms.
A	0·1641	0·1144	1·4344
	0·2048	0·1427	1·4351
	0·2395	0·1669	1·4349
B	0·2260	0·1527	1·4800
	0·3113	0·2104	1·4795

In addition to these samples the water equivalent of a third sample has been determined in the way described by Mr. R. E. Summers, and a mean value of 1·4492 obtained, while Rivett (*loc. cit.*) found 1·4324. The close agreement between these results is interesting and seems to show a remarkable constancy of composition in commercial calcium carbide, I. O. Masson (*loc. cit.*) found a similar close agreement between ratio of the volume of gas evolved to the weight of water taken, obtained by himself and by Dupré (*loc. cit.*) The practical importance of this agreement lies in the fact that except for cases in which the highest accuracy is desired it renders unnecessary a special determination of the water equivalent; unless a somewhat abnormal sample of carbide, such as sample B, be used, results very close to the truth are obtainable by using the factor 1·44. This is clearly shown in Table II in which are given the moisture content of a sample of coal which lost 11·11 per cent. of water in a vacuum desiccator.

TABLE II.

Water equivalent.	Moisture.
	per cent.
1·4324	10·83
1·4344	10·85
1·4492	10·96
1·4800	11·19

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* Analyst, 31, 213.
† This J., 1910, 29, 197.
‡ Analyst, 34, 519.
§ Proc. Soc. Chem. Ind. of Victoria, 1900.
‖ J. Chem. Soc., 98, 851.
¶ Chem. News, 103, 37.
** Chem. News, 104, 261.

The results of determinations of the moisture content of various materials are given in the following tables.

TABLE III.

Per cent. moisture in roasted coffee.

	Carbide method.	Vacuum without heat.	Vacuum at 98° C.	Differences.	
	I.	II.	III.	I and II.	I and III.
	2·90	2·83	2·78		
	2·91	2·87	2·61		
Mean	2·90	2·85	2·69	+0·01	+0·21

The determinations with carbide were carried out according to the method described. In the second method the sample spread in a thin layer in weighing bottles was dried in a vacuum of about 15 mm. over concentrated sulphuric acid, drying being taken to be complete when no further loss in weight occurred in 48 hours. The third method is that adopted by the American Association of Official Chemists,* the samples being heated in a vacuum over sulphuric acid for five hours at a pressure of about 25 mm.

TABLE IV.

Percentage of moisture in sweetened cocoa.

	Carbide method.	Vacuum without heat.	Vacuum at 98° C.	Air oven at 100° C.	Differences.		
	I.	II.	III.	IV.	I & II.	I & III.	I & IV.
	4·29	4·29	3·54	3·92			
	4·38	4·34	3·58	4·08			
Mean	4·33	4·32	3·56	4·00	+0·01	+0·77	+0·33

Methods I, II and III are the same as the corresponding ones used with coffee, method IV is that adopted as official in France,† the cocoa being heated in an air oven at 100° to 105° C. for 6 hours.

TABLE V.

Percentage of moisture in tea.

	Carbide method.	Vacuum without heat.	Vacuum at 98° C.	Water oven at 96° C.	Difference.		
	I.	II.	III.	IV.	I & II.	I & III.	I & IV.
	6·53	6·29	5·72	5·85			
	6·54	6·32	5·91	6·06			
Mean	6·54	6·31	5·86	5·95	+0·23	+0·68	+0·59

The details of methods I, II and III are as given above, in the fourth method the sample was heated for 3 hours in a water jacketed oven in which the water was boiling briskly.‡

Tea was found to hold its moisture very persistently, requiring a longer heating period with carbide than most of the substances examined, and also required drying for 15 days in the vacuum desiccator.

Reference to Tables III, IV and V shows that in each case the vacuum oven method gives the lowest results, the reason for this has not been determined.

TABLE VI.

Percentage of moisture in butter.

Sample.	Carbide method.	Air bath at 100° C.	Air bath at 60°—120° C.	Differences.	
	I.	II.	III.	I and II.	I and III.
A	12·89	12·85	12·49		
	12·84	12·88	12·68		
Mean ..	12·86	12·86	12·58	0·00	—0·28
B	12·49	12·10	12·25		
	12·55	12·20	12·17		
Mean ..	12·53	12·15	12·21	—0·38	—0·32
C	12·22	12·47	12·32		
	12·27	12·55	12·48		
Mean ..	12·24	12·51	12·40	—0·27	—0·16

The butter was introduced into the reaction tube inside a somewhat narrower tube from which it was pushed by means of a glass rod. Before mixing in the carbide the butter was melted at as low a temperature as possible and allowed to run to the bottom of the tube, on addition of the carbide the action went on rapidly, and in some cases moisture collected in the upper part of the tube (cf. Rivett, *loc. cit.*). In order to bring about reaction between this moisture and carbide it was found convenient to use a tube in which a bulb had been blown on the under side, and to shake a part of the carbide into this, and to retain it there until required. This modification will be found useful with other substances such as syrups.

The second method is that adopted as official by the American Association of Official Chemists,* the butter being heated in an air oven at 100° C., for hourly periods until the weight is constant; as a rule this occurs in one hour.

The third method is that used by Rivett as a check on his carbide tests, the butter being heated for one hour at temperatures rising gradually from 60° C. to 105° C., for one hour at temperatures increasing from 105° to 120° and for a third hour at 120° C.

Except in the case of butter C which had a distinct odour of butter milk, higher results were obtained by the carbide method than by the heating methods. This indicates that when heated in the air butter takes up oxygen more quickly than it gives off volatile substances, a conclusion to which Rivett's results lead also.

Of the coals examined that from the Wallsend Mine, Tasmania, is a bright black, somewhat friable coal, that from the Strezlecki Mine, Victoria, is a dull black coal high in ash, while that from Morwell is a typical lignite.

TABLE VII.

Percentage of moisture in coals.

Sample.	Carbide method.	Vacuum without heat.	Air oven.	Vacuum 98°	Differences.		
	I.	II.	III.	IV.	I and II.	I and III.	I and IV.
Wallsend	2·96	3·00	3·15				
(Tas.) coarse...........	3·10	3·01	3·19	—			
,, fine	3·04						
Mean	3·03	3·00	3·17		—0·03	—0·14	—
Strezlecki	10·85	11·24	10·65				
(Vic.) coarse...........	10·99	10·98	10·53	—			
,, fine	11·04						
Mean	10·96	11·12	10·59		—0·17	—0·55	—
Morwell (Vic.)	15·48	15·33	15·06	14·78			
	15·54	15·51	15·07	14·86			
Mean	15·51	15·42	15·06	14·82	—0·09	—0·45	—0·69

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* U.S. Dept. of Agric., Bureau of Chem., Bull. 107 (Rev.), 3.

† Ann. fals. 4, 417; Abstracts Am. Chem. Soc., 6 (1912), 257,

‡ Official method, Customs Dept., Commonwealth of Australia. folio 13.

* Bull. 107 (Rev.), 124.

Methods I, II and IV have already been described. Method II is as follows: 1 grm. of coal is heated in a weighing bottle at 100° C. in an air oven for half an hour, cooled in a desiccator and weighed, heating is repeated for 10 minute periods until a constant weight is obtained, or until a gain in weight takes place.

As both the Wallsend and Strezlecki coals consisted of particles of various sizes, determinations of the moisture content were carried out by the carbide method on these coals both before and after grinding to an impalpable powder. As will be seen by reference to Table VII the results obtained are practically identical, this is regarded as very satisfactory as it proves that actual contact between carbide and every part of the material under examination is not necessary to secure complete reaction; incidentally the result shows that in these cases no appreciable amount of moisture was lost during the grinding of the coal. In Table VIII are given the results obtained by grading the coals by means of a set of standard sieves.

TABLE VIII.

Sample.	Percentage remaining on: 30-mesh sieve.	60-mesh sieve.	90-mesh sieve.	Percentage passing 90-mesh sieve.
Wallsend ..	24	38	20	18
Strezlecki .	54	22	12	12

CONCLUSIONS.

1. The method described is as accurate as the cold vacuum method.
2. It is more rapid than any of the recognised methods.
3. Methods involving heating such substances as those examined give low results owing to oxidation.
4. The apparatus necessary is simple and inexpensive.

DETERMINATION OF MOISTURE IN FOODS AND OTHER ORGANIC SUBSTANCES.

BY W. P. SKERTCHLY, F.I.C.

It is well-known that almost every substance may be dried completely at the ordinary temperature by exposing it to sulphuric acid or other dehydrating agent under reduced pressure. Certain conditions have to be observed with different substances; for instance, it is advisable to place liquids on some such substance as sand, asbestos, or the like, in order to expose a larger surface and accelerate the rate of evaporation of the water. This method of determining moisture is particularly suitable in the case of substances which undergo changes when heated as in the usual method of carrying out the determination. That such changes do take place, probably to an extent not hitherto recognised, is shown by the results which I record in the following table. In each case, about 3 grms. of the sample were dried until no further loss in weight took place; this usually required about 24 hours at the ordinary temperature and under a pressure of 2 to 3 mm., or 2 hours in a water-oven at 100° C.

Substance.	*In vacuo.* Time.	Moisture.	At 100° C. Time.	Moisture.
		per cent.		per cent.
Flour	24 hours	12·23	2 hours	10·96
,, ...	,,	13·36	,,	12·15
,, ...	,,	13·17	,,	11·40
,, ...	,,	11·98	,,	10·73
Biscuit .	,,	5·87	,,	5·55
,, .	,,	6·88	,,	6·44
,, ...	,,	6·76	,,	6·40
,, ...	,,	6·71	,,	6·29
Maize meal ..	,,	9·92	,,	8·95
Arrowroot ..	,,	15·72	,,	13·69
,, ...			3 hours	13·89
Ground rice .	,,	11·66	2 hours	11·17
Soap	18 hours	28·90	15 hours	27·93
Cotton wool ..	24 hours	6·24	2 hours	6·16
Mustard	24 hours	6·04	,,	5·31
,, ...	18 hours	6·12		
Manure (from horses)	18 hours	10·04	,,	9·92

It will be seen that the substances generally yielded more moisture when dried *in vacuo* than at 100° C., and that the difference was particularly marked in the case of the farinaceous materials. It was also observed with the latter that, when the heating at 100° C. was prolonged for more than 2 hours, the substance began to increase in weight to the extent of a few milligrams for each period of 1 hour. Results of two experiments are appended to show this increase in weight and apparent decrease in the amount of moisture after 2 hours' heating:—

Substance.	*In vacuo.* Time.	Moisture.	At 100° C. Time.	Moisture.
		per cent.		per cent.
Biscuit	24 hours	7·39	2 hours	6·92
,, ...	42 hours	7·62	3 ,,	6·86
,, ...	48 ,,	7·65	4 ,,	6·84
,, ...			6 ,,	6·81
Biscuit	24 ,,	7·13	2 ,,	6·69
,, ...	42 ,,	7·48	3 ,,	6·63
,, ...	48 ,,	7·48	4 ,,	6·63
,, ...			6 ,,	6·60

In conclusion I desire to express my thanks to Mr. Otto Hehner, the work in connection with this paper having been carried out in his laboratory.

DISCUSSION.

Mr. E. GRANT HOOPER said that it seemed to him that the use of carbide would show a much greater error of experiment than the determination of moisture by other means, and the suggestion therefore appeared of doubtful utility. There were a large number of substances which readily oxidised, and if this property were not kept in mind and due care exercised substantial error might occur. On the other hand he thought there had been some exaggeration of the danger which was connected with the use of the ordinary drying oven. He had known a great deal of carelessness in connection with the determination of moisture, such as a lump of soft soap being put in a basin without any regard to the reasonable probability of its drying, and other instances such as the use of relatively deep vessels with too large an amount of substance. He agreed that, generally speaking, more accurate results might be expected from the vacuum method such as had been described than by the use of the ordinary drying oven. He thought the chief value of the papers lay, not in the substitution of new methods, but rather in calling attention to the errors which might quite easily arise in connection with the determination of moisture.

Mr. W. C. REYNOLDS asked whether the authors of the papers had carried out any experiments to ascertain whether the necessity arose for the use of any desiccating agent in the determination of moisture *in vacuo*. Some years ago he devised a very simple form of apparatus for determining the water of crystallisation in morphine. The alkaloid oxidises in air somewhat readily at temperatures over 100° C., although the water is not given off at this temperature. He found he could determine the water accurately and quickly by heating a weighed quantity in a tube of about the dimensions of one's finger, sealed at one end and drawn out at the other slightly. The open end was connected by pressure tubing to a pump and the whole of the tube almost up to the pressure tubing was immersed in an oil bath heated to 120° C. In the course of about half-an-hour the moisture was given off and one merely wiped the tube whilst it was still hot, removed the pressure tubing and immediately put on a rubber cap or cork, cooled and re-weighed it. He had used that method in obtaining the water of crystallisation in many alkaloid salts by dipping the whole of the tube in boiling water and keeping it there for half an hour or an hour at a time. He did not think there was any difficulty in determining the water with very considerable accuracy in that way, where the substances did not decompose at 100°, and he did not think it was necessary to have any desiccating agent present.

Dr. P. Schidrowitz said that although the papers dealt exhaustively with heat and vacuum methods separately, there appeared to be no mention of the combined use of vacuum and heat. He was rather surprised at this, for in many respects and for many purposes the principle of "vacuum drying," *i.e.*, of combining the action of heat and of a vacuum, was the ideal one, and nowadays excellent laboratory as well as works vacuum driers could be obtained.

Mr. A. Philip said he had found a great deal of difficulty in the determination of water in oil, and about eight years ago had devised a method very similar to that of Allen and Jacobs published in 1912. He heated about 500 grms. of the oil to about 100° C. in an oil bath. A water pump was used to suck dried air slowly in very fine bubbles through the oil; the air then passed through cooling tubes in a freezing mixture, and the greater part of the water and all the volatile matter, such as oil, was condensed in these tubes. The air then passed on into a series of drying tubes. The method gave extremely accurate results. The water was determined by weighing, and any volatile oil could be separated and accurately weighed; but generally, they estimated the volume of the water in the cooled tube and added the increase of weight of the calcium chloride tube. The procedure of analysing coal by determining the moisture, the ash, the volatile hydrocarbons, and the non-volatile organic matter, was a very arbitrary one. It was, nevertheless, extremely useful, but its real function was to give information as to the character of the coal, *i.e.*, as to whether it was bituminous, etc., rather than to fix its value for steam-raising purposes. He did not think the determination of water with even 1 per cent. error was of great importance for the uses which were made of such an analysis. Such an error threw out the percentage of volatile hydrocarbons proportionately, of course, but that was not very important from the point of view of the information which had to be gathered from the arbitrary proximate analysis of a material such as coal. Where such incorrect determinations of moisture might perhaps become of some importance, was when one calculated the lower calorific value of a coal from the higher calorific value as obtained experimentally: besides other corrections, one had to deduct from the calorific value as found the amount of latent heat of vaporisation of the water present in the coal.

Dr. R. Lessing said that the Committee's report was received very favourably in New York and had rather a good discussion. It had been published in the General Report of the International Analysis Committee which, unfortunately, had only a very small circulation, but the report of the Moisture Sub-Commiteee was reprinted in the Transactions of the Congress. If only part of the Committee's recommendations were heeded, it would be a good thing for the analytical community. It was surprising what an enormous difference it made to weigh the dried substance under cover. That in itself and the provision of a shallow drying vessel would tend to the standardisation of moisture determinations. With regard to the drying in gas currents he had been endeavouring to employ coal-gas as the inert gas. The small percentage of oxygen had been troubling him less than the higher hydrocarbons and carbon bisulphide in the gas, which tended to increase the weight of coal thereby leading to low moisture figures. Those errors could be avoided by passing the coal-gas through fuming sulphuric acid and thereby removing the heavy hydrocarbons. This being done, the ordinary gas supply could be used, and no special apparatus for generation of inert gases was required. In certain cases, like that of the determination of moisture in spent oxide from gas works, it was most important that the drying should be done in a non-oxydising atmosphere, since oxygen would revivify the spent oxide and liberate the sulphur, and would not only throw out the moisture figure itself but especially the sulphur figure, on which many contracts were based, and in that case it was absolutely essential that an oxydising atmosphere should be avoided.

Mr. W. J. A. Butterfield said that coal was a material which in the course of transit and in storage was liable to big accidental variations in the total moisture owing to exposure at one time in wet and at another time in dry weather. He questioned very much whether for commercial purposes a higher degree of accuracy than something like 1 per cent. was essential.

For research purposes, however, an accurate method was necessary. He preferred the method, which was originally introduced by Mr. Lewis T. Wright, namely the collection and weighing of the water driven off by a stream of dry gas from the coal contained in a U-tube heated in a water or hot-air bath. The gas used should certainly be one which did not oxidise the coal. He had found coal gas satisfactory provided the absorption tube was packed with calcium chloride which had been freed from causticity by passing CO_2 through it beforehand. He did not find much difference with most coals between the loss of weight of the U-tube containing the coal and the gain in weight of the absorption tube but he always took the gain in weight of the latter as the correct figure for the moisture. If there were a large number of samples to be dealt with it was not a very cumbrous or tedious method, because the same train of absorption tubes served for a large number of determinations, particularly if the tubes were of the Haldane double type. On the whole it was as rapid a method as most of the others. In regard to the temperature of the hot oven he had used an oven containing a solution of calcium chloride in the jacket in preference to toluene, and a temperature of something like 104° C. was quite readily obtained with it. The solution, however, caused some corrosion of the material of the oven.

Mr. F. Evershed said that in his own work he had to deal with the determination of moisture in mixtures of sugar with other organic matters as found in confectionery. Even commercially pure white sugar by prolonged drying in air at 105° C. would continuously lose weight and in time become yellow and deliquescent, owing to some decomposition. In experiments he had made recently, some "acid drops" consisting of sugar and so-called glucose with a little tartaric acid, which drops, according to manufacturing statistics, could not contain more than about 3 per cent. of water, continued to lose weight up to more than 10 per cent. when dried in a water oven for several days and became yellow. It then occurred to him that if, instead of being expelled by heat, the water could be washed out by some easily volatile liquid like alcohol or acetone which would not affect the solid matter, more accurate results might be obtained, and in less time. Accordingly he took 2 grams of the same drops, coarsely crushed, covered them, in a flat bottomed porcelain dish, with acetone, after 10 minutes poured this off and repeated this washing several times, further crushing the sugars under the acetone, and finally drying for an hour or two in the water oven. The loss was 3 per cent. and the residue was colourless and apparently quite dry. He then tried 2 grams of sweetened condensed milk, mixing it with 5 cc. of acetone. In this case, the latter could not be decanted as it would carry the milk-fat with it. It was, however, sufficient to dry it off at about 50° C. and repeat the operation several times. The evaporating acetone carried the water off with it. The residue, when nearly free from water, could be powdered under the acetone and after heating for a short time at 90°—100° C. was obtained as a dry powder without discolouration, the loss being, in the only experiment tried, 24·8 per cent. The same milk dried in the usual way at 97° C. for 3 hours lost 23·1 per cent. and in 5 hours 23·5 per cent. He did not suppose the use of acetone for removing water was a new idea but apparently it deserved more attention and if on furthur experience the method proved trustworthy it might have a wide application.

Mr. W. F. Reid said that the assumption that underlies the Campbell process was that commercial calcium carbide was a definite chemical compound: but it was very irregular indeed in composition, and it would be most dangerous to base any analytical method where precision was required upon the regular composition of carbide from whatever source. There were not only several different methods of making calcium carbide, but according to the raw materials used they got very different gases mixed with the acetylene.

Mr. W. P. Dreaper said that in some investigations in organic work it was necessary to endeavour to find out whether the water present was absorbed, or whether, as Mr. Coste and Mr. Huntly had said, it was in closer combination. It had been noticed some time ago, when treating certain organic substances in a desiccator, that if a vacuum were used, the water was given up so rapidly that no differences of the order mentioned could be observed, but if such materials were dried in an ordinary desiccator over sulphuric acid and examined at intervals for loss of weight, one could sometimes get an indication of a break in the curve, which might possibly show that at this point mere absorption finished and the water remaining, was in a closer state of combination. This matter was one of considerable interest in cases when the presence and "state" of water materially altered or actually controlled the course of certain industrial operations.

Mr. A. GREENWELL said that the accuracy of the determination of the presence of moisture in coal was not too small a matter to affect the practical question of the sale of coal. Very little moisture was a matter of importance. He thought that the discrepancies there had been as the result of the various methods of analysis employed by different chemists producing different results had done very much to damage the reputation of analysis in the view of the coal owners and colliery managers. He thought everything that could be done to remove those discrepancies, however small they might be, was desirable.

Mr. HUNTLY, in reply, said that the method of working in a vacuum, without any drying agent suggested by Mr. Reynolds, was of interest and worthy of trial. The use of a vacuum and a high temperature, mentioned by Dr. Schidrowitz, had been included under the second direct method, but if correct results could be obtained with either a vacuum or high temperature, it seemed an unnecessary complication to use both. Mr. Huntly agreed with Mr. Philip that the direct distillation method was almost the only one available for a complicated liquid like crude fuel oil. Mr. Butterfield regarded an accuracy of 1 per cent. in the determination of moisture in coal as good. With this he could not agree; in large contracts this amount represented too large a sum to be neglected by the contractor. In this connection it should be mentioned that the problem of sampling large bulks of coal was expressly excluded from the paper. Mr. Huntly agreed with Mr. Evershed that moisture was extremely difficult to estimate in sweets, but did not quite follow the method of powdering with acetone. The vacuum method would probably give reliable results in such a case. Mr. Skertchly's figures showed that dealing with non-volatile substances, a vacuum always gave higher results than the oven. There seemed some doubt amongst different workers as to the length of time necessary for exposure to a vacuum at the ordinary temperature for all the water to be removed. Mr. Hillebrand found losses up to eight days. But given a vacuum of about 1 mm., and a sufficient surface of strong sulphuric acid, 48 hours appears to be ample. (See comparison of figures, Hillebrand & Badger, with those of Huntly for the same coals.)

Mr. COSTE also replied.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, November 22nd, 1912.

PROF. M. C. WHITAKER IN THE CHAIR.

MILKWEED.

BY ARTHUR C. NEISH, PH.D.

The following is an account of some preliminary experiments conducted with the object of suggesting uses for the vast amount of this wild plant going to waste annually. There are about eighty-five species in the milkweed family[*] and a number of allied plants, all having a milky juice. The most common species, *Asclepias syriaca* or common milkweed or silkweed, is found growing abundantly on all kinds of soil of a dry sandy or clay nature in Canada and the United States. Another species, swamp milkweed (*Asclepias incarnata*), is richer in bast fibres, although its occurrence is by no means so common. This latter species, as the common name indicates, is found in wet or boggy places. The plant is a perennial, coming up in early June, blossoming in July, and going to seed in August or September. When the plant has come up about six inches, it is often cut and used as a pot-herb,[*] having a taste much like asparagus. The plant when full-grown resembles the familiar house rubber plant, the leaves having much the same shape and appearance. The height of mature plants is from three to four feet for the common milkweed, and three to six feet for the swamp milkweed. The leaves are collected by some people and cooked like spinach as greens. Both these species have a very attractive and fragrant flower.

The milkweed is very abundant in Ontario, where the author's attention was drawn, about six years ago, to the great quantities going to waste annually. Different possibilities and uses were presented, such as the extraction of rubber from the latex, the separation of the bast fibre, the extraction of the oil in the seed and the use of the cake as a cattle food, the uses of the coma, and the utilization of the woody stalk as a source of paper.

Rubber.—Some preliminary qualitative experiments were performed on the methods of the extraction of the latex, and the preparation of rubber and resins from the same. The publication of a paper on "Milkweed rubber," by Chas. P. Fox,[†] where the subject of the manufacture of rubber was treated most fully, turned the author's experiments in the direction of the fibre, oil, coma, and paper stock. Mr. Fox's work, which covered a period of twelve years, is not very gratifying from a financial standpoint. Quoting from Mr. Fox's paper, "The yield of rubber on the basis of latex is 2—3 per cent., the resin is white, tasteless, odorless, and insoluble in alcohol. A careful study of the question covering a period of twelve years, indicates that while rubber is a product of the plant, the amount is so small, its quality is so inferior and its cost of production is so high, that a profitable industry is out of the question." The nature of the soil had a decided influence on the quantity of rubber and resin available; dry soils give a higher yield than wet or swampy soils.

Fibre.—The fibre, especially the fibre of the *Asclepias incarnata*, presents a most promising field. The bast fibres lie between the inner woody tissue of the stalk and outer skin or bark. The separation of the fibre is a problem both chemical and mechanical. The fibres run the whole length of the stalk and may be obtained in this length (3—6 feet) by carefully regulated processes. One stalk (*Asclepias syriaca*) when thoroughly air-dry gave a yield of 9·18 per cent. fibre. The green plants were treated mechanically for fibre but the fibres were gummy. Plants cut green and dried were retted similarly to the method used in retting flax for linen; nine days gave sufficient decomposition to enable the fibres to be removed mechanically. Some plants (*Asclepias incarnata*) gone to seed, gave all the fibre in one strand by a simple mechanical process followed by a simple carding operation; these were free from other tissue, and bleached to a pure white with dilute sodium hypochlorate, and had a silky lustre. The ash content of the bleached fibres was 0·36 per cent. The fibres resemble flax very closely; they are stronger than flax but not quite as strong as the fibres of similar diameter of manila hemp. On account of the silky appearance, whiteness, and strength, this fibre offers itself as a possible textile fibre. The length of the fibre and the strength makes it applicable as a thread or rope material. The leaves contained little fibre and were not used in any of this work.

Seeds and oil.—The native plants of the common milkweed have from 10—20 pods, each pod containing about 177 seeds. The weight of the seeds from one pod is about 1 gram, so that an average of 15 grms. of seeds per plant may be safely counted on. The seeds were ground fine and dried to constant weight in a water oven; samples of from 5—15 grms. were extracted with ether; the yield of oil, on the basis of air-dried seeds, averaged 21 per cent. The oil had about the same colour and consistency as fresh linseed oil. The iodine value on these samples averaged 130. The resultant cake or meal contained 4·9 per cent. ash; the nitrogen content is under analysis.

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[*] "Illustrated Flora, Northern States and Canada." Britton and Brown, Vol. III, p. 65.

[*] U.S. Dept. of Agric., Bulletin 245, p. 25.

[†] Ohio Naturalist, Vol. XI., No. 3, p. 271.

Coma. The seeds in the pod are each attached to a coma or down; this is readily blown away when the pods dry up, but it is possible to save all the coma if the plants are harvested green or just before the pods open. The average yield of about 6 grms. of coma per plant was obtained. The coma is pure white or creamy white, of very silky appearance, very soft and springy. The ash content is 0·9 per cent. It is a question whether this could be woven, but it could be used as an upholstering material or a substitute for feathers or silk floss in cushions. It would also make a high grade paper stock.

Paper. The woody tissue, making up about 80 per cent. of the total weight of the plant, presented the possibility of a new source of material for paper stock. It was found that the usual soda process at 120 lb. for four hours, with 112 grms. of soda per litre, was too severe a treatment, causing the entire wood to become gummy. A treatment for two hours at 120 lb. caused complete disintegration, and on heating and bleaching gave a pulp which showed itself to be a true chemical pulp. The sulphite process was not tried. The pulp could be made into paper of good strength and appearance and took dye equally as well as other standard stocks. The paper made contained some natural sizing material, as the difference in the sized and unsized papers was hardly noticeable. The ash content of the bleached pulp was 1·69 per cent.

In the process of paper making, the author is indebted to Dr. Otto Kress of the Industrial Laboratory, for his valuable suggestions and services; liberal use was made of the new paper making machinery recently installed in that department through the efforts of Professor M. C. Whitaker.

The author's sincere thanks are due to Professor Marquette, Department of Botany, Columbia University; Dr. N. A. Cobb and Dr. Brand of the U.S. Bureau of Plant Industry, Washington, and to Mr. H. T. Güsson, Dominion Botanist, Ottawa, Ontario, for their valuable suggestions and references.

After the publication of the programme for the meeting of the Local Section, Mr. Wm. Haskins of Chicago, Ill., wrote to the effect that milkweed and the allied plants, *Calotropis procera* and *Calotropis gigantea*, of India, had interested him considerably for a number of years. His correspondence was put at the author's disposal and a most interesting English patent was found: English Patent, A.D. 1885, No. 11,561, granted to Dr. George Kassner of Breslau, Germany, for "Improvements in the process or manner of manufacturing caoutchouc, wax, fat, vegetable fibre, fibre wood, etc., from lactucarious plants." Among the plants containing milky juice *Asclepias* was included (see this J., 1886, 495).

The possibilities of starting a new industry relying on the wild plants solely as the supply is indeed problematic, so that some system of cultivation and harvesting would have to be relied on to supplement the vast amount of the wild plant. The fact that one species can be grown on dry soils unsuited for other crops, and that another species can be grown on wet soils, presents a new profitable crop for some of our dry or wet soils which are now of little use.

Work is still in progress on this subject, and extended work will be undertaken during the coming summer and fall.

THE HYDROGENATION OF OILS.

BY CARLETON ELLIS.

See this J., Dec. 31st., 1912, pp. 1155—1166.

Discussion.

Dr. C. F. Chandler said that his attention had been attracted to the matter of the solidification of liquid fatty oils a long time ago. The subject had originally come up about 125 years ago when, in 1787, the bodies in the Cemetery of the Innocents in Paris were removed, and Foucroy discovered that many bodies, which had been buried there more than thirty years before, were in a remarkable state of preservation and had changed in great part to a wax-like substance, since called adipocere, Leichenfett or Fettwachs in German. In 1859 bodies in the Potters Field in New York, which was at 49th to 50th Street, and between Lexington and Madison Avenues, were removed to Hart's Island to make way for the Women's Hospital. There had been buried here about 30,000 paupers in trenches, and when the bodies were taken up, it was found that many of them had been transformed into adipocere. One of the complete bodies had been preserved at the College of Physicians and Surgeons. Other similar cases of the transformation of animal remains into adipocere had been noted in the case of a pig, of some sheep, and even of a fossil bison, and there were many instances of the finding of bog butter in the bogs in Ireland in which a similar hardening of fatty matters had occurred. The adipocere on analysis proved to consist of fatty acids and not glycerides, and the melting point, 62° C., corresponded closely with that of palmitic acid. The iodine figure of the adipocere in one case was found to be 9·8 and in another case 14·0, whereas the iodine figure of human fat was 41·5. Two theories have been advanced to explain the origin of adipocere. One theory assumed that the glycerides of the body had simply been hydrolised, the glycerin washed away, and the fatty acids left *in situ*. But the fatty acids did not correspond to human fat in which olein largely predominated. If the adipocere consisted largely of stearic acid, it might be assumed that the olein had been hydrogenized into stearin, or the oleic acid into stearic acid. But as the adipocere was chiefly palmitic acid with only sixteen carbon atoms, hydrogenation would have to diminish carbon, and increase hydrogen. That was not impossible. The other theory was that the adipocere was not derived from the human fat, but from the decomposition of proteids.

Sydney Section.

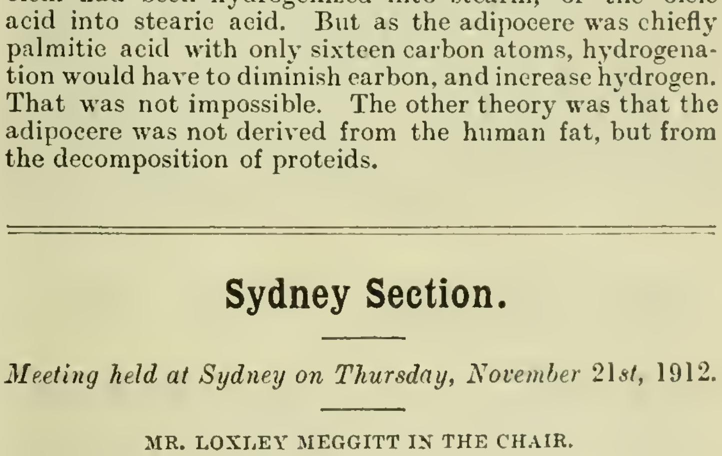
Meeting held at Sydney on Thursday, November 21st, 1912.

MR. LOXLEY MEGGITT IN THE CHAIR.

A DANGEROUS TYPE OF SPIRIT LAMP.

BY THOMAS STEEL, F.L.S.

There have been for some years past on sale in Sydney, and doubtless in other cities, small tin-plate spirit lamps of a highly dangerous type. The construction of the lamps in question is shown in the accompanying sketch. The tube, A, perforated at the top, contains a wick and is surrounded by a second wick, B. The wick-tube in some



such lamps fits fairly tightly into the neck of the lamp, and a small vent-hole is provided close up to the central opening, and therefore to the flame. In others the wick-tube lies loose in the body of the lamp, there being about ⅛-in. clearance all round it."

In such a type of lamp the space in the lamp-body, over the spirit, becomes filled with an explosive mixture of air and spirit vapour which is readily ignited when the lamp is lit. Immediately on lighting the lamp the explosive vapour took fire and blew out the flaming wick together with a shower of ignited spirit.

To make the lamps safe, a sheath tube should be fitted from the neck nearly to the bottom, so as to be sealed by the spirit, and the wick should be thick enough to fit fairly tightly at the neck. This would prevent ignition of the explosive vapour in the lamp. To facilitate filling, a suitable opening, closed by a perforated screw plug, should be provided near the top edge of the body.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8d. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Measuring steam, gas, or liquid; Devices for ——. C. A. Hartung, Berlin. Eng. Pat. 27,357, Dec. 6, 1911. Under Int. Conv., Dec. 6, 1910.

The volume of a current of gas, steam, or liquid is measured by means of a float connected by a rigid rod with one or more measuring rods dipping into mercury and adapted to oppose a greater or smaller resistance to the passage of a current of electricity passing through them, in accordance with the position of the float, which depends upon the rate of flow of the fluid. The float chamber is rendered gas-tight by means of a mercury seal carried by the float rod, so that friction is reduced to a minimum and the sensitiveness of the apparatus correspondingly increased. —H. H.

Drying process and apparatus. C. P. Bossert, Assignor to Pfister and Vogel Leather Co., Milwaukee, Wis. U.S. Pat. 1,046,254, Dec. 3, 1912.

The process consists in maintaining a forced heated draught through an enclosure and in passing wet articles, which have previously been heated to a temperature equal to that of the outlet end of the draught, through the enclosure in a direction opposite to that of the draught. For this purpose a tunnel may be employed having an air outlet in the middle and heating devices at each end for heating the draught and wet articles respectively.—H. H.

Desiccating apparatus. J. M. Gabler-Saliter, Obergünzburg, Germany. U.S. Pat. 1,046,767, Dec. 10, 1912.

The substance to be desiccated is directed in a thin layer upon the outer surface of a revolving drum which is partially surrounded by a vacuum chamber having a perforated wall in proximity to the drum. The vacuum may be created by means of a fan.—H. H.

Dryer; Rotary ——. S. W. Bonsall, New York. U.S. Pat. 1,047,905, Dec. 17, 1912.

The apparatus comprises a rotary cylindrical casing having two longitudinal slots in the form of scoops running along the sides and diametrically opposed to each other. Outlet openings for the air carried into the casing by the scoops are arranged in the walls of the casing between the scoops, and steam pipes carried by the casing are fitted in proximity to the scoops and outlet openings.—H. H.

Vacuum apparatus, condensers, and the like; Means for removing air and non-condensed steam from ——. E. Josse and W. Gensecke, Charlottenburg, Germany. U.S. Pat. 1,046,303, Dec. 3, 1912.

Air and uncondensed steam are removed from a condenser by means of a steam jet, and the partially compressed mixture of air and steam is then passed through a cooling device where the steam is partially condensed, after which the air is further compressed and the steam completely condensed by a water jet apparatus operated by the cooling water of the condenser.—H. H.

Vacuum apparatus; Means for evacuating ——. E. Josse and W. Gensecke, Charlottenburg, Germany. U.S. Pat. 1,046,304, Dec. 3, 1912.

A condenser is provided with a conduit, permanently open to the atmosphere, in which is fitted a steam ejector capable of discharging the air and vapour against a pressure of at least one atmosphere. Two heat-exchanging devices are fitted on the discharge side of the jet, through the first of which the water of condensation from the condenser is passed for the purpose of heating it, and through the second of which the cooling water of the condenser is passed for the purpose of condensing the ejected steam.—H. H.

Filter-press; Automatic ——. R. Lemmon and R. P. Holmes, Boulder City, W. Australia. U.S. Pat. 1,047,093, Dec. 10, 1912.

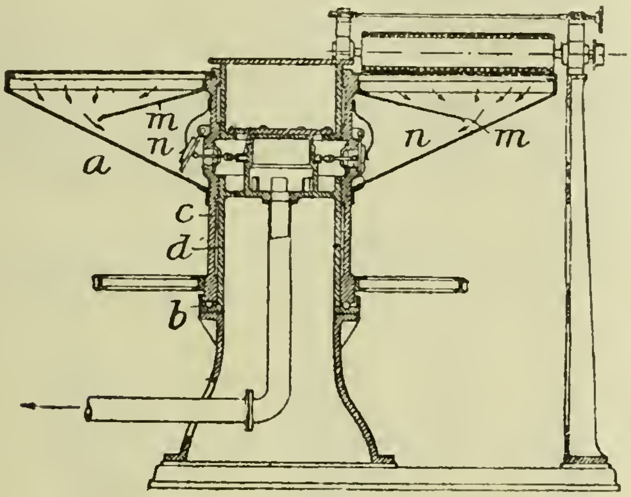
A disc or table, which is rotated intermittently, carries a number of filtering chambers each having a movable filtering bed. Two sets of reciprocating plungers are adapted to enter the filter chambers from above. The plungers of one set fit air-tight in the chambers and press the liquid from the pulp by air pressure. The plungers of the other set are hollow and carry agitating fingers which are adapted to discharge water on to the pulp and at the same time to stir the mixture. The chambers are charged with pulp at one position of the rotating table, and the pulp is subjected to alternate filtering and washing actions as the table rotates, until the finished cake of solid material is discharged by raising the movable filtering bed.—H. H.

Filter. C. E. Ballow, Los Angeles, Cal. U.S. Pat. 1,048,384, Dec. 24, 1912.

A filter is built up of two semi-cylindrical vessels the flat sides of which consist of perforated boards covered with filtering cloth. The filter-boards are spaced apart, and enclosed to form a filtrate chamber through which runs a hollow shaft with pipes for supplying liquid to be filtered to the semi-cylindrical vessels, the whole arrangement forming a drum which is rotated. Rotary agitators may be mounted within the filtering vessels.—H. H.

Filter. O. Riemann. Ger. Pat. 251,932, Oct. 15, 1911.

The filter (see fig.) is of the type in which a filter-chamber covered with a filter-cloth revolves around a central fixed pillar, *b*, towards which the floor, *a*, of the filter-chamber slopes downwards; in the central pillar is a suction chamber, with which the compartments, *n*, of the filter-chamber are placed in communication in a definite order. From the sleeve, *c*, on the central pillar an inclined partition, *m*, projects into the compartments of the filter-chamber to within a short distance of the inclined floor, *a*, of the latter, whereby the suction is distributed approximately uniformly over the whole surface of the filter-cloth.—A. S.



Filter-press; Combined hydraulic press and ——. Chem. Fabr. Griesheim Elektron. Ger. Pat. 252,577, Oct. 5, 1911.

Between the filter-plates of an ordinary filter-press, hydraulic cylinders are interposed, the rams of which are used to compress the filter-cakes after the filter-chambers have been completely filled. The faces of the rams turned towards the filter-chambers may be provided with a filtering surface, and in order to increase the capacity of the press without increasing the number of hydraulic rams, intermediate plates having filtering surfaces on both sides may be fitted in the press.—A. S.

Gases, vapours, or vapours and gases; Separation of mixtures of —— by means of charcoal (wood charcoal, blood charcoal) or other adsorbent material. J. Behrens. Ger. Pat. 251,693, Jan. 16, 1912.

The adsorption is effected under atmospheric or increased pressure, at a temperature between the critical points of the respective gases or vapours, and the adsorbed gases are subsequently recovered by diminishing the pressure. The process is specially applicable to mixtures of gases of which one has a critical point below and the other a critical point above the ordinary temperature. It may be applied to the separation of flue gases into carbon dioxide and nitrogen and for recovering ether from air containing ether vapour.—A. S.

Column apparatus described in Ger. Pat. 194,567; *Application of the* ——. K. Kubierschky. Ger. Pat. 252,155, May 10, 1911. Addition to Ger. Pat. 194,567, Dec. 13, 1906 (see Fr. Pat. 384,982; this J., 1908, 494).

Claim is made for the application of the column apparatus to the washing of one liquid by another, the lighter liquid taking the place of the ascending vapours, and the heavier liquid being introduced into the upper part of the apparatus.—A. S.

Dust collectors; Process for preventing deposition of moisture in ——. W. F. L. Beth. Ger. Pat. 252,431, May 27, 1911.

The gas or gas mixture (air) which is used for cleaning purposes by passing it through the filtering material in the opposite direction to that of the gas to be purified, is preheated before it enters the dust-chamber, so that any appreciable cooling of the filtering material and of the interior of the dust chamber is avoided.—A. S.

Atomisation of liquids by gases; Apparatus for the ——. C. Oetling. Ger. Pat. 253,156, Nov. 5, 1910.

The liquid passes downwards through a conduit in which transverse baffle-plates project alternately from either side wall up to the middle of the conduit. The gas is introduced through openings in the side walls opposite the baffle plates and forces the falling liquid against the edges of the latter, whereby it is atomised.—A. S.

Dryer; Rotary ——. S. W. Bonsail, Rye, N.Y. U.S. Pat. 1,047,610, Dec. 17, 1912.

See Fr. Pat. 443,498 of 1912; this J., 1912, 972.—T. F. B.

Distilling column. F. Pampe, Halle-on-Saale, Germany. U.S. Pat. 1,048,425, Dec. 24, 1912.

See Fr. Pat. 384,775 of 1907; this J., 1908, 493.—T. F. B.

Erratum.

This J., 1912, 1167, col. 1, line 11 from bottom, delete first eight words to comma, and substitute the following:—"In a known form of gas-washing apparatus the contact between liquid and gas or vapour, is obtained by leading the liquid by fixed, inverted, truncated cones, etc., towards and upon the centre of central rotating discs from where the liquid is thrown outwardly and broken up. In the present method for securing a more perfect atomising action"——

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Alcohol as a motor fuel. Times Eng. Suppl., Jan. 15, 1913.

If alcohol and petrol be compared, it is seen that the calorific value of the former is not much more than half that of the latter, so that from this point of view alcohol would appear to be out of the question as a competitor:—

	Calories. per kilo.	B.Th.U. per lb.
Petrol, sp. gr. 0·684	11,624	20,923
Methylated spirit	6,200	11,160

In practice, however, this difference almost disappears, and a test made with the fuels in two 8-h.p. engines, designed for their use, gave the consumption as follows:—

Petrol	340 grams per h.p. hour
Methylated spirit	373·5 ,, ,,

The efficiency obtained with the petrol was thus only 16·5 per cent., as against 28 per cent. with the alcohol.

It must be remembered that by far the largest proportion of the work that has been done in internal combustion engines has been carried out with the object of perfecting them for use with petrol, and only a small amount of attention has been given to alcohol as a motive power. Possibly when a similar amount of research has been directed to the use of alcohol, this liquid will be found more suitable than petrol as a motor fuel. The higher efficiency obtained with alcohol is due to two factors—the greater ease with which complete combustion can be obtained, and the smaller proportion of air needed as compared with petrol; further, with alcohol far higher compression and a comparatively cool cycle are possible, conditions which are among the most important in fuel economy. The Government allows the use of denatured or methylated spirit duty free, but even so its cost is about equal to that to which petrol has now risen. This however is not due to cost of material or manufacture, but to the Government charges for supervising the production to make sure that none leaves the distillery in a drinkable condition. If it were recognised that it is essential for the national welfare that cheap motor fuel should be obtainable, 10 per cent. of crude benzol dissolved in spirit would yield a fuel which, so far as manufacturing charges go, would not cost much over 6d. a gallon, and could be used in all existing petrol motors with—at most—a slight alteration in the carburettor.

Briquetted fuels. Manufacture and properties. Times Eng. Suppl., Jan. 1, 1913.

BRIQUETTES are largely used on the Continent for steam raising, especially for locomotive firing, and also for domestic use: in the United Kingdom they are not often met with. In the United States they are somewhat commoner. The industry abroad is a wide one, including the briquetting of all kinds of coal, lignite, peat, &c. In the United Kingdom it is almost entirely confined to the patent fuel industry of South Wales, which is responsible for the production of a million and a half tons of briquetted fuel yearly, almost all of which is exported.

Practically all the briquettes made in the United Kingdom have pitch as the binding agent, with sometimes the addition of a little starchy material. The mixing of the fine coal with the binding agent is carried out at a fairly high temperature; sometimes superheated steam is injected, the volatile matter not being allowed to escape. The mixture is briquetted under a high pressure on cooling. In some cases the briquettes are heated or partially coked, this treatment rendering them less likely to give off smoke when burnt. An average amount of pitch binder is 6 per cent. by weight on the finished briquette. The quality of the pitch used is an important factor in making good briquettes. Free carbon in the pitch greatly detracts from its binding value.

The following results were obtained at the Monks Ferry Fuel Laboratory, Birkenhead, in tests on the various briquettes made for steam raising. The calorific values were determined by the Mahler bomb calorimeter:—

	A.—Very poor briquettes.	B.—Crown brand.		C.—Another brand.	D.—Arrow brand.	E.—Anchor brand.	F.—Ferndale steam coal.
		(1)	(2)				
Moisture, per cent.	2·20	1·30	—	1·80	1·12	2·33	1·09
Ash, per cent.	16·80	9·65	6·61	7·53	9·92	5·07	4·35
Carbon, per cent.	81·00	80·89	—	80·95	80·45	85·15	86·03
Hydrogen, per cent.		3·96	—	4·20	3·99	3·98	3·94
Sulphur (combustible), per cent.		0·91	0·64	0·75	0·82	0·91	0·92
Oxygen, nitrogen, per cent.		3·29	—	4·77	3·70	2·56	3·67
	100·00	100·00	—	100·00	100·00	100·00	100·00
Spec. gravity	—	1·24	1·22	1·17	1·20	—	—
Volatile matter, per cent.	—	15·15	12·64	15·00	12·88	9·77	11·29
Net Cal. value B.Th U.	11·286	13·583	13·919	13·682	13·529	14·213	14·513
Evap. power, lb.	11·68	14·05	14·40	14·15	14·00	14·70	15·01

Now that residues from petroleum, which have in general a high calorific value, are becoming increasingly common, it is possible that coal will be briquetted to have a still greater steam-raising power.

Coal; Fractional distillation of ——. L. Vignon. Comptes rend., 1912, **155**, 1514–1517.

AFTER fractionally distilling different kinds of coal and analysing the gaseous products produced at the various temperatures, the author comes to the following general conclusions. The unsaturated hydrocarbons (acetylene, ethylene, benzene, etc.) are practically all evolved below 600° C., and they are not found at all at the higher temperatures. Methane is very abundant up to 800° C., and then begins to fall off in quantity as the temperature rises. Hydrogen, which is not evolved in any quantity below 600° C., predominates at 800° to 1000° C., and finally diminishes from 1000° to 1200° C. Carbon monoxide usually forms much less than 10 per cent. of the gas evolved up to 800°, but often forms over 30 per cent. of that evolved above 1000° C. (See also this J., 1910, 1291; 1911, 806.)—W. H. P.

Naphthalene; Vapour-pressure of ——, *and determination of naphthalene in purified coal-gas.* E. Schlumberger. J. Gasbeleucht., 1912, **55**, 1257—1260.

THOROUGHLY dried air was slowly passed over naphthalene in a thermostat so as to become saturated with the vapour, which was then frozen out from the air in its further passage through two tubes cooled respectively by ice and by solid carbon dioxide. The loss of weight of the naphthalene tube and the gain of the condensing tubes confirmed one another. The air after removal of the naphthalene was passed through a meter. The following table gives the results:—

Temperature, °C.	Vapour pressure in mm. of mercury	Grms. of naphthalene in 100 cub. m.
0	0·006	4·51
5	0·010	7·38
10	0·021	15·23
15	0·035	24·95
20	0·054	37·83
25	0·082	56·48
30	0·133	90·10
35	0·210	139·96
40	0·320	209·88
45	0·518	334·39
50	0·815	517·94

Rutten's modification of Colman and Smith's method for determining naphthalene in coal-gas (this J., 1909, 875, 1179) was examined and slightly modified by the author, who finds the following method quite satisfactory:— In a 10-bulb absorption tube exactly 2·7 grms. of picric acid are placed, and made up with water to about 100 c.c. The gas is passed through saturated citric acid solution to free it from ammonia, then through the absorption tube, finally through a meter: 300—400 litres of gas should pass in 10—15 hours. The contents of the tube are washed into a 250 c.c. flask and made up to the mark. The flask is stoppered, and warmed for half an hour to 40° C., with frequent shaking, then cooled, and the contents filtered through asbestos. The picric acid in 100 c.c. of the filtrate is determined by adding 25 c.c. of potassium iodide-iodate solution (150 grms. of iodide, 30 grms. of iodate, 400 c.c. of water), and titrating with thiosulphate and starch; 2·7 grms. of the same picric acid have been previously dissolved in 250 c.c. of water and 100 c.c. of this titrated in the same way. The difference between the two titrations gives the picric acid combined with the naphthalene. Benzene in coal-gas produces no effect on picric acid, and hence does not interfere with the naphthalene determination. —J. T. D.

Dehydrogenation catalysis; Selective ——. N. Zelinsky. Ber., 1912, **45**, 3678—3682.

THE author has shown previously (this J., 1911, 1368) that catalytic dehydrogenation by palladium or platinum at about 300° C. appears to be characteristic of hexamethylene hydrocarbons, and in the present paper he describes experiments made to apply the reaction to the separation of pentamethylene and hexamethylene hydrocarbons and to the investigation of petroleum distillates. A mixture of methylcyclopentane and cyclohexane was subjected three times in succession to the action of platinum black at 300° C.; the quantity of hydrogen evolved was 93·4 per cent. of the theoretical quantity calculated for the conversion of cyclohexane into benzene. The product was treated with sulphuric acid (2 vols. of acid of sp. gr. 1·84 mixed with 1 vol. of fuming acid containing 7 per cent. of anhydride), which sulphonated the benzene; the residual unattacked hydrocarbon, after distillation over sodium had the properties of the original pure methylcyclopentane. A fraction (b. pt. 102°—104° C., sp. gr. 0·7647 at 18° C., n_D^{18} = 1·4215) from Baku petroleum, after purification by treatment with sulphuric acid of the strength mentioned above, when treated in a similar manner yielded toluene and a hydrocarbon (b. pt. 101°—102·5° C., sp. gr. 0·7488 at 20°/4° C., n_D^{20} = 1·4101), which was probably a derivative of cyclopentane or cyclobutane. A petroleum fraction (b. pt. 100°—100·5° C.) obtained by repeated treatment of so-called "naphtha-heptanaphthene" with a mixture of nitric and sulphuric acids, gave similar results.—A. S.

PATENTS.

Peat; Wet carbonising of ——, and the like. T. Rigby. Dumfries, and N. Testrup, London. Eng. Pat. 19,330, Aug. 29, 1911.

STEAM, under suitable conditions of temperature and pressure, is utilised for the wet carbonising of peat and the like. The material is contained in iron tubes enclosed in a boiler-like shell into which the steam is admitted. Formerly (see this J., 1911, 833) gases of combustion were used for heating the material. Steam has the advantages of producing no local over-heating, and can be readily worked at any given temperature, the condensed water being returned to the steam-raising plant.—G. H. F.

Peat; Removal of water from wet-carbonised ——. T. Rigby, Dumfries, Scotland, and N. Testrup, London. Eng. Pat. 24,748, Nov. 7, 1911.

THE patent describes a method of removing water from peat carbonised by Ekenberg's process (see Eng. Pat. 10,834 of 1903; this J., 1904, 14), alternative to that described in Eng. Pat. 16,958 of 1911 depending upon the direct drying action of flue gases (see this J., 1912, 1114). The peat containing about 70 per cent. of water as it comes from the filter-press is finely divided in a pulveriser and introduced into a current of hot flue gases which carry it forward towards the briquetting press where it is separated from the gas by means of cyclone separators. It was found in one trial that the percentage of water was reduced to 25 per cent. by causing the peat to be carried through a duct 150 ft. long by a current of flue gas moving at 55 ft. per sec. and entering the duct at a temperature of about 450° C. The flue gases were cooled to a temperature of about 70° C. If necessary an auxiliary furnace is provided to give the required volume of flue gas.—H. H.

Coking and carbonisation of coals; Shaft furnace for ——. J. Lütz. Ger. Pat. 252,154, Nov. 18, 1911. Addition to Ger. Pat. 250,576, June 27, 1911 (this J., 1912, 1172).

THE central portion of the furnace which is surrounded by the conical bottom plate of the annular coking chamber, as described in the main patent (*loc. cit.*), rests on a perforated water-chest, so that when the bottom-plate is lowered, the coke is flooded with water. Nozzles are provided in the water-chest through which jets of water are forced on to the coke to complete the quenching. The gases and vapours evolved are withdrawn through an exhaust-pipe. The valves controlling the water-supply and exhaust pipes are connected with the bottom-plate, in such a manner that they are opened when the latter is lowered.—A. S.

Coke oven. E. Chur. Ger. Pat. 252,437, Jan. 30, 1912.

THE oven has vertical heating flues and the combustion of the heating gases is effected not only at the top or at the bottom of the flues, but also at a point about half-way up. The heating gases and air are led to the point of combustion in the middle of the flue through two concentric pipes projecting downwards from the top, or upwards from the bottom, of the flue. A third concentric pipe, surrounding the two just mentioned, is used as the supply pipe for the heating gases for the burners at the top or bottom of the flue.—A. S.

Fuel; Production of gaseous ——. A. W. Southey, Edgware, London. Eng. Pat. 27,612, Dec. 8, 1911.

GASEOUS fuel for use in internal combustion engines is produced by spraying liquid fuel into a chamber where it is partially burnt by a limited supply of air. The oil which does not become fixed or vapourised, falls to the bottom of the chamber and is again pumped through the spraying nozzle. The air supply is sucked into the vapourising chamber by the suction of the engine, and ignition is effected by means of a pilot flame which is also drawn into the chamber by the suction through a hole in the side wall.—H. H.

Gas producers. The Dowson and Mason Gas Plant Co., Ltd., Manchester, and J. Cunningham, Glasgow. Eng. Pat. 14,894, June 26, 1912.

IN gas producers of the type having revolving pokers projecting into the upper layers of the fuel, the pokers are carried by a series of rotatable heads annularly disposed around the central feed hopper, each head being preferably water-luted. The pokers, which may be water cooled, are mounted in cylindrical bearings on the heads so that they can be inclined at any angle, thus causing the points to describe circles of desired radius, and they may also be caused to project to any desired distance. The heads may be rotated either by means of a chain or by spur gearing.—H. H.

Oil-gas; Generating —— and oil-gas producer. F. H. Bates, Elyria, Ohio, Assignor to Power Plant Engineering Co. U.S. Pats. 1,046,539, 1,046,540, 1,046,541, and 1,046,542, Dec. 10, 1912.

(1) OIL-GAS for explosive engines is produced by circulating the oil through a vaporiser which contains a body of oil at a constant level. The oil is circulated more rapidly than it is vaporised, the excess returning to the supply tank. (2) Apparatus for carrying out the process described above comprises an oil tank from which oil is pumped to the constant-level feed-pot of the vaporiser, the excess of oil passing by an overflow pipe back to the tank. The feed-pot has connections to the vaporiser above and below the level of the liquid. (3) The process is carried out in a series of vaporisers, the oil being caused to flow from one vaporiser to another in such a way that a lighter oil is added to one from which more of the lighter constituents has been distilled. In this way, the body of oil in each vaporiser remains of a constant composition. The vapours from all the vaporisers are mixed together for use in the engine. (4) The vaporisers are heated by the exhaust gases of the engine, and the vapours are superheated by means of an oil-burner which is fed with the oil not vaporised in the process.—A. T. L.

Water-gas; Plant for the manufacture of carburetted ——. A. G. Glasgow, Richmond, Va. U.S. Pat. 1,047.201, Dec. 17, 1912.

THE steam generator of a plant for making carburetted water-gas is traversed by two sets of tubes, which are respectively heated by the blast products from the gas-producing apparatus and by the newly made carburetted gas. To minimise fouling of the tubes by smoke, etc., the gases may first be passed through a water-heating apparatus which partially cools them before they are led through the steam-generator tubes. In an alternative arrangement two boilers separately heated by the respective gases may be employed, or two such boilers may be used in conjunction with an independently-heated steam generator.—H. H.

Water-gas; Manufacture of carburetted ——. A. G. Glasgow, Richmond, Va. U.S. Pat. 1,047,512, Dec. 17, 1912.

THE process consists in forcing the hot newly made carburetted water-gas, without previous cooling, into contact with water in such a manner that the water collects and removes a large proportion of the carbonaceous impurities and is itself largely converted into steam, while the partially cleaned gas still remains heated to a degree materially in excess of 212° F. (100° C.). The mixed gas and superheated steam is then passed through the heating tubes of a steam generator, whereby the gas is cooled and at the same time steam is generated for use in the gas generator. The blast gases from the generator may be similarly treated and utilised in a separate steam generator.—H. H.

Gas-generating apparatus. H. F. Wallmann, Chicago, Ill. U.S. Pat. 1,047,348, Dec. 17, 1912.

IN a gas producer of the type in which the gaseous products are drawn off from a number of orifices disposed around the middle section of the retort: (1) The air supply enters the ends of the retort from a casing surrounding the retort in which the air is heated; (2) The fuel is supplied by a spiral conveyer from a chamber above the retort in such a manner that there is always a space free from fuel in the upper portion of the retort; (3) The steam is supplied to the fuel feed chamber from a generator heated by the gaseous products; (4) The fuel is periodically pressed down by a reciprocating pusher operated by a hydraulic motor which also serves to actuate the fuel conveyer and the ash-discharging device.—H. H.

Tar and liquor: Means for the discharge of —— *from the hydraulic mains of gas plant.* H. Clarke, London, and J. A. Campbell, Ilford. Eng. Pat. 14,065, Dec. 12, 1911.

THE tar and liquor from hydraulic mains of gas plants are separated and discharged through different outlets, by fitting on to the hydraulic main a take-off chamber, provided with a partition for separating the tar and liquor according to their specific gravities. A weir valve is fitted on the tar outlet, and a valve on to the liquor outlet, making it possible to adjust, as desired, the level of the tar and liquor in the main.—G. H. F.

Illuminating and coke oven gas; Purification of ——. W. B. Davidson, Birmingham. Eng. Pat. 23,696 of 1911, date of Appl., Apr. 25, 1912.

THE patent relates to the process in which ammoniacal liquor is led into a still into which steam is blown so as to liberate carbon dioxide, hydrogen sulphide, and ammonia, and the acid gases are separated from the ammonia by leading them off at a higher level. According to the invention the temperature and pressure within the still are both graduated, and the pressure is comparatively high where the ammonia is drawn off. The gaseous ammonia from the still is led through absorbers to remove traces of the acid gases, and is then introduced into the condensers or scrubbers of the gas plant, exercising a jet action, so as to be thoroughly mixed with the gas to be purified. The liquor from these scrubbers is returned to the still, the process thus being a continuous one. The ammonia gas from the still contains 95 per cent. of pure ammonia. The gas from the ammonia scrubbers is treated with a sludge of ferrous hydroxide to ensure complete removal of hydrogen sulphide.—A. T. L.

Gas purifiers: Grids for supporting the oxide in ——. H. Crossley and F. Hobbs, Elland, Yorks, Eng. Pat. 3142, Feb. 7, 1912.

THE oxide is supported by independent self-supporting structures consisting of uprights carrying horizontal bearers which in turn carry cross bars for supporting the oxide.—H. H.

Lighting gases and the like: Process for the purification of ——. O. Guillet, Clermont Ferrand, France. Eng. Pat. 18,597, Aug. 13, 1912. Under Int. Conv., April 2, 1912.

THE carbon bisulphide contained in illuminating gas issuing from the ordinary purifiers is removed by passing the gas through a second purifier containing iron oxide heated to a temperature of from 80° to 200° C. The moisture present in the gas causes the formation of hydrogen sulphide, which is immediately absorbed by the iron oxide. The process can be combined with the ordinary purification by causing the crude gas, with or without a sufficient quantity of air for the regeneration of the iron oxide, to pass directly into the hot purifier. When air is used it may be necessary to pass the gas through an alkaline solution to absorb acid vapours. —H. H.

Hydrocarbon oil; Apparatus for distilling ——. C. W. Turner, Brooklyn, N. Y. U.S. Pat. 1,046,683, Dec. 10, 1912.

THE apparatus comprises a steam-generating coil, an oil-vaporising coil and a coil for mixing steam and oil vapour. The oil is fed under pressure to the lower end of a vertical heating and separating drum. Heavy constituents are drawn off at the lower end of this drum, and the oil passes from the upper end to the vaporising coil. The mixed steam and oil vapour from the mixing coil pass to a second separating drum in which tarry matter is deposited, and the mixture of steam and oil vapour is further heated in another coil.—A. T. L.

Paraffin; Filtration process for obtaining ——. G. Platz. Ger. Pat. 252,791, Oct. 5, 1911.

DURING the filtration, which may be assisted by vacuum or pressure, the cake of residue which forms on the filter surface is continuously or intermittently spread over the surface, in order to remove the crevices in the cake which hinder filtration. When the filtration is completed, the cake is melted by means of hot air or steam, and the liquefied portion is removed through one or more orifices in the filter-surface. Finally the filter is cleaned by passing a solvent through it, both from above and from below.—T. F. B.

Coke; Manufacture of ——. J. Guebels, Namur, Belgium. Eng. Pat. 27,378, Dec. 6, 1911.

SEE Fr. Pat. 437,231 of 1911; this J., 1912, 481.—T. F. B.

Coke; Method of manufacturing and purifying ——. W. S. Simpson, London. U.S. Pat. 1,047,845, Dec. 17, 1912.

SEE Eng. Pat. 20,237 of 1909; this J., 1910, 1193.—T.F.B.

Smelting operations [*with wet carbonised peat*]. Eng. Pat. 27,150. *See* X.

Gas analysis apparatus. Eng. Pat. 11,664. *See* XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

A dangerous type of spirit lamp. Steel. *See* Sydney Section, p. 73.

PATENTS.

Incandescent gas mantles; Manufacture of ——. J. O. Zdanowich, London. Eng. Pat. 27,354, Dec. 6, 1911.

INCANDESCENT gas mantles are made to adhere to their supports by impregnating the threads by which they are attached, or the upper parts of the mantles themselves, with a solution of a salt (an alkali borate, carbonate or phosphate with addition of ammonium phosphate) which fuses at low temperature, thus serving as a flux which binds the mantles to their support.—G. H. F.

Electric incandescent lamps; Connection between metallic filaments and feed-wires of ——. F. Hanaman, Budapest, Assignor to General Electric Co., New York. U.S. Pat. 1,046,780, Dec. 10, 1912.

The joint is made by means of a phosphide of a metal. —A. T. L.

Carborundum filaments; Method of manufacturing ——. F. C. Thoms, Pittsburg, Pa., Assignor to The Nernst Lamp Co. U.S. Pat. 1,048,231, Dec. 24, 1912.

The method consists in admitting to an exhausted flashing jar predetermined amounts of the vapour of silicon tetrachloride and of a mixture of hydrogen and ethylene, and then flashing a carbon core in such atmosphere.—H. H.

Lamp filaments; Art of manufacturing ——. W. D. Coolidge, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,047,502, Dec. 17, 1912.

See Eng. Pat. 17,620 of 1908; this J., 1909, 417.—T. F. B.

Tungsten filaments for incandescent electric lamps; Manufacture of ——. A. Lederer, Atzgersdorf, Austria-Hungary. U.S. Pat. 1,047,540, Dec. 17, 1912.

See Eng. Pat. 7803 of 1906; this J., 1907, 83.—T. F. B.

Metallic glow-filaments for electric incandescent lamps; Support for ——. A. Lederer, Atzgersdorf, Austria-Hungary. U.S. Pat. 1,047,541, Dec. 17, 1912.

See Eng. Pat. 18,812 of 1906; this J., 1907, 1042.—T. F. B.

III.—TAR AND TAR PRODUCTS.

o-Hexahydrocresol; Dehydration of —— *in presence of alumina and cupric oxide.* W. I. Ipatiew and O. Routala. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1692—1695.

It has been shown previously by Ipatiew that dehydration of *o*-hexahydrocresol at 350° C. in presence of alumina yields a mixture of $\Delta^{1:2}$ and $\Delta^{3:4}$ methylcyclohexenes. The authors find that, under a high pressure of hydrogen, this dehydration takes place at 240° C. if both alumina and cupric oxide are present, the sole product being $\Delta^{1:2}$ methylcyclohexene. Various derivatives of this compound are described.—T. H. P.

Patents.

Benzoyl derivatives [of aminoanthraquinones]; Process for the preparation of ——. R. Wedekind und Co. m b.H., Uerdingen on Rhine, Germany. Eng. Pat. 14,476, June 20, 1912. Under Int. Conv., June 21, 1911.

The conversion of 1- and 2-aminoanthraquinones, and of 1.4-, 1.5-, and 1.8-diaminoanthraquinones, into their benzoyl derivatives may be effected by heating the bases with benzoic acid, without addition of a solvent or condensing agent. *Example:* 10 kilos. of α-aminoanthraquinone and 50 kilos. of benzoic acid are heated to boiling in an open vessel for 1—1½ hours; on cooling the benzoyl derivative separates out.—T. F. B.

Monohalogen-2-aminoanthraquinones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 253,683, Sept. 5, 1909.

The sulphonic group may be eliminated from 1-halogen-2-aminoanthraquinone-3-sulphonic acids by heating with dilute mineral acids.—T. F. B.

Aminoazobenzene, its homologues and analogues; Process for preparing acetyl compounds of ——. Kalle und Co. Ger. Pat. 253,884, Jan. 12, 1912.

The aminoazo base is treated with an acetylating agent, especially acetic anhydride, in such quantity and for such a period that at least two acetyl groups are introduced into the molecule.—T. F. B.

1-*Aminoanthraquinone-2-carboxylic acid and 2-aminoanthraquinone-3-carboxylic acid: Manufacture of* ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 82, Jan. 1, 1912.

See Fr. Pat. 438,621 of 1912; this J., 1912, 579.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Oxythionaphthene, oxythionaphthene carboxylic acid, and thioindigo; Action of hydrogen peroxide on ——. M. Lanfry. Comptes rend., 1912, **155**, 1517—1519.

In dilute alkaline solution oxythionaphthene gives with hydrogen peroxide a blue precipitate and leaves a solution containing only gummy material. The blue precipitate dissolves in water to give a blue solution, but on adding acids the solution deposits red flakes which have all the properties of thioindigo. From dilute alkaline solutions of oxythionaphthene a precipitate of thioindigo (25 per cent. yield) is at once precipitated, and from the filtrate extraction with benzene will remove a substance, $C_8H_6SO_3$ (20 per cent. yield), with phenolic properties quite similar to those of oxythionaphthene. This is therefore presumably *S*-dioxy-oxythionaphthene, *i.e.*, the sulphone corresponding to oxythionaphthene. The acid corresponding to oxythionaphthene loses its phenolic reaction on oxidising with hydrogen peroxide. One or two per cent. of thioindigo are formed, but the bulk of the acid is resinified. Thioindigo itself is not attacked by hydrogen peroxide except when finely divided, and then it is converted entirely into resinous products.—W. H. P.

Patents.

Vat dyestuffs of the anthraquinone series; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 28,723, Dec. 20, 1911.

Vat dyestuffs which have a particular affinity for wool, are obtained by replacing in anthraquinone-mercaptans the hydrogen of the mercapto group by a radical which does not contain a group forming soluble compounds with alkalis and which is not an acidyl radical: the radicals especially suitable for the purpose are acetylene and ethylene residues, and alkyl, aryl, aralkyl, or anthraquinonyl groups, substituted or not. The method of preparing dianthraquinonyl thio-ethers described in Eng. Pat. 12,614 of 1912 (this J., 1912, 1025) is not claimed. For example, dianthraquinonyl sulphides are obtained by the action of monohalogen-anthraquinones on anthraquinonyl-mercaptans in presence of alcoholic or aqueous alkali. The products dye wool and cotton yellow and brown shades.—T. F. B.

Vat dyestuffs; Process for preparing ——. Ges. f. Chem. Ind. in Basel. Ger. Pat. 253,762, May 2, 1911. Addition to Ger. Pat. 205,377, Jan. 17, 1907.

Nitroacetanthrenequinone, obtained by treating acetanthrenequinone with the calculated quantity of mixed acids in sulphuric acid solution, is condensed with oxy-3-thionaphthene-(1)-carboxylic acid-2 in presence of acetic acid, and the product is reduced by means of sodium sulphide. Hydrosulphite converts the dyestuff into vats in which unmordanted wool is dyed fast chocolate shades.—T. F. B.

Azo dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 253,933, Oct. 10, 1911.

The diazo compounds of amines of the benzene or naphthalene series are combined with alkylaralkyl-*m*-toluidinesulphonic acids. Fast yellow, orange, and red dyestuffs may be obtained by this method, which are faster than the corresponding dyestuffs from alkylaralkylanilinesulphonic acids (compare U.S. Pat. 1,003,293; this J., 1911, 1205).—T. F. B.

Sulphide dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 253,934, Nov. 5, 1911.

WHEN nitro- or amino-derivatives of perimidine and its derivatives are melted with polysulphides, with or without addition of copper or a copper compound, fast catechu-brown dyestuffs are obtained.—T. F. B.

Condensation products of the anthraquinone series; Process for preparing ——. H. Sander. Ger. Pat. 253,983, Jan. 26, 1911.

THIOXANTHONE derivatives of the anthraquinone series are obtained by treating with dehydrating agents the products formed by condensing 2.3-halogenanthraquinonecarboxylic acids with anthraquinone-mercaptans. The halogen-anthraquinonecarboxylic acids may be obtained by eliminating the elements of water from the dicarboxylic acids obtained by oxidising *o*-chlorotoluyl-*o*-benzoic acids, or by passing chlorine into melted 2.3-chloromethylanthraquinone to form the 2-chloro-3-trichloromethyl compound, and heating this with sulphuric acid.—T. F. B.

Sulphur [sulphide] dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,776, May 17, 1912.

SEE Ger. Pat. 253,934 of 1911: preceding.—T. F. B.

Anthracene dyes and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,047,812, Dec. 17, 1912.

SEE Fr. Pat. 428,338 of 1911; this J., 1911, 1153.—T.F.B.

1.1′-Dianthraquinonyl-2.2′-dialdehyde bodies and process of making such compounds. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 1,047,813, Dec. 17, 1912.

SEE Ger. Pat. 241,786 of 1911; this J., 1912, 119.—T. F. B.

Vat dyestuffs of the anthraquinone series and process of making same. M. Hessenland, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,047,940, Dec. 24, 1912.

SEE Eng. Pat. 29,031 of 1911; this J., 1912, 223.—T. F. B.

Manufacture of bluish-red colour lakes [from azo dyestuffs]. Eng. Pat. 23,427. *See* XXIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silkworm; Chemical composition of the —— at different stages of its metamorphosis. R. Inouye. J. Coll. Agric., Imp. Univ., Tokyo, 1912, 5, 67-79.

SILKWORMS of the same race were analysed at three stages. The composition of the worm is greatly changed in producing the cocoon; there is less difference between the pupa and the moth. During metamorphosis there is no loss of nitrogen as gas. Fat is accumulated when the silkworm pupates and nearly all consumed again during the subsequent stages. In every stage the nitrogen-compounds were mainly present in the filtrate from the phosphotungstic acid precipitate; in the cocoon they were almost entirely in the filtrate. In the pupal and moth stage the waste of body protein is repaired with amino-acids and a part of the latter is further transformed into ammonia. The fission of the protein is caused by the action of some proteolytic enzyme.—E. F. A.

Nitro artificial silks; Acid tendering ["Säurefrass"] in ——, and the stability test. P. Heermann. Färber-Zeit., 1913, 24, 6—10.

ARTIFICIAL silks prepared from nitrocellulose are liable to develop on storage a damage which the author terms "*Säurefrass*" and which is manifested by the appearance of milky-white specks which show an acid reaction due to free sulphuric acid; the trouble may spread over the whole skein and sometimes the action of the acid is shown by general tendering or at any rate deficient strength. The defect is attributed to the presence of unstable sulphuric esters of cellulose (see this J., 1910, 939), but chemical analysis is not a sufficiently definite means of recognising positively the kinds of silk which are susceptible to the damage, although as a negative test the absence of sulphates is conclusive. The types of sulphuric ester which are dangerous are those which are in an unstable condition, and for the detection of these, the author prescribes the following stability test:—The silk to be tested is washed exhaustively with distilled water until perfectly neutral; it is then heated for one hour in the drying oven at a temperature of 135°—140° C. and examined for the presence of free sulphuric acid and for brown or black discolouration. Either of these results indicates the presence of unstable sulphuric esters of cellulose, and the silk may, if the conditions of storage be favourable, develop the damage of "*Säurefrass*"; such silks must be described as under suspicion. On the other hand, the author shows that those commercial nitro-silks which, although not free from combined sulphuric acid, are perfectly stable under his special test, may be used with full confidence.—J. F. B.

Milkweed. Neish. *See* New York Section, p. 72.

PATENTS.

Electric charges formed on textiles, fibres, paper and like materials during the working processes; Methods of neutralising ——. Siemens Bros. and Co., Ltd., London. From Siemens und Halske, A.-G., Berlin. Eng. Pat. 1554, Jan. 19, 1912.

THE material to be discharged is passed across a source of ultraviolet rays which is connected with an earthed electrode. The rays may be produced by means of mercury vapour lamps or by a voltaic arc between iron electrodes; cathode or Lenard rays or Röntgen rays may also be used for the purpose. The source of the rays is preferably encased in a closed compartment with an opening which only allows the transmission of the rays in the required direction. It is better not to allow the rays to traverse the material itself but only to ionise the air between the material and the earthed electrode. The arrangement may be disposed in duplicate above and below the material to be discharged.—J. F. B.

Flax-straw; Treatment of ——. H. P. Bassett, Newark, Del. U.S. Pat. 1,046,538, Dec. 10, 1912.

THE straw is boiled in a 1 per cent. solution of sulphuric acid in order to hydrolyse the basic waxes and gums and loosen the fibre from the shive; it is then washed to remove the products of hydrolysis, and boiled in a 1 per cent. solution of alkali. After washing out the alkali, the product is disintegrated and the fibre is separated completely from the shive by combing or carding.—A. T. L.

Paper and product thereof; Process of making ——. R. A. Marr, Blacksburg, Va. U.S. Pat. 1,046,475, Dec. 10, 1912.

IN the process of making paper stock, vegetable material is treated with a chloride, such as zinc chloride, for the purpose of converting the more easily attackable carbohydrate constituents into a cementitious material to bind the remainder together.—J. F. B.

Waterproof fabrics. G. M. Anderson, and Anderson, Anderson, and Anderson, Ltd., London. Eng. Pat. 26,623, Nov. 28, 1911.

SEE Fr. Pat. 445,885 of 1912; this J., 1912, 1177.—T. F. B.

Celluloid and like compositions; Manufacture of ——. H. Dreyfus, Basle, Switzerland. Eng. Pat. 20,976, Sept. 22, 1911. Under Int. Conv., July 5, 1911.

SEE Fr. Pat. 432,047 of 1911; this J., 1912, 24.—T. F. B.

Paper, cardboard, and the like; Manufacture of ——. O. E. Tingberg, Stockholm. U.S. Pat. 1,048,110, Dec. 24, 1912.

See Eng. Pat. 6491 of 1912; this J., 1912, 812.—T. F. B.

Pulp for making paper and like materials; Apparatus for use in the manufacture or treatment of ——. H. Arledter, Frodsham. U.S. Pat. 1,048,123, Dec. 24, 1912.

See Fr. Pat. 418,584 of 1910; this J., 1911, 80.—T. F. B.

Manufacture of ethyl alcohol by fermenting sulphite liquor. U.S. Pat. 1,046,160. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Silk; The tin-phosphate weighting of ——. H. Ley. Chem.-Zeit., 1912, **36**, 1405—1407, 1466—1469.

The results of the author's experiments on a practical scale bear out the theory of Heermann (see this J., 1911, 1007). The theory of a preliminary mechanical absorption (Sisley, Chem.-Zeit., 1911, 621) of the tin chloride is accepted, but it is suggested that the tin chloride then undergoes a chemical change within the silk substance, becoming converted into hydroxide, which is at once capable of further chemical combination with the tin chloride of the bath, forming an insoluble oxychloride. This accounts for the increase in weight with successive baths of "pink salt," which would not result from mere impregnation; this increase is not mathematically regular, probably owing to the formation of a more or less basic tin oxychloride within the silk fibre. The phosphate weighting is regarded as a further chemical reaction, whereby the stannic oxide first becomes converted into sodium stannate, which reacts with the free phosphoric acid to form a tin phosphate of the formula, SnO_2,P_2O_5, $2SnO_2,P_2O_5$, or $3SnO_2,P_2O_5$. An important consideration from the industrial point of view is that the phosphate bath often contains tin salts (sodium stannate and colloidal tin hydroxide) which have a detrimental effect on the sheen and durability of the silk.—G. H. F.

Hydroxyanthraquinones; Reaction of colloidal metallic hydroxides with ——. R. Haller. Färber-Zeit., 1912, **23**, 489—493, 523—528.

By dialysing a solution of aluminium hydroxide in aluminium chloride a colloidal solution of aluminium hydroxide, $Al_2(OH)_6$, is obtained. This forms a slightly opalescent liquid, which is unchanged by heating, but precipitated by electrolytes. The addition of alizarin suspended in water to the colloidal solution results in the formation of a clear red solution, also of a colloidal nature; aluminium hydroxide combines directly with alizarin, combination taking place slowly at the ordinary temperature, and being much accelerated by heat, requiring only a few seconds at the boil. The liquids were free from calcium salts, so that the combination is not brought about by their presence. The compound produced is not identical with that obtained by Liechti and Suida (this J., 1885, 587) by precipitation of an ammoniacal alizarin solution with a solution of aluminium sulphate, being much more stable and giving a precipitate on addition of concentrated ammonia, or of Turkey red oil, whereas Liechti and Suida's product gives no precipitate. Moreover, solutions of the two products of the same concentration give different absorption spectra. Flavopurpurin, anthrapurpurin and purpurin give similar results to those obtained with alizarin. The author further shows that the formation of a compound depends upon the colloidal nature of the aluminium compound used, for the sulphates, sulphate-acetates and basic sulphate-acetates of aluminium, which are non-colloidal, give no reaction on warming with alizarin paste. The acetates, on the other hand, are colloidal and give a red colour with alizarin in the cold. The hydrolysis of normal aluminium acetate on dialysis at 100° C. proceeds quickly, and is easily followed through its stages of basicity by observation under the ultramicroscope, till finally all the acetic acid is removed from the solution, leaving a gel which combines with alizarin on warming, forming a red lake. Liechti and Suida, under no conditions, could get aluminium hydroxide to combine with alizarin. The author suggests that this was due to slight impurity, because sulphates, for example ammonium sulphate, prevent this formation. He concludes that only when a solution contains an aluminium salt in colloidal form, is it possible for direct combination with alizarin at ordinary temperatures, and that an aluminium hydroxide perfectly free from sulphates can combine with alizarin on heating. Working under the conditions necessary in Turkey red dyeing, a very useful bright red is obtained upon oiled goods, by using a bath of alizarin together with colloidal aluminium hydroxide. Colloidal ferric hydroxide, prepared by dialysing a solution of ferric hydroxide in ferric chloride, was a dark red brown perfectly clear liquid, exactly similar in behaviour to aluminium hydroxide sol with alizarin, anthrapurpurin, etc. Colloidal chromium hydroxide, prepared in a similar manner, formed a green solution of markedly greater stability than the two foregoing, and behaved in a similar manner. Equivalent quantities of aluminium, ferric, and chromium hydroxide sols formed a mixed alizarate.—G. H. F.

Diazo colours; Preparation of stable ——. E. Siefert. Sealed Note No. 2116, dated Aug. 28, 1911. Report thereon by L. Bloch. Bull. Soc. Ind. Mulhouse, 1912, **82**, 586—591.

The author makes use of the extremely stable and soluble diazonium salts of naphthalenepolysulphonic acids for the preparation of diazo solutions for textile printing. The keeping qualities of solutions obtained in this way allow of their preparation some days before use. The process is carried out by sulphonating naphthalene with an excess of sulphuric acid (100 per cent.) at 160°—170° C. for about 7 hours, or until the reaction has got well past the stage of the formation of the monosulphonic acid. The mixture is diluted, allowed to stand to get rid of sulphur dioxide, and then used directly for the diazotisation of *p*-nitraniline or *p*-nitro-*o*-anisidine, a sufficient excess of sulphuric acid for this having been taken in the first instance. Two parts of *p*-nitraniline require one part of naphthalene. Perfectly clear solutions are obtained on diluting. The best thickening medium is oxidised starch made by treating starch paste with permanganate. The report states that although the use of naphthalenesulphonic acids is not novel, the author has made a distinct achievement in preparing directly diazo solutions which can be obtained in a concentrated state, couple easily, and, in their application offer advantages over the solid preparations of commerce.—J. B.

Brown colours; Conversion to —— *of aromatic amines oxidised on the fibre.* Fabr. de Prod. Chim. de Thann et de Mulhouse. Sealed Note No. 1300, dated Nov. 8, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1912. **82**, 592—593.

When Aniline Black is diazotised and combined on the fibre with phenol, naphthol, etc., unstable products are obtained which do not appear to be true azo compounds. If, however, the brown colour obtained by oxidising a diamine on the fibre is diazotised and combined with a phenol or amine, the resulting product is stable and fast to boiling soap. Naphthol and naphthylamine tend to redden the shade, resorcinol makes it yellower. The process is reported on as having been anticipated by Lummertzheim's Ger. Pat. 192,032 of 1906 (this J., 1908, 625). It has proved too complicated in practice, and to-day yellow shades of Paramine Brown are obtained by the addition of Fuscamine.—J. B.

Reserve colours under Aniline Black; Fixation of ——. Fabr. de Prod. Chim. de Thann et de Mulhouse. Sealed Note No. 1301, dated Nov. 8, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1912, **82**, 593—594.

Colours such as Persian berries, Prune, Alizarin Yellow N, Alizarin Red, Anthracene Brown and Fast Steam

Green N give coloured reserves under Prussiate Black when printed with a chromium or aluminium mordant and a suitable reserve (for example sodium acetate, bisulphite or sulphite), and passed for one to two minutes through the Mather and Platt The report states that the short duration of steaming and the presence of ferrocyanide hardly appear favourable to the production of good lakes, especially in the case of Alizarin Red.—J. B.

Multicoloured reserves under ice colours without albumin or tannin. Fabr. de Prod. Chim. de Thann et de Mulhouse. Sealed Note No. 1308, dated Dec. 16, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1912, **82**, 595—597.

Zinc ferrocyanide is used as a fixing agent for the reserve colour, in combination with a suitable resist. For instance, an illuminated Para Red is produced by grounding with β-naphthol and potassium ferrocyanide, an antimony salt being added to render the mixture stable. The reserve colour (for example Thioflavine T and Thionine Blue) is applied together with zinc-potassium sulphite, the double sulphite acting as the resist and supplying the zinc at the same time. The fabric is dried, passed into the diazo mixture, rinsed and soaped. The report states that zinc ferrocyanide has been used as early as 1893 for fixing basic colours on Prussiate Black, and priority for the application of the same principle to azo colours belongs to F. Oswald, who used it in 1893. To-day the process is of merely historic interest.—J. B.

Patents.

Mercerising; Treatment of cotton goods prior to ——. E. Knecht, Marple, and J. Hübner, Cheadle Hulme, Chester. Eng. Pat. 25,206, Nov. 13, 1911.

The natural wax-like substances contained in cotton yarns or fabrics are first extracted by suitable solvents, the portion of the latter remaining in the fabric being recovered by evaporation, and the extracted goods are then mercerised.—B. N.

Printing hydron or sulphide dyestuffs; Process for ——. L. Lichtenstein. Ger. Pat. 252,267, Dec. 28, 1911.

Salts of unsulphonated higher fatty acids, and of aromatic sulphonic and carboxylic acids, are added to the printing colours prepared in the usual manner.—T. F. B.

Discharging fabrics dyed with blue vat colours; Process for ——. H. Pomeranz. Ger. Pat. 253,155, April 25, 1912.

Fabrics dyed from the vat with blue dyestuffs, are printed with a ferrous salt and passed through a hot alkaline bath, in which the dyestuff is reduced and at the same time removed from the fibre. White or coloured discharges can be produced by this process.—T. F. B.

Waterproofing fabrics, straw goods, paper, fibres, leather, etc.; Process for ——. Act.-Ges. f. Chem. Industrie. Ger. Pat. 254,042, Feb. 16, 1911.

The patent refers to a process of waterproofing fabrics, in which the material is treated first with a solution of a substance capable of forming an insoluble precipitate with gelatin or the like, and then with a solution of gelatin. After treatment with the hardening or precipitating agent, the excess of this is removed from the surface by washing or heating, and the process is completed by applying a solution of glue, gelatin, or similar substance. —T. F. B.

Bleaching processes. E. L. Maupai, New York. Eng. Pat. 17,668, July 30, 1912. Under Int. Conv., April 9, 1912.

See U. S. Pat. 1,032,151 of 1912; this J., 1912, 770.—T.F.B.

Dyeing vegetable fibres; Process of ——. G. C. Dörr, Frankfort on Maine, Germany. U.S. Pat. 1,047,923, Dec. 24, 1912.

See Fr. Pat. 427,756 of 1911; this J., 1911, 1052.—T.F.B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitric acid; Detection of —— *in presence of nitrous acid.* W. N. Iwanow. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1772—1775.

As little as 0·0001 grm. of nitric acid may be detected in presence of 100 times as much nitrous acid by the blue colouration which it yields with a quadrivalent iridium salt. The reagent may be prepared conveniently from 0·025 grm. of iridium in the form of iridium tetrachloride or dioxide, which is dissolved in 3—5 c.c. of water, 100 c.c. of concentrated sulphuric acid (98—99 per cent.) being then added with constant stirring. The liquid is then heated to boiling to decolourise it and, when cold, is stored in a well-stoppered bottle. It should contain 96—96·5 per cent. of sulphuric acid. To make a test, 5 c.c. of the reagent are heated to incipient boiling and the substance to be tested, which must be in the solid state, quickly added. If a water is to be examined, it is first evaporated to dryness with a slight excess of alkali. The test-tube is not heated while the substance is being added, owing to the danger of converting the nitrous acid into nitric acid; on the other hand, if the reagent is insufficiently heated, a yellow and not a blue colouration is obtained. With a large amount of nitrous acid, a colouration may appear after a time, as a result of the reaction between nitrogen peroxide and water vapour:

$$N_2O_4+H_2O=HNO_3+HNO_2.$$

By means of a tube fitted with a ground stopper and with two side-tubes for the passage of a current of carbon dioxide, the gas formed is rapidly removed and satisfactory results are obtained.—T. H. P.

Nitrous and nitric acids; Effect of temperature on the equilibrium of —— *formed from oxides of nitrogen and water.* E. Briner and E. L. Durand. Comptes rend., 1912, **155**, 1495—1497.

The authors have already (this J., 1912, 981) studied the effect of pressure on this system and shown that it comprises the three reversible reactions:

(1) $N_2O_3+H_2O\rightleftharpoons2HNO_2$
(2) $2NO_2+H_2O\rightleftharpoons HNO_3+HNO_2$
(3) $3HNO_2\rightleftharpoons2NO+H_2O+HNO_3$

The effect of temperature has been studied by determining the ratio, HNO_2 : HNO_3. Equation (3) is endothermic from left to right (—18·4 Cals.) and consequently a rise in temperature would be expected to produce more nitric acid and lower the above ratio. Experiment shows this to be the case, the ratio falling in one series from 1·54 at 0° C. to 0·76 at 40° C. Therefore to promote the formation of nitrous acid it is necessary to have a high pressure and a low temperature.—W. H. P.

Nitric oxide formation; Changes involved in —— *in the high pressure arc.* F. Fischer and E. Hene. Ber., 1912, **45**, 3652—3658.

The formation of nitric oxide is due to preliminary "activation" of the oxygen and not of the nitrogen. The highest yield of nitric oxide is obtained by allowing previously sparked oxygen to pass into untreated nitrogen. In this way the yield is practically double that obtained by sparking air and allowing it to pass into more air. The lowest yields are obtained by sparking nitrogen and allowing it to pass into pure oxygen. If air which has been passed through a high pressure arc with constant current, is passed into oxygen, the yield of nitric oxide (referred to the volume of air which has passed through the arc) is greater than it is when the air from the arc is passed into more air or into nitrogen. It appears likely that the yields of nitric oxide at present obtained, may be improved by passing only the oxygen through the arc (using magnetite electrodes) and then rapidly mixing this with nitrogen and cooling.—W. H. P.

Oxides of nitrogen; Evolution of —— by heating pyrolusite in a current of air. [*Determination of very small quantities of nitrogen compounds.*] P. Askenasy and E. L. Rényi. Z. Elektrochem., 1912, **19**, 23—32.

When natural or artificial manganese dioxide is heated in air, a volatile compound of nitrogen and oxygen is evolved in very small quantities (not more than 0·2 mgrm. reckoned as nitric oxide from 10 grms. of pyrolusite in 20 hours). The phenomenon is also observed on heating in a current of carbon dioxide, though it is not so pronounced as in air. The authors' experiments lead to the conclusion that the source of the nitrogen is not the atmosphere but the oxide of manganese, in which it is initially present to the extent of not more than 0·002 per cent. Its mode of combination has not been ascertained. The product obtained by heating potassium permanganate for several hours at 445° C., consisting of manganate and manganite, when treated in the same way as the pyrolusite, gives no indication of a nitrogen compound either in the gas or in the solid preparation. For the determination of very small quantities of nitrogen (as nitrate or in any other form) the author has devised a process which is practically a combination of the Kjeldahl-Jodlbauer method and the colorimetric determination of ammonia. 2 to 3 grms. of the substance are dissolved or suspended in 5 c.c. of dilute sulphuric acid. Sulphur dioxide is passed through the gently warmed solution till all manganese dioxide is reduced. The resulting product is treated with about 2 grms. of Devarda alloy, a little phenolsulphonic acid and 20 c.c. of purest fuming sulphuric acid containing 20 per cent. of phosphoric anhydride. After heating for 4 hours the acid is neutralised, the ammonia distilled and estimated colorimetrically. In this way quantities of nitrogen of the order of 0·00001 grm. can be determined quantitatively with a relative error of not more than 40 per cent.—W. H. P.

Nitrogen trioxide and tetroxide; Change in the boiling points of ——, on drying. H. B. Baker and M. Baker. Chem. Soc. Trans., 1912, **101**, 2339—2341.

A sample of liquid nitrogen trioxide which had been sealed up with phosphorus pentoxide for three years was distilled into a series of bulbs forming part of the containing vessel, and the separate bulbs sealed off. A bulb was then placed in a specially constructed apparatus, and after three months' drying of the nitrogen-filled apparatus by phosphorus pentoxide, the boiling point at atmospheric pressure was found to be 43° C. The vapour was red, and condensed at —10° C. to the green liquid, which on further cooling turned blue. A similar experiment was made with nitrogen tetroxide. The sample was unfortunately too small, and all evaporated before the boiling point was reached; but at 22° C., the ordinary boiling point, the liquid showed no change, and at 69° C. there was still liquid visible which had not begun to boil. The authors consider that the molecules of the liquid are more complex than the formula N_2O_3 or N_2O_4 represents, and that in the absence of water dissociation into simpler molecules does not take place, but the complex liquid boils as such.—J. T. D.

Formaldehyde and nitrous acid; Interaction between ——. [*Determination of nitrites.*] L. Vanino and A. Schinner. Z. anal. Chem., 1913, **52**, 21—28.

Nitrous acid is reduced by excess of formaldehyde in accordance with the equation, $4HNO_2+3H.CHO=3CO_2+5H_2O+4N$, and the reaction furnishes a convenient gasometric method for the determination of nitrite. A weighed quantity of the material is warmed with the reagent in the presence of hydrochloric acid, in such a manner that the evolved gas may be collected over potassium hydroxide solution. Suitable apparatus for carrying out the process is described, and pressure-temperature tables are given for converting the observed volume of gas (employing potassium hydroxide solution of sp. gr. 1·23) to mgrms. of nitrogen or sodium nitrite. Too high a temperature and a large excess of formaldehyde should be avoided.—F. Sodn.

Alkali nitrites; Some properties of ——. M. Oswald. Comptes rend., 1912, **155**, 1504—1506.

The author has prepared pure sodium nitrite by recrystallisation, the silver salt by precipitation, and the potassium, lithium, and other salts from the silver salt by double decomposition with the chlorides of these metals. The potassium salt is yellower than the sodium salt and very much more deliquescent. The following determinations have been made:—

	$NaNO_2$.	KNO_2.
M. pt.	217° C.	297·5° C.
Temperature of decomposition ...	320°	350°
Density at 0° C. referred to water at 0° C.	2·168	1·912
100 grms. of saturated solution contain	45·8 grms. (20° C.)	74·5 grms. (17·5° C.)
Density of saturated solution referred to water at 0° C.	1·3585 (20° C.)	1·6464 (17·5° C.)

—W. H. P.

Sodium hypochlorite solutions; Photo-kinetics of ——. W. C. McC. Lewis. Chem. Soc. Trans. 1912, **101**, 2371—2382.

When aqueous solutions of sodium hypochlorite, neutral or alkaline, are exposed to radiation from a "Uviol" mercury-vapour lamp, decomposition occurs, the products being chiefly sodium chloride and oxygen. The infra-red rays have no share in effecting this decomposition, which is due to the visible and ultra-violet rays only; the solutions show a marked absorption band in the ultra-violet. The rate of decomposition is measurable, and the order of the reaction is probably unimolecular. By cutting off the ultra-violet, the violet, and the blue radiation by solutions of potassium ferrocyanide of increasing concentration, the rate of decomposition is reduced to zero; and by using some of the hypochlorite solution itself as a light-filter, a similar reduction of rate of decomposition is observed.—J. T. D.

Hypochlorites; A new method for the determination of ——. H. G. Williams. Proc. Chem. Soc., 1912, **28**, 327.

Hypochlorites can be titrated with a *N*/10-solution of hydrazine sulphate, the end point being determined by starch-iodide paper. The reaction appears to be:

$$N_2H_4+2MOCl=N_2+2H_2O+2MCl.$$

It is necessary to keep the mixture alkaline throughout, sodium bicarbonate being added if required. Comparison titrations made with *N*/10 arsenic trioxide and *N*/10-hydrazine sulphate showed very close agreement. The author finds that, contrary to the statement of Browne and Shetterly, neither ammonia nor azoimide is formed.

Barium sulphide; Valuation of ——. J. F. Sacher. Z. anal. Chem., 1913, **52**, 28—31.

A weighed quantity of the barium sulphide solution is mixed in the cold with an excess of standard lead nitrate solution (16 grms. per litre), the mixture is slightly acidified with acetic acid, and, after standing for some hours, the precipitated lead sulphide is filtered off and washed with cold water or better with dilute alcohol. The excess of lead nitrate is then titrated with ammonium molybdate (this J., 1910, 47).—F. Sodn.

Silicates; Decomposition of ——. W. Hempel. Z. anal. Chem., 1913, **52**, 86—90.

A series of comparative experiments have been made to test the various methods which have been proposed for the decomposition of refractory silicates, the time taken in each case to dissolve ordinary sand being observed. The method recommended consists in heating 1 grm. of the silicate with 3 grms. of barium carbonate in a platinum crucible (5 c.c. capacity) for 10—15 minutes at 1360° C., and a specially designed gas-furnace is described in which the necessary temperature may be readily maintained. The barium is subsequently separated as sulphate. —F. Sodn.

Metals; Separation of —— from aqueous solutions of their salts by hydrogen at high temperatures and pressures. W. Ipatiew and B. Zvjagin. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1712—1715.

Investigation of the displacement of cobalt from aqueous solutions of its sulphate, nitrate and chloride by hydrogen at high temperatures and pressures shows that such similar metals as nickel and cobalt give in this way substances of different properties, although the general character of the phenomena is the same as with copper and nickel salts (see this J., 1911, 900). Cobalt salts show a number of independent reactions, which depend on critical temperatures and pressures and give rise to separation of basic salts, the oxide of the metal and, finally, the metal itself. —T. H. P.

Uranyl nitrate; Asserted "explosivity" of ——. L. W. Andrews. J. Amer. Chem. Soc., 1912, **34**, 1686—1687.

Many years ago the author had an experience similar to that of Iwanow (this J., 1912, 362) of the explosion of samples of uranyl nitrate. The salt had been isolated by shaking an aqueous solution of nitric acid and uranyl nitrate with ether. A sample of the nitrate quite free from odour developed a marked odour of ether when moistened with potassium hydroxide solution, and another sample when dissolved in water gave an acid reaction with Congo-red test-paper. The presence of "ether and nitric acid of crystallisation" is regarded as a much more probable cause of the explosive character of the salt than its radioactivity.—A. S.

Hydrogen peroxide; Compounds of salts with ——. J. Rudenko. J. Russ. Phys.-Chem. Ges., 1912, **44**, 1209—1218. Chem. Zentr., 1912, **2**, 1893—1894.

The author has studied the action of 30 per cent. hydrogen peroxide on the nitrates, phosphates, and arsenates of potassium, sodium, and ammonium. From 0·5 to 1 grm. of the salt was dissolved in 10—15 c.c. of 30 per cent. hydrogen peroxide, the solution evaporated to dryness on the water-bath and the residue washed with alcohol and ether. Or, 2—3 grms. of the salt were dissolved in 20—40 c.c. of the hydrogen peroxide, the solution cooled to 0°—5° C., treated with twice to three times its volume of alcohol, and the precipitate filtered off, and washed with alcohol and ether. No compounds containing active oxygen could be obtained from the nitrates. The ternary phosphates and arsenates decompose hydrogen peroxide at 100° C., but in the cold the sodium and ammonium salts give compounds containing active oxygen. Of the secondary salts disodium phosphate at 100° C. gives a compound containing up to 10·2 per cent., and at 0°—5° C., one containing up to 3·2 per cent. of active oxygen; di-ammonium phosphate gives a compound containing up to 5·6 per cent. of active oxygen. The primary phosphates and arsenates and all the potassium salts form no compounds with hydrogen peroxide. Sodium pyrophosphate gives a compound containing up to 11 per cent., and sodium metaphosphate one containing up to 3 per cent., of active oxygen. The following definite compounds were isolated: (1) Na_2HPO_4,H_2O_2, a finely crystalline mass, which evolves some oxygen on dissolving in cold water, but gives a stable solution; (2) $Na_2HPO_4,\frac{1}{2}H_2O_2,6H_2O$, similar to (1); (3) $Na_4P_2O_7,2\frac{1}{2}H_2O_2$, a very stable compound containing 10·4 per cent. of active oxygen after being kept for 1 month. The author was unable to obtain the potassium pernitrate, and sodium perphosphate and perarsenate described by Alvarez (this J., 1907, 607); the products invariably consisted of mixtures of the original salt and sodium peroxide.—A. S.

Sodium nitrate. Shipments and consumption from 1910 *to* 1912. W. Montgomery & Co., Dec. 31, 1912. [T.R.]

12 months ending 31st December	1910. Tons.	1911. Tons.	1912. Tons.
Shipments from South American Ports to all parts	2,300,000	2,412,000	2,478,000
Consumption in U.K.	120,000	132,000	130,000
,, in Continent	1,531,000	1,564,000	1,778,000
,, in United States	501,000	556,000	481,000
,, in other countries	89,000	103,000	115,000
,, in the world	2,241,000	2,355,000	2,504,000

Ammonia production of Great Britain in 1912. Bradbury and Hirsch, Liverpool. January, 1913. [T.R.]

The total production of ammonia from all sources, calculated as sulphate, in the United Kingdom (including that used in the manufacture of ammonia-soda and other chemical processes) in 1911 and 1912 was as follows:—

	1911.	1912.
	Tons.	Tons.
Gas works	169,000	166,000
Iron works	20,000	20,000
Shale works	61,000	61,000
Coke and carbonising works and producer gas plant	135,000	132,000
Total	385,000	379,000

Of last year's production it is estimated that England contributed 255,000 tons, Scotland 121,000 tons, and Ireland 3000 tons. The exports during 1912 amounted to 287,000 tons and the home consumption 90,000 tons, the stock carried forward to 1913 being 18,000 tons.

Magnesite deposits in Mexico. Board of Trade J., Jan. 9, 1913. [T.R.]

The Consul at La Paz, Mexico, states that large deposits of high-grade magnesite, containing 92 per cent. of magnesium carbonate, have been found in the neighbourhood of Magdalena. The largest bed has an area of some 30 acres, and is situated on Margarita Islands; deposits have also been found on Cedros Island. The material is so hard that it must be blasted before it can be removed. A company has been formed to develop these deposits. One calcining plant will be installed on Cedros Island and another on Margarita Island, each with a capacity of 200 tons per day.

Detection and determination of free white phosphorus in phosphorus sesquisulphide. Schloosing. *See* XXII.

Patents.

Nitric and sulphuric anhydrides; Solid compound of —— and process of making same. W. Schultze, Assignor to General Chem. Co., New York. U.S. Pat. 1,047,576, Dec. 17, 1912.

The compound claimed contains sulphuric and nitric anhydrides and water (less than 3 mols. for each molecule of the compound), preferably so as to correspond to the formula, $N_2O_5,(SO_2)_4,H_2O$. It is made by adding sulphuric anhydride (suitably as vapour) to concentrated nitric acid, or to a mixture of this and concentrated sulphuric acid, until on cooling a portion, crystals are deposited; the whole is then cooled. The product forms a "water clear," white or yellowish, hygroscopic crystalline mass, having a sp. gr. of about 2·18, which melts at 93°—104° C., and, on further heating, decomposes with evolution of nitrous fumes.—F. Sodn.

"Contact mass"; Method of regenerating ——. W. M. Kelsey, Depue, Ill., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 1,047,236, Dec. 17, 1912.

A volatilised mixture of nitric and hydrochloric acids is blown through the mass, preferably by means of an "aeriform fluid" which is preheated to a temperature above 400° C.—F. Sodn.

Acetic acid; Process for denaturing ——. P. Mühsam. Ger. Pat. 253,923, Nov. 22, 1910.

The higher homologues of acetic acid, such as butyric, valeric, or caproic acid, are used as denaturants for acetic acid.—T. F. B.

Washing compositions or detergents [washing soda]. W. P. Thompson, Liverpool. From A. Groeben, Brussels. Eng. Pats. 26,958, Dec. 1, 1911, and 8751, April 13, 1912. Additions to Eng. Pat. 4111, Feb. 18, 1911 (this J., 1912, 545).

Claim is made for the manufacture of hydrates of sodium carbonate containing five and seven molecules of water of crystallisation, or of a mixture of these, by mixing sodium carbonate and water in the required proportions, heating the mixture with constant stirring to the point at which it just begins to soften, and keeping it at that temperature, preferably in a closed vessel, until the required salt has fully crystallised out.—O. R.

Phosphates; Process for the decomposition of ——. H. C. Woltereck and J. Moeller, London. Eng. Pat. 28,920, Dec. 22, 1911.

Phosphates of alkali and alkaline-earth metals are decomposed by means of steam at atmospheric pressure, superheated to 700°—900° C., with the liberation of phosphoric acid, which is carried off by the steam, and with the formation of hydroxides of the metals, which were combined with phosphoric acid in the raw material.—O. R.

Potassium hydrogen phosphate; Process of producing ——. B. Peacock, Philadelphia, Pa., Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,046,327, Dec. 3, 1912.

Phosphate rock is heated to about 1500° C. with a mineral containing potassium oxide in such proportions as to form potassium pyrophosphate and various silicates, the mixture is quenched with water, and finally treated with steam under pressure, whereby potassium hydrogen phosphate is obtained.—O. R.

Alkali perborates; Treating mother-liquors formed in making ——. F. Hoyler, A. L. Gardner, and H. Foersterling, Perth Amboy, N.J., Assignors to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,046,594, Dec. 10, 1912.

Mother-liquors containing alkali carbonate are concentrated and a portion of the alkali carbonate is deposited and removed; the remaining liquor is diluted, and colemanite (calcium borate) is added to the solution with the formation of an alkali boron compound and an insoluble compound, which is removed.—O. R.

Calcium phosphamide; Process of producing ——. S. Peacock, Chicago, Ill., Assignor to The Southern Electro-Chemical Co., New York. U.S. Pat. 1,047,440, Dec. 17, 1912.

An alkaline-earth phosphide is heated in an atmosphere of nitrogen to a temperature at which reaction occurs; for example, calcium phosphide is heated to a temperature above 800° C., and under such conditions that the calcium phosphamide and nitride of phosphorus produced are recovered.—F. Sodn.

Phosphorus from mineral phosphates; Process of producing ——. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,047,864, Dec. 17, 1912.

An intimate mixture of natural phosphate, an acid flux, such as silica, and carbon is subjected to a temperature "above that practical to obtain in fuel fed furnaces," in order to bring it to a fluid condition and drive off substantially all the phosphorus in the form of gases. These gases are then mixed with air, and the phosphoric anhydride produced is treated with water to give phosphoric acid, the heat liberated being utilised in preheating the mixture before feeding it into the furnace. —F. Sodn.

Ferrous sulphate sludge; Recovery of sulphuric acid and iron oxide from ——. C. A. Weeks, Philadelphia, Pa. U.S. Pat. 1,048,247, Dec. 24, 1912.

Ferrous sulphate sludge is concentrated and forced in the form of spray into the cooler, outlet end of a heated furnace, from which it passes through zones of gradually increasing temperature, until it is entirely decomposed and the residue oxidised. The sulphuric acid vapours are removed from the outlet end of the furnace and absorbed by means of dilute sulphuric acid, until the latter cannot advantageously take up any more.—O. R.

Decolourising-carbon; The production of revivified —— to adapt it for re-use. A. Wynberg, Amsterdam. Eng. Pat. 19,357, Aug. 23, 1912.

The special product known as "decolourising carbon," after it has been used for purifying purposes, is again rendered serviceable for such purposes, by first freeing it from any portion of the bodies which it has been used to purify, and then treating (boiling) it with a solution of an alkali, or alkaline compound, or of an alkaline-earth. —W. C. H.

Ammonia; Manufacture of —— and catalytic agents for use in said manufacture. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,167, Dec. 14, 1911. Addition to Eng. Pat. 19,249, Aug. 16, 1910.

See Addition of May 24, 1912, to Fr. Pat. 425,099 of 1910; this J., 1912, 1125.—T. F. B.

Detergents [washing soda]; Process of manufacturing ——. W. R. Ormandy and J. W. Spensley, Manchester. U.S. Pat. 1,046,847, Dec. 10, 1912.

See Eng. Pat. 26,958 of 1911; preceding.—T. F. B.

Tin tetrachloride; Process for the manufacture of anhydrous —— from tin dioxide. F. Bräunlich, Brünn, Austria. Eng. Pat. 28,605, Dec. 19, 1911. Under Int. Conv., Dec. 20, 1910.

See U.S. Pat. 1,039,356 of 1912; this J., 1912, 1032.—T.F.B.

Oxygenated salts; Process of manufacturing ——. G. F. Jaubert, Paris. U.S. Pat. 1,047,645, Dec. 17, 1912.

See Fr. Pat. 399,720 of 1908; this J., 1909, 938.—T. F. B.

Ferrous to ferric solutions; Process of oxidising ——. A. McKechnie, Birmingham, and F. G. Beasley, Smethwick. U.S. Pat. 1,047,826, Dec. 17, 1912.

See Eng. Pat. 15,849 of 1911; this J., 1912, 780.—T. F. B.

Hydrogen; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6683, March 18, 1912.

See Fr. Pat. 440,780 of 1912; this J., 1912, 876.—T.F.B.

Treating furnace gases. U.S. Pat. 1,046,915. *See* X.

VIII.—GLASS; CERAMICS.

Baryta water [and lime water]: Action of —— on certain kinds of glass [containing sulphate]. C. Bunge. Z. anal. Chem., 1913, 52, 15—17.

A deposit of barium sulphate is formed when baryta water is stored in contact with glass containing sulphate, and such glass is also attacked by lime water.—F. Sodn.

Iron and titanium in ceramic materials; Determination of ——. R. Rieke and R. Betzel. Archiv Phys. Chem. des Glases u. keram. Massen (Sprechsaal), 1912, 1, 45—49.

THE effect of titanic oxide, TiO_2, always present in clays, is to increase the apparent content of iron when estimated by permanganate after reduction with zinc. This may be overcome by adding bismuth oxide after the reduction, or by reducing with stannous chloride or sulphurous acid instead of zinc. The iodometric estimation of iron by thiosulphate is recommended as a substitute for the permanganate method, the titanic oxide remaining unaffected. Titanic oxide is best estimated colorimetrically, by oxidation with hydrogen peroxide and dilute sulphuric acid to TiO_3. A convenient apparatus for the test is described. The titanic oxide content of various clays is given as follows: Zettlitz kaolin 0·36 per cent., washed china clay 0·14, washed Löthain clay 0·78, washed Halle clay 0·98, raw Halle clays 0·20—0·32, Grossalmerode plastic clay 2·42 per cent. The colour of a body after burning depends on the titanic oxide as well as on the iron content, and depends also on the subdivision of the iron and titanium compounds. A few well-known bodies are estimated to have the following amounts of iron and titanic oxide :—

	Burning colour.	Fe_2O_3 per cent.	TiO_2 per cent.
Berlin technical porcelain	Yellowish	0·83	0·31
Berlin table porcelain	Yellowish specks	0·71	0·26
Berlin Seger porcelain	Whitish	0·36	0·21
Meissen porcelain	White	0·45—0·69	0·15—0·11
Hutschenreuther (Hohenberg) ..	Very pure white	0·34	0·10

—H. H. S.

Waterglass sandstone. W. Pukall. Sprechsaal, 1913, **46**, 1—2.

BURTON'S recent conclusion that old Egyptian ware consists of a sandstone, and not of a clay, body was anticipated by the author in 1894 with regard to Persian tiles. A similar conclusion has been arrived at by Heinecke and Eisenlohr in their examination of the tiles in the Omar mosque at Jerusalem. The successful manufacture of these bodies to withstand European climates depends on the artificial reproduction of the richly alkaline, non-aluminous sandstone. The author recommends the mixture: fine sand 100 parts, soda crystals 9, water glass (sp. gr. 1·38) 12, water 4 parts by weight. The body is submitted to hydraulic pressure, and burnt at cone 05, undergoing a linear contraction of 4·7 per cent., which at higher temperatures increases to 8·8 per cent.—H. H. S.

PATENTS.

Ceramic furnaces and the like; Method of operating ——. F. Burgass, Chemnitz, Saxony. Eng. Pat. 7978, April 2, 1912.

AIR which has been passed through one or more furnaces for the purpose of cooling them when the firing operation is complete, is mixed with the waste gases issuing from furnaces that are being fired, and the heat generated by the combustion of this mixture is employed in some heat-exchange apparatus, *e.g.* a steam boiler.—W. C. H.

IX.—BUILDING MATERIALS.

Portland cement; Physical and chemical properties of ——. *Parts IV. and V.* W. C. Reibling and F. D. Reyes. Philippine J. Sci., 1912, 7, 135—194. (See also this J., 1911, 748, 1117.)

Part IV. deals with the strength of Portland cement, and the author discusses the characteristic fall in tensile strength shown by high testing cements made in rotary kilns. The fluctuations cannot be attributed to the different rates of hardening of the various constituents of the cement, nor do they appear to depend upon any available chemical information, but for greatest temporary efficiency it is necessary to grind finely and to burn at a high temperature. The endurance of early strength, the increase in strength with age, and the volume-constancy are greater, the less free lime or magnesia the indurated cement contains, it being always possible to obtain Portland cement of the desired quality by proper mixing, hard burning, and fine grinding. In *Part V.* the previous sections are recapitulated and conclusions are arrived at which may be summarised as follows: Volume-constancy should be assured by producing clinker which yields sound cement without aeration; the specific gravity of dried but not ignited cement should be not less than 3·10, unless the loss on ignition is less than 2 per cent.; the cement should leave a residue of not more than 5 per cent. on No. 100, and not more than 20 per cent. on No. 200 sieve; the average of at least four briquettes, representing at least two separate mixtures of the same sample, should be taken for each test of tensile strength, such tests to be considered final, except for results which are manifestly faulty. Great attention should be paid to the question of free lime, for the detection of which the calcium hydroxide-phenol microscopic test is again strongly recommended.—O. R.

Cements from blast-furnace slag. H. Kühl. Tonind.-Zeit., 1912, **36**, 1987—1989.

THE author distinguishes between three classes of cement obtained from blast-furnace slag: (1), *Puzzuolana cements*, which consist of ground slag, containing 42—52 per cent. of calcium oxide, mixed with sufficient slaked lime to bring the content of calcium oxide up to 63—66 per cent. The resulting cement is scarcely superior to a good, hydraulic lime, does not harden satisfactorily in the air, and possesses only feeble resistance to wear and tear. (2) *True Portland and iron-Portland cements*; in the former, slag replaces clay in the mixture of raw materials used for making Portland cement clinker. Any slags may be utilised, avoiding such as contain excessive proportions of magnesium and manganese. Iron-Portland cement consists of a mixture of 70 per cent. of Portland cement clinker and 30 per cent. of water-granulated blast-furnace slag. In strength and general properties iron-Portland cement is practically identical with Portland cement, and both materials possess the disadvantage of being highly susceptible to chemical action, especially the action of sulphuric acid and magnesium salts. (3) *Blast-furnace cements* are prepared by mixing rapidly cooled and granulated slags, which possess innate hydraulic properties, with a considerable quantity of plaster of Paris. Such cements contain only a negligible quantity of free lime and consequently offer great resistance to the action of acids and magnesium salts.—O. R.

Concrete; The effect of acids and oils on ——. W. L. Gadd. Engineering, 1913, 95, 20—21.

MINERAL acids, even when exceedingly dilute, dissolve the constituents of Portland cement. The destructive action of organic acids is less strong, but also takes place in consequence of the combination of any acid with the calcium hydroxide, which is liberated when cement is gauged with water. With regard to oils and fats, the author's experiments lead him to the conclusion that the addition of oil or fat of any kind to concrete has a weakening effect. Animal and vegetable oils have a direct action on green concrete and eventually destroy it, owing to the saponification of glycerides by calcium hydroxide. Indurated concrete is less attacked. Mineral oils, though saponification does not come into question, weaken mortar to some extent, even when only small proportions of oil are used, and the resulting concrete is less waterproof, in the author's opinion, than dense mortars in which the aggregates are properly graded to fill the voids. (Compare this J., 1911, 1213; 1912, 925.)—O. R.

Calcium sulphate; Gelatinous —— and the setting of plaster. Cavazzi. Gaz. chim. ital., 1912, 42, II., 626—632.

If about 0·5 grm. of very finely powdered calcium sulphate, which has been dehydrated at 130°—140° C., be well triturated in a glass mortar with 4 c.c. of water cooled to 15° C., the mixture after a short time acquires the appearance of starch paste; on examining a portion of the gelatinous mass microscopically, it is seen to change after a few minutes into a mass of minute crystals of calcium sulphate dihydrate. The gelatinous calcium sulphate can be obtained more easily by well mixing 0·5 grm. of plaster of Paris with 25 c.c. of cold water, filtering, and adding to the filtrate an equal volume of alcohol, preferably after first cooling both the solution and the alcohol with ice. A precipitate of gelatinous calcium sulphate is obtained in this way, which gradually changes into a mass of needle-shaped crystals. In the author's opinion on mixing plaster with water, this unstable gelatinous calcium sulphate, richer in water than the dihydrate, is first formed, and its dehydration and transformation into the crystalline dihydrate is the cause of the setting of the plaster.—A. S.

Patents.

Waterproofing cement substances and the like; Process of ——. A. E. Spooner, Renfrew, Ontario. Eng. Pat. 26,941, Dec. 1, 1911.

Cement and like substances are treated at the ordinary temperature with a mixture of wood-tar-creosote and a dry pigment, which is applied in a thin layer, so that the superficial pores of the cement are filled whilst the surface grain is left exposed.—O. R.

Marble, alabaster, and similar stones; Processes for increasin the transparency of ——. H. W. Engel, Hamburg, Germany. Eug. Pat. 28,361, Dec. 16, 1911.

The transparency of marble, alabaster, and similar materials is increased by about 150 per cent. by saturating the same with a solution of a resin, such as shellac, or of a cellulose preparation, such as celluloid, guncotton, or the like, in solvents, such as alcohol, ether, amyl acetate, benzene, or the like. In some cases it may be necessary to remove the impregnating substance again from the upper layers of the stone. To that end, the surface of the saturated stone is treated with magnesia or rubbed with a cloth previously dipped in one of the above-mentioned solvents, until the face of the stone is completely dry and free from the saturating medium.—O. R.

Building materials. M. Glaser, Sheffield. Eng. Pat. 9672, April 24, 1912.

A cellular or spongy material is first prepared by burning some kind of fuel mixed with a substantial amount of clay. The product is broken in pieces of suitable size, and mixed with clay to form bricks which are burned in the usual manner, and are light in weight and good heat insulators. The cellular product may also be mixed with cement to form concrete, or with lime for plastering purposes.
—W. C. H

Heat-insulating material and method for manufacturing same. C. H. Belknap, New York, Assignor to Armstrong Cork Co., Pittsburgh, Pa. U.S. Pat. 1,045,933, Dec. 3, 1912.

A heat-insulating, porous composition is prepared by incorporating diatomacious earth and asbestos with about 30 per cent. of lime and sufficient water to form a mixture which can readily be poured, shaping the same without compression, and driving off the excess of water, so as to leave a large number of air cells within the mass.—O. R.

Wood; Method of preserving —— from decay. W. F. Goltra, Cleveland, Ohio. U.S. Pat. 1,047,404, Dec. 17, 1912.

The timber is first treated directly with live steam, whereby the cells are ruptured and the sap and natural juices are liberated, and at the same time the pores are more or less filled with deposits from action of the steam. The timber is then dried, at first slowly in the open air, and, after being machined, in a closed oven till thoroughly dried and heated to a temperature suitable for receiving the preservative solution with which it is impregnated under pressure till saturated.—W. C. H.

Woods; Process of treating red-gum and other like ——. T. H. Sampson, New Orleans, La. U.S. Pat. 1,048,102, Dec. 24, 1912.

The wood is subjected—in a retort—to the action of saturated steam at atmospheric pressure until the condensed steam ceases to be charged with black, flocculent matter; the steam pressure is then raised to 20 lb. and the treatment continued until the whole of the charge attains the temperature due to this pressure. It is claimed that this treatment prevents sap-stain and stick rot when in pile, after-warping and twisting when dried, and causes the wood to become deeper red in colour.
—W. E. F. P.

Paints made with hydraulic cement and water. Eng. Pat. 18,095. *See* XIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast iron; Influence of sulphur on ——. H. I. Coe. Proc. Brit. Foundrymen's Assoc., 1911—1912, 78—95.

A series of test-bars was prepared from pure materials, and examined chemically, physically and metallographically. The results tend to show that: (a) With low silicon content a small amount of sulphur causes nearly all the carbon to pass into the combined form. With high silicon content, sulphur has a much less marked effect in this respect. (b) There appears to be a critical point, the position of which varies with the silicon content, and at which the effect of sulphur changes suddenly. (c) The addition of sulphur increases tenacity, transverse strength and hardness. Its influence is due partly to its effect on the condition of the carbon, partly to its modifying the dendritic character of the silicious irons. (d) Manganese neutralises the influence of sulphur on the condition of the carbon, and, in excess, eliminates sulphur by separation of manganese sulphide. Sulphur is most dangerous in irons low in silicon and manganese. These results were obtained in the absence of phosphorus, and would probably need modification if commercial pig iron were considered. Cast iron is desulphurised either by the addition of ferromanganese or by Saniter's process, which consists in mixing burnt lime and calcium chloride with the molten charge, producing calcium sulphide. For malleable cast iron, if the Réaumur process is employed, 0·2 to 0·4 per cent. of sulphur may be present, but for "Blackheart" castings 0·05 per cent. is the maximum permissible, as in the Réaumur process the annealing is of an oxidising nature, and the stability of the carbide as regards decomposition into iron and graphite is of little importance, while the production of "Blackheart" castings depends essentially on the decomposition of iron carbide. Sulphur, opposing this decomposition, is therefore harmful.—R. W. N.

[*Steel.*] *Slag enclosures.* W. Rosenhain. Report to the International Association for Testing Materials. Rev. Mét., 1912, 9, 998—1014. (See also this J., 1909, 1133).

The author's report is arranged under the following headings:—(1). *Nomenclature.* Objections are raised against the coined word "sonim" proposed by Hibbard (this J., 1911, 898), and the author prefers to retain the term "slag enclosures." (2). *Study of the constitution of the enclosures.* Reference is made to the work of Matweieff on the behaviour of enclosures with various reagents (this J., 1910, 822, 1385) and of Levy (J. Iron and Steel Inst., 1911, 3) on the properties of the sulphides and silicates of manganese and iron. The necessity of a careful study of the equilibrium diagram of the system, FeS—MnS, or better of the equilibria of a portion of the ternary system, Fe—Mn—S, corresponding to a narrow strip of the ternary triangle lying upon either side of the MnS—FeS line, is pointed out. (3). *Mode of formation of the enclosures and methods for their prevention.* In molten steel the enclosures are probably present in the form of liquid globules, and in order to minimise the quantity of enclosures it is necessary to devise conditions whereby the globules may coalesce so as to form a few large globules instead of very numerous small ones, and to give time for these globules to rise to the surface. (4). *Distribution of the enclosures in steel and their mechanical effects.* In this connection attention is directed especially to the work of Ziegler (this J., 1911, 1214), who has brought forward evidence in support of the view that the enclosures serve as nuclei upon which the α-iron crystallises when it is liberated from the austenite. (5). *Suggested directions for further investigation.* In addition to studies of the sulphides and silicates of iron and manganese and of mixtures of the same, the following objects of investigation are suggested: the solubility or otherwise of the oxides of iron in iron, and of sulphides and silicates of iron and manganese in steel at high temperatures; and the mechanical effects of enclosures.—A. S.

[*Iron and steel*]. *Carburising materials; The action of various commercial* ——. R. R. Abbott. Trans. Amer. Inst. Min. Eng., 1912, 1407—1456.

THE investigation was made to compare—as regards rapidity, depth and cost of carburisation—the more important of the solid materials commercially used for carburising steel by cementation. The steel employed contained: C, 0·205; P, 0·015; S, 0·025; Mn, 0·53; and Si, 0·04 per cent.; the experiments were conducted in covered white cast-iron pots, weighed pieces of the steel 0·75 in. long and 0·75 in. in diameter being embedded in the various carburising materials and maintained at temperatures of 1600° F. (871° C.), 1750° F. (954·5° C.) and 1900° F. (1038° C.) respectively for periods of from 1 to 10 hours. Of the 25 carburising materials employed in the tests, 4 consisted of pure bone charcoal, 2 of bone charcoal mixed with other carbonaceous matter, 1 of partly-roasted nuts, 1 of the husks and kernels of seeds or beans, and 2 of charred carbonaceous material heavily charged with chemicals; the remainder were generally composed of graphite, coal, coke or charcoal in admixture with various chemical substances. After withdrawal from the furnace, the pots were allowed to cool unopened and the pieces of steel washed, re-weighed, sawn in halves, polished, etched and examined microscopically. The total depth to which the carbon had penetrated in each case was measured by means of a micrometer eye-piece, as also were the thicknesses of the successive zones of carburisation, the percentage carbon contents of the latter being (A) above 0·9, (B) 0·9 (the eutectic ratio), (C) above 0·5, and (D) below 0·5 respectively; the percentage of carbon in the extreme outer surface of each test-piece was also determined. The results obtained are recorded in a series of 31 tables and 72 diagrams; the following table shows the total depths of carburisation attained, and the percentages of carbon at the surfaces of the test-pieces, after 1 and 10 hours' heating at the temperatures indicated:—

Temperature.	Time of carburisation.	Total depth of carburisation (inches).			Percentage of surface carbon.		
		Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.
1600° F. (871° C.) ..	1 hour 10 hours	0·0000 0·0084	0·0156 0·0576	0·0102 0·0427	0·20 0·20	0·90 1·10	0·836 0·878
1750° F. (954·5° C.) .	1 hour 10 hours	0·0120 0·0492	0·0312 0·0948	0·0192 0·0759	0·50 0·00	1·00 1·20	0·869 0·892
1900° F. (1038° C.) .	1 hour 10 hours	0·0180 0·0416	0·0432 0·1608	0·0333 0·1264	0·60 0·00	1·10 1·20	0·902 0·875

The relative costs and efficiencies of equal weights of the different materials, based upon (1) combination of a given weight of carbon, and (2) carburisation to a given depth, were calculated. Upon the first basis the minimum and maximum costs, at 1600° F. (871° C.), 1750° F. (954·5° C.) and 1900° F. (1038° C.) respectively, were as 1 : 11·71, 1 : 34·10 and 1 : 32·40; while upon the second basis the corresponding figures were 1 : 10·10, 1 : 34·75 and 1 : 44·75. The maximum and minimum efficiencies at the same temperatures were as 100 : 12·2, 100 : 13·9 and 100 : 16·4 respectively, calculated upon the first basis, and 100 : 11·0, 100 : 19·3 and 100 : 22·8 upon the second. The selection of carburising materials for specific purposes is regarded as a matter of considerable importance; and preliminary testing on the lines indicated is advocated as a means to greater efficiency.—W. E. F. P.

Steel castings and the effect of heat-treatment. H. Brearley. Proc. Brit. Foundrymen's Assoc., 1911—1912, 237—252.

STEEL castings slowly cooled are coarsely crystalline though generally an aggregation not of crystals but of crystalline grains. In commercial castings weighing several tons, a single crystal may measure over ½ in. across, whereas after annealing, the fractured casting resembles well-forged or rolled material. The fragility of unannealed steel castings is due to the ease of fracture along the intercrystalline lines of weakness. Annealing breaks down the large intercrystalline boundaries. After this operation, the fractured surface is no longer distinguished in appearance from that of a cogged billet. Castings often superficially absorb carbon from the moulds, and this cementation is dangerous, as the brittle skin thus formed is favourable to the occurrence of cracks. Annealing decarburises this surface, and the presence or absence of carbon in the surface-layer is an indication as to whether the casting has been annealed or not. Annealing at very high temperatures restores the primitive triangular crystallisation to some extent. Slag is most harmful when it forms a film between the crystalline grains. "Silico-sulphide" streaks or films persist after annealing and are a source of much weakness. Tantalum and boron have the effect of forming brittle envelopes around the primary crystals. Boron to the extent only of 0·02 per cent. suffices to form visible films which persist after annealing at 1300° C. Shrinkage cavities, apart from the "pipe," are almost invariably present. "Pulling," in the foundry sense of the word, may be due to shrinkage and normal contraction, or else to expansion at the critical temperatures. The thinner portions of a casting will cool quickest, with the result that they will be subjected to severe strains as the thicker portions in turn reach the critical temperatures.—R. W. N.

Manganese dioxide; Reduction of —— *by nitrous acid, and the application of this reaction to the determination of phosphorus in iron and steel without separating the silicon.* E. R. E. Müller. Chem.-Zeit., 1912, 36, 1490.

THE author finds that the sodium peroxide used in his method (this J., 1911, 1315), can be conveniently replaced by nitrous acid. After boiling the solution with permanganate, the beaker is removed from the hot plate, and 0·5 c.c. of alcohol and 1 c.c. of 10 per cent. sodium nitrite are added. On gently shaking the manganese dioxide dissolves quite easily, and after adding 1 c.c. of concentrated ammonia the phosphorus may be precipitated with ammonium molybdate in the usual way.—W. H. P.

Iron, nickel, manganese, and copper; Quaternary alloys of ——. N. Parravano. Gaz. chim. ital., 1912, **42**, II., 589—609.

The author has examined previously the ternary systems: Fe-Ni-Mn, Fe-Ni-Cu, Fe-Mn-Cu, and Ni-Mn-Cu (this J., 1912, 1081, 1131) and he now gives the results of a theoretical and experimental study of the quaternary system, Fe-Ni-Mn-Cu. Eighty-four alloys were examined belonging to series (containing respectively 10, 20, 30, 40, 50, 60, and 70 per cent. of manganese) corresponding to sections (parallel to the base) of a tetrahedron of which the corners of the triangular base represent iron, nickel, and copper, whilst the fourth corner represents manganese. The experimental results are tabulated and a series of seven duplicate triangular diagrams showing the temperatures of initial and complete solidification of the alloys is given. The micro-structure of the quaternary alloys is substantially that which would be expected from the study of the ternary component systems. Photomicrographs of alloys of the following composition are given: (1) Fe 10, Ni 60, Mn 10, and Cu 20 per cent.; (2) Fe 50, Ni 20, Mn 10, and Cu 20 per cent.; (3) Fe 20, Ni 30, Mn 10, and Cu 40 per cent.; (4) Fe 50, Ni 10, Mn 20, and Cu 20 per cent.; (5) Fe 20, Ni 20, Mn 30, and Cu 30 per cent.; and (6) Fe 10, Ni 10, Mn 70, and Cu 10 per cent.—A. S.

Ferrozirconium; Analysis of ——. M. Wunder and B. Jeanneret. Z. anal. Chem., 1913, **52**, 99—101.

The authors uphold the accuracy of their method (this J., 1911, 1412), in face of the criticism of Weiss and Trautmann (Z. anal. Chem., 1912, **51**, 303). They point out that hardened filters should be used.—F. Sodn.

Gold; Condition of —— *in quartz.* P. P. von Weimarn. Z. Chem. Ind. Kolloide, 1912, **11**, 287—290.

On mixing together solutions of sodium silicate and sodium aurichloride, the mixture, at first colourless, slowly becomes pink, then lilac, and finally blue, and on standing exposed to the air, a precipitate appears at the surface, which is at first dark blue, but as it dries, becomes first black, and then usually golden. These results show that if gold silicate is formed, it slowly undergoes spontaneous "reduction" with formation of colloidal gold, which on precipitation and drying, changes gradually into ordinary metallic gold. The conclusion drawn is that the presence of a reducing agent is not necessary for the separation of metallic gold under the experimental conditions of Hatschek and Simon (this J., 1912, 439), namely in a dispersion medium containing silicic acid and its salts in a highly disperse condition. It is considered probable that in the formation of auriferous quartz veins the simultaneous separation of quartz crystals and gold silicate (which gradually undergoes spontaneous "reduction") plays a part. The author states also that he has obtained crystals of silver of the ordinary form from a silver sol on prolonged standing.—A. S.

Silver-zinc equilibrium; The ——. H. C. H. Carpenter and W. Whiteley. *Appendix on the copper-zinc, silver-zinc, and silver cadmium equilibria.* H. C. H. Carpenter. Int. Zeits. Metallogr., 1912, **3**, 145—175. (See also this J., 1912, 133, 926, 927.)

In determining the equilibrium diagram of the silver-zinc system under carefully chosen conditions, the phases observed were:—α, between 100 and 62·7 atoms per cent. of silver, stable at the ordinary temperature; β, existing only above 264° C. and undergoing at this temperature an eutectoid inversion to $\alpha + \gamma$; γ, between 40 and 37·3 atoms per cent. of silver, stable at the ordinary temperature. (At 40 per cent. this is the pure compound Ag_2Zn_3); v, between 29 and 14·3 atoms per cent. of silver, stable at the ordinary temperature; ϵ, existing only above 300° C. (an approximation); η, between 1 and 0 atoms per cent. of silver, stable at the ordinary temperature. (1 per cent. is the maximum solubility of silver in zinc.) The eutectoid inversion was found to extend from 62·7 to 40 atoms per cent. of silver, the eutectoid composition being about 53 atoms per cent. The existence of the compound, Ag_2Zn_5, was indicated but not definitely established. From 0 to 60 atoms per cent. of zinc the diagram was very similar to that of the copper-zinc system over the same concentration. In the appendix, the close relationship between the copper-zinc, silver-zinc, and silver-cadmium equilibria is emphasised and discussed, and the suggestion made that the character of the α and β phases, between 0 and 60 atoms per cent. of zinc or cadmium, is determined by the compound X_2Y_3 (X representing copper or silver and Y zinc or cadmium). The bearing of this on the general nature of solid solutions is briefly considered.—W. E. F. P.

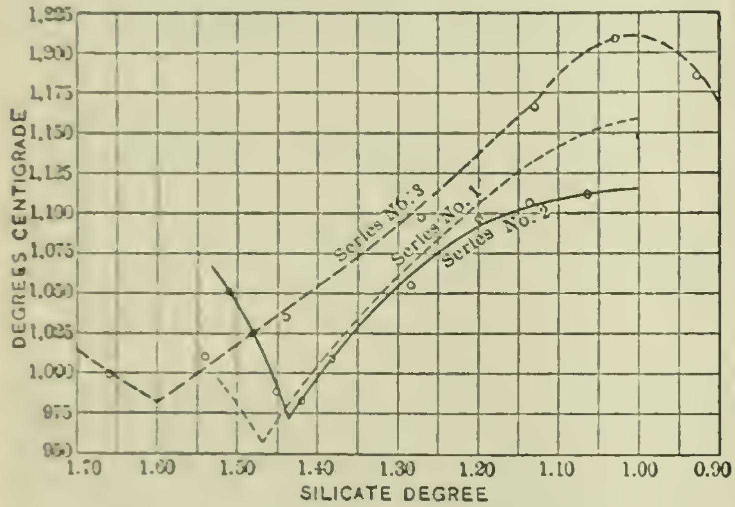
Copper-slags; The constitution and melting-points of a series of ——. C. H. Fulton. Trans. Amer. Inst. Min. Eng., 1912, 1457—1486.

With the object of determining the effect of increasing proportions of lime upon the melting points of copper-slags and ascertaining the limits of the silica-lime ratio permissible for practical reverberatory smelting, three series of slags were investigated (one olivine-augite, and two melilite-augite series) in each of which the iron-alumina ratio remained constant while the lime varied with the silicate degree. A "basal" slag for each series was selected or prepared, and from one weighed quantity of this (contained in a platinum crucible heated by means of an electric resistance furnace) all the members of the series were consecutively produced—by successive additions of limestone in weighed quantities—and examined. The contents of the crucible were finally weighed and analysed and from the data obtained the composition of each member of the series was calculated. The composition and melting point of each of the slags investigated is shown in the following table:—

SiO_2.	Percentage composition.				Silicate degree.	M. pt. (°C.)
	FeO.	CaO.	Al_2O_3.	Total.		
			Series I.			
42·65	36·12	6·20	11·30	96·37	1·40	979
40·66	34·33	10·80	10·70	96·49	1·28	1011
38·80	32·60	14·95	10·02	96·37	1·19	1060
36·90	31·10	18·52	9·75	96·27	1·09	1081
35·40	29·65	22·12	9·35	96·52	1·02	1137
33·92	28·48	25·14	9·00	96·54	0·96	1151
			Series II.			
44·50	38·20	5·10	11·85	99·65	1·51	1050
44·00	37·80	6·14	11·73	99·67	1·48	1025
43·50	37·30	7·15	11·60	99·55	1·45	988
43·20	37·00	8·16	11·51	99·87	1·42	982
42·25	36·20	10·04	11·23	99·72	1·38	1010
40·50	34·65	13·60	10·75	99·50	1·28	1054
38·90	33·25	16·80	10·40	99·35	1·20	1091
37·55	32·10	19·90	10·05	99·60	1·13	1103
36·20	30·807	22·56	9·67	99·30	1·06	1107
			Series III.			
44·3	43·10	6·80	4·85	99·05	1·66	1000
42·65	41·51	10·29	4·69	99·14	1·54	1010
41·11	40·01	13·53	4·51	99·16	1·44	1034
38·34	37·22	19·35	4·21	99·12	1·27	1097
35·92	34·97	24·13	3·94	99·26	1·13	1167
33·79	32·89	28·92	3·71	99·31	1·03	1207
31·90	31·05	32·90	3·50	99·35	0·934	1186

The melting-point curves—plotted on the basis of temperature and silicate degree (each value of the latter representing a certain mixture of two minerals, one an orthosilicate and the other a metasilicate)—indicated that the three series were of a type in which an eutectic occurs.

The respective silicate degrees of the eutectics of series III. and II. were found to be about 1·62 and 1·44, which values it is stated, correspond to those deduced by Vogt for a certain augite-olivine series and a certain augite-melilite series respectively. Remarking upon the low analytical totals (96·5) obtained in series I., the author states that this is probably due to the presence of magnetite; the probability of the eutectic having been missed during the investigation of this series is also mentioned, and on these assumptions the melting-point curve was re-plotted, the result, together with the curves of series II. and III. being shown in the accompanying figure.



Those slags having a silicate degree between 1·4 and 1·65 were found to melt at the lowest temperatures. With slag of a given silicate degree within the range of 1·70 and 1·00, the replacement of iron and lime by some alumina, up to 11 per cent., was found to lower the m. pt., while the replacement of iron by lime (in slags of which the latter was already a constituent) was found to raise the melting point somowhat. It is stated that although slags of higher silicate degree than those investigated have comparatively low temperatures of formation and melting points, the amount of superheating necessary to render them sufficiently fluid for reverberatory practice increases rapidly as the silicate degree is raised and is greatly accentuated by an increase in the proportion of alumina, especially if the latter already exceeds 5 or 6 per cent. In the author's opinion, slags approaching the bisilicate composition could be successfully employed in oil-fired or similar furnaces of ample temperature reserve.—W. E. F. P.

Copper; Behariour of ——, under the impact bending test as applied to nicked bars. H. Baucke. Int. Zeits. Metallogr., 1912, 3, 195—207

The results of the investigation are summarised as follows: The resilience (specific work of fracture) of cast copper is low but is increased by forging, attaining a maximum—which afterwards remains constant—when the original thickness has been reduced to one-fifth. The S.F. (resilience) value for copper free from oxygen is 28—30 kilos., longitudinal, and 26—28 kilos., transverse, the the corresponding values for copper containing oxygen being 8—14 and 3—10 kilos. respectively; practically, the resilience value is dependent upon the presence or absence of oxygen (and, to a much smaller degree, bismuth) in the metal. Cold-drawn copper can be annealed at 200° C., the S.F. value increasing with the annealing temperature and attaining a maximum at 700° C. The S.F. value is lowered by overheating, especially when the metal is forged 'and heated in contact with fire gases. Hydrogen has no effect on copper free from oxygen, but during the reduction of copper containing oxygen the S.F. value of the metal falls considerably on account of the "rending" of the metal. The author considers that as a means of distinguishing between oxygeniferous and other kinds of copper the Frémont impact bending test on nicked bars is entirely satisfactory.—W. E. F. P.

[Bronze] Brass founding; Modern ——. H. S. Primrose. Proc. Brit. Foundrymen's Assoc., 1911—1912, 119—133.

An outline is given of the principles guiding the management of a modern foundry, dealing with Admiralty gunmetal or bronze (Cu 88, Sn 10, Zn 2 per cent.). The arrangement of shops, furnaces, and plant is discussed, also the methods of control, physical and chemical. Stress is laid on the value of laboratory tests, both chemical and metallographic. The specification of Admiralty gunmetal is given as follows: "*Composition.* Tin, 10 per cent.; zinc (max.), 2 per cent.; copper, remainder. Impurities nil. All copper is to be of approved quality. A deviation of more than 1 per cent. from the specified composition is sufficient to condemn the material. *Tensile tests.* The test-pieces taken from the casting have to stand the following tests: Ultimate strength not less than 14 tons per square inch; elongation on 2 inches not less than 7·5 per cent. *General:* The castings to be sound, clean, and free from blow-holes."—R. W. N.

Copper-zinc-nickel alloys. L. Guillet. Comptes rend., 1912, **155**, 1512—1514.

The author has studied the effect of adding nickel to brass, in continuation of his previous work on special brasses (see this J., 1906, 540, 813). He finds that the "coefficient of equivalence" of nickel is about 1·1, *e.g.*, an alloy containing: Cu 56·7, Zn 39·7, and Ni 3·4 per cent. behaves very like a simple brass containing {56·7 + 1·1 (3·4)} = 60·4 per cent. of copper. The addition of nickel therefore, within certain limits, improves the mechanical properties of brass.—W. H. P.

Zinc ores; The rôle of calcium and barium sulphates in the reduction of ——. E. Prost and M. Ubaghs. Bull. Soc. Chim. Belg., 1912, **26**, 532—541.

The authors remark upon the frequency with which calcium and barium sulphates occur in zinc ores and quote the conclusions of Mostowitsch (this J., 1909, 886; 1912, 76) and Blenau as to the influence of these compounds upon the reduction process. Blenau, working under the direction of one of the authors, found that only in the presence of silica was zinc retained by the residues from the distillation of mixtures of rich, dead-roasted blende with calcium or barium sulphate and wood charcoal; but the form in which the residual zinc occurred (although apparently as sulphide) was not conclusively shown. In the present investigation, pure zinc oxide was employed, with retort graphite (gas-carbon) as reducing agent; distillation experiments were conducted on similar lines to those of Blenau—the charges being maintained for six hours at a temperature between 1200° and 1250° C.—and similar results were obtained. Additional tests were made, however, in which the mixture of zinc oxide and carbon was distilled with large proportions of (1) silica alone and (2) silica and lime together; no zinc was found in the residues from these mixtures and the authors conclude that the zinc retained by the residues from the distillation of mixtures containing calcium or barium sulphate and silica is present as sulphide formed by the agency of the sulphur dioxide liberated by the interaction of the alkaline-earth sulphate and silica. This view was confirmed by subsequent distillation experiments (conducted in tubes) in which the formation of crystals of zinc sulphide from sulphur dioxide and zinc vapour in the presence of carbon (graphite) was demonstrated, the sulphur dioxide and zinc vapour being produced simultaneously in adjoining parts of the same tube—the former by the action of quartz upon calcium or barium sulphate and the latter by the reduction of zinc oxide with gas-carbon.—W. E. F. P.

Vanadium; Preparation of metallic ——. III. W. Prandtl and H. Manz. Z. anorg. Chem., 1912, 79, 209—222. (See this J., 1909, 1202 and 1910, 1312.)

Further experiments on the preparation of metallic vanadium by the alumino-thermic method, from the pentoxide and trioxide respectively, with various added substances and at different reaction temperatures, have led to no improvement in the purity of the product. The effect of added calcium fluoride appears to be due partly to its action as a flux and partly to the formation of a more readily reducible vanadium oxyfluoride, but aluminium alone is capable of effecting the reduction. The metal obtained by Ruff and Martin (this J., 1912, 134) is considered to be no purer than that prepared by the authors; the difference lies in the presentation of results. Experiments on the reduction of vanadium trichloride by means of sodium have given a product containing 96 per cent. of vanadium. The authors have been unsuccessful in attempts to prepare vanadium hydride; the product obtained by the method of Muthmann, Weiss, and Riedelbauch (this J., 1907, 1011) is shown to contain nitride and oxide, but less than 0·2 per cent. of hydrogen.—F. Sodn.

Hardness of metals ; Formation of twin crystals by quenching, and its influence upon the ——. C. A. Edwards. Int. Zeits. Metallogr., 1912, 3, 179—194.

The results of the investigation are summarised as follows:—The characteristic dark and light acicular structure of quenched aluminium-copper alloys containing from about 9 to 16 per cent. of aluminium is due to the angles at which the light is reflected from the respective areas and not to constitutional differences between the latter; the angles of reflection are entirely dependent upon the orientation of the crystals (or crystal facets) of which the alloy is composed, the varying orientation of the crystal grains of quenched specimens (which must have been uniform at the quenching temperature) being due to prolific twinning. Twinning being caused by the bodily slipping or twisting, on the cleavage planes, of a layer or layers of the small primary crystals of which the crystal grains are formed (without the occurrence of any molecular disturbance or rearrangement), it would appear that the pressures—from the action of which the twinning results—are brought to bear directly upon the crystalline layers and not upon the molecules. The fact that twinning is produced by quenching indicates that mechanical pressures are developed during the latter operation, and this view is supported by the fact that the sp. gr. of the metal is at the same time increased; the initial pressures brought into action by quenching are doubtless of varying magnitude at different parts of a crystal and twinning is probably the natural means by which these pressures are equalised. There is every reason to suppose that, at the surfaces of slip upon which twinning or internal movement occurs, Beilby's vitreous phase is produced which, under the conditions of quenching, is prevented from recrystallising; in the author's opinion the existence of the vitreous layers is definitely indicated by the slip lines observed in the twin crystals examined. In view of the foregoing conclusions the following theory is advanced in explanation of the hardening of metals by quenching:—The decomposition of the solid solution into two constituents, which occurs by slow cooling, is prevented by rapid cooling, the heat normally evolved during the change being retained in the latent condition in the quenched specimen. This evolution of heat is suppressed by at least its equivalent amount of energy in one form or another, the latter being probably caused by the molecular contraction of the mass. A further absorption of energy occurs by the sudden contraction of the outer shell of the specimen, with the result that internal crystalline motion, or twinning of the crystals, is produced. Twinning of this kind results in the formation of Beilby's hard, vitreous phase at the surfaces of slip, the rapidity of cooling preventing this phase from reverting to the more stable crystalline condition.—W. E. F. P.

Mineral production of the United Kingdom in 1911. Board of Trade J., Jan. 9, 1913. [T.R.]

The following table, showing the quantity and value (definitive figures) of the minerals produced in the United Kingdom in 1911, as compared with 1910, is taken from the General Report with Statistics on Mines and Quarries, 1911, Part III.

Description of Mineral.	1910.		1911.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shale	6,674	667	10,516	1,051
Arsenical pyrites	944	876	1,170	1,290
Arsenic	2,153	17,602	2,144	14,413
Barium (compounds)	44.667	43.909	44.118	40.386
Bauxite	3,792	882	6,007	1,294
Bog ore	2,562	640	2,700	540
Chalk	4,631,432	183.057	4,884,020	199,573
Chert, flint, etc.	73,904	12,795	71,577	14.074
Clay and shale	14,090,320	1,761,410	13,835,038	1.758.466
Coal	264,433,028	108,377,567	271,891,899	110,783,682
Copper ore	3,986	14,922	3,135	14.620
Copper precipitate	192	5,980	127	3.548
Fluorspar	61,621	20,678	55,231	18,941
Gold ore	6,154	7,509	2,752	992
Gravel and sand	2,199,852	164,281	2,275,177	172,214
Gypsum	255,559	98,242	276,684	104,221
Igneous rocks	6,608,705	1,263,410	6,524,696	1,241,967
Iron ore	15,226,015*	4,022,269	15,519,424*	4,035,893
Iron pyrites	9,380	4,018	10,114	4,237
Lead ore	28,534	232,346	23,910	219,314
Lignite	—	—	120	60
Limestone (other than chalk)	12,512,736	1,296,169	12,183,355	1,268,853
Manganese ore	5,467	4,673	4,987	3,997
Mica	21,743	9,341	25,335	8,748
Natural gas ... cubic feet	262,000	Not stated.	221,400	Not stated.
Ochre, umber, etc.	16,515	15,377	14,585	13,732
Oil shale	3,130,280	860,827	3,116,803	857,120
Salt	2,050,630	581,504	2,082,688	601,324
Sandstone	4,386,281	1,300,705	4,044,907	1,194,420
Slate	416,324	1,063,994	425,125	1,050,667
Sulphate of strontia	4,761	3,570	5,869	4,400
Tin ore (dressed)	7,572	655,871	7,746	837,957
Uranium ore	76	Not stated.	67	Not stated.
Wolfram ore	274	27,093†	266	24,629†
Zinc ore	11,238	53,398	17,652	82,690
Total values	—	122,105,582	—	124,579,313

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* Exclusive of 395 tons in 1910 and 372 tons in 1911 of micaceous iron ore used for paint, and placed under the heading "Ochre, umber, etc."

† Value of 254 tons only for 1910 and 251 tons only for 1911.

The increase in the total value of the minerals raised during the year is mainly due to the increased output of coal. The average price of coal was 8s. 1·79d. per ton in 1911, as compared with 8s. 2·36d. in 1910.

The quantity of coal exported, exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade, was 64,599,266 tons, or 2 million tons more than that for 1910. France received over 10¼ million tons, Italy nearly 9¼ million tons, Germany nearly 9 million tons, Sweden nearly 4 million tons, Russia nearly 3½ million, Argentina over 3¼ million, Egypt and Spain over 3 million each, Denmark over ¾ million, and the Netherlands nearly 2¼ million. Adding the 3,217,927 tons exported in the form of coke and manufactured fuel, and the 19,264,189 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 87,081,382 tons, as against 84,541,678 tons in 1910.

The amount of coal remaining for home consumption was 184,810,517 tons, or 4·079 tons per head of the population. 36,096,857 tons were used in the manufacture of coke and briquettes, and 19,218,491 tons in the blast furnace for the manufacture of pig iron, as against 36,487,218 tons and 20,485,514 tons respectively in the previous year.

The iron ore yielded 5,020,510 tons of iron, or more than one-half of the total quantity of pig iron made in this country.

Mercury imports and exports; British ——. A. S. Pickering. Jan., 1913. [T.R.]

	Imports. Bottles.	Exports. Bottles.
1912	47,261	32,240
1911	46,547	31,438
1910	44,595	24,748
1909	43,163	22,050
1907	39,448	29,465
1905	34,034	21,330
1903	34,886	18,846

The estimated consumption in the United Kingdom is 14,000 bottles per annum.

Electrolytic extraction of copper ore in Norway. C. A. Holder. Min. and Eng. World, Dec. 14, 1912.

For several months a company at Aamdal, Norway, has been successfully extracting copper from the crude ore by the Hybinette electrolytic process. The Aamdal works have proved so successful that plans are now under way for increasing the output to 3 tons of copper per day. The treatment, which is done at the mine, consists in leaching the crushed ore with a solution of sulphuric acid; a strong current of electricity is then passed through this solution and the pure copper is precipitated. Experiments with copper pyrites from the Orkla and Sulitjelma mines have been equally successful, and as a result will probably be treated by the Hybinette process in the future. The ores were formerly shipped to Germany and Sweden, respectively, owing to their refractory character and to the lack of proper Norwegian reduction works, but of late the Sulitjelma Co. has not been able to mine with any profit owing to the costs of transportation.

"*Strain disease*"; *So-called* —— *of metals.* E. B. Wolff. Z. Elektrochem., 1913, **19**, 19—23.

The author argues that the assumptions underlying the usual explanation of the "strain disease" of tin and other metals (see this J., 1910, 94, 281) are not beyond question. When a smooth polished piece of metal is treated with acid, and takes up the appearance known as "*moiré metallique*," it is usually assumed that a change in the whole mass has taken place and that the previously metastable deformed metal has been stabilised. The author believes however that the process consists only in the dissolving away of a thin outer layer and the exposure of the more coarsely crystalline mass in the interior. This view is supported by the fact that thin tinfoil will not show the "*moiré metallique*" in its normal condition. If heated on a glass plate till just melted and then allowed to cool, the foil although apparently unchanged readily shows the "*moiré*" with the etching liquid. The view that "stable" metal of the above type (*i.e.* produced by etching) can "infect" deformed metal is not supported by many of the author's experiments.
—W. H. P.

Patents.

Steel turnings, shavings, and the like; Treatment of ——. Vickers Ltd., W. Clark, and J. H. S. Dickenson, Sheffield. Eng. Pat. 28,057, Dec. 13, 1911.

The turnings are melted down with one-fourth of their weight of spiegel containing 20 per cent. of manganese, in a basic-lined cupola or similar furnace. The flux, added with the coke, may consist of limestone or burnt lime, sufficient being used to ensure the formation of a highly basic slag capable of acting on the metal and removing the sulphur. The product is a hard white iron containing as a rule very little sulphur, about 4 per cent. of carbon, and 2 per cent. of manganese, and is a suitable raw material for steel making. Practically the whole of the nickel is recovered from nickel-steel turnings.—T. St.

Steel or wrought iron; Coating ——, *with chilled cast-iron.* E. L. Davies, Clydach, Wales. Eng. Pat. 28,184, Dec. 14, 1911.

The wrought iron or steel body, heated to a temperature of about 1100° C., and coated with a thin film of flux (fusible silicate), is placed in a chill mould; the latter having the required space between the chills and the iron or steel body, the molten cast-iron is poured into this space through suitable runners or "gits."—W. E. F. P.

Iron; Manufacture of —— *from scrap metal.* H. W. Lake, London. From Sellers Manufacturing Co., Chicago, Ill., U.S.A. Eng. Pat. 28,279, Dec. 15, 1911.

Scrap iron, low-carbon steel, etc., is fed into the upper end of a cylindrical rotary heater, whose axis is suitably inclined to the horizontal. Alternatively the axis may be horizontal, and the heater conical in shape. At the lower end, nearer the furnace, is an enlarged welding chamber, so arranged that the blast of hot gases from the furnace is directed downwards. The charge in the welding chamber is thus subjected to the most intense heat. The heater is mounted on a turn-table, and when it is turned out of register, the flue at the upper end, and the furnace at the lower, are automatically shut off, whilst at the same time the rotation need not be stopped. Before charging, the refractory lining of the heater is brought throughout to a white heat by means of a strong blast from the furnace. The charge feeds down towards the welding chamber, the larger pieces arriving first. These should have been heated to welding temperature when the smaller pieces arrive, so that the operation may then be concluded as quickly as possible, and loss by burning of the smaller pieces avoided. When the whole of the charge has entered the welding chamber the heater is rotated more rapidly. The charge thus becomes welded together to form a relatively homogeneous ball or mass of wrought iron. This is then put through a squeezer or otherwise treated, the product being suitable for being formed directly into billets. During the feeding the rotation may be made intermittent to suit the character of a particular charge. Imperfect "balling" is avoided by adding a proportion of finely divided wrought iron to the charge. During the passage through the heater, the rubbing of the pieces of scrap against each other dislodges scale, etc., which is carried away by the strong blast. It is claimed that a relatively solid ball of metal weighing 500 lb. or more can be formed from cold scrap at the rate of one ball every 10 minutes, and with a fuel consumption of 500 to 700 lb. of coal to a ton of metal. The mechanical arrangements are described in great detail, and illustrated by 13 drawings.—T. St.

Steels; Manufacture of silicon or other ——. C. P. Williams, Wrexham, and The Brymbo Steel Co., Ltd., Brymbo. Eng. Pat. 1293, Jan. 16, 1912.

A known amount of melted ferro-silicon is run into a ladle of known capacity, and the ladle is then filled with steel from a basic open-hearth furnace. The furnace capacity being greater than that of the ladle, the latter receives steel entirely free from slag. The remaining steel and slag are run into another ladle on a casting carriage in the usual way. The first ladle is carried to another empty ladle fitted with stoppers and nozzles, and the steel poured into this empty ladle. This pouring brings about a vigorous action, causing uniform mixing and giving a steel regular in quality. The ingots are now cast from this ladle in the usual manner.—T. St.

Cast-iron; Manufacture of vanadium ——. F. W. Stickle, Newington, Conn. U.S. Pat. 1,046,232, Dec. 3, 1912.

The required quantity of vanadium is enclosed in a receptacle (the fusing point of which is about the same as that of the iron under treatment) and placed in the lower part of the cupola, the charge of iron being then added and melted.—W. E. F. P.

Furnaces; Electric [smelting] ——. N. Testrup, London, and T. Rigby, Dumfries, Scotland. Eng. Pat. 19,923, Sept. 7, 1911.

The furnace is of the shaft type, the gases being partly withdrawn at a point intermediate of the extremities of the shaft, and returned to the crucible. The gases thus returned are free from components, such as water vapour, which exercise a disturbing effect upon the reactions in the crucible. Above the point of withdrawal of the gases, means are arranged for preheating the charge by combustion of the shaft gases.—B. N.

Sintering-furnace. M. H. Kauffman, Denver, Colo. U.S. Pat. 1,045,853, Dec. 3, 1912.

The apparatus consists of a hood or chamber enclosing a number of superposed, removable pans provided with perforated bottoms and adapted to contain the material to be sintered. Means are provided for heating the latter and for the admission of compressed air to the bottom of the chamber, the air current passing successively through the layers of heated material to a flue at the top of the apparatus.—W. E. F. P.

Furnace; Metal-melting ——. C. D. McCourt, London, Assignor to Radiant Heating, Ltd., Leeds. U.S. Pat. 1,046,828, Dec. 10, 1912.

The apparatus consists of an enclosed melting-chamber provided with one or more vertical heating-tubes and with a collecting-chamber having a fusible plug which is released automatically for facilitating the discharge of the molten metal. The heating-tubes are filled with coarsely granular, refractory material, in the interstices of which the surface combustion of an explosive gaseous mixture is maintained, the mixture being injected into the tubes at a velocity greater than that of back-firing. Access to the heating-tubes is obtained by means of a door in the hood which covers the melting-chamber; and the hood communicates with an inclined exhaust flue which also serves as a shoot for charging purposes.—W. E. F. P.

Furnace; Reverberatory ——. J. B. F. Herreshof, Assignor to Nichols Copper Co., New York. U. S. Pat. 1,047,521, Dec. 17, 1912.

In a reverberatory furnace for refining copper the foundation of the furnace is protected from attack by the charge by means of two series of closely laid, parallel cooling-pipes arranged one above the other, the members of one series being placed longitudinally and those of the other transversely. The pipes are interposed between the foundation and the layer of bricks by which the furnace bed (sand) is supported.—W. E. F. P.

Zinc-furnace. G. Londress and W. Worley, Grafton, W. Va. U.S. Pat. 1,048,420, Dec. 24, 1912.

In a gas-fired zinc-furnace of the type in which two series of inclined, superposed retorts are disposed on opposite sides, the walls supporting the retorts consist of vertical buck-stays; some of the latter are provided with ribs on opposite sides, each rib having a recess, while others have short, vertical ribs on one side and are provided on this side with supporting lugs at their lower ends. Means are also provided by which the stays having short vertical ribs—over which latter grooved hydrocarbon-burner casings are adapted to slide—form interlocking connections with those having recessed ribs.—W. E. F. P.

Reducing soluble metal salts for the purpose of subsequently electrolytically depositing the metals present in said salts. P. Marino, London. Eng. Pat. 24,562, Nov. 4, 1911.

The electrolyte, for use in the deposition of a metal or metallic alloy, is prepared from an aqueous solution of the salt or salts of the metal or metals to be deposited, to which is added an organic reducing agent, such as magnesium boro-citrate. The mixture is heated, and, when cold, an organic reducing agent, such as gluco-citric or gluco-tartaric acid, is added " to complete the dissociation of the salts " in solution.—B. N.

Coatings upon metal sheets; Production of non-porous electro-deposited ——. B. Löwy and F. Müller, Vienna. Eng. Pat. 2423, Jan. 30, 1912.

Sheets of metal, covered with electro-deposited tin or tin alloy, are rendered non-porous and capable of taking a high polish, by heating the sheets to or above the temperature at which the coating melts. This is done by plunging the sheets into a bath containing a carbon compound, which will not react with the coating, such as vaseline, kerosene, paraffin, fats or oils, with the addition of organic or inorganic salts. The sheets are then passed under smoothing or polishing devices whilst the coating is in a molten or flowing condition.—B. N.

Smelting operations [with wet carbonised peat]. N. Testrup, London, and T. Rigby, Dumfries, Scotland. Eng. Pat. 27,150, Sept. 7, 1911.

Claim is made for the use of press cakes or briquettes of wet carbonised peat (see Eng. Pats. 6041 of 1910 and 17,610 of 1911; this J., 1911, 883; 1912, 1171) in smelting operations. In the reduction of iron ore, for example, the peat becomes coked as it descends in the shaft, so that in the reaction zone it has become substantially or entirely coked. The shaft gases are treated for the recovery of nitrogen and tar, and the high percentage of carbon monoxide usually present in the gases makes it advantageous to introduce them into the foul main of an ammonia recovery gas producer.—T. St.

Metals and alloys; Method of melting ——. R. S. Wile, Pittsburg, Pa., U.S.A. Eng. Pat. 27,836, Dec. 11, 1911.

The metal or alloy to be melted is charged into a furnace containing a molten bath of inert glassy or slag-like material of higher melting point than that of the metal or alloy. The layer of molten metal is kept always substantially thinner than the overlying protective layer. An electric tilting furnace of the resistance type is used, the upper movable electrodes dipping into the molten slag. By using suitable materials a temperature of 5500° F. (3038° C.) can be easily obtained. The method is suitable for metals or alloys which are liable to oxidation or vaporisation when melted with exposure to air, and may be made substantially continuous.—T. St.

Metal surfaces; Process for producing clean or deoxidised ——. J. A. Hatfield and C. R. Yates, Newport. Eng. Pat. 27,949, Dec. 12, 1911.

The metallic surface is first coated with silica or a silicate, either dry as a powder, or in solution. The whole is then heated to about 700° C., allowed to cool, and the coating which is thus formed is removed from the cold surface by suitable mechanical means, or by immersion in hydrofluoric acid. The method is applicable to the preparation of iron or steel plates for tinning or galvanising.—T. St.

Sampling of ores; Plant or apparatus for the ——, and for like purposes. A. S. Clift, London. Eng. Pat. 2416, Jan. 30, 1912.

Claim is made for an apparatus comprising, in one frame or casing, a series of rolls and intermediate deflectors by means of which an adjustable proportion of the ore is rejected at certain stages, that retained at any one stage being further comminuted before passing to the next. The bulk having been thus reduced to the amount required for the samples, the material issuing from between the final pair of rolls is passed to a shaking screen (from which the coarser material is automatically returned to the rolls) and thence to a bottle-filling device provided with a revolving distributor.—W. E. F. P.

Ores; Dressing of tin bearing —— and the like. H. Bailey, Ilford. Eng. Pat. 18,490, Aug. 12, 1912.

Water containing finely divided sulphur in suspension is added to the water used in dressing the ores of tin, wolfram (tungsten), etc., in order to cause the finely powdered ore to settle, thus rendering it capable of being collected by the dressing machinery.—T. St.

Bi-metallic plates; Method of making ——. F. R. McBerty, New Rochelle, N.Y., Assignor to Western Electric Co., Chicago, Ill. U.S. Pat. 1,046,824, Dec. 10, 1912.

A sheet of platinum foil, mounted upon a cylindrical mandrel, is rotated in a plating-bath the electric current to which is gradually increased from a very low value to the maximum necessary for the production of a heavy, adherent deposit, of, for example, copper on the platinum. —W. E. F. P.

Furnace gases; Treating ——. U. Wedge, Ardmore, Pa. U.S. Pat. 1,046,915, Dec. 10, 1912.

In order to obtain a gas rich in sulphur dioxide, the furnace gases are passed upwards through a wet scrubber having an outlet for gas rich in sulphur dioxide at about the middle of its height, and a second outlet for gas poor in sulphur dioxide at the top. Water flows downwards over trays in the upper part of the scrubber, absorbing sulphur dioxide from the gases which are not drawn off at the lower outlet. In the lower part of the scrubber, the water passes over packing material or is agitated, and is heated by the gases, so that the sulphur dioxide dissolved in the water is liberated and mixes with the gases below the lower outlet.—A. T. L.

Flue-dust; Method of briquetting ——. G. L. Collard, Sharon, Pa. U.S. Pat. 1,047,174, Dec. 17, 1912.

A mixture of the flue-dust, etc., with crushed limestone, is treated with dilute sulphuric acid, the resulting mass being moulded while in a plastic condition.—W. E. F. P.

Slag; Process of disintegrating molten ——. J. G. Bergquist, Chicago, Ill. U.S. Pat. 1,047,370, Dec. 17, 1912.

The molten slag, spread into a relatively thin coherent stream into the bottom of which water is introduced, is subjected to a series of blows—from a (rotating) body moving upwards and in the direction of flow—whereby disintegration is effected and the particles are projected outwards and upwards through the air. Claim is also made for the comminution of metals, etc., by a process in which particles of the molten material are projected into a cooling medium by the rotation of a body suitably disposed within the molten bath.—W. E. F. P.

[Gold and silver]. Solutions; Apparatus for precipitating value-bearing ——. W. Symmes, Virginia City, and W. E. Trent, Reno, Nev. U.S. Pat. 1,048,373, Dec. 24, 1912.

In an apparatus for precipitating and recovering gold and silver from cyanide solutions, the vessels containing the solution are each provided with a suction-pipe connected with a series of vacuum pans. Each of the pans contains a bed of precipitant and a layer of filtering material, through both of which media, in succession, the solution is thus caused to pass.—W. E. F. P.

Metals; Processes of extracting —— from ores. H. S. Mackay, Riverside, Cal., U.S.A. Eng. Pats. 27,342 and 27,345, Dec. 6, 1911.

See Fr. Pats. 437,481 and 437,841 of 1911; this J., 1912, 542.—T. F. B.

Ores and products used in the extraction of iron, spiegeleisen and other iron-manganese products; Process for the elimination and recovery of arsenic, antimony, copper, lead, zinc, sulphur, and like undesirable constituents of ——. C. A. Brackelsberg, Stockum, Germany. Eng. Pat. 27,451, Dec. 7, 1911. Under Int. Conv., Dec. 9, 1910.

See Ger. Pat. 241,321 of 1910; this J., 1912, 136.—T.F.B.

Ore-roasting furnaces with vertical rabble shafts; Mechanical ——. J. Parent, Paris. Eng. Pat. 28,078, Dec. 13, 1911.

See Fr. Pat. 424,269 of 1910; this J., 1911, 894.—T. F. B.

Vanadium from ores; Method of extracting ——. B. D. Saklatwalla, Pittsburgh, U.S.A. Eng. Pat. 6118, March 11, 1912.

See U.S. Pat. 1,020,224 of 1912; this J., 1912, 394.—T. F. B.

Furnaces for the treatment of metalliferous ores, coking coal, and treating other bodies. G. H. Benjamin, New York. Eng. Pat. 9986, April 26, 1912.

See U.S. Pat. 1,026,197 of 1912; this J., 1912, 591.—T. F. B.

Metals and alloys; Treatment of —— to render them ductile and malleable. Westinghouse Metallfaden Glühlampenfabrik G. m. b. H., Vienna. Eng. Pat. 12,869, May 31, 1912. Under Int. Conv., June 7, 1911.

See Fr. Pat. 445,208 of 1912; this J., 1912, 1186.—T. F. B.

Metals; Process for forming a protective coating on —— so as to render them unaffected by atmospheric and other effects. E. J. J. Tonet, Watermael, Belgium. Eng Pat. 17,676, July 30, 1912.

See Fr. Pat. 443,623 of 1912; this J., 1912, 995.—T. F. B.

Welding plant. N. J. Anderson, Coffeyville, Kans., Assignor to The Anderson Manufacturing Co., Tulsa, Okla. U.S. Pat. 1,047,140, Dec. 17, 1912.

See Eng. Pat. 15,537 of 1911; this J., 1912, 763.—T. F. B.

Zinc and lead from mixed sulphides; Process of separating ——. C. A. L. W. Witter, Hamburg. U.S. Pat. 1,047,360, Dec. 17, 1912.

See Fr. Pat. 408,612 of 1909; this J., 1910, 635.—T. F. B.

Nickel-copper mattes; Method of treating ——. A. McKechnie, Birmingham, and F. G. Beasley, Smethwick. U.S. Pat. 1,047,825, Dec. 17, 1912.

See Eng. Pat. 15,850 of 1911; this J., 1912, 780.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Changes involved in nitric oxide formation in the high-pressure arc. Fischer and Hene. *See* VII.

Patents.

Batteries; Secondary or storage ——. W. Clark, London. From Comp. Internationale des Accumulateurs Vedeka, Paris. Eng. Pat. 29,318, Dec. 29, 1911.

The active material is supported on a foraminous structure of insulating material, with a porous insulating sheath enveloping the material, and with conductive wires for distributing the current throughout the material. Perforated separators are interposed between adjacent electrodes of opposite polarity, and means are provided for maintaining the whole assemblage under yielding pressure applied in a direction normal to the contiguous surfaces. The negative electrodes are prepared from a mixture of lead sulphate and potassium sulphate crystals made into a paste with potassium sulphate solution; after pasting the grid in the usual manner, the potassium sulphate is dissolved out in an alkaline formation-bath.—B. N.

Battery plates and process of making. E. G. Dodge, South Orange, N.J. U.S. Pats. 1,045,822 and 1,045,823, Dec. 3, 1912.

The plates are constructed from a metallic oxide, such as copper oxide, as depolarising material, and a backing composed of compressed finely divided earthy material made into a plastic mass with a suitable flux. The copper oxide, in the form of a plastic mass, is compressed upon a plastic mass of the earthy material, and the whole is fired at a temperature sufficiently high to fuse the oxide, thus uniting it to the backing, whilst at the same time consolidating or hardening it.—B. N.

Cadmium electrodes for secondary batteries with an alkaline electrolyte; Manufacture of ——. R. Pörscke and E. Achenbach. Ger. Pat. 252,707, May 13, 1911. Addition to Ger. Pat. 250,385, July 13, 1910 (this J., 1912, 1040).

Finely divided cadmium, for the preparation of the electrodes, is obtained by introducing magnesium or aluminium powder into a solution of a cadmium salt.
—A. S.

Electrodes [of wrought tungsten] in electrical apparatus; Terminals such as contacts and ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 535, Jan. 6, 1912.

The terminals for X-ray or cathode-ray tubes, or for the make and break contacts in electrical apparatus are constructed of wrought tungsten.—B. N.

Furnaces; Electric ——. E. Stassano, Turin, Italy. Eng. Pat. 21,281, Sept. 18, 1912. Addition to Eng. Pat. 8901, April 10, 1911 (this J., 1911, 1067).

The external casing of the furnace is suspended on two pivots on the extremities of a cross-piece, the latter being arranged above the furnace chamber. The cross-piece is mounted on fixed supports, by means of two lateral pivots, at right angles to the fixed pivots.—B. N.

Chemical reactions; Process and apparatus for producing ——. J. L. R. Hayden, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,046,421, Dec. 3, 1912.

The apparatus comprises an enclosed receptacle containing liquid, together with co-operating electrodes for producing an arc, one electrode containing a perforation opening into the receptacle. Means are provided for passing a gaseous mixture through the arc, and bringing the gas immediately afterwards into contact with the body of liquid in the receptacle, thus rapidly cooling the gas whilst in a greatly subdivided state.—B. N.

XII.—FATS; OILS; WAXES.

Fats; Anomalies in the consistence and melting points of ——. A. Grün. Ber., 1912, 45, 3691—3701.

Further investigation of the solid and fluid modifications of α-α-dilaurin obtained by Grün and Schacht (this J., 1907, 536) has shown that the liquid form may also be prepared by the action of α-α-dichlorhydrin upon potassium laurate at higher temperatures. For example at 150° C. a mixture containing about 2 per cent. of the fluid modification was obtained, whilst at 170° to 180° C. the product consisted of about 30 per cent. of the solid and 70 per cent. of the fluid modification. In the case of symmetrical triglycerides forming two modifications, the the maximum difference between the melting points was 16° C. The liquid form is apparently the result of the supercooling of another solid modification while in the melted state. Crystals were obtained from the fluid modification melting at 40° C. as compared with 57° C. for the solid modification first described. After standing for several months both forms changed and then melted at about 45° C., whilst the modification of m. pt. 57° C. also gave a much lower melting point. A crystalline triglyceride was prepared by the interaction of lauryl chloride upon the modification melting at 57° C. This melted at 45° C. and agreed in its other properties with natural trilaurin and Schley's synthetical trilaurin. On the other hand, the fluid dilaurin yielded a fluid trilaurin, which after long standing formed crystals which melted at a very low temperature and were much more soluble than the other trilaurin. Determinations of the molecular weights of the crystalline dilaurins and trilaurin gave results approximating the calculated values, but in the case of fluid dilaurin and trilaurin the results were only about half the amounts of the calculated molecular weights. (See also this J., 1903, 427; and 1905, 851.)
—C. A. M.

Wood oil and linseed oil. W. Fahrion. Farbenzeit., 1912, **17**, 2530—2532, 2583—2584, 2635—2636, 2689—2691. Chem. Zentr., 1912, 2, 2154—2155.

Chinese wood oil may become solid in two different ways, viz., by molecular transformation or by polymerisation. The former process occurs at the ordinary temperature under the influence of light and leads to a crystalline product, m. pt. about 32° C., completely soluble in the ordinary fat solvents. Polymerisation occurs at temperatures above 150° C. and results in an amorphous, infusible product insoluble in the usual solvents. Both processes take place even when air is completely excluded. During the polymerisation a certain amount of oxidation occurs also unless the oil be heated in completely exhausted sealed tubes. The polymerised oil is not affected by light, but oil which has been solidified by exposure to light has not lost its capacity of polymerising. Wood oil dries less rapidly than linseed oil at the ordinary temperature, but more rapidly at higher temperatures. Films of the oils after drying on glass plates for 10 days had the following characters:—

	Tungoxyn.	Linoxyn.
Fatty acids	11·2 per cent.	25·3 per cent.
M. pt. of acids	40° C.	38° C.
Iodine value of acids	47·6	42·9
Hydroxy-acids soluble in ether	70·6 per cent.	40·2 per cent.
Hydroxy-acids soluble in alcohol	—	20·2 ,,
Iodine value	26·2	28·3
Hehner value	81·8	85·7

The tungoxyn was white, firm, only slightly elastic, and quite free from stickiness, whereas the linoxyn was yellowish, softer, very elastic, and slightly sticky. Polymerised drying oils may be distinguished from the oxidised oils by saponifying and separating the fatty acids: the polymerised acids are soluble, the oxidised acids insoluble in petroleum ether. For testing drying oils the author recommends the use of cotton yarn impregnated with the oil; the drying can be controlled by periodical weighings, and the oxidised oil can subsequently be saponified with alcoholic potash. The "baking process" in the manufacture of *papier maché* is stated to be a process not of polymerisation but of autoxidation.—A. S.

Oil of manketti nuts. C. Grimme. Chem. Rev. Fett Ind., 1913, 20, 1—3.

The manketti tree, *Ricinodendron rautenii*, Schinz, belonging to the *Euphorbiaceæ*, is a native of German

South-West Africa where it is found in the Okawango district. The fruit contains seeds the kernels of which yielded 51·5 per cent. of oil (= 5·15 per cent. of the entire fruit). The oil was light yellow, fairly viscous, and had a pleasant nutty odour and taste. It gave the following values :—Sp. gr. at 15° C., 0·9286 ; solidification point, —8° to —10° C. ; refractive index (15° C.), 1·4805 ; acid value, 0·94 ; saponification value, 194·8 ; Reichert-Meissl value, 1·24 ; Polenske value, 0·56 ; iodine value (Wijs), 134·8 ; glycerin, 10·6 per cent. ; unsaponifiable matter, 0·85 ; insoluble fatty acids, 94·8 per cent. *Fatty acids* :—M. pt., 41·0° C. ; solidification point, 35° to 36° C. ; refractive index at 50° C., 1·4694 ; iodine value, 137·6, and molecular equivalent, 285·6. In its drying properties the oil resembled poppy seed oil, and could be used in the manufacture of varnishes, paints and soaps, and possibly as food. A company has been floated to produce the oil and it is anticipated that for the first years there will be an annual output of about 25,000 to 30,000 hl. (550,000—660,000 galls.). It will not pay to transport the entire fruit containing only 5 per cent. of oil, but it is suggested that the kernels may be transported after gentle roasting, without risk of the contained oil becoming rancid.—C. A. M.

Fat of Hydnocarpus alpinus seeds. H. H. de Wolff and H. B. Koldewijn. Pharm. Weekblad, 1912, **49**, 1049—1050. Chem. Zentr., 1913, **1**, 31.

THE fat had the following characters : Sp. gr. at 100 °C., 0·898 ; m. pt., 22°—26° C. ; solidif. pt., 22·5° C. ; acid value, 0·35 ; saponif. value, 207 ; iodine value, 84 ; Hehner value, 87 ; $n^{40}_D = 1·4709$; $[a]_D = +49·5°$.—A. S.

Oil of Eurycoma longifolia, Jacq. J. J. C. Bakker. Pharm. Weekblad, 1912, **49**, 1050—1051. Chem. Zentr., 1913, **1**, 31.

THE light yellow oil, of bitter taste, had the following characters : $n^{25}_D = 1·4688$; saponif. value, 191 ; iodine value, 89 ; Hehner value, 94 ; glycerol content, 11 per per cent.—A. S.

Marine animal oils ; Distillation of the fatty acids of ——. M. Tsujimoto. Chem. Rev. Fett Ind., 1913, **20**, 8—9.

CLUPANODONIC acid and homologous acids of the series $C_nH_{2n-5}O_2$, to which the bad odour of marine animal oils is largely due (this J., 1909, 316), do not readily distil with superheated steam, or under reduced pressure. They can in this way be wholly or partially separated from the more saturated fatty acids, and the distillates will have a much less unpleasant odour. For example on distilling the methyl esters of the total fatty acids of Japanese sardine oil under a reduced pressure of 10 mm., the distillates had much lower iodine values and refractometer readings, and in particular gave much lower yields of octobromide, whereas the values of the residues showed a corresponding increase. In another experiment the fatty acids of herring oil from an autoclave (acidity, 96·56 per cent. : iodine value 136·52 ; octobromide, 25·90 per cent.) were distilled under a reduced pressure of 21 mm., and the distillates twice redistilled, with the following results :—

	Weight.		Iodine value.
		grms.	
Distillation I.	1	42·5	86·2
	2	42·4	102·95
	3	43·0	126·60
	Residue (diff.)	172·1	164·96
Distillation II. .... 104 grms. of a mixture of the three distillates from I.	1	43·7	63·40
	2	43·0	96·10
	Residue (diff.)	17·3	172·56
Distillation III. .... 49 grms. of a mixture of the two distillates from II.	Distillate ...	39	59·81
	Residue	10	120·64

Analogous results were obtained on distilling 1500 grms. of the fatty acids of an inferior fish stearine, the distillates being very greatly improved in their odour. The more highly unsaturated fatty acids of linseed and perilla oils were also less readily distilled than the other fatty acids. The explanation of the phenomenon, which it is suggested will be of technical value, is probably to be found in the polymerisation of the highly unsaturated fatty acids.
—C. A. M.

Oleic acid ; New isomerides of —— *and effect of a displacement of the double linkage in the molecule.* S. Fokin. J. Russ. Phys.-Chem. Ges., 1912, **44**, 653—661. Chem. Zentr., 1912, **2**, 2058.

BY the reduction of carefully purified ricinoleic acid in alcoholic solution with hydrogen in presence of platinous hydroxide, $Pt(OH)_2$, a hydroxystearic acid, $CH_3(CH_2)_5CH(OH)(CH_2)_{10}COOH$, was obtained. This was converted into the corresponding bromostearic acid, and the latter was boiled with twice the theoretical quantity of alcoholic potassium hydroxide ; the crude reaction product (mixture of fatty acids) was separated into a solid and liquid portion, which were purified separately. The solid portion yielded the 12,13-oleic acid, m.pt. 33°—34° C., whilst the liquid portion yielded the isomeric 11,12-acid, m.pt. 6°—8° C. From a comparison of the properties of these acids with other isomeric oleic acids, the author points out that the 8,9-, 10,11- and 12,13- acids are crystalline at the ordinary temperature, whereas the 9,10- and 11,12-acids are liquid.—A. S.

Soaps ; Surface tension of solutions and suspensions of ——. F. Bottazzi. Atti R. Accad. dei Lincei, Roma, 1912, **21**, II., 365—378.

THE experiments were made with the aid of Traube's stalagmometer and were confined to the oleates of sodium and potassium, the stearates and palmitates being insoluble in water ; finely divided sodium stearate and potassium stearate had no effect on the surface tension of water when suspended therein, nor even after the addition of a few drops of alkali. On adding gradually 0·05 *N* sodium hydroxide to a turbid solution of sodium oleate containing soap in suspension, it gradually becomes clearer and the surface tension falls, until a perfectly clear solution is obtained ; on further addition of alkali, the liquid becomes turbid again and the surface tension rises, but less rapidly. Solutions of sodium and potassium oleates are always turbid, owing to hydrolytic dissociation, and this dissociation may become complete on prolonged dialysis. The surface tension of dialysed solutions increases proportionately to the degree of hydrolytic dissociation, thus indicating that it is chiefly the undissociated molecules of soap which depress the surface tension of the water, the products of dissociation being less active or even inactive. The increase of surface tension observed when a soap solution which has been cleared by addition of alkali is treated with a further quantity of alkali, is due to aggregation, leading finally to partial precipitation of the undissociated soap ; on adding hydrochloric acid gradually, the surface tension first falls as the excess of alkali is neutralised, and then again rises owing to precipitation of fatty acids, which leads to a lowering of the concentration of undissociated soap in the solution.—A. S.

PATENTS.

Oil presses. F. H. Smulders and Utrechtsche Machinefabriek, Utrecht, Holland. Eng. Pat. 13,706, June 11, 1912.

IN a filling device for oil presses the opening of the hopper is kept closed by a slide-valve, controlled by a spring, as long as the measuring box is not directly underneath. The movement of the measuring box is produced by coupling a spindle mounted in the frame to a pulley, the coupling being effected by means of a lever and a friction-clutch. Lever arms fitted to the spindle move the measuring box by means of connecting rods until a tappet connected with the spindle meets an arm pivoted in the frame and shifts it in such a way that the clutch is disengaged and the spindle and the measuring box are brought back to their original position by means of a balance weight.—W. P. S.

Meal, powders, or the like ; Steeping or maceration of —— *[for the extraction of oil]*. B. C. Barton, Ferriby, Yorks. Eng. Pat. 13,836, June 13, 1912.

A trough or tank, divided into a number of compartments, is fitted at the bottom of a closed chamber ; these compartments contain liquids for extracting or steeping the meal. The latter is delivered from a hopper into a number of perforated receptacles attached to an endless travelling band, which runs over guide-wheels in such a manner that the receptacles and their contents are immersed successively in the liquid contained in the compartments of the tank. The contents of the receptacles are then discharged into a chamber and removed from the same. —W. P. S.

Fat compound ; Hydrogenated edible ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,047,013, Dec. 10, 1912.

A mixture consisting of vegetable oil and animal fat is hydrogenated and the product is agitated with air so that a relatively small volume of air is introduced into the fat. —W. P. S.

Soap ; Process for the manufacture of a sweat-decomposing ——. A. Pfeffer, Bochum, Germany. Eng. Pat. 584, Jan. 8, 1912.

To ordinary soap there is added a mixture of boric acid, chromic acid (crystallised), sodium chloride, salicylic acid (free of lead), alcohol, chromium acetate solution, cocoanut oil, caustic soda, caustic potash solution, and salt water. —E. W. L.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Red lead ; Physico-chemical study of ——. J. Milbauer. Chem.-Zeit., 1912. 36, 1436—1437, 1484—1485.

A continuation of former work (see this J., 1912, 193). Lead monoxide was heated for three hours to temperatures, kept constant in each experiment, but varying in different experiments from 325° C. to 520° C., in oxygen at 1, 3, 6, and 12 atmospheres pressure. At the end of each experiment the reaction-tube was rapidly cooled, and then the pressure released and the product analysed. The whole of the results lie on a single curve when plotted, showing that pressure has no influence on the ultimate state of equilibrium. The percentage of red lead (Pb_3O_4) formed rises from 4·2 at 325° C. to 100 at 470°—480° C. At 520° C. it has again fallen to 78·4. A series of experiments of only 5 minutes' duration at 445° C. (ultimate result about 90 per cent. of red lead) showed that increased pressure greatly accelerates the speed of reaction, for the percentages of red lead formed at 1, 3, 6, 9 and 12 atmospheres were respectively 1·1, 3·7, 8·7, 20·9, and 38·1. —J. T. D.

Patents.

Paints made with hydraulic cement and water. W. P. D. Moross, Chattanooga, Tenn., U.S.A. Eng. Pat. 18,095, Aug. 6, 1912. Under Int. Conv., Aug. 14, 1911.

A non-corrosive water paint is composed of 55 parts of Portland cement, 5 parts of hydrated lime, 5 parts of kaolin, and equal proportions of actinolite (fibrous hydrous magnesium silicate) and silica, all the ingredients being ground to pass through a No. 200 mesh standard sieve. A small proportion of prepared casein or glutinous matter may be added to increase the initial adhesiveness of the paint, and any suitable pigment may be incorporated with it to give the desired colour.—O. R.

Lakes [from azo dyestuffs] ; Manufacture of bluish-red colour ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 23,427, Oct. 14, 1912. Under Int. Conv., March 15, 1912.

The disazo dyestuff obtained by combining the tetrazo derivative of *m*-tolidine with two mols. of 2-naphthol-3.6-disulphonic acid, is converted into colour lakes by the usual methods. The products are pure bluish-red in colour.—T. F. B.

Phenolic condensation products ; Method of forming ——. J. W. Aylsworth, East Orange, N.J. U.S. Pat. 1,047,484. Dec. 17, 1912.

See Fr. Pat. 441,017 of 1912 ; this J., 1912, 828.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber ; Chemistry of ——. *VI. Theory of vulcanisation. IV.* D. Spence and C. A. Ward. Z. Chem. Ind. Kolloide, 1912, 11, 274—280. (See also this J., 1911, 816 ; 1912, 81, 651, 785.)

Axelrod (this J., 1910, 34) has stated that rubber which has been "depolymerised" by mechanical working, or by heat, acquires a greater affinity for sulphur, and has put forward an explanation of the irregularities in Weber's vulcanisation curves, based on this assumption. The authors have carried out comparative experiments, in a hydraulic steam-heated vulcanisation press and also in the small experimental apparatus described previously (this J., 1912, 1043) and find that if proper precautions be taken, smooth vulcanisation curves are obtained. The experiments were made with washed dry Hard Cure Para, 100 parts of which were mixed with 10 parts of sulphur, and in some cases the rubber was first worked for different periods on the hot mixing rolls. It was found that there was no essential difference in the rates at which the treated and untreated rubber combined with sulphur, but there were considerable differences in the mechanical properties of the vulcanised products, those from the "depolymerised" rubber being inferior to those from untreated rubber ; in order to obtain a vulcanised product from rubber which has been worked excessively on the rolls equal in quality to a product from untreated rubber, the former must possess a higher coefficient of vulcanisation. —A. S.

Indiarubber production in 1912. S. Figgis and Co., London. Jan. 1, 1913. [T.R.]

The world's supply of rubber in 1912 amounted to about 92,009 tons (or 99,000 tons including guayule) : the production in 1911 was 88,000 tons. About 950,000 acres are now under rubber in the East, and about 80,000 acres in Mexico, Nicaragua, and Honduras. Exports from Brazil, Bolivia, and Peru were 50,720 tons in 1912, against 44,170 tons in 1911 ; about 7,000 tons of guayule were exported from Mexico last year. Exports from Ceylon and India amounted to 6,300 tons, from Malaya 22,200 tons, and from the West African Coast about 13,800 tons.

Imports, etc., of all kinds of rubber into England were :—

	Imports.	Deliveries.	Stocks, Dec. 31.
	Tons.	Tons.	Tons.
1910	32,659	29,980	5231
1911	33,964	34,054	3954
1912	43,853	44,238	3569

Imports of Parà (Manaos) rubber into England were 11,377 tons in 1912, 11,726 tons in 1911, and 12,433 tons in 1910, and of Peru (cauchu) 3792 tons in 1912, 3753 tons in 1911, and 5577 tons in 1910. Of East India and Malay plantation rubber 21,211 tons were imported into England in 1912, as compared with 10,656 tons in 1911 and 6598 tons in 1910.

PATENTS.

India-rubber ; Extraction or coagulation and other treatment of —— from the latex. S. C. Davidson, Belfast, Ireland. Eng. Pats. 25,256, Nov. 13, 1911, and 11,273, May 11, 1912.

THE process described consists essentially in the addition to rubber latex of a soluble, sulphur-containing compound from which elementary sulphur can be liberated by the action of weak acids, and of the subsequent addition to the latex, thus treated, of an acid which not only brings about coagulation but at the same time precipitates sulphur in a very active form in intimate admixture with the coagulum. Sodium thiosulphate and liver of sulphur are given as examples of soluble sulphur compounds which may be employed. If thiosulphate or other neutral sulphur compound be used alone, the latex should first be rendered neutral by the addition of alkali. In some cases formaldehyde and/or other suitable disinfectant, such as an alkaline solution of carbolic acid or creosote, may be added with the sulphur-compound. A second method of procedure is to render the solution of the sulphur-compound alkaline by the addition of ammonia, caustic soda, caustic potash, sodium carbonate, borax, or alkaline preparations of carbolic acid, creosote or mixtures of the two, before adding such solution to the latex. After the above additions to the latex have been made, the latex may be heated, and a dilute solution of an acid such as acetic, trichloracetic, sulphuric, hydrochloric, or hydrofluoric acid or mixtures thereof is added. Such acid solution may contain creosote or carbolic acid, and the quantity added should be only sufficient to produce coagulation and decompose the sulphur compounds. The rubber is removed from the serum, washed between rollers, passed in the form of thin sheet through a neutralising bath, and finally again washed in water.—E. W. L.

India-rubber ; Smoking and coagulating the latex of ——. G. W. Sutton, Stevenage, Herts. Eng. Pat. 27,424, Dec. 7, 1911.

LATEX is delivered from a covered-in hopper on to an endless band conveyor, provided with flanges at its edges, and travelling within a smoking chamber. Smoke, produced by the rapid evaporation of creosote, is driven by means of a fan on to the upper face of the latex-covered band, in a direction opposite to that in which the latter travels, and is led by means of a baffle-plate round to the under face and thence back to the smoke-producing chamber. Heat is also applied to the band by means of steam or hot-water pipes. The band may be duplicated, and the second band may be arranged to receive the uncoagulated latex from the first. When a sheet of rubber of the requisite thickness has been built up, it is removed from the band through doors in the end of the smoke-chamber.—E. W. L.

India-rubber ; Coagulating and curing of ——. F. A. Byrne, Birmingham. Eng. Pat. 27,664, Dec. 9, 1911.

RUBBER latex is coagulated, or coagulated rubber is cured, by subjecting it to the action of the vapours, as distinct from smoke, produced by the volatilisation, as distinct from burning, of the products of the destructive distillation of wood, wood waste or the like. Wood tar or pyroligneous acid, or mixtures of the two may be employed in this process which may be carried out by means of the apparatus described in Eng. Pat. 27,665 of 1911 (this J., 1913, 35). In order to obtain the best results the wood tar should be freshly prepared and the pyroligneous acid should be be strong. In preparing these products the first portion of the distillate from the wood, etc., is collected in a receiver until it has attained the sp. gr. 1·03. The receiver is then changed for one provided with a bottom tap for drawing off tar, and a second tap, higher up, for drawing off the acid.—E. W. L.

India-rubber ; Coagulation and curing of ——. F. A. Byrne, Birmingham. Eng. Pat. 27,666, Dec. 9, 1911.

LATEX is delivered from a trough, with an adjustable slot-like outlet, on to a faced sheet which passes over a roller and under a knife similar to those of a spreading machine. On leaving the knife the sheet, with its thin coating of latex, passes over heated surfaces, similar to those of the steam-chests of a spreading-machine, but which are, however, covered in by a box provided with slots for entry and exit of the cloth, and containing smoke ducts. Smoke, or the vapours of wood tar and pyroligneous or acetic acid, is delivered under pressure through the tubular smoke ducts, which are perforated or slotted on their under sides, and are provided with channels below to catch the liquid products that may separate from the smoke.—E. W. L.

Rubber and the like ; Process for the coagulation of latex to form ——. W. Pahl, Dortmund, Germany. Eng. Pat. 24,795, Oct. 29, 1912. Under Int. Conv., Feb. 2, 1912. Addition to Eng. Pat. 26,173, Feb. 4, 1910 (this J., 1911, 225).

IT has been found that if, instead of using carbonic acid alone for the coagulation of rubber and similar latices, as described in the original patent (*loc. cit.*), a mixture of carbonic acid with another acid such as dilute hydrochloric acid, acetic acid, formic acid, etc., be employed, the process of coagulation is much facilitated and results in a purer and more perfect product. The process can be carried out by passing carbonic acid gas which contains vapours of aqueous hydrochloric acid into the latex, at a temperature of about 30° C. for a certain time, up to about an hour.—E. W. L.

Rubber and the like ; Machines for washing ——. J. E. Pointon, Peterborough. Eng. Pat. 3191, Feb. 8, 1912.

IN the washing-machine described, the rolls revolve in a shaped trough, the bottom slotted outlets from which can be closed more or less completely by the top edges of adjustable plates. The heavy impurities are washed through the slotted outlets into a sump to the interior of which access is gained by opening the hinged side-plates. The lighter impurities are floated off through screens arranged at the top of the washing trough, and are carried away through vertically adjustable overflow pipes. The screens are adjustable so as to permit of the formation of outflow spaces at their lower edges in order to remove any obstructive accumulations. In order to secure the possibility of a considerable increase in the height of the water level with a comparatively small movement of the outflow pipe, a subsidiary trough weir is provided, into the bottom of which the top of the pipe may be caused to fit.—E. W. L.

Vulcanisable articles ; Method of vulcanising ——. W. W. Duncan, Boston, and N. E. Tousley, Watertown, Mass., Assignors to Hood Rubber Co. U.S. Pat. 1,048,138, Dec. 24, 1912.

THE articles are placed in a hermetically closed chamber to which air at a temperature of not less than 270° F. (132° C.) and under a pressure of not less than 60 lb. per sq. in. is then admitted. The temperature of the articles being in this way raised to a point above that at which steam would condense on them, steam at not less than 80 lb. pressure is admitted to displace the air. When vulcanisation is complete, hot air is again admitted to displace the steam, in order to prevent any final condensation of water on the articles.—E. W. L.

Rubber or vulcanite or the like ; Process for treating —— and manufacture of articles therefrom. W. E. W. Richards, London. Eng. Pat. 2075, Jan. 25, 1912.

OLD waste vulcanised rubber, or new rubber, or vulcanite, or a mixture of the two latter, is finely disintegrated and heated to a suitable high temperature—about 300° C.—in a machine, *e.g.*, of the Werner-Pfleiderer type, in which it can be continuously agitated, until the mass has fused. Asbestos or other filling or strengthening substance is then added, and after the mass has been allowed to cool down somewhat, sulphur is added (from 4 or 5 to 25 per cent. in the case of new rubber). The temperature may then again be raised, say to a vulcanising temperature, and the agitation of the mass continued until it loses its stickiness and is converted into a granular mass, which may be removed and shaped in heated moulds under pressure. Or the mass may be removed after working in the sulphur and shaped in moulds and vulcanised, or it may be mixed with new rubber on ordinary mixing rolls, then moulded and vulcanised.—E. W. L.

Vulcanised caoutchouc ; Manufacture of products similar to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 5430, Mar. 4, 1912.

The caoutchouc-like substance obtained by polymerising isoprene, or a homologue thereof in the presence of oxidised caoutchouc, or in the presence of from 2 to 5 per cent. of the ozonide of isoprene, or of a member of the same homologous series, or of the ozonide of a terpene or similar body (Eng. Pat. 22,454 of 1911 ; this J. 1912, 1088), can be vulcanised in a similar manner to ordinary rubber, for example, by mixing it with 8 per cent. of sulphur and heating the mixture for from 1½ to 2 hours in steam at a pressure of 3 atmospheres or by treating it with a 1 per cent. solution of sulphur chloride.—E. W. L.

Chewing gum ; Manufacture of ——. R. B. Ransford, London. From J. D. Darling, Philadelphia, U.S.A. Eng. Pat. 18,277, Aug. 8, 1912.

A natural gum such as commercial gum dammar, or the resin extracted from mixtures of resin and rubber, such as Mexican guayule, is introduced into a boiling 10 per cent. solution of caustic alkali, and repeatedly washed until the saponifiable part of the material is removed and a pure, tasteless, odourless resene remains. This resene, which is quite brittle, is rendered plastic at the temperature of the mouth by adding when melted, 1—15 per cent. of pure Para rubber, the latter being first softened by addition of say 30 per cent. of benzol. The quantity of rubber required may be reduced in some cases by the employment of a vegetable or other wax, or it may be replaced by a suitable gum containing rubber, *e.g.*, gum chicle.—L. E.

Plastic substances ; Manufacture of ——. L. Lilienfeld, Vienna. Eng. Pat. 15,657, July 4, 1912. Under Int. Conv., July 18, 1911. Addition to Eng. Pat. 636, Jan. 10, 1910.

See Addition of June 28, 1912, to Fr. Pat. 417,392 of 1910 ; this J., 1913, 36.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

β-Glucoside of gallic acid ; Synthesis of a ——. E. Fischer and H. Strauss. Ber., 1912, **45**, 3773—3779.

From gallic acid ethyl ester and acetylbromoglucose the authors prepared a tetracetyl glucoside of gallic acid ester, which on hydrolysis yielded a glucoside of gallic acid, $C_6H_{10}O_5{\cdot}O{\cdot}C_6H_2(OH)_2COOH$. The latter is a crystalline monobasic acid, very soluble in hot water and soluble in alcohol and acetone. In aqueous solution it is lævorotatory, gives a brownish red colouration with ferric chloride, and does not reduce Fehling's solution. It is probably a β-glucoside, since it is hydrolysed by emulsin. Two simple glucosides of gallic acid have previously been described. One, discovered by Gilson in Chinese rhubarb, resembles the new compound in many respects, but is only slightly soluble in water, and gives a bluish black colouration with ferric chloride. The other, extracted from Turkish gall-nuts by Feist, differs very much from the authors' compound.—J. H. L.

Patents.

Iron tanning process for skins. J. Bystron, Teschen, Bohemia, and K. von Vietinghoff, Berlin. Eng. Pat. 13,952, June 15, 1912.

The delimed and unhaired skins, freed from acid, are placed in a solution of a ferrous salt of 5°—10° B. (sp. gr. 1·037—1·075), which may also contain a large quantity of neutral alkali salts. The liquor is then oxidised by passing through it a stream of either nitrogen peroxide (NO_2) gas, or a mixture of nitrogen peroxide (NO_2) and nitric oxide (NO). The nitrogen peroxide yields oxygen to the ferrous salt, and a basic ferric salt is produced which combines in the nascent state with the skin. As long as the nitric oxide produced by the reduction of the nitrogen peroxide is not present in excess, it is dissolved by the ferrous salt, forming the well-known complex brown compound without oxidising it, as no heat is used. The nitric oxide in excess escapes, and on coming in contact with the air is reconverted into nitrogen peroxide. The nitrogen peroxide may also be regenerated inside the actual tanning vessel by passing a small quantity of the peroxide in and then air. The nitrogen peroxide in this case acts practically as a catalytic agent only. The oxides of nitrogen may be generated in the tanning vessel by mixing small quantities of nitrate with the iron protoxide salt solution and adding the calculated quantity of a suitable acid. The oxidation of the iron salt and the tanning of the skin need not necessarily take place at the same time; the iron salt may be first oxidised separately and the skin afterwards tanned in the oxidised liquor.
—D. J. L.

Leather-board ; Method of producing stock for making ——. A. L. Clapp, Braintree, Mass., Assignor to Hideite Leather Co., Boston, Mass. U.S. Pat. 1,046,555, Dec. 10, 1912.

The solution which drains from the leather-stock as it is formed into sheets is re-used with successive charges of material in the beater in which the stock is formed. A quantity of gelatinous substance is added to the solution from time to time in order to combine with the dissolved tannin.—D. J. L.

Glue or gelatin ; Process of drying ——. C. H. Campbell, Chicago, Ill., Assignor to American Glue Co., Boston, Mass. U.S. Pat. 1,047,165, Dec. 17, 1912.

The gelatin solution is applied to the surface of a drum revolving in a chamber from which the air has been exhausted ; the interior of the drum is maintained at a temperature of 180° F. (82° C.) by means of a current of hot water.—W. P. S.

Hide ; Method of treating raw —— *and the products resulting therefrom.* A. H. Henderson, Baltimore, U.S.A. Eng. Pat. 6790, March 19, 1912.

See U.S. Pats. 1,020,497 and 1,020,498 of 1912 ; this J., 1912, 447.—T. F. B.

Sole leather ; Manufacture of ——. P. Castiau, Renaix, Belgium. Eng. Pat. 14,248, June 18, 1912.

See Fr. Pat. 440,736 of 1912 ; this J., 1912, 830.—T. F. B.

Tanning process ; Ferric ——. J. Bystron, Teschen, Austria-Hungary, Assignor to Karl Baron von Vietinghoff, Berlin. U.S. Pat. 1,048,294, Dec. 24, 1912.

See Eng. Pat. 13,952 of 1912 ; preceding.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Osmosis in soils. Soils act as semi-permeable membranes. C. J. Lynde and F. W. Bates. J. Phys. Chem., 1912, 16, 759—781.

Experiments are described showing that heavy clay subsoils act as semi-permeable membranes ; negative results were obtained with sandy subsoils. In the experiments the air-dried subsoil was allowed to stand in water for about one week, then disintegrated, the mixture of soil and water sterilised, and centrifuged, and the column of settled soil used in place of a membrane in an apparatus arranged for measuring osmotic pressure. With the heavy clay subsoil a distinct osmotic pressure was observed which increased with the depth of the column of soil and with the temperature. The authors put forward explanations of the beneficial effect of tillage, drainage, organic manures, mineral fertilisers, rise of temperature, soil mulches, and dry farming on the productivity of soils based on the theory that the subsoil acts as a semi-permeable membrane, water passing from a place of lower to a place of higher concentration.—A. S.

Nitrate; Behaviour of —— in arable soils. II. Vogel. Landw. Vers.-Stat., 1912, **78**, 265—301. Chem. Zentr., 1912, **2**, 2135.

Potassium nitrate and calcium nitrate undergo decomposition in the soil in a similar manner to sodium nitrate (see this J., 1912, 1000). The decomposition sets in after a short time, and may attain its maximum in 3—4 days. It is a purely chemical process, for it occurs also in sterilised soil. Oxides of nitrogen are formed, and, at times, probably also nitrogen and ammonia.—A. S.

Guano; Philippine ——. A. J. Cox. Philippine J. Sci., 1912, **7**, 195—199.

Phosphatic guanos occur in the Philippine Islands in large quantities, mainly in numerous limestone caves, the deposits in some of the latter being reported to amount to thousands of tons. The guano most commonly found is bat guano, which is granular in appearance and grey to brown in colour, its chemical composition being very variable, good specimens having been found to contain up to nearly 9 per cent. of nitrogen, over 5 per cent. of total phosphoric anhydride, and about 1 per cent. of potassium oxide. It is, however, only in unusually dry and protected places that the guano exists unleached. In many places the guanos have been deprived of a great part of their soluble ingredients (ammonium salts and uric acid), and their manurial value, as shown by analysis, is greatly inferior to that of the sample quoted above. —O. R.

Potassium in potash salts; Determination of —— as perchlorate. A. Strigel and J. Dodt. Landw. Vers.-Stat., 1912, **78**, 179—188. Chem. Zentr., 1912, **2**, 2145.

The authors draw attention to some sources of error in the determination of potassium as perchlorate, and recommend the following procedure in the analysis of potash fertilisers:—10 grms. of the sample are heated to boiling with 300 c.c. of water and 2 c.c. of hydrochloric acid of sp. gr. 1·125, and after boiling for 5 mins., sulphates are precipitated with barium chloride, a great excess of the latter being avoided. After cooling, the whole is diluted to 500 c.c., filtered, and 25 c.c. of the filtrate are treated in a glass dish with 10 c.c. of a 22 per cent. solution of perchloric acid and evaporated to syrupy consistence. The residue is then treated in the usual way. The potassium perchlorate is dried at 130° C.—A. S.

Patents.

Land-fertilisers; Process of preparing ——. C. S. Bash, jun., Assignor to C. S. Bash, sen., and W. E. Webbe, Fort Wayne, Ind. U.S. Pat. 1,048,454, Dec. 24, 1912.

Phosphate rock, sulphuric acid, and undried peat are mixed and dried by the application of heat.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Beet; Simplified method of judging the quality of the —— by means of the immersion refractometer. V. Staněk. Z. Zuckerind. Böhm., 1913, **37**, 175—182.

The author has previously described (this J., 1912, 448) a modification of Krause's method of estimating the purity of the diffusion juice it is possible to obtain from a given sample of beets. It has now been found that the process may be simplified as follows:—Twice the normal sugar weight of pulp, preferably obtained by the use of the Staněk rasp, after thoroughly mixing, is treated in a metal vessel (*cf.* this J., 1910, 1071), with 354 c.c. of distilled water, and digestion carried on for half an hour at 75° C., the liquid being stirred at intervals. After cooling and once more agitating, 50 c.c. of the solution are examined in the immersion refractometer, and the amount of dry substance read from the author's tables (Zeits. Zuckerind. Böhm., 1912, **86**, 357—382), making the necessary temperature corrections. The remaining portion of the digested liquid, about 300 c.c., is treated with 4 grms. of finely pulverised dry basic lead acetate, thoroughly shaken, filtered, and read in the polarimeter, the percentage of sugar being likewise deduced from the author's tables (*loc. cit.*) From the dry substance and the sucrose thus determined, the quotient of purity is calculated. The determinations are always made in duplicate. A series of tests made in four different houses during the last campaign showed that the quotients obtained as described above differ only by a few tenths of a per cent. from those obtained in the ordinary way with factory diffusion juices, and agree even more closely than this with the values found with press juices.—J. P. O.

Raw [beet] juice; Defecation experiments with —— containing pulp. Reduction of polarimetric reading during the process of defecation. J. Neumann. Z. Ver. deut. Zuckerind., 1912, 1349—1359.

In order to ascertain whether the presence of unseparated beet pulp in the diffusion juice passing to the defecators might influence the reduction in the polarimetric reading that occurs during the process of defecation by lime, owing to the formation of optically active substances, preliminary experiments were made by digesting exhausted slices with milk of lime at 85°—90° C. for 30 minutes, treating the liquid thus obtained with basic lead acetate, and then polarising in the ordinary way. The results obtained as compared with those found in similar experiments without the addition of lime, indicated that a lævo-rotatory substance was formed. Further experiments, imitating as closely as possible the conditions obtaining in the factory, were then made, and from the results it is concluded that the presence of pulp rich in pectin substances causes a lowering of the readings during defecation by lime in the factory, which lowering may vary according to the nature of the pulp, the time the pulp is in contact with the lime, and the amount of lime used. It is suggested that by the action of the lime on the pulp, pectoses are decomposed with the formation of *m*-pectin, and probably also *m*-pectic acid. These compounds are soluble in water, and are not precipitated by basic lead acetate, and consequently cause an appreciable decrease of the polarisation, owing to their strong lævo-rotatory nature. —J. P. O.

Beet sugar of the 1912—1913 *campaign; Raw —— judged according to observations made in an Austro-Hungarian sugar refinery.* T. Koydl. Deutsche Zuckerind., 1912, **37**, 999—1001.

The author has examined the raw sugar used in an Austro-Hungarian sugar refinery according to different standards, and has obtained the following results: *Ratio of ash to organic non-sugars:* With first products this was found to average 1·75, being lower than the averages found during the past four years, viz., 2·06, 1·87, 1·81, and 1·92. *Alkalinity:* This was always satisfactory, the sugars being strongly alkaline to phenolphthalein, which had not been the case in other years. *Cupric-reducing power:* Similar to that found in previous years. *Plus polarisation:* In the months of October and November, 1912, this value was 0·13—0·16 and 0·18—0·19 per cent. respectively, whereas during the past four years it had averaged 0·12, 0·15, 0·08, and 0·07 per cent. *Crystal content:* This was 99·12 per cent., against 100·36 per cent. for 1911—1912, and with the exception of 1905—1906 it was the lowest figure hitherto obtained. The purity of the adhering molasses, the coefficient of saturation, and the amount of adhering molasses were 70·76, 2·25, and 10·58 respectively, as compared with 66·32, 2·31, and 10·25, the respective average values for the past four years. *Affinability:* By this is meant the time necessary to wash a raw sugar in the centrifugals. Denoting "the time required for a thoroughly good quality sugar, one that is desirable for affination, but is seldom met with, as 1," then for 1912—1913 the value was 1·42, while for the past four years it had been 1·32, 1·16, 1·20, and 1·12 respectively. Commenting upon these results, the author concludes that from the point of view of the sugar refiner it is not a hot and dry summer (as that of 1911) which adversely affects the raw sugar produced from the beets then grown, but a cold and wet one (as, for example, that of the past year).—J. P. O.

Sugars; Determination of [*reducing*] —— *by a combination of the methods of Kjeldahl and Bertrand.* P. Beyersdorfer. Z. ges. Brauw., 1912, **35**, 556—559, 569—572, 582—585.

The results obtained in determining maltose by Bertrand's method (see this J., 1907, 60) are somewhat low. Kjeldahl's method (this J., 1895, 896) gives more accurate results, and it may be rendered more expeditious, without any loss of accuracy, by determining the unreduced copper volumetrically by Bertrand's method. After reduction has been effected by heating for 20 minutes in a water-bath, the solution is decanted from the cuprous oxide through a Soxhlet filter, and the subsequent operations are carried out as prescribed by Bertrand. Kjeldahl's tables (*loc. cit.*) are used. Results of analysis of a solution containing 0·461 per cent. of maltose were, by this method 0·456, by Kjeldahl's original method 0·456, by Bertrand's method 0·445, and by Wein's method 0·442 per cent.
—J. H. L.

Sucrose; Hydrolysis of —— *by dilute acids.* F. P. Worley. Proc. Roy. Soc. 1912, A **87**, 555—563.

Armstrong and Caldwell (this J., 1904, 1165) have shown that when sucrose is hydrolysed by very dilute hydrochloric acid, the change at first proceeds at an approximately linear rate, and deduced that the hydrolytic action of a small proportion of an acid is comparable with that of a small proportion of an enzyme. These observations have been repeated using a more delicate polarimeter and a far more accurate temperature regulator; in addition, the values of the velocity constant, K, are calculated using the equation $K = \frac{1}{t_2 - t_1} \log \frac{a - x_1}{a - x_2}$. This has been shown to give more reliable values than the older form, $K = \frac{1}{t} \log \frac{a}{a - x}$, in which an error in the value of a affects all the separate values of K unequally, those at the beginning being most affected. Under these conditions all evidence of a linear rate disappears completely, and the marked difference in behaviour of enzymes and acids is accentuated.—E. F. A.

Sucrose; Hydrolysis of —— *by sulphuric acid.* F. P. Worley. Proc. Roy. Soc., 1912, A **87**, 563—581.

Attention is drawn to the complexities met with in studying the rate at which hydrolysis of sucrose is effected by sulphuric acid of different concentrations by means of the polarimeter. As with other acids the apparent molecular hydration of sulphuric acid increases to a maximum as dilution proceeds, whilst the molecular hydrolytic activity decreases to a minimum. Sulphonic acids behave like sulphuric acid in reaching the maximum molecular hydration at an early stage. Sulphuric acid in concentrated solution acts mainly as a monobasic acid. The ratio of the final to the initial rotation decreased very considerably as the dilution of the acid solution was increased: this is attributed to alteration of the rotatory power of one or more of the sugars present, probably the lævulose, which is shown to be influenced by the presence of acid. The validity of the polarimetric method of following the course of a chemical change is discussed. It is considered satisfactory, but in general it is necessary to investigate all disturbing factors, and when an accurate chemical method is available the latter is far superior to the physical method.—E. F. A.

Dextrose; Transformation of —— *in presence of alkali. A contribution to the theory of catalysis.* L. Michaelis and P. Rona. Biochem. Zeits., 1912, **47**, 447—461.

The authors have studied the velocity of transformation of dextrose in alkaline solutions in the sense of the reaction of Lobry de Bruyn. This velocity, as measured by the fall in the optical rotatory power of the liquid, is proportional to the concentration of hydroxyl ions present. The acid nature of dextrose is proved by the fact that this sugar reduces the concentration of hydroxyl ions in solutions of sodium hydroxide. The magnitude of this reduction corresponds to a dissociation-constant of 5×10^{-13} for dextrose at 19° C. (Cohen found $5{\cdot}9 \times 10^{-13}$ at 25° C. by another method). The dissociation-constants of mannose, galactose, and sucrose are of the same order of magnitude, but that of lævulose is somewhat higher. The authors suggest that the catalytic action of hydroxyl ions on the transformation of sugars is due to their influence in raising the concentration of negative sugar ions in accordance with the law of mass action. These sugar ions then undergo spontaneous transformations into isomeric sugars.—J. H. L.

Dextrose; Transformation of —— *into a methylpentose.* E. Fischer and K. Zach. Ber., 1912, **45**, 3761—3773.

When triacetylmethylglucoside bromhydrin is reduced with zinc dust and acetic acid, the bromine atom is replaced by hydrogen, and when the product is hydrolysed, a methyl-pentose is obtained, which is the antipodal form of iso-rhamonse and identical with the iso-rhodeose discovered by Votoćek (Ber., 1911, **44**, 819, 3287). This transformation shows that in triacetylmethylglucoside bromhydrin the bromine atom is attached to the terminal carbon atom. Since the new compound possesses the configuration of dextrose, and indeed only differs from the latter by containing a methyl group in place of the terminal $\cdot CH_2OH$ group, the authors designate it *d*-iso-rhamnose, and the antipodal form obtained from rhamnose through rhamnonic acid, *l*-iso-rhamnose. This is the first synthesis of a methylpentose, and it establishes the configuration of the rhamnose group of sugars, concerning which there has hitherto been some doubt respecting the asymmetric carbon atom adjacent to the methyl group. β-Methyl-*d*-iso-rhamnoside, like β-methylglucoside, is hydrolysed by emulsin, yet both α- and β-methylxylosides, which differ from the former only in the absence of the terminal methyl group, are indifferent towards this enzyme.—J. H. L.

Sugar (*bioses and trioses*) *by ultra-violet rays; Photolysis of various complex* ——. D. Berthelot and H. Gaudechon. Comptes rend., 1912, **155**, 1506—1509.

Ten per cent. solutions of maltose and lactose exposed to sunlight ($\lambda > 0{\cdot}294\mu$) for six months underwent no change. When exposed to ultra-violet rays of relatively long wave length ($\lambda > 0{\cdot}25\mu$) there was decomposition in two stages (see this J., 1912, 1141) and gases (2 vols. of carbon monoxide to one vol. of hydrogen) were evolved. The solutions remained neutral, did not reduce Fehling's solution in the cold, and had only a slight effect on ammoniacal silver nitrate. When exposed to the extreme ultra-violet radiation the solutions became acid and strongly reducing, and carbon dioxide and methane appeared in the gases evolved. The gases from maltose contained: CO, 29; H, 51; CO_2, 14; and CH_4, 6 per cent. Almost the same proportions were obtained with lactose, trehalose, and gentiobiose. Trioses are decomposed by the radiation of longer wave length each into two molecules of aldose and one of lævulose, the composition of the gas being approximately 3 of carbon monoxide to 1 of hydrogen. This has been observed with raffinose, melezitose and gentianose. When the rays of shorter wave lengths are used, the composition of the gases alters in the same respects as in the case of the bioses. The authors suggest that, since ultra-violet radiations can perform all the functions of enzymes in the scission of sugars and of fats, the reason for the behaviour of enzymes is not to be sought in their chemical structure, but in their vibratory rhythm.—W. H. P.

Starch; Solution-stability of ——. M. Samec. Kolloidchem. Beihefte, 1912, **4**, 132—174.

THE author has studied the variation in the viscosity of starch solutions when kept either alone or after addition of electrolytes. It was found that the ageing or retrogression of a starch solution is accompanied by a very great irreversible diminution of viscosity; the final viscosity of a 1 per cent. starch solution is of the order of that of molecular-disperse (true) solutions. Concurrently with the change of viscosity, the solution also alters in appearance, becoming first turbid, and then clearer again owing to the settling of the separated flocks; the electrical conductivity of the solution increases. The rate at which the viscosity falls is greater in dilute than in more concentrated solutions and is increased by agitation of the liquid. Addition of hydrochloric acid has a stabilising influence, for although it reduces the initial viscosity of the starch solution, it retards the subsequent decrease of viscosity; the stabilising action varies according to the concentration of the acid and with increasing concentration passes through a maximum, the position of which varies with the concentration and condition (age) of the starch solution. At very low concentrations (up to $1\cdot10^{-4}N$) potassium hydroxide increases the viscosity. At somewhat higher concentrations (up to $1\cdot10^{-3}N$) it reduces the viscosity, and then on increasing the concentration further, it causes an enormous increase of viscosity. In presence of alkali, the fall of viscosity of the starch solution on keeping is slowest at those concentrations of hydroxyl ions in presence of which the initial velocity is lower than that of a pure starch solution. Ammonium sulphate and ammonium thiocyanate both reduce the initial viscosity of starch solution; the former salt retards the subsequent fall of viscosity, but the latter salt does not. The sensitiveness towards the influence of electrolytes diminishes with increase in the age of the starch solution. The author considers that his results and those of other workers can be best explained on the assumption that the "starch substance" consists wholly or partly of a carbohydrate combined with phosphoric acid, the whole complex being united with a suitable cation or cations in the form of a salt of the type, $(C_6H_{10}O_5)n(PO_4)\ yKx$, where K represents a cation.—A. S.

Catalytic reduction of carbohydrates. Ipatiew. *See* XX.

PATENTS.

Sugar; Process of manufacturing beet ——. V. Kolarik, Owosso, Mich. U.S. Pat. 1,047,082, Dec. 10, 1912.

THE raw juice is heated to about 70° C., and treated with milk of lime. The mixture is treated with carbon dioxide until a maximum precipitation is produced, heated to at least 100° C., and treated with more milk of lime until a well-granulated precipitate is obtained.—L. E.

Gas-distributing pipe for saturation apparatus [for sugar juice]. H. Müller. Ger. Pat. 253,115, Sept. 14, 1911.

THE pipe, which is divided longitudinally into two halves to facilitate cleaning, has V-shaped gas-distributing slots in the lower part. Inside the pipe, mounted on a longitudinal shaft, is a series of scrapers or blades, with projecting pegs. On rotating the shaft, deposits are removed from the slots by the pegs and from the inner surface of the pipe by the scrapers.—A. S.

Starch, etc.; Process of treating ——. H. C. Neuberger and F. P. Bergh, Assignors to General Reduction Co., New York. U.S. Pat. 1,047,831, Dec. 17, 1912.

STARCH, in the form of a moist powder, is introduced into the upper part of a closed vessel and falls first through a zone of moist gas of sufficiently high temperature to effect gelatinisation and then through a zone of heated dry gas, the dry gritty product thus obtained being continuously withdrawn from the vessel.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Mashing; Influence of different acids during ——. E. Moufang. Z. ges. Brauw., 1912, **35**, 591—593.

THE author has carried out a number of parallel malt mashes, to some of which lactic acid (0·108, 0·162, and 0·216 grm.) was added, and to others phosphoric acid in approximately equivalent amounts (0·049, 0·062, and 0·082 grm.). Premashing was carried out in some cases at 45°, and in others at 60° C. The two acids showed certain specific differences in their influence on the mashing process. Lactic acid exerted a more favourable influence on saccharification and yield of extract, and also produced worts of higher acidity and protein-content, than phosphoric acid. Whilst the effect of phosphoric acid was more marked at 45° than at 60° C., lactic acid produced a greater effect at the higher temperature. As regards the brightness of the fermented beers prepared from the worts, however, phosphoric acid at 45° C. gave less satisfactory results than lactic acid at the same temperature or than phosphoric acid at 60° C.—J. H. L.

Yeast fermentation without sugar. IX. Fermentation of keto-acids by wine yeasts. X. Fermentation of α-keto-butyric acid. C. Neuberg and J. Kerb. Biochem. Zeits., 1912, **47**, 405—412, 413—420. (See also this J., 1911, 379, 705, 1179, 1465; 1912, 893.)

ON account of the importance of pyruvic acid, as a probable intermediate product of alcoholic fermentation, the authors propose to investigate the behaviour of different classes of micro-organisms towards this acid. Wine yeasts, like beer- and distillery yeasts, ferment it readily, with production of carbon dioxide and acetaldehyde. As much as 40 per cent. of the quantity of aldehyde corresponding to the general reaction, $R{\cdot}CO{\cdot}COOH = CO_2 + R{\cdot}CHO$, was isolated from the products of fermentation. Wine yeasts also ferment oxalacetic and α-keto-butyric acids, the latter with extreme readiness. Whilst some of the keto-acids fermented by yeasts are closely related to compounds which occur in nature, this is not the case with α-keto-butyric acid. Yet this acid is very readily fermented by beer yeasts in absence or in presence of toluene, and also by dried yeast, "hefanol," and yeast juice prepared by maceration (see Lebedeff, this J., 1911, 147). The gas evolved was found to be pure carbon dioxide, and propionic aldehyde was also detected in the products, but only to the extent of about 4 per cent. of the amount corresponding to the general reaction (see above). It is therefore probable that other substances are also formed. —J. H. L.

Yeast and other fungi: Action of metallic salts on ——. Bokorny. Z. Spiritusind., 1912, **35**, 673—679.

MONO- and dipotassium phosphates are suitable sources of potassium and phosphorus for yeast, and 0·1 per cent. of either salt is a sufficient addition to nutrient media; the sulphate and nitrate are not injurious even at a concentration of 4 per cent. The growth of yeast is arrested by sodium carbonate and chloride at concentrations of 0·5 and 4 per cent. respectively, but the fermentative activity is not injured by 2 per cent. of the latter salt. Yeast is not injured by manganese sulphate at 1 per cent. or magnesium sulphate at 2 per cent. concentration, and can withstand the action of still more concentrated solutions of magnesium chloride, calcium chloride and nitrate, and aluminium chloride. The growth of yeast is retarded or prevented by the following salts at the concentrations given:—Zinc sulphate, 1; ferrous sulphate, 0·2; potassium permanganate, 0·01; potassium chromate, 0·001; stannous chloride, 0·1 per cent.—Yeast is killed by lead acetate and gold chloride at 0·1 per cent. concentration, and by salts of copper, mercury, and silver of much lower concentration (see this J., 1905, 1316). Solutions of salts of rubidium and cæsium stimulate the growth of yeast.—L. E.

"Koji acid"; New organic acid formed by Aspergillus oryzae. T. Yabuta. J. Coll. Agric., Imp. Univ., Tokyo, 1912, **5**, 51—58.

Aspergillus oryzae when grown on steamed rice forms "Koji acid," $C_{12}H_{14}O_8$, which contains four hydroxyl and two carboxyl groups. It crystallises in colourless needles or prisms, m. pt. 152° C. (uncorr.), and gives a strong wine-red colouration with ferric chloride. The copper salt forms light-green rhombic crystals. The tetra-acetyl compound melts at 102° C., the tetrabenzoyl compound at 135°, and the dibenzoyl compound at 137° C. Different varieties of *Aspergillus oryzae* produce different amounts of "Koji acid" under the same conditions. The acid is also produced by some other *Aspergillus* species, but not by *Penicillium* or *Mucor*. It is formed when *Aspergillus* is grown on certain cereals but not on leguminous seeds: sweet potato was the only root crop which produced the acid.—E. F. A.

Citric acid in wine; Detection of ——. W. Fresenius and L. Grünhut. Z. anal. Chem., 1913, **52**, 31—35.

Comparative tests by the methods of Denigès (this J., 1898, 802), Möslinger (Z. Unters. Nahr. Genussm., 1899, **2**, 105), and Schindler (this J., 1902, 1415), made on wines to which known amounts of citric acid had been added, have shown that a positive result with Denigès' process cannot be taken as conclusive evidence of added citric acid, whereas Möslinger's test, as modified by Krug (Z. Unters. Nahr. Genussm., 1906, **11**, 155 and 394), whilst being very delicate, gives no reaction with natural wines. Schindler's modification is not reliable in testing for very small quantities of citric acid.—F. Sodn.

Methyl alcohol in spirits; Determination of ——. J. Hetper. Z. Unters. Nahr. Genussm., 1912, **24**, 731—737.

Hot solutions of potassium permanganate oxidise methyl alcohol to carbon dioxide and water, and ethyl alcohol to acetic acid (see this J., 1911, 450). One grm. of methyl alcohol requires 187·5 c.c. of $N/1$ permanganate solution, and one grm. of ethyl alcohol 87 c.c. These wide differences enable the composition of mixtures of the two alcohols to be calculated accurately from the volume of permanganate solution required to oxidise 1 grm. The following analytical method is based on these observations:—If the liquid to be investigated consists only of an aqueous solution of the two alcohols, it is first diluted or concentrated until its sp. gr. at 15·5° C. is about 0·91—0·925, corresponding to an alcohol-content of about 50 per cent. by weight. An exact determination of the sp. gr. will then enable the percentage by weight of the mixed alcohols in the solution to be at once found by reference to specific gravity tables of either alcohol, for the two tables are almost identical between the limits mentioned above. (Appended to the paper is a table showing the specific gravities at 15·5° C. of solutions of both ethyl and methyl alcohols ranging from 45 to 55 per cent. by weight, and the mean of the two specific gravities for each percentage is also shown.) If the liquid to be investigated contains also essences and non-volatile matters, it is twice distilled, once after addition of sodium hydroxide, and again after addition of a few drops of phosphoric acid. The specific gravity is then brought to about 0·91—0·925 and accurately determined. Of this liquid 1·5—2 grms. are accurately weighed out and diluted to 200 c.c. Ten c.c. of the diluted solution are mixed with 60 c.c. of water and 30 c.c. of $N/2$ potassium permanganate solution containing 40 grms. of crystallised phosphoric acid per litre. The mixture is heated on a water-bath for 2 hours in a 200 c.c. flask connected by a ground glass joint with a reflux condenser. The temperature of the liquid should be at least 92° C., and during the heating the interior of the condenser is washed down several times with a few c.c. of water. After heating for 2 hours, the hot liquid is decolourised by addition of 30 c.c. of $N/2$ oxalic acid solution, and titrated back with $N/2$ permanganate solution. If $v =$ the volume of permanganate solution required, and $p =$ the weight of mixed alcohols contained in the 200 c.c. of diluted liquid (of which 10 c.c. were taken for titration), then x, the percentage of methyl alcohol by weight calculated on the total mixed alcohols, is $10v/p$—87. In a test mixture, the author found by this method 31·5 per cent. of methyl alcohol instead of 31·7 per cent. actually present. In standardising the permanganate solution against the oxalic acid, 25 c.c. of the former are diluted with 75 c.c. of water and warmed on a water-bath for $\frac{1}{2}$—1 hour, decolourised whilst hot by $N/2$ oxalic acid solution, and then titrated back with permanganate. Most of the essences, ethereal oils and higher alcohols, in the amounts in which they are usually present in spirits, exert no considerable influence on the accuracy of the method, but ethyl ether and furfural introduce serious errors; 1 grm. of furfural reduces 208 c.c. of $N/1$ permanganate solution. —J. H. L.

Fusel oil; Quantitative determination of —— [*in spirits*]. A. Politzer. Chem.-Zeit., 1912, **36**, 1438.

In Rose's method of determining fusel oil, much time and labour are needed to reduce the spirit to exactly 30 per cent. by volume, corresponding to a sp. gr. of 0·965575. The author has worked out a series of tables, giving the exact weight of water which must be added to 50 grms. of any spirit containing from 75 to 99·99 parts of alcohol by volume, in order to reduce it to 30 per cent. strength. The specific gravity is determined, the volume-percentage ascertained from the usual tables, and the reduction then made by mixing the necessary weighed quantities from the author's tables. An extract from the tables is given, showing 100 stages from 95·00 to 95·99 per cent.—J. T. D.

Patents.

Yeast; Manufacture of ——. C. H. Field. London. Eng. Pat. 27,711, Dec. 9, 1911.

Pressed or liquid yeast is mixed with water at a temperature of say 45° F. (7° C.), and a nutrient material which may consist of ground malt, cereal flour, peptonised yeast food or malt coombs, etc., or a mixture of these substances. The whole is allowed to ferment, with or without agitation or aeration, until the fermentation has diminished to about half the original strength. The yeast is then separated from the liquid and worked into a thick mass with a hygroscopic or absorbent substance such as gypsum, starch, ground husks, woody fibre, etc. The mass is broken up to any convenient size and dried at say 40°—100° F. (4°—38° C.). Prior to addition of the absorbent substance, the yeast may be treated, if desired, with about 7 per cent. of glucose or other suitable carbohydrate, and with about 3 per cent. of a peptonised yeast food.—L. E.

Yeast; Processes for maintaining the vitality of dried ——. P. D. H. Ohlhaver. Sande, Germany. Eng. Pat. 16,901, July 19, 1912. Under Int. Conv., Aug. 24, 1911. Addition to Eng. Pat. 27,573 of 1911 (see Fr. Pat. 436,915 of 1911; this J., 1912, 454).

Starch, or a material containing starch, is used as the hygroscopic substance for keeping the air in the closed vessel in a dry state. The compartment containing the yeast is separated from that containing the starch by a partition which is porous to air.—L. E.

Brewers' yeast; Process for the removal of bitter substances from ——. Versuchs- und Lehranstalt für Brauerei. Ger. Pat. 248,561, Nov. 10, 1910.

The yeast is first treated with acid (sulphuric, hydrochloric, phosphoric, or lactic acid), and after removal of the solid hop-resins and the like by screening or centrifuging, is treated with alkali, washed, and then again treated with acid to neutralise the last traces of alkali. The treated yeast, after drying, is suitable for use as a foodstuff.—A. S.

Alcohol; Manufacture of ethyl —— *by fermenting sulphite liquor.* P. G. Ekström, Harnäs, Sweden, Assignor to Aktiebolaget Ethyl, Falun, Sweden. U.S. Pat. 1,046,160, Dec. 3, 1912.

Urine is added to the sulphite liquor to be fermented. —L. E.

Brewing process. L. Braun. Ger. Pat. 252,996, April 11, 1911.

The process is intended for the manufacture of lager beer, with formation of lactic acid in the mash or wort. In order to avoid excessive proteolysis in the chief mash, the acidification is effected in a portion of the mash or wort, in a manner similar to that adopted in the manufacture of spirit or of pressed yeast, and is carried to such a stage that the desired degree of acidification of the chief mash is attained at once by addition of the acidified mash or requires only a short time.—A. S.

Vinegar; Apparatus for the production of —— by fermentation in closed generators. A. Marktscheffel. Ger. Pat. 252,150. Jan. 26, 1911.

The generator is provided with ventilating shafts in which water sprays are supplied for condensing the volatile products evolved from the generator. The quantity of water supplied to the sprays is so adjusted that it is just sufficient for the production of vinegar of the desired strength in the generator.—A. S.

Champagne; Process for the manufacture of —— and apparatus therefor. A. Greppo, Paris. Eng. Pat. 28,877, Dec. 21, 1911.

See Fr. Pat. 437,164 of 1911; this J., 1912, 454.—T. F. B.

XIXa.—FOODS.

Natto; Preparation of ——. S. Muramatsu. J. Coll. Agric., Imp. Univ., Tokyo, 1912, 5, 81—94.

Natto is a kind of vegetable cheese made by fermenting boiled soya beans wrapped in rice straw and set in a warm cellar for a few days. The product develops bacteria and becomes white and mucilaginous. It is consumed mixed with condiments. The bacteria are present on the surface of the beans and their spores are not killed by boiling. The straw is used to "supply the good aroma of straw to natto, to take away ammonia" and to facilitate the free access of air to the loosely packed beans. Three bacilli have been isolated in pure culture with which natto of three qualities can be produced. The mean composition of the dry matter of natto which amounts to 46·5 per cent., is: protein 46, fat 20, fibre 6, nitrogen-free extract 3·3, and ash 5 per cent.—E. F. A.

Roselle [Hibiscus sabdariffa]. D. S. Pratt. Philippine J. Sci., 1912, 7, 201—208.

The food plant roselle, *Hibiscus sabdariffa*, has recently been introduced into the Philippine Islands and is the sole representative of a type, in which the calyx supplies the chief edible portion of the plant. After flowering, the calyx thickens and enlarges until it assumes the appearance of a large bud, when it is harvested for making jam or jelly of a brilliant red colour and pleasant acid taste, and for the preparation of syrup and wine. The chemical composition of the calyx is very similar to that of the cranberry, comprising *inter alia* 3·31 per cent. of malic acid, 0·82 per cent. of invert sugar, and 0·24 per cent. of sucrose. The malic acid present consists entirely of the dextro-rotatory modification, which form has never previously been identified in plant composition, and the acidity of the fruit is entirely due to it, analysis proving the absence of tartaric and citric acids. The roselle leaves contain about 1·25 per cent. and the stems about 0·60 per cent. of dextro-malic acid, in consequence of which both stems and leaves can be utilised in conjunction with the calyxes, except when a brilliantly coloured food product is required.—O. R.

Amyl acetate in bananas; Occurrence of ——. C. Kleber. Amer. Perfumer and Essent. Oil Rev., 1912, 7, 235—236.

The pulp from a bunch of bananas was distilled with steam, whereby a few drops of oil were obtained with an intense banana-like odour. This oil was hydrolysed with an aqueous solution of sodium hydroxide and subsequently oxidised by means of permanganate solution, with the formation of valeric acid. As silver acetate was obtained from the alkaline aqueous liquid obtained in the hydrolysis, the presence of amyl acetate in the original oily distillate was inferred.—F. Shdn.

Stachyose; Presence of —— in the haricot and in the seeds of other leguminous plants. G. Tanret. Comptes rend., 1912, 155, 1526—1528.

Stachyose, $C_{24}H_{42}O_{21}$, forms with strontium hydroxide an insoluble compound which is comparable with that of sucrose, and which enables stachyose to be easily separated and purified. In this way the author has shown that haricots (*Phaseolus vulgaris*) contain about 21 grms. of stachyose and 39 grms. of sucrose per kilo. They do not contain reducing sugars. Stachyose has also been isolated with ease from the soya bean (*Soja hispida*), clover (*Trifolium incarnatum*) and goat's rue (*Galega officinalis*), less easily from the lentil (*Ervum lens*) and lupin (*Lupinus luteus*), and not at all from the pea (*Pisum sativum*).—W. H. P.

Flavouring extracts; Canadian standards for ——. Oil, Paint, and Drug. Rep., Dec. 28, 1912. [T.R.]

The standards adopted by the Canadian Government with reference to flavouring extracts are as follows:—

1. A flavouring extract is intended for the purpose of flavouring food, is a solution of correct strength, as hereinafter defined, of sapid and odorous principles derived from an aromatic plant or parts of a plant, with or without its natural colouring matters, and conforms in name to the plant used in its preparation.
2. The usual solvents employed in the preparation of flavouring extracts are ethyl alcohol, water, and glycerin. In the event of any other solvents than ethyl alcohol, water, and glycerin being used, such solvents shall be harmless to health, and their names shall be plainly stated on the label.
3. Solutions of natural or synthetic preparations such as vanillin, coumarin, benzaldehyde, methyl salicylate, or other sapid and odorous compounds, more or less resembling substances found in plants, or absolutely identical with these, if harmless to health, may be sold for flavouring purposes, if properly labelled so as to make it quite clear that they are not extracts as above defined; and preferably by the use of the word "Artificial" or "Imitation."
4. If an extract be fortified or strengthened by having such natural or synthetic preparations as are referred to in the immediately preceding section added to it, the fact of such addition shall be clearly stated on the label, or the word "Compound" or "Mixture" shall be used to describe it.
5. Lemon extract is the flavouring extract prepared from the lemon peel, or from oil of lemon, and contains, along with more or less of the terpenes of lemon oil, not less than 0·2 per cent. of citral derived from oil of lemon.
6. Terpene lemon extract is the flavouring extract prepared as above described, and contains not less than 5 per cent. of oil of lemon and not less than 0·2 per cent. of citral, derived from oil of lemon.
7. Vanilla extract is the flavouring extract prepared from vanilla bean with or without sugar or glycerin, and contains in 100 c.c. the soluble matters from not less than 5 grms. of the vanilla bean (the dried, cured fruit of *Vanilla planifolia*).

Patents.

Margarine and such like products; Manufacture of —— and the production of a synthetic agent suitable as an ingredient therefor. A. R. Wilson, Hornchurch, Essex. Eng. Pat. 24,050, Oct. 30, 1911.

A flavouring material for margarine is produced by the action of bacteria on a solution containing suitable quantities of casein and lactose; the casein may be dissolved in dilute alkali solution and the proportions of the two substances employed is such that no excess of either remains when the bacterial action is complete.—W. P. S.

Butter; Process of purifying ——. I. Worrill, Boston, Ga. U.S. Pat. 1,045,926, Dec. 3, 1912.

Butter is subjected in a closed vessel to the action of steam, care being taken that the temperature does not exceed 213° F. (100·5° C.); water, casein, salt, and

lactic acid separate to form a layer at the bottom of the vessel, whilst the butyric acid is volatilised. The clear butter-fat is then removed, allowed to crystallise at 70° F. (21° C.), and stirred "until the whole is perfectly smooth."
—W. P. S.

Fruit; Method of treating [preserving]. E. L. P. Thomas, Philadelphia, Pa. U.S. Pat. 1,047,592, Dec. 17, 1912.

A mixture is prepared consisting of resorcinol, 1 part, terpene hydrate, 1 part, copper sulphate, 2 parts, sodium salicylate, 2 parts, sodium benzoate, 2 parts, and ammonium carbonate, 4 parts; a portion of this mixture is then mixed with a small quantity of petroleum, and water is added so as to form a "solution" in which the fruits are immersed. The fruits are dried subsequently. The process is particularly suitable for citrus fruits.—W. P. S.

Flour; Apparatus for testing ——. P. Ott. Ger. Pats. 251,732, Dec. 22, 1911, and 252,802, March 26, 1912.

The patents relate to the testing of flour by the so-called water test of Pekar. (1) Pats of the flour are prepared in the usual way by pressing on a glass plate, divided into sections by partitions, and the plate is then slipped into a guide-frame fixed at the requisite angle in a receptacle containing water. On withdrawal from the water, the plate with the pats of wet flour is examined by a suitable optical magnifying device, *e.g.*, by means of a mirror. (2) This relates to a plate and pressing device so formed that several pats of flour can be made side by side and then combined to form a single large pat.—A. S.

Food fats, such as margarine or the like; Production of ——. P. A. Schmitt, Hamburg, Germany. Eng. Pat. 27,487, Dec. 7, 1911. Under Int. Conv., Jan. 16, 1911.

See Fr. Pat. 437,665 of 1911; this J., 1912, 554.—T. F. B.

Milk; Sterilisation of ——. A. Shelmerdine, Liverpool. Eng. Pat. 14,840, Feb. 29, 1912.

See Fr. Pat. 445,170 of 1912; this J., 1912, 1196.—T. F. B.

Potatoes; Process of treating raw —— *in order to obtain both a cattle food and a proteid.* H. Gumpel, Schlagenthin, Germany. U.S. Pat. 1,047,627, Dec. 17, 1912.

See Eng. Pat. 17,937 of 1909; this J., 1910, 713.—T. F. B.

Hydrogenated edible fat compound. U.S. Pat. 1,047,013. *See* XII.

Process for the removal of bitter substances from brewers' yeast. Ger. Pat. 248,561. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Potable water; Source of error in determining the permanganate consumption of —— *by Schulze's method.* L. Grünhut. Z. anal. Chem., 1913, **52**, 36—40.

The determination of oxidisable matter by Schulze's method (boiling with standard permanganate in alkaline solution and subsequent titration) is liable to error in the presence of manganese salts, these being oxidised during boiling, by atmospheric oxygen, to hydrated manganese dioxide which affects the titration. In such a case, the manganese should be first removed by allowing the water (120—150 c.c.) to stand for some minutes, with occasional shaking, after adding 0·6 or 0·75 c.c. of 33 per cent. sodium hydroxide solution, and then filtering through a perforated crucible, after which the determination is made on 100·5 c.c. of the clear filtrate.—F. Sodn.

Formaldehyde in formaldehyde solution; Determination of ——. A. de Bournonville. Ann. de Pharm., July, 1912, 287. Pharm. J., 1913, 7.

The details of this method, taken from the Swiss Pharmacopœia, are as follows:—10 c.c. of formaldehyde are diluted with water to 400 c.c., and to 5 c.c. of the dilute solution 40 c.c. of $N/10$ solution of iodine are added. Caustic soda solution is then run in drop by drop till the colour becomes bright yellow, and the solution is allowed to stand for ten minutes. 2·5 c.c. of dilute hydrochloric acid are added, and the non-combined iodine is titrated back by a $N/10$ solution of sodium thiosulphate. It is very necessary to use a solution of formaldehyde of 1 per cent. strength.

The slate-bed treatment of sewage. Dibdin. *See* London Section, p. 55.

Patents.

Water or other liquids; Process for treating —— *by means of ultra-violet rays produced in a quartz lamp, and apparatus therefor.* C. Knips, Charlottenburg, Germany. Eng. Pat. 5635, March 6, 1912. Under Int. Conv., March 6, 1911.

A quartz mercury lamp, having the form of a hollow circular or elliptical cylinder is mounted in a chamber; the water to be treated enters the lower part of the latter, flows upwards past the outer surface of the lamp, then downwards through the central space, and is discharged at the bottom of the chamber.—W. P. S.

Water; Process for sterilising and removing iron from —— *by introducing compressed air in closed vessels.* R. Lantzsch. Ger. Pat. 254,357, Oct. 3, 1911.

Air is compressed to a very high degree (up to 30 atmos.) and then passed through a reducing valve to bring it to a lower pressure before allowing it to come in contact with the water.—T. F. B.

Fluids such as water and sewage; Process of treating ——. J. M. Neil, New York. U.S. Pat. 1,045,096, Nov. 19, 1912.

Water or sewage is mixed in a tank with a suitable precipitant, the quantity of the latter employed being more than sufficient to precipitate the foreign organic matters in the liquid. While the mixture is being stirred, clear water is withdrawn through a filter situated in the tank until the surface of the filter becomes coated; the filter is then quickly cleaned and the process continued.—W.P.S.

Sewage-disposal plant. S. B. Goff, Camden, N.J. U.S. Pat. 1,046,172, Dec. 3, 1912.

A settling tank is provided with a horizontal partition at its upper part; an opening at the centre of this partition is fitted with a float-valve, a pipe from which extends into the lower portion of the tank. The walls of the tank above the partition are perforated, and a liquid receptacle, provided with a straining device, surrounds the tank. The bottom of this receptacle is in communication with a filter through which the liquid passes in an upward direction, and means are provided for aerating and agitating the liquid flowing from the upper part of the filter chamber.
—W. P. S.

Liquids; Method of purifying ——. E. Gates. Chevy Chase, Md., Assignor to Germproof Rapid Sand Filtration Co., New York. U.S. Pat. 1,045,830, Dec. 3, 1912.

The liquid is passed through a filter-bed while the particles constituting the bed are moved in a direction opposite to that in which the liquid is flowing; the rate of movement of the particles is such that solid impurities in the liquid are prevented from traversing the filtering medium. The particles are discharged at the surface of entry for the liquid, sterilised, and continuously returned to the filter.
—W. P. S.

Sewage sludge, faeces, etc; Process for rendering inodorous and utilising ——. F. Gebhard. Ger. Pat. 249.936. Jan. 13, 1911.

The sludge or the like is treated with the mud (North Sea mud, sea mud), containing finely divided alumina and silica, which is found in practically unlimited quantities at the mouths of rivers. The mud is dried and ground and is used in the proportion of 1 part to 1 part of the sewage sludge, whereby an inodorous product, suitable for transport, is said to be obtained.—A. S.

Water: Apparatus for effecting the sterilisation of —— by ozonation. E. L. Joseph, Westminster. U.S. Pat. 1,047,534, Dec. 17, 1912.

See Eng. Pat. 27,226 of 1908; this J., 1910, 171.—T. F. B.

Sulphur [fungicide]; Suspensible —— and process for producing same. H. W. Hillyer, Farmington, Conn., Assignor to Thomsen Chemical Co., Baltimore, Md. U.S. Pat. 1,048,161, Dec. 24, 1912.

See Fr. Pat. 435,197 of 1911; this J., 1912, 351.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine assay. P. J. Kruysse. Chem. and Drug., 1913, **82**, 2.

In order to determine the amount of quinine in cinchona bark, use is made of the insolubility of the nitroprusside. 5 grms. of the finely powdered bark are made into a paste with 3·5 c.c. of water and 1 c.c. of 10 per cent. ammonia solution. The moist mass is mixed with 2·5 grms. of calcium hydroxide and extracted with acetone in a Soxhlet for 2 hours. The acetone is distilled off and the residue dried. The alkaloids are extracted from the residue by warming it with 25 c.c. of 1 to 1·5 per cent. hydrochloric acid. The acid solution is filtered into a separator, made alkaline with potassium hydroxide, and shaken out twice with ether, using 200 c.c. each time. The alkaloids are removed from the ether by shaking out with small portions of hydrochloric acid (1 to 1·5 per cent.), the extracts mixed, and neutralised with potassium hydroxide solution. The liquid obtained, measuring about 50 c.c., is heated to boiling and 0·5 grm. of ammonium oxalate added. When cold the crystals are collected on a filter and washed with small portions of water. The oxalates are dissolved on the filter with 5 c.c. of 2 per cent. hydrochloric acid, and the filter is washed. $N/2$ ammonia is added to the filtrate and washings in quantity just insufficient to cause precipitation. A few drops of a concentrated solution of calcium chloride are then added, and the calcium oxalate filtered off. The filtrate is exactly neutralised with $N/2$ ammonia, using litmus paper as indicator. The solution is warmed, treated with 0·5 grm. of sodium nitroprusside, and allowed to cool. The crystals are collected on a filter, washed with small amounts of water, and dried at 100° C. The weight obtained is multiplied by 1·03, and corrected by the addition of 0·05 grm. to cover loss as oxalate and nitroprusside. The result gives the weight of quinine sulphate in the original weight of bark taken.—F. Shdn.

Strychninesulphonic acid; Isolation of the hydrate of a fourth ——. H. Leuchs and J. Wutke. Ber., 1912, **45**, 3686—3691.

The fourth isomeric strychninesulphonic acid (see this J., 1909, 905) forms a hydrate. It melts at 275° C. with decomposition and has $[\alpha]_D = +18{\cdot}3°$ in sodium hydroxide solution.—F. Shdn.

Digitalis. S. Hirohashi. J. Pharm. Soc. Japan, No. 369. Chem. and Drug., 1913, **82**, 18. (See also this J., 1913, 44.)

The active principles of digitalis leaves can be nearly all extracted by using considerable quantities of cold water. Infusion gives good results, but it is not advantageous to concentrate the infusion. Absolute alcohol is a better solvent than water, chloroform, or dilute alcohol. An infusion can be evaporated without loss of any of its physiological effects. The leaves gathered from different parts of the plant differ in their physiological effect, there being a diminution in the latter from the top downwards. The best time to collect the leaves is before inflorescence. The flowers, which probably contain more active principles than the leaves, have a maximum of activity during budding. There is no appreciable difference in activity between red and white flowers. The activity of the flowers remains unchanged for over a year if they are carefully preserved.—F. Shdn.

Cytisine, the alkaloid of Cytisus laburnum; The constitution of ——. Part I. The synthesis of α- and β-cytisolidine. A. J. Ewins. Proc. Chem. Soc., 1912, **28**, 329.

By the action of hydriodic acid and phosphorus on cytisine, $C_{11}H_{14}ON_2$, at a temperature of 225°—230° C., Freund (Ber., 1904, **37**, 16) obtained among other products a feebly basic, crystalline solid, cytisoline, $C_{11}H_{11}ON$ (m. p. 198°), and a strongly basic oil, β-cytisolidine, to which he gave the formula $C_{11}H_{15}N$. Cytisoline, on reduction with sodium in alcoholic solution, gave a strongly basic oil of the composition $C_{11}H_{15}N$, which was termed α-cytisolidine on account of its supposed isomerism with β-cytisolidine. The constitutions of these two bases have now been established by their synthesis. α-Cytisolidine is identical with 6:8-dimethyl-1:2:3:4-tetrahydroquinoline ($C_{11}H_{15}N$), and β-cytisolidine with the corresponding 6:8-dimethylquinoline ($C_{11}H_{11}N$). The formula assigned to β-cytisolidine by Freund is thus inaccurate.

The relationship of the bases obtained by Freund must therefore be as follows:—

Cytisoline, $C_{11}H_{11}ON$....	(?)-Hydroxy-6:8-dimethylquinoline.
β-Cytisolidine, $C_{11}H_{11}N$..	6:8-Dimethylquinoline.
α-Cytisolidine, $C_{11}H_{15}N$..	6:8-Dimethyl-1:2:3:4-tetrahydroquinoline.

The constitution of cytisine, from which cytisoline is formed by the elimination of the elements of ammonia, remains undetermined.

Liquorice root and liquorice extract; Constituents of ——. P. A. Houseman. Amer. J. Pharm., 1912, **84**, 531—546.

After describing the methods in use for the analysis of liquorice extracts (see this J., 1911, 647), the results are given of determinations of the resins, bitter principles, glycyrrhizin and sugars in roots obtained from different countries. The resins are confined to the bark of the root, and if careful extraction with hot water is carried out they remain behind for the most part. About one-third of the glycyrrhizin is decomposed during the extraction process when hot water is used.—F. Shdn.

Asafetida. E. J. Parry. Chem. and Drug., 1913, **82**, 34.

Recently the U.S. Customs authorities have required, in analyses of samples of asafetida destined for importation into that country, the so-called "lead value" of the ether-soluble resin. The author points out the worthlessness of such a figure as a criterion of the purity of asafetida. Apart from the fact that numerous organic substances are precipitated by lead acetate and that it is thus easy to adulterate asafetida so as to obtain any desired "lead value," it is pointed out that in the present state of our knowledge the chemical analysis of asafetida is of little value. It is stated that five samples of asafetida, with lead values between 144 and 172, were recently rejected by the U.S. Customs authorities, apparently on the ground that their lead values were below 200, although these samples were described as of "the best quality possible" by experts in London.—A. S.

Bergapten; Constitution of ——. H. Thoms and E. Baetcke. Ber., 1912, **45**, 3705—3712.

The constitution assigned to bergapten by Pomeranz (Monats. f. Chem., 1893, **14**, 28) was that of a cumarin-cumarone derivative. This is now confirmed, and a formula is given for the substace. Nitrobergapten was reduced by the action of tin and hydrochloric acid with the production of aminobergapten, $C_{12}H_7O_4NH_2$, m. pt. 198° C. This was oxidised by means of chromic acid to form a quinone, $C_{11}H_4O_6$, m. pt. 248°—250° C. Aminoxanthotoxin (this

J., 1911, 1468) was prepared by a similar series of reactions, and melts at 246°—247° C. after crystallising from alcohol. When oxidised by means of chromic acid, a quinone is produced identical with that obtained from aminobergapten. A quinol, $C_{11}H_4O_3(OH)_2$, can be formed by reducing the quinone with sulphurous acid. The diacetyl derivative of the quinol melts at 208°—209° C. —F. Shdn.

Terpenes and essential oils. 112th Communication. Condensation products of cyclic ketones with acetone. O. Wallach. Annalen, 1912, **394**, 362—384.

Cyclic ketones were mixed with acetone, cooled, and a solution of sodium ethoxide added. The mixture was kept at 0° C. for an hour, then allowed to stand at the ordinary temperature for 2—3 days. The whole was mixed with water, and the oil which formed separated and fractionated. The condensation products, which were unsaturated ketones, were purified by means of the semicarbazones. Saturated ketones were prepared from them by reduction. The characters of the condensation products were as follows. From cyclopentanone; unsaturated ketone, $C_8H_{12}O$, b. pt. 195°—199° C., sp. gr. 0·9565 at 20° C., $n_D=1·4932$; saturated ketone, $C_8H_{14}O$, b. pt. 176·5°—177·5° C., sp. gr. 0·9000 at 21° C., $n_D=1·4419$. From 1,3-methylcyclopentanone; unsaturated ketone, $C_9H_{14}O$, b. pt. 203°—205° C., sp. gr. 0·9315 at 21° C., $n_D=1·4846$; saturated ketone, $C_9H_{16}O$, b. pt. 186°—187° C., sp. gr. 0·8850 at 20° C., $n_D=1·4392$. From cyclohexanone; unsaturated ketone, $C_9H_{14}O$, b. pt. 203°—204° C., sp. gr. 0·9375 at 19° C., $n_D=1·4736$; saturated ketone, $C_9H_{16}O$, b. pt. 200° C., sp. gr. 0·9050 at 20° C., $n_D=1·4514$. From 1,4-methylcyclohexanone; unsaturated ketone, $C_{10}H_{16}O$, b. pt. 216°—217° C., sp. gr. 0·9160 at 21° C., $n_D=1·4672$; saturated ketone, $C_{10}H_{18}O$, b. pt. 214°—215° C., sp. gr. 0·8930 at 21° C., $n_D=1·4499$. From 1,3-methylcyclohexanone; unsaturated ketone, $C_{10}H_{16}O$, b. pt. 214°—216° C., sp. gr. 0·9180 at 20° C., $n_D=1·4673$; saturated ketone, $C_{10}H_{18}C$, b. pt. 213°—214° C., sp. gr. 0·8910 at 21° C., $n_D=1·4496$. From 1,2-methylcyclohexanone; unsaturated ketone, $C_{10}H_{16}O$, b. pt. 216°—217° C., sp. gr. 0·936 at 19° C., $n_D=1·4778$; saturated ketone, $C_{10}H_{18}O$, b. pt. 212°—214° C., sp. gr. 0·9050 at 21° C., $n_D=1·4546$.—F. Shdn.

Essential oils; Constituents of ——. Constitution of selinene. F. W. Semmler and F. Risse. Ber., 1912, **45**, 3725—3731.

The naturally occurring selinene (this J., 1912, 1200) is a mixture consisting for the most part of pseudo-(β)-selinene and a little ortho-(α)-selinene. The pseudo-compound can be nearly all converted into the ortho-compound by regenerating the hydrocarbon from the dihydrochloride, both hydrocarbons yielding the same dihydrochloride. In the pseudo-compound there is a double bond in the methylene position which migrates into the nucleus in the ortho-compound. The pseudo-compound was oxidised by means of ozone, and a diketone was produced, which was purified through the disemicarbazone, m. pt. 228° C. The pure diketone, $C_{13}H_{20}O_2$, boils at 178°—180° C. at 11 mm., has the sp. gr. 1·0566 at 20° C., $n_D=1·49994$, and $\alpha_D=+15°$. A small amount of a diketomonocarboxylic acid, $C_{14}H_{22}C_4$, is produced at the same time, the methyl ester of which boils at 185°—190° C. at 11 mm. When the ortho-compound is oxidised in the same way, larger amounts of the acid are produced, but less of the diketone. —F. Shdn.

Menthadiene from carvacrol; Synthesis of a ——. Chemistry of the terpenes. Part XV. G. G. Henderson and S. P. Schotz. Chem. Soc. Trans., 1912, **101**, 2563—2568.

The synthesis of a methadiene from carvacrol by similar methods to those employed by Henderson and Boyd for the synthesis of a menthadiene from thymol (Chem. Soc. Trans., 1911, **99**, 2159) is described. The steps employed were briefly: (i), conversion of carvacrol into hexahydrocarvacrol (carvomenthol) by treatment with hydrogen in presence of finely-divided nickel; (ii), dehydration of the hexahydrocarvacrol, yielding a menthene, apparently the Δ^1-isomeride; (iii), conversion of the menthene into a dibromomenthane; and (iv), elimination of hydrobromic acid from the latter. The menthadiene obtained gave no crystalline nitrite and was therefore not phellandrene; it was not identical with the product obtained by Kondakow and Schindelmeiser (this J., 1905, 1029; 1907, 341), but was very similar to the product obtained from thymol and had the following constants—b. pt. 172°—174° C.; sp. gr. at 20°/4° C.. 0·8272; $n_D=1·4643$; molecular refraction 45·36 (calculated 45·24); it was an unsaturated compound and readily absorbed oxygen, combustion showed its composition to be that of a terpene—$C_{10}H_{16}$, but its constitution has not yet been determined. The authors are of the opinion that intramolecular change took place during the synthesis of the menthadiene, probably in the formation of the dibromide from the Δ^1-menthene.—R. G. P.

Terpenes; Hydrogenation of ——. Combined actions of catalysts. W. I. Ipatiew and N. Matow. J. Russ. Phys.-Chem. Soc., 1912, **44**. 1695—1703. (See this J., 1911, 108; 1912, 46.)

When heated at 240° C. for 20 hours with nickel oxide in an atmosphere of hydrogen under high pressure (initial pressure, 110 atmospheres), fenchone gives an excellent yield of the corresponding alcohol, fenchenol. In presence of alumina and nickel oxide and in an atmosphere of compressed hydrogen, fenchenol is transformed at 215° C. into fenchane, which agrees in its properties more closely with Zelinsky's fenchane than with that of Kijner. Similarly, in presence of nickel oxide at 240° C., camphene yields isocamphane, which is also obtained from borneol in presence of nickel oxide and alumina at 215°—220° C. The following catalytic changes are also effected by these oxides in presence of compressed hydrogen at high temperatures: isoborneol into isocamphane, camphor into isocamphane, borneol into camphene, and isoborneol into camphene. The bearing of these transformations on the constitution of various derivatives of camphor is discussed.—T. H. P.

Catalytic reactions at high temperatures and pressures. Aldehydes, ketones, alcohols and diketones; Catalytic reduction of unsaturated ——. W. Ipatiew. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1703—1709.

The author has carried out a number of reductions in presence of various catalysts and in an atmosphere of hydrogen under high pressure. The use of a stirrer which keeps the catalyst continually mixed with the liquid is found to effect considerable increase in the rate of the reaction and to prevent the formation of condensation products. With reduced palladium as catalyst and an initial pressure of hydrogen of 110 atmospheres, β-methyl-β-ethylacrolein gives a good yield of γ-methyl-*n*-amyl alcohol, $CH_3.CH_2.CH(CH_3).CH_2.CH_2.OH$, b. pt. 145°—146° C. (758 mm.), sp. gr. 0·8227 at 18° C. Under similar conditions, mesityl oxide, $C(CH_3)_2:CH.CO.CH_3$, gives methyl isobutyl ketone, while, if reduced nickel is used instead of palladium, a mixture of this ketone with methylisobutylcarbinol is obtained. Citral yields 2 : 6-dimethyloctanol-8, $C_{10}H_{22}O$, b. pt. 107°—108° C. (12 mm.), sp. gr. 0·8296 at 18° C.; if the stirring is intermittent, this is accompanied by 2 : 6-dimethyloctane and certain unsaturated products. Geraniol gives decanol (see Enklaar, this J., 1908, 766) mixed with small amounts of decane. According to the conditions employed, acetylacetone yields αγ-dimethyltrimethyleneglycol, $CH_3.CH(OH).CH_2.CH(OH).CH_3$, or methyl propyl ketone.—T. H. P.

Carbohydrates; Catalytic reduction of ——. W. Ipatiew. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1710—1712.

The author's method of reduction (see preceding abstracts) serves as a suitable means of preparing polyhydric alcohols from the corresponding sugars. The latter were employed in 20—30 per cent. aqueous-alcoholic solutions and the catalysts used were reduced palladium and a mixture of reduced nickel with nickel oxide; a temperature of

130°—135° C. is convenient. Under these conditions, lævulose yielded *d*-mannitol, dextrose yielded *d*-sorbitol, and lactose, dulcitol and an uncrystallisable syrup. —T. H. P.

p-Lactylphenetidine with bromine water ; Reaction of ——. O. Anselmino and H. Grossheim. Apoth.-Zeit., 1912, **27**, 1020—1021.

In order to get a satisfactory reaction between *p*-lactylphenetidine and bromine water certain precautions must be observed. A solution of 0·1 grm. of the substance in 10 c.c. of hot water is prepared and afterwards cooled and well shaken. After filtering, the amount left in solution should not exceed 1 : 500. A nearly saturated aqueous solution of bromine is added, preferably from a burette to avoid the action of the bromine vapour, till a yellow colouration is obtained which persists for at least a minute. The solution should then show no turbidity. The yellow colouration disappears after a short time, giving place to a white crystalline precipitate, the liquid subsequently turning reddish-brown. The precipitate, which consists of dibromo-*p*-lactylphenetidine, can be crystallised from alcohol and melts at 164° C.—F. Shdn.

Salol ; Incompatibility of ——. I. Bellucci. Atti R. Accad. dei Lincei, Roma, 1912, **21**, II., 610—616.

It frequently happens that when two solid dry pharmaceutical substances are intimately mixed, the mixture after a longer or shorter period becomes pasty or liquid. The author has examined, by the method of thermal analysis, mixtures of salol with β-naphthol, antipyrine, urethane, menthol, chloral hydrate, thymol, and guaiacol, and finds that in all these cases the softening is due not to the formation of a chemical compound but to that of an eutectic mixture. The melting points and percentages of salol in the eutectic mixtures of salol with the substances mentioned above and with camphor and camphor bromide (see Caillé, Comptes rend., 1909, **148**, 1458) are as follow : with β-naphthol, 34° C., 90 per cent. ; with antipyrine, 30° C., 83 per cent. ; with urethane, 29° C., 86 per cent. ; with menthol, 28° C., 45 per cent. ; with camphor bromide, 21° C., 64 per cent. ; with chloral hydrate, 17° C., 61 per cent. ; with thymol, 13° C., 66 per cent. ; with camphor, 6° C., 56 per cent. ; with guaiacol, 3° C., 53 per cent. Salol and menthol form a continuous series of solid solutions.—A. S.

Glycerotriphosphoric acid ; Contardi's ——. P. Carré. Comptes rend., 1912, **155**, 1520—1521. (See also this J., 1912, 203, 1006.)

Contardi has stated that when one molecule of glycerol and 3 molecules of phosphoric acid are heated together, the product is almost exclusively glycerotriphosphoric acid, $C_3H_5(H_2PO_4)_3$. The author shows that in reality the reaction produces glycerodiphosphoric acid, glycerophosphoric acid and an ethereal salt of the type RH_2PO_4, while a large proportion of the phosphoric acid remains unchanged. It is the formation of the ester, and not of glycerotriphosphoric acid, which accounts for the low yields in making glycerophosphate technically.—W. H. P.

Ethyl acetate ; Purification, density, expansion, and vapour pressure of ——. J. Wade and R. W. Merriman. Chem. Soc. Trans., 1912, **101**, 2429—2438, and 2438—2443.

Ethyl acetate was prepared by the continuous process of Wade (this J., 1905, 1322) and purified by one or other of the methods previously described. The specific gravities were determined by means of a Gay-Lussac pyknometer with a mark on a capillary neck, provided with a special apparatus for filling with the liquid without access of moisture ; all determinations give the sp. gr. at 0° C. compared with water at 4° C. Four different preparations gave values lying between 0·92453 and 0·92457, mean 0·92454. Young and Thomas' lower values of 0·92434—0·92438 were probably caused by slight decomposition on heating the ester with phosphorus pentoxide ; the authors obtained products with similar low densities by distilling the pure ester from phosphorus pentoxide. The phosphorus pentoxide must only be used to dry the ester in the cold, and the ester must be poured off before fractionating. Nine determinations of the expansion were made at temperatures from 0° (sp. gr. 0·92454) to 34·83° C. (sp. gr. 0·88236) ; and from the smoothed curve resulting from the plotting of the results, the following formula was deduced for the density at any temperature *t*° between 0° and 40° C. :—

$$\text{Density} = 0{\cdot}92454-(0{\cdot}001168t+0{\cdot}00000195t^2-0{\cdot}00000002t^3).$$

The following table of specific volumes is also given :—

	0° C.	10° C.	20° C.	30° C.
Elsässer (Annalen, **218**, 306)	1	1·01263	1·02613	1·04045
Wade and Merriman ..	1	1·01301	1·02663	1·04080
Zander (quoted by Elsässer)	1	1·01353	1·02728	1·04142

The vapour-pressure was obtained by determining the boiling-point at various constant pressures by means of the authors' apparatus (this J., 1911, 769) ; curves were drawn by plotting the results, and also *dt/dp* and log *p* against the temperature, and a table of mean vapour pressure at temperatures from 0° C. (24·1 mm.) to 100° C. (1536·0 mm.) is given. The boiling-point at 760 mm. is 77·15° C.—J. T. D.

Errata.

This Journal, Jan. 15, 1913, p. 45, col. 1, line 39 from bottom, *for* " nitro-*bis*-apomethyldihydro- " *read* " nitro-*bis*-apomethyldehydro " ; and line 37 from bottom, *for* " nitro-*bis*-apomethyl-*iso*-quinolone " *read* " nitro-*bis*-apomethyl-*iso*-brucinolone."

Determination of glyceryl acetate in essential oils. Hall and Harvey. *See* London Section, p. 61.

Patents.

Bromonaphthol compounds ; Process for the preparation of tasteless therapeutically utilisable ——. W. E. Lake, London. From Pearson und Co. G. m. b. H., Hamburg, Germany. Eng. Pat. 5436, March 4, 1912.

The esters of mono-, di-, or tribromo-β-naphthol with organic acids possessing antiseptic or other therapeutic properties, are claimed as intestinal disinfectants. They are prepared by esterifying in the usual manner the products obtained by the action of bromine on β-naphthol dissolved in sodium hydroxide solution. For example, the esters with benzoic, cinnamic, salicylic, camphoric, phenolsulphonic, naphtholsulphonic, or cresolsulphonic acids may be used. Monobromo-β-naphthol benzoate melts at 94°—95° C., the dibromo compound at 174° C., and the tribromo compound at 191°—192° C.—T. F. B.

Iron, phosphorus, and albumin ; Manufacture of compounds of ——. O. Imray, London. From Soc. of Chem. Industry in Basle, Switzerland. Eng. Pat. 13,866, June 13, 1912.

Easily resorbed iron salts of the assimilable phosphorus compound contained in plants (inositol-phosphoric acid), are obtained by the action of iron salts on the phosphorus compound, either in the form of the free acid or its alkali or alkaline-earth salts, in presence of albumin, in such manner that the albumin is precipitated at the same time. The iron salts thus formed possess colloidal properties, even when dry ; they are insoluble in water and in indifferent organic solvents, and are slowly decomposed by sodium carbonate solutions ; 15 per cent. hydrochloric acid dissolves the iron from them. *Example :* 160 parts of egg-albumin and 45 parts of sodium inositol-phosphate are dissolved in 2500 parts of water and 70 parts of 30 per cent. caustic soda solution ; the mixture is added rapidly to a solution of 70 parts of 60 per cent. ferric chloride and 500 parts of common salt in 2000 parts of water heated to 80°—90° C. When filtered, washed, and dried, the precipitate contains about 5 per cent. of phosphorus and 7·8 per cent. of iron.—T. F. B.

Aromatic stibinic acids and their alkali salts; Manufacture of ——. Chem. Fabr. von Heyden A.-G., Radebeul, Saxony. Eng. Pat. 16,350, July 12, 1912. Under Int. Conv., Aug. 2, 1911.

Phenylstibinic acid and its derivatives are readily obtained by treating aromatic diazo compounds with antimonious acid or its salts and splitting off the diazo group by the usual method. *Example:* A solution of diazobenzene sulphate obtained from 93 parts of aniline, 71 parts of sodium nitrite, 1000 parts of water, and 147 parts of sulphuric acid, is added at about 0° C. to a solution of sodium antimonite obtained from 140 parts of antimonious acid. After some hours the excess of alkali is neutralised by adding dilute sulphuric acid, the mixture is filtered, and phenylstibinic acid is precipitated from the filtrate by adding hydrochloric acid. It may be purified by converting it into phenylstibine oxychloride and re-forming it by means of sodium carbonate solution. The acid thus produced is not decomposed even at 250° C., and forms sparingly soluble salts with alkalis. The preparation and properties of *p*-hydroxy- and *p*-acetaminophenylstibinic acid are also described.
—T. F. B.

Pharmaceutical compounds [fatty acids containing arsenic or phosphorus]; Manufacture of ——. F. Heinemann, Berlin. Eng. Pat. 18,732, Aug. 15, 1912. Under Int. Conv., Nov. 29, 1911.

When fatty acids of the acetylene series are heated with trihalogen derivatives of arsenic or phosphorus, products are obtained which, in the case of the higher acids, resemble fats, and are absorbed in the digestive organs. *Example:* Two parts of stearolic acid and 3 parts of arsenious chloride are heated in a closed vessel for six hours at 140° C.; the unchanged chloride is removed from the product by distillation or by shaking the ethereal solution with water. When converted into its potassium salt, the new compound is obtained in a semi-fluid form, containing 10—11 per cent. of arsenic and 6—7 per cent. of chlorine. The preparation of similar products from stearolic acid and phosphorus trichloride, and from behenolic acid and arsenic trichloride and tribromide and phosphorus tribromide, is also described in detail.—T. F. B.

Organic arseno-compounds; Process for preparing ——. H. Bart. Ger. Pat. 254,092, Dec. 8, 1910.

A salt of arsenious acid or of an arylarsenious acid in solution or suspension is treated with a diazo compound in presence of a catalytic agent, such as copper powder, a copper compound, silver, etc.; the resulting compounds differ from those prepared according to Eng. Pat. 568 of 1911 (this J., 1911, 1087) in that they are readily reduced by hydrosulphites in the cold to arsenobenzene derivatives.—T. F. B.

Organic arseno-compounds; Process for preparing ——. H. Bart. Ger. Pat. 254,345, Nov. 3, 1910. Addition to Ger. Pat. 250,264, Jan. 8, 1910 (see Eng. Pat. 568 of 1911; this J., 1911, 1087).

Triarylarsinic acids or their anhydrides are obtained by the action of aromatic diazo compounds on diarylarsenious acids.—T. F. B.

Separating [odourous] substances; Method of ——. F. Ecaubert, New York. U.S. Pat. 1,046,568, Dec. 10, 1912.

A method of transferring an odour from a material holding it to another material consists in mixing the odourous material with a substance having a greater attraction for the odour, a different specific gravity, and a lower melting point, exposing the mixture in liquid form and substantially constant mass to the action of centrifugal force, and cooling the mixture while separation is taking place to a temperature intermediate between the melting points of the materials until the material to be treated solidifies, leaving the odour-attracting material in liquid form.—H. H.

Medicinal and pharmaceutical preparation. B. L. Maltbie, East Orange, N.J. U.S. Pat. 1,047,961, Dec. 24, 1912.

Preparations are claimed consisting of or containing the calcium salts of phenol-monomethyl ethers, especially calcium "creosate" or a mixture thereof with calcium guaiacate. Such preparations may be obtained by the action of basic calcium compounds on beech-wood creosote.
—T. F. B.

Tobacco and tobacco ribs (leaf stalks, etc.); Process for improving ——. W. Koenig. Ger. Pat. 252,121, July 2, 1911.

The tobacco is treated with proteolytic enzymes, such as pepsin, trypsin, or papaïn, whereby its protein-content is diminished and its burning properties improved. Tobacco of high protein-content is thus rendered suitable for the manufacture of cigars, etc.—A. S.

Condensation products resembling acetals, from polyhydric alcohols with aldehydes or ketones; Process for preparing ——. W. Gerhardt. Ger. Pat. 253,083, March 23, 1910.

A mixture of a polyhydric alcohol (glycerol, glycols, etc.) with an aldehyde or a ketone is heated in such a manner that the water, formed during the reaction, is distilled off, so that the formation of the acetal may be complete. To obtain a solid product, the residual mass is treated with gaseous hydrochloric acid.—T. F. B.

Ethylene from acetylene and hydrogen; Process for preparing —— *in presence of a catalyst.* W. Karo. Ger. Pat. 253,160, May 21, 1911.

As catalyst for this process is used a mixture of at least one metal of the platinum or palladium group (platinum, osmium, iridium, palladium, rhodium, ruthenium) with one of the following metals:—iron, nickel, cobalt, copper, silver, magnesium, zinc, cadmium, aluminium. The catalyst is used in such a form that adequate free surface of each metal is exposed. The common metals act as protective agents for the rarer metals, since they combine more readily with the impurities in the gases.—T. F. B.

Acetaldehyde and its condensation and polymerisation products from acetylene; Process for preparing ——. N. Grünstein. Ger. Pats. 253,707 and 253,708, March 10, 1910, and Jan. 28, 1911. Additions to Ger. Pat. 250,356, Feb. 16, 1910 (this J., 1912, 1053).

(1) Acetylene is passed into a solution of a mercury salt in a highly concentrated organic or mineral acid, other than sulphuric or hydrochloric acid, at temperatures below 50° C. The aldehyde is extracted from the resulting solution by means of naphtha, etc. (2) A solution of the mercury salt in any organic or mineral acid, other than sulphuric acid, is treated with acetylene in presence of a solvent for aldehyde which is not miscible with or acted upon by the mercury salt solution.—T. F. B.

Ether; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 253,755, Dec. 23, 1910.

The crude spirit vapours obtained by distillation of fermented worts, are treated with sulphuric acid by a continuous process, without separation of the impurities of low boiling-point; these consist mainly of acetaldehyde and crotonaldehyde, which are converted into ether by treatment with sulphuric acid.—T. F. B.

Fenchyl ester [salicylate]; Process for preparing a ——. Chem. Fabr. Dr. von Kereszty, Dr. Wolf und Co. Ger. Pat. 253,756, Nov. 30, 1911.

Fenchyl alcohol is converted into fenchyl salicylate by treatment with salicylic acid or a salicylic ester according to the usual method. The product is solid and crystalline, and possesses antirheumatic properties.—T. F. B.

Dimethylacetylene and ethylacetylene from carbides ; Process for preparing ——. C. W. Schlechter. Ger. Pat. 253,802, Jan. 15, 1911.

When alkaline-earth carbides are heated with methyl alcohol in closed vessels to temperatures between 60° and 250° C., mixtures of dimethylacetylene and ethylacetylene are produced, the proportions depending on the temperature used. Carbides of average quality yield from 50 to 60 per cent. of hydrocarbons. The reaction may be carried out in very hard glass tubes or in iron or iron-lined autoclaves. The product may be converted into the corresponding ketone (methylethylketone) by treatment with mercuric chloride solution.—T. F. B.

Infectious diseases ; Process for preparing protective and curative agents for ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 254,102, Feb. 19, 1911.

Various kinds of virus, or bacteria, which have not been extracted nor freed from fat, are heated to boiling, preferably with agitation, with solutions of soaps or polyhydric alcohols, and the resulting emulsions are injected into animals, from the blood of which the serum is finally extracted in the usual manner.—T. F. B.

Strontium cholate ; Process for preparing ——. Knoll und Co. Ger. Pat. 254,530, Dec. 2, 1911.

Strontium cholate, which is of value in therapeutics, may be prepared by the usual methods of salt formation, notably by the interaction of cholic acid with strontium hydroxide in solution.—T. F. B.

Iodine solutions and methods of manufacturing the same. J. Wemer, New York. Eng. Pat. 1197, Jan. 15, 1912.

See U.S. Pat. 1,013,913 of 1912 ; this J., 1912, 204.—T. F. B.

Di[hydr]oxydiamino-arsenobenzene ; Derivatives of —— *and process of making same.* F. Stolz and F. Flächer, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,048,002, Dec. 24, 1912.

See Fr. Pat. 441,392 of 1912 ; this J., 1912, 844.—T. F. B.

Hemoglobin preparations ; Making clear and durable ——. P. Lewy, Berlin-Wilmersdorf, Germany. U.S. Pat. 1,048,185, Dec. 24, 1912.

See Eng. Pat. 27,113 of 1907 ; this J., 1908, 522.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic silver prints ; Sulphide toning of —— *by means of colloidal sulphur.* A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1912, **3**, 378—380.

To avoid the necessity for using hot toning baths for sulphide toning of bromide and similar prints, such as are necessary in the ordinary hypo-alum process, it is proposed to utilise the method of forming colloidal sulphur by adding an acid to a solution of sodium thiosulphate containing a colloid, such as albumin, glue, dextrin, or gum arabic. A suitable solution consists of 125 grms. of thiosulphate and 250 grms. of a 50 per cent. dextrin solution in 1000 c.c. of water, to which is added 50 c.c. of hydrochloric acid at the time of use. Silver gelatino-bromide or gelatino-chloride prints are only very slightly altered in colour when immersed in this solution, but if they are allowed to remain in it for 20—25 minutes and then washed for a considerable time (*e.g.*, 90 minutes) with water, brown tones, similar to those produced by the hot hypo-alum baths, are obtained. It is possible in this process to replace the acid by alum or a bisulphate, but this prolongs the process ; it is, however, advantageous to add alum to the toning bath for hardening purposes. —T. F. B.

Patent.

Photographic chemicals. A. A. Kelly, Sidcup. Eng. Pat. 27,589, Dec. 8, 1911.

Photographic chemicals are packed in a semi-solid or semi-liquid form in collapsible containers, the delivery orifices of which are of such a size that a unit length of extruded chemical represents a standard quantity of the product. A graduated stirring rod is provided to receive and measure the extruded material.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; The energy of ——. W. O. Snelling. Proc. Eng. Soc. of Western Pennsylvania, 1912, **28**, 653—673.

The author describes the methods used in measuring the total energy of explosion, and the component parts, "percussive" and "propellent" energy. He considers the most useful figures for the relative proportions of the two latter are given by a Trauzl block suspended on its side in a stirrup, so that it forms the bob of a pendulum of long radius. The "percussive" force is used in enlarging the cavity of the block, and the "propellent" force causes the block to swing. The question of the most suitable explosives for different kinds of mining work is discussed, and tables are given of the common explosives in their order of decreasing percussive force, and of rocks in their order of toughness. The best explosive for a particular piece of work is that which combines in the best proportions the two properties of "breaking" by percussion, and "shaking" by heaving. The author considers that the most serious of the common losses of energy in explosives work is due to the use of explosives not suited to the work which they are called upon to perform. Other common losses are : (1) the employment of detonators too weak to explode the charge properly ; and (2) insufficient use of tamping. The author shows the fallacy of the popular idea that high explosives "strike" downwards.—T. St.

Phosphorus sesquisulphide ; Detection and determination of free white phosphorus in ——. T. Schloesing. Comptes rend., 1912, **155**, 1461—1464.

It is not possible to estimate small quantities of white phosphorus in phosphorus sesquisulphide by extracting with the usual good solvents for phosphorus since these always dissolve large quantities of the sesquisulphide. By using a solvent (*e.g.*, petroleum ether) which does not dissolve either so freely, a great difference in behaviour is found between the pure sesquisulphide and specimens containing as little as 0·5 per cent. of free phosphorus. On shaking the specimen with the solvent, and decanting off an aliquot portion for analysis, the total amount dissolved, and the ratio of phosphorus to sulphur are much greater when the specimen contains free phosphorus. When white phosphorus is added to the sesquisulphide, some of it appears to form a lower sulphide, as the above method of examination shows a lower proportion of free phosphorus than was added, assuming that the difference between the petroleum ether extracts of pure and impure specimens represents the whole of the free phosphorus. When the percentage of free phosphorus is low, the ratio of solvent to sesquisulphide is made relatively greater. —W. H. P.

Patents.

Explosive nitro-bodies ; Process of and apparatus for increasing the density of ——. W. Fairweather, London. From Deutsche Sprengstoff-Act.-Ges., Hamburg, Germany. Eng. Pat. 24,960, Nov. 9, 1911.

The apparatus consists of a mould, in the top of which a nozzle fits closely, and resting on the top of the nozzle is a jacketed cylinder containing a plunger. The plunger hermetically seals the apparatus. The melted nitro-body is poured in until it partially fills the jacketed cylinder. The plunger is then brought down to the surface of the

liquid and pressure applied by means of weights or by means of a screw, the nitro-body in the cylinder being maintained in the molten condition by passing steam through the jacket. Solidification of the nitro body in the mould may be hastened by surrounding the latter with cold water. By this means the nitro-body solidifies free from hollow spaces and with a density of 1·60 to 1·62.
—T. St.

Explosives ; Manufacture of ——. A. T. Cocking, and Kynoch, Ltd., Birmingham. Eng. Pat. 28,177, Dec. 14, 1911.

The drying and digesting of plastic explosive materials such as blasting gelatin is effected by drawing the material through small tubes around which a heating medium at any desired temperature is caused to circulate. The apparatus consists of two juxtaposed chambers communicating through the tubes, the chambers and tubes being jacketed. The material having been placed in one of the chambers, it is drawn through the tubes by evacuating the other, the feeding material being kept in a compact mass to prevent the formation of air channels. By then evacuating the first chamber the material may be caused to return, the operation being repeated as often as desired.
—T. St.

Explosives ; Manufacture of ——. A. T. Cocking, and Kynoch, Ltd., Birmingham. Eng. Pat. 28,178, Dec. 14, 1911.

In making blasting gelatin, wet nitro-cotton (still containing say, 20 to 30 per cent. of water) is directly mixed with the desired amount of nitroglycerin, preferably at a temperature of 40° to 60° C. The jelly-like product requires but little further treatment, if any, to secure the desired homogeneity. The residual water is quickly removed in the drying apparatus described in Eng. Pat. 28,177 of 1911 (see preceding abstract).—T. St.

Priming mixture. H. C. Pritham, Assignor to The Union Metallic Cartridge Co., Bridgeport, Conn. U.S. Pat. 1,048,207, Dec. 24, 1912.

The mixture comprises a compound containing oxygen in a condition easy for liberation, a substance containing an element that will combine readily with oxygen, and a self-hardening mineral cement in a set condition. Particularised, the constituents may be potassium chlorate, mercuric fulminate, antimony sulphide and a self-hardening mineral cement.—T. St.

XXIII.—ANALYTICAL PROCESSES.

Melting-point ; Simple method of determining the ——, *for substances of high melting-point.* E. Havas. Chem.-Zeit., 1912, **36**, 1438.

This is a modification of the method of melting the substance on the surface of mercury, substituting for the volatile mercury a non-volatile fusible metal, such as soft solder (2 pts. tin, 1 pt. lead, m. p. 170° C.). A small porcelain or nickel crucible is filled with the melted alloy, the thermometer inserted, a fragment of the substance floated on the surface, and the temperature gradually raised till the substance melts. Temperatures up to 450° C. can be thus determined with a nitrogen-filled thermometer, and the apparatus is quickly cooled and ready for another determination. The remains of the substance, and any dross formed at high temperatures, are easily removed by a spatula.—J. T. D.

Copper ; Determination of —— *by means of sodium hypophosphite.* R. Windisch. Z. anal. Chem., 1913, **52**, 1—13.

Working with solutions of pure copper sulphate, or with mixtures of such and ferrous sulphate, it is found that copper is completely precipitated by reduction with sodium hypophosphite, and, contrary to the assertion of Hanus and Soukup (this J., 1911, 574), no appreciable proportion of the copper enters the filtrate. The author's procedure is as follows (compare Dallimore ; this J., 1909, 962) :—50 c.c. of solution, containing 5 grms. of copper sulphate crystals and 3 c.c. of dilute sulphuric acid (1 : 5), are heated for 10 minutes with 20 c.c. of hypophosphite solution (200 grms. per litre). The precipitate is immediately washed with hot water until free from acid, and then with alcohol, after which it is rapidly dried and ignited till of constant weight. These operations may be completed in less than half-an-hour, and the results are shown to be almost as accurate as those obtained by electrolysis.
—F. Sodn.

Formaldehyde and bismuth or copper compounds respectively, in presence of strong alkali ; Interaction between ——. F. Hartwagner. Z. anal. Chem., 1913, **52**, 17—20.

Copper sulphate interacts with formaldehyde, in the presence of sodium hydroxide, in a similar manner to silver nitrate (Vanino ; this J., 1903, 1261) ; each molecule of the salt requires 1 mol. of formaldehyde and 3 mols. of sodium hydroxide for quantitative reduction to metallic copper. With bismuth chloride, however, complete precipitation is only secured by using a large excess of alkali and of a sufficiently concentrated solution of the reagent. Acetaldehyde reduces gold salts even in acid solution, and in alkaline solution may be employed for the quantitative precipitation of gold and silver ; copper and bismuth salts are not reduced by this reagent. Chloral hydrate reacts only in alkaline solution, the reduction of gold, silver, and copper salts being complete ; bismuth salts are partially reduced. Chloral hydrate is preferred as a more powerful reducing agent than acetaldehyde, and by its use any possible formation of aldehyde-resin is avoided.—F. Sodn.

Palladium ; Determination of —— [*with dimethylglyoxime*], *and its separation from copper and iron.* M. Wunder and V. Thüringer. Z. anal. Chem., 1913, **52**, 101—104.

The determination of palladium by means of dimethylglyoxime (this J., 1912, 663) is not hindered by the presence of iron or copper, but a sufficient excess of the reagent must be employed for the reduction of any ferric salt present. Copper may be determined in the filtrate as cuprous thiocyanate, and iron is subsequently separated with ammonium sulphide, the precipitate being dissolved in hydrochloric acid, the solution oxidised, and ammonia added in the usual way.—F. Sodn.

Vapour pressure of naphthalene and determination of naphthalene in purified coal gas. Schlumberger. *See* IIa.

Detection of nitric acid in presence of nitrous acid. Iwanow. *See* VII.

Evolution of oxides of nitrogen by heating pyrolusite in a current of air. [*Determination of very small quantities of nitrogen compounds.*] Askenasy and Rényi. *See* VII.

Interaction between formaldehyde and nitrous acid. [*Determination of nitrites.*] Vanino and Schinner. *See* VII.

New method for the determination of hypochlorites. Williams. *See* VII.

Valuation of barium sulphide. Sacher. *See* VII.

Decomposition of silicates. Hempel. *See* VII.

Action of baryta water [*and lime water*] *on certain kinds of glass.* Bunge. *See* VIII.

Determination of iron and titanium in ceramic materials. Rieke and Betzel. *See* VIII.

Reduction of manganese dioxide by nitrous acid, and the application of this reaction to the determination of phosphorus in iron and steel without separating the silicon. Müller. *See* X.

Analysis of ferrosilicon. Wunder and Jeanneret. *See* X.

Determination of potassium in potash salts as perchlorate. Strigel and Dedt. *See* XVI.

Simplified method of judging the quality of the beet by means of the immersion refractometer. Stanek. *See* XVII.

Determination of [*reducing*] *sugars by a combination of the methods of Kjeldahl and Bertrand.* Beyersdorfer. *See* XVII.

Detection of citric acid in wine. Fresenius and Grünhut. *See* XVIII.

Determination of methyl alcohol in spirits. Hetper. *See* XVIII.

Determination of fusel oil [*in spirits*]. Pollitzer. *See* XVIII.

Source of error in determining the permanganate consumption of potable water by Schulze's method. Grünhut. *See* XIXb.

Determination of formaldehyde in formaldehyde solution. De Bournonville. *See* XIXb.

Quinine assay. Kruysse. *See* XX.

Detection and determination of free white phosphorus in phosphorus sesquisulphide. Schloesing. *See* XXII.

Determination of moisture. Coste and Huntly. *Determination of moisture in organic substances.* Campbell. *Determination of moisture in foods and other organic substances.* Skertchly. *See* London Section, pp. 62 *et seq.*

Determination of glyceryl acetate in essential oils. Hall and Harvey. *See* London Section, p. 61.

Patents.

Gas mixtures; Apparatus for the continuous and simultaneous determination of the composition and velocity of ——. W. Heckmann. Ger. Pat. 252,538, March 28, 1912.

The gas mixture is led into a throttle-chamber connected in the known manner with a manometer, and an absorbing liquid is sprayed into the chamber, so that the manometer registers not only the pressure corresponding to the velocity of the gas mixture, but also the diminution of pressure caused by the absorption of one of the constituents.—A. S.

Pyrometer. J. E. Wilson, New York. U.S. Pat. 1,046,925, Dec. 10, 1912.

The temperature of a rotary furnace is indicated by a thermo-electric pyrometer connected with a number of insulated slip rings carried on brackets projecting from and moving with the furnace, which engage with a stationary brush connected with a galvanometer.—H. H.

Extraction of liquids with specifically heavier solvents; Apparatus for the ——. E. Berlin. Ger. Pat. 251,459, June 24, 1911.

The vapour of the solvent passes from the distillation vessel through an ascending tube, which divides into two branches, one of which projects into the upper part of the extraction vessel, whilst the other passes through the wall of the extraction vessel at an intermediate point and then extends nearly to the bottom. The extraction vessel is surmounted by a condenser; the vapour issuing from the upper branch tube is condensed, the condensed solvent falls in drops through the liquid to be extracted, and collects at the bottom of the vessel, whence it eventually continuously siphons over into the distillation vessel through the lower branch tube, in consequence of the hydrostatic pressure exerted by the liquid being extracted.—A. S.

Gas analysing apparatus. Ingeniorsfirma Fritz Egnell, Stockholm. Eng. Pat. 29,211, Dec. 28, 1911. Under Int. Conv., Dec. 29, 1910.

See Fr. Pat. 438,390 of 1911; this J., 1912, 665.—T. F. B.

Oil-testing apparatus. P. Wendt, Assignor to Oelwerke Stern-Sonneborn A.-G., Hamburg, Germany. U.S. Pat. 1,047,469, Dec. 17, 1912.

See Ger. Pat. 232,233 of 1910; this J., 1911, 652.—T. F. B.

Apparatus for the sampling of ores. Eng. Pat. 2416. *See* X.

XXIV.—MISCELLANEOUS ABSTRACTS.

Colloidal solutions and precipitates; Theory of the preparation and stability of ——. *II.* P. P. von Weimarn. Kolloidchem. Beihefte, 1912, 4, 101—131.

A discussion of the general principles governing the formation and stability of colloidal solutions, classified under the following headings:—Preparation of disperse precipitates; alterations of disperse precipitates with time; formation of colloidal solutions and the cause of their stability: flocculation. Among the experiments described are the formation of jellies of inorganic substances (see this J., 1910, 754, 1399).—A. S.

Mulberry leaves; Presence of adenine and aspartic acid in ——. Z. Mimuroto. J. Coll. Agric., Imp. Univ., Tokyo, 1912, 5, 63—65.

Young mulberry leaves contain a considerable proportion of their nitrogen as non-protein nitrogen. Adenine and aspartic acid were identified in the aqueous extract: the latter is probably present as asparagine.—E. F. A.

Galactose and alcohol; Synthetic reaction between —— *under the influence of képhir.* E. Bourquelot and H. Hérissey. Comptes rend., 1912, 1552—1554.

The formation of ethyl β-galactoside from galactose and alcohol, which has been previously shown to be brought about by the emulsin of almonds, may be due not so much to the emulsin itself as to the lactase which is always found in the ferment from almonds. This view is rendered more likely by the fact that képhir, which contains lactase in quantity and no emulsin, will bring about the same union.—W. H. P.

Books Received.

Mines and Quarries. General Report, with Statistics for 1911, by the Chief Inspector of Mines. Part II.—Labour. Cd. 6532.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 3d.

This publication contains a general report and statistics, relating to persons employed and accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts.

Weltadressbuch der Chemischen Industrie, 1913. Verlag der Union Deutsche Verlagsgesellschaft Stuttgart, Berlin, Leipzig.

Cloth-bound volume, $9\frac{1}{4} \times 6\frac{1}{4}$ in. consisting of 1053 pages. The work is divided into three parts, the first part containing an alphabetical list of chemical products, each followed by the names of producers thereof; the second part gives a list of raw materials of the chemical and pharmaceutical industries with addresses of the principal suppliers, and the third part a list of machinery and apparatus for use in chemical industry, with the addresses of the principal firms supplying the same. Indexes of the products and apparatus dealt with are given in German, English, French, and Spanish.

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Canadian Section.

Meeting held at Montreal on Friday, 8th March, 1912.

DR. R. F. RUTTAN IN THE CHAIR.

MANUFACTURE OF CALCIUM CARBIDE.

BY R. A. WITHERSPOON.

The commercial manufacture of calcium carbide, credited to Willson in America, and to Héroult in Europe, started in the early eighties, and by progressive development, has risen to become a consumer of electrical energy greater than any other electric furnace process. As is the case with all new industries, the beginnings were crude and inefficient. At present, although the proposition presents problems of some magnitude, the average of excellence is high, and the operation of numerous works is successful, from a commercial standpoint. The steadily increased demand for carbide resulted in increased size of furnaces, together with the electrical transformers necessary to their successful operation. The manufacturers of electrical apparatus have, therefore, been forced to design and build generators and transformers specially adapted to the need of electrical smelting.

The raw materials used in the manufacture of calcium carbide are lime and some form of carbon, such as anthracite coal or coke. Both these materials should be as pure as possible, special attention being paid to their freedom from phosphorus. Sulphur, magnesia, silica, iron, and alumina should be present in small quantities only.

Phosphorus occurs as calcium phosphate, which is reduced at the temperature of the electric arc, and in the presence of carbon, to calcium phosphide, which when brought into contact with water, gives off phosphoretted hydrogen. This gas mixes with the acetylene, and when burners are lighted, causes a haze of phosphorus pentoxide, which is very objectionable. So carefully, however, are the raw materials selected, that to-day, all commercial carbides are practically free from phosphorus, the average content of phosphine in acetylene being less 0·002 per cent. by volume.

Sulphur, unless present with considerable amounts of alumina, has little influence in the carbide. Calcium sulphide formed in the furnace by the reduction of calcium sulphate, does not decompose in the water. In the presence of alumina, aluminium sulphide may be formed; this yields hydrogen sulphide when brought into contact with water. Practically speaking, very little trouble is experienced with sulphur, inasmuch as the lime and coal used rarely contain a prohibitive quantity.

Magnesia has the peculiar property of interfering with the formation of calcium carbide in the furnace. If more than 1 per cent. of magnesia be present in the lime and coal, the electrical energy required becomes noticeably so much greater, that such raw material is considered unfit for use. To counteract its effect a flux of fluorspar has been recommended by some authorities. In the experience of the writer, this is not very successful. It is well known that magnesia mixed with carbon and treated in the electric furnace, will not form a carbide, and is highly infusible, even at the highest temperatures obtainable. Metallic magnesium heated in a current of acetylene, however, readily forms magnesium carbide.

Barium and strontium form carbides with ease when their oxides or carbonates are reduced under similar conditions with carbon at electric furnace temperatures.

Silica, iron oxides, and alumina form silicates, aluminates, and ferro-silicon, which reduce the purity of the carbide, and its output from the furnaces.

The presence of *water*, either in the free state in the coal or combined as hydroxide in the lime, is the greatest difficulty the carbide maker has to contend with, as it reduces the furnace output more than any other factor. For this reason, the coal is thoroughly dried, usually in a rotary coal- or gas-fired dryer. The lime should be burned in kilns at the carbide works, and fed direct to the electric furnace to secure the best results.

The preparation of the charge for the furnaces. The lime is roughly crushed to pieces of one inch size, the coal, thoroughly dried, to about pea size. They are then roughly mixed in about the theoretical proportions called for by the equation, $CaO + 3C = CaC_2 + CO$, or approximately 100 parts by weight of the lime contents of the lime to 65 parts of the carbon contents of the coal or coke.

In the early history of the industry, it was believed necessary that both the lime and the coal should be ground very fine, and thoroughly mixed, in order to secure uniform results in the quality of the carbide. This fine grinding, however, caused the furnace to blow out large quantities of dust, which upset the proportions of the mixture, frequently producing very irregular results. With experience in operation, and particularly with furnaces of increased size, the fine grinding was abandoned, until at the present time, lime as large as eggs is used in some furnaces; the coal, however, is kept about ¼ in. mesh. In this way the dust losses from the furnaces are decreased to a minimum, the actual output and quality of the carbide being at the same time improved. In other electric furnace processes the same change has been effected, and the prevailing practice is to use coarsely ground raw material, which offers little resistance to the free escape of the furnace gases.

Electric furnaces for the manufacture of carbide can be divided into two types, the ingot furnace, in which the carbide is allowed to solidify, and the tapping furnace, in which the product is run in the molten state in the same manner as iron. At first, carbide was made entirely in the ingot furnaces, on account of the difficulty of attaining a temperature sufficient to melt it thoroughly.

The simplest form of ingot furnace is the Borchers, or pot furnace, in which some form of iron crucible is lined on the bottom with a layer of carbon, this being connected to one side of the electrical circuit. The other terminal of the circuit is connected to a carbon rod held in a suitable holder, which is suspended vertically in the centre of the crucible, and adjustable up and down within it. To accomplish this, some form of hoist is used, as these carbon rods and holders are heavy, weighing sometimes nearly a ton. To start such a furnace, the moving electrode is lowered to contact with the carbon bottom forming an arc: the mixture of lime and coal, previously prepared and usually stored in a bin above the furnace, is fed in around the arc and entirely covering it. An ammeter in the circuit indicates the current used, and the hoist is raised or lowered, often by automatic relays, to keep the current at a constant figure. The early Willson furnaces used in America used a current of 2000 ampères and 75 volts. The arc so started and burned in the charge smelts a pool of carbide, which gradually deepens, necessitating frequent lifting of the electrode, until the crucible is filled. The crucible is then wheeled out, and an empty one substituted. When sufficiently cool, these crucibles were dumped on a grating, the unconverted mixture going through the grates to a recovery storage bin, and the ingot itself taken to a clearing room. Here the crust or scale was removed by the use of axes or pneumatic tools. This process was unsatisfactory from the standpoint of uniform quality of product and cost of production. A large quantity of lime and coal surrounding the ingot was unconverted, and therefore had to be rehandled. A considerable quantity of coal was burned out in the operation of dumping the pots, necessitating further addition of coal before the mixture could be used again. In practice 4 tons of raw materials were handled to make one ton of carbide. The ingot itself varied from almost pure carbide in the centre, where the heat of the arc was greater, to an outside layer of melted lime and coal which had not become sufficiently hot to be converted into carbide. The removal of this outside layer was often difficult and frequently the crust was found in the carbide, causing much dissatisfaction.

At this stage the American makers began to use a very ingenious furnace to offset these difficulties. This is known as the Horry rotary furnace, and while still adhering to the ingot principle, it has been so perfected, both in operation and efficiency, that it competes successfully with any other process.

The body of the furnace is formed like a spool with wide flanges fastened to the drum, thus forming with it three sides of a square if viewed in cross section. The fourth side is formed by removable plates, which are clamped across the ends of the sides or flange plates by use of bolts or clamps. Two electrodes, suspended from above, hang vertically in this square space. There is no electrical connection made to the furnace itself, the current passing from one electrode to the bath of carbide, and through the carbide to the second electrode. The furnaces are therefore known as two-electrode single-phase, and use a current of about 4000 ampères at 75 to 80 volts. In operating this furnace, a small quantity of broken coke or carbon is placed under the electrodes, the arc sprung, and the charge of lime and coal fed in until the arcs are well covered up. The electrodes themselves are fixed, the regulation being accomplished by slowly revolving the drum away from the arc as the carbide accumulates in a pool beneath the electrodes. This regulation is automatic, being controlled by a relay which engages a pawl to increase or decrease the current by revolving the furnace to the right or left. The revolution of the furnaces is very slow, the movement at the circumference being about 6 inches per hour.

The ingot so formed passes slowly downwards from the electrodes under the axle of the furnaces and upwards at the back. In the rear the end plates are unbolted and the carbide ingot exposed. Holes are drilled across the ingot by compressed air drills with water cooled points, the water cooling the carbide and slaking it in front of the drill. Into the holes so formed, wedges are driven and a section of the ingot broken off and carried away by a crane to the cooling room.

The operation of these furnaces is continuous during the life of the electrodes, which, being kept well buried in the charge, are consumed very slowly. The actual fusion of the carbide extends very close to the cast-iron sides of the furnaces, thus minimising the quantity of unconverted charge and crust.

Two other electrode furnaces having a crucible instead of the revolving wheel are also in use. These differ in principle from the rotary furnaces only in not being continuous, the crucibles being changed when full, and new ones substituted every 10 and 12 hours.

The tapping furnace.—In Europe the early pot furnaces of the ingot type were slowly changed to tapping furnaces, in which the carbide was heated to sufficient temperature to run out in the molten state into cast-iron moulds. The type of furnace used was much the same as the ingot pot furnaces, with a single electrode suspended in the centre of the pot, which latter was lined at the bottom with carbon and provided with a suitable connection to the other side of the circuit. One of the greatest difficulties to contend against was actual maintenance of the carbide at a temperature at which it could run readily from the furnace. To meet this a flux of lime was added which increased the fluidity, but somewhat reduced the quality of the carbide.

With the developments of larger transformers larger furnaces were built. Also skill in the art of tapping the furnaces played no small part in their ultimate success. At the present time, carbide is tapped easily at the highest temperature, and the grade of the material so made is fully equal to the best ingot product.

Later developments in tapping furnaces tend towards two or three electrodes suspended vertically in the furnace, using two- or three-phase current to distribute more equally the load to suit the necessities of the generating plants. Such furnaces can be built to large sizes of 2000 to 3000 h.p. and even more, with great economy gained from the labour and power standpoint.

The manufacture of suitable furnace electrodes has been the deciding factor in many cases. Often manufacturers of carbide were unable to use furnaces because no satisfactory electrodes could be had. In 1892 the only satisfactory electrode made in the United States was 4 inches square, and would carry about 500 ampères. To-day, electrodes 18 inches to 22 inches are in the market, which are satisfactory and reliable. Even larger electrodes are advertised capable of carrying very heavy currents. Electrodes made by assembling a number of 8-inch diameter units in parallel in a single head or holder, have been in successful use at Shawinigan Falls for a number of years. Currents up to 40,000 ampères are occasionally used, with 25,000 to 30,000 ampères the average load.

With reference to the use of graphitised electrodes, there is a great difference of opinion, the ingot makers using graphite, whereas those using the tapping process prefer the amorphous carbon electrodes. The writer, in using both, found that the graphite consumed too rapidly in the tapping furnace, making the cost prohibitive, so the amorphous carbon electrodes were adopted on account of their cheaper price. This is easily understood when it is considered that the ingot makers use an excess of carbon in the furnace charge, while the tapping furnace requires a slight excess of lime.

Whether the carbide itself is made by the ingot or tapping process, its subsequent treatment is much the same. The ingot carbide possesses the disadvantage of having to be freed from scale or crust.

The problem of crushing and sizing is one of successive reduction through crushers and rolls, making the least possible dust. Ingot carbide has a natural tendency to break into cubes on account of its crystalline structure caused by the slow cooling of the ingots. Tapped carbide, on the contrary, is cast at approximately 2500° C. into a heavy cast-iron chill, and is consequently close grained and dense. It is much harder to break and requires very strong machinery. For the first breaking, jaw crushers of the Blake type are common, although some makers prefer gyratory crushers. For granulation of carbide to sizes of ¼-inch to ⅛-inch, low speed rolls are used, as these machines make the minimum amount of dust. The sizing is usually done on trommels or rotary screens, which deliver the product in sizes varying from large lumps, 8 inches by 4 inches, to fine materials, 16 by 30 mesh, suitable for a certain type of table lamp.

A can-making plant is a necessary part of every works, where steel and tin air-tight receptacles are turned out in large quantities to hold the carbide. The standard packages in use hold 100 lb., 110 lb., and 220 lb. net weight of carbide. Small tins containing from 1 to 25 lb. are also filled to suit the trade for automobile lamps, etc. All carbide which is exported by water is subject to rigid insurance rules, which necessitate the steel drum being cased in wood. A complete installation of box and stave-making machinery is therefore part of the equipment of every export works.

The largest use for carbide is in the generation of acetylene for lighting purposes, and this business steadily advances from year to year, showing the satisfaction that is experienced in the use of this beautiful light. The oxy-acetylene blowpipe is becoming a common tool in well-equipped shops, and in the hands of skilled operators gives great economy in repairing broken parts and in cutting away unnecessary metal. The cyanamide industry in Europe is believed to be on a sound financial basis, and is now using thousands of tons annually. The decomposition of the cyanamide and the formation of ammonium sulphate has also been undertaken.

Liverpool Section.

Meeting held at The University, on Wednesday, 30th October, 1912.

PROFESSOR F. G. DONNAN IN THE CHAIR.

RELATIONS OF PHYSICAL CHEMISTRY TO MODERN CHEMICAL INDUSTRY.

BY PROFESSOR F. G. DONNAN, F.R.S.

(Abstract.)

In the course of a brief retrospect of the development of chemistry, especially since the introduction of the atomic theory, it was pointed out that up to from twenty-five to thirty years ago, attention was paid chiefly to the classification and arrangement of substances, without sufficient consideration of their energy content or of chemical forces and equilibria. Within the past two or three decades, however, chemistry has undergone a far-reaching change, in consequence of the progress of physical chemistry based largely upon thermodynamics and including accurate quantitative study of the conditions determining the reactivity of substances and the velocity of chemical change. The study of the behaviour of catalysts comes within the province of physical chemistry and as examples of technical processes based upon catalytic action, the Deacon chlorine process, the contact sulphuric acid process, the reduction (hydrogenation) of unsaturated oils, the synthesis of ammonia from its elements, the oxidation of naphthalene in the production of synthetic indigo, and Bone and McCourt's method of surface combustion were mentioned. Enzymes also are essentially catalysts and hence fermentation, agriculture, etc., are dependent upon physical chemistry for their further progress and development: in this connection attention was drawn to the work of Bertrand on the stimulating effect, on the growth of plants, of exceedingly small quantities of inorganic compounds, such as those of manganese. Reference was made to the development of the science of metallography by the aid of the phase-law; to the application of the latter doctrine, by van't Hoff, to the better utilisation of the Stassfurth salt deposits; and to electrochemistry, photochemistry, and the study of the colloidal state of matter; and it was shown that the successful solution of the problems of the oxidation of atmospheric nitrogen, the synthesis of ammonia from its elements, the manufacture of sulphuric acid by the contact process, etc., etc., was made possible only by the knowledge of the principles and methods of chemical dynamics and thermodynamics.

The following examples were given:—

The formation of nitric oxide from nitrogen and oxygen is a reaction concerning which physical chemistry shows that:—

(1) The maximum yield of nitric oxide will be the greater the higher the temperature, and can be calculated for every temperature from theoretical principles. The result shows that the yield will only be of technical importance at very high temperatures. (2) The mixture of nitrogen, oxygen, and nitric oxide must be very rapidly cooled or the nitric oxide will re-form nitrogen and oxygen. (3) Increase of pressure will not increase the output. These conditions have been successfully realised in several forms of apparatus in which the high temperature is obtained by suitably operated electric arcs.

In the formation of ammonia from nitrogen and hydrogen, it has been found that:—

(1) The maximum amount of ammonia will be the greater the lower the temperature, and can be calculated for each temperature. (2) Increase of pressure will increase the output. The following table will illustrate these statements:—

Equilibrium percentage of NH_3 *from* N_2+3H_2.

Temp.	1 atm. pressure.	100 atm. pressure.
800°	0·011	1·1
700°	0·021	2·1
600°	0·048	4·5
500°	0·13	10·8

But the lower the temperature the lower will be the velocity of the reaction. Hence in order to satisfy condition (1) as far as possible, the most active contact catalyst or contact accelerator must be discovered, and the process must be carried on at as low a temperature as possible. As is well-known, these optimum conditions have been determined by Professor Haber in the Physico-chemical Institute of the Technical High School at Karlsruhe. During the course of this most important research he was assisted in every way by the famous Badische Anilin und Soda Fabrik, and now, as Dr. Bernthsen has recently stated, this company is erecting a works at Oppau to carry out the process.

A model of the system, water, KCl, $MgCl_2$, was exhibited, showing the exact conditions of temperature and concentration which determine the formation and decomposition of carnallite. From such a model the conditions for obtaining a maximum output of potassium chloride from a ton of carnallite could be calculated.

The opinion was expressed that British chemical industry is at the present time in a state of intellectual stagnation, owing to the fact that many of our technical chemists have no real conception or working knowledge of the principles of modern chemistry, which has become to a large extent an exact dynamical science. Physical chemistry is frequently described as physics and mathematics, not chemistry, and it is still possible to take an Honours Degree in Chemistry at many important British universities without any real knowledge of physical chemistry. Just as Great Britain, the greatest producer of coal tar, allowed the manufacture of synthetic dyes, drugs, and perfumes to pass largely into the hands of another nation owing to ignorance of the value and technical importance of synthetic organic chemistry, so it is to be feared, owing to a similar lack of perception of the technical value of physical chemistry, Great Britain may fail to take an honourable place in the chemical industry of the future.

Manchester Section.

Meeting held at the Grand Hotel, Manchester, on Friday, January 10th, 1913.

DR. GILBERT J. FOWLER IN THE CHAIR.

PROGRESS IN BY-PRODUCT RECOVERY AT COKE OVENS.

BY J. E. CHRISTOPHER.

At the present time the chief outlet for coke is the iron industry, which uses approximately three-fourths of the whole. The diagram (Fig. 1) shows the progress of the iron industry since the introduction of coke as a fuel and the outputs of pig iron in round figures. Percy states in his "Fuels" that coke had become general (1870), so that it may be assumed that the coke industry in general advanced from that period in proportion to the output of the iron trade. The earliest method of coking was on the lines of the old charcoal pile, but was extremely wasteful. Attempts were next made to confine the air supply to channels more under the control of the coke burner. This gave place to ovens of the enclosed type leading up to the modern beehive oven. The first attempts in this country to recover by-products were made by Jones,[1] in 1859, who proposed to draw off the vapours from the old type of coke heap through a "series of metal pipes or condensers such as are used in the manufacture of gas." About 1870 extensive trials were made by Messrs. Bell Brothers and the Wigan Coal and Iron Company of the Pernolet type of coke oven.[2] (Fig. 2).[3]

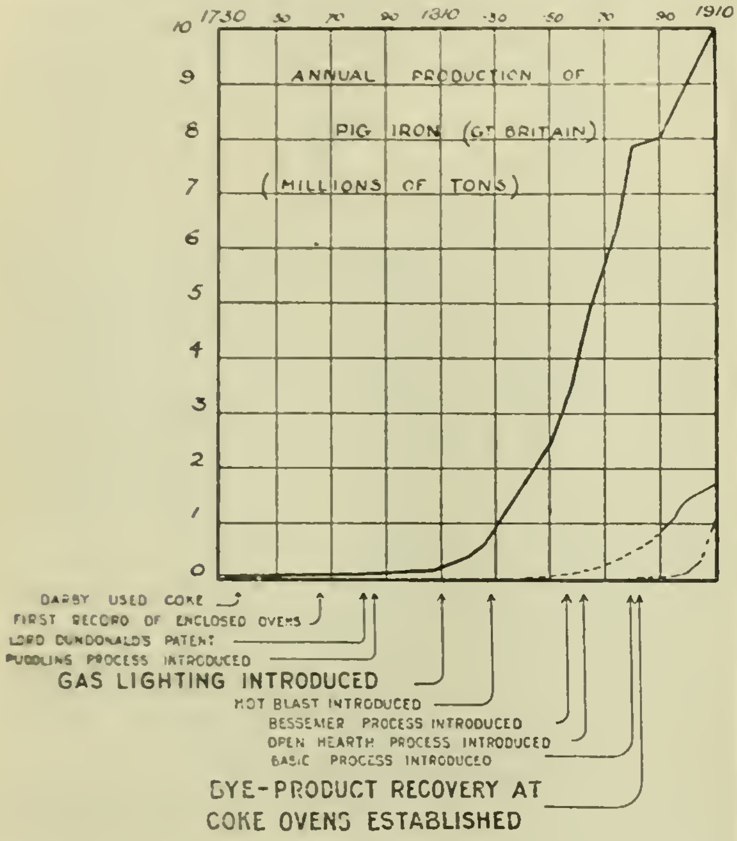

FIG. 1.

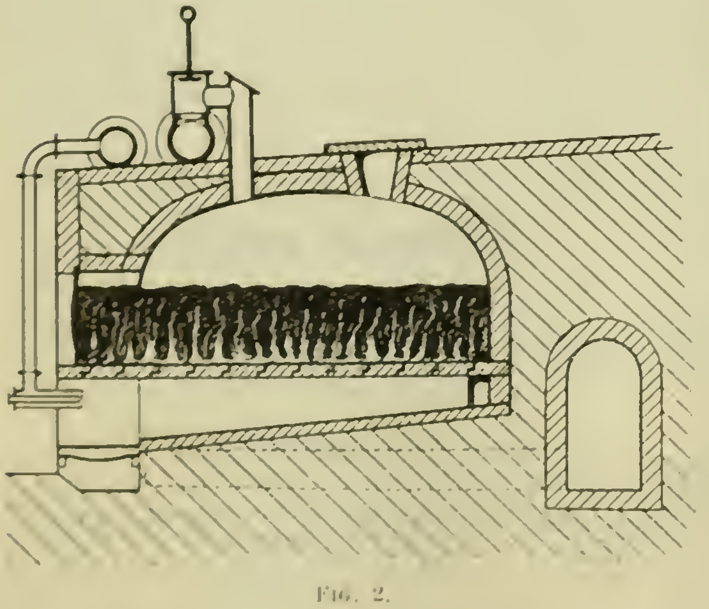

FIG. 2.

The type put down by the latter firm was a modification by Young.[4] In Young's patent the gases were drawn off just above the coal by an exhauster, and after passing through a by-product plant the waste gases were fed into the furnace underneath the oven and burnt, the products of combustion thence passing through a casing enclosing the dome, and finally passing to the chimney. Aitken[5] (Fig. 3) and Jameson[6] also endeavoured to adapt the beehive-shaped oven for the recovery of by-products, both following the plan of downward suction. All these early adaptations failed on account of the doubtful quality of the coke produced. In the non-recovery beehive oven, the tarry vapours had to pass upwards through the layers of hot coke depositing a portion of their carbon by decomposition and helping to cement the whole, giving finally the hard silvery beehive coke.

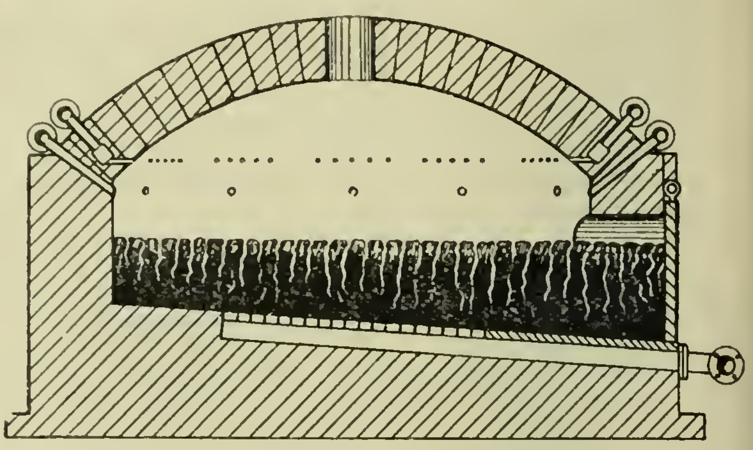

FIG. 3.

In the Pernolet, Aitken, and Jameson ovens, etc., the vapours were drawn away as fast as produced through the cooler layers, and no deposition of carbon took place. The portions of the charge farthest removed from the source of heat were distilled very slowly, and by the time the heat reached them their coking properties would be considerably lessened. The Pernolet oven was rightly designed, in that the chamber was kept enclosed and air excluded as much as possible, but the distillation was, after all, a low-temperature one, and consequently the tars produced were thin, containing a large percentage of paraffin bodies, whilst the sulphate yield was low. The following yields are quoted from contemporary papers :—

	Tar (galls per ton)	Sulphate (lb. per ton).
Bell Bros. (Pernolet)[7]	5·37	4·14
Wigan Coal and Iron Company[7]		5·6
Aitken[8]	10 to 11	5·5
Jameson[9]	6·2	6·3

Gasworks are quoted as giving at that period 10 gallons of tar per ton and 16 lb. of sulphate.[10] The condensing surface works out at about 1 square foot per 1000 cub. feet of gas per day, whilst the saturator, owing to the inefficient "spreading" of the gas, must tend to losses in yield, as well as local alkalinity. However, a later development of the Pernolet oven was erected at the Shamrock Pit, Westphalia, in 1886, in which a regenerative system was used. The charges were coked in comparatively shallow-layers and the quality of the coke was satisfactory. The condensing plant was efficient, and the yield is quoted by Lunge as 5 per cent. tar and 1 per cent. sulphate of ammonia.[11] The disadvantage of coking in comparatively deep layers especially with lean coals being now apparent, attention was drawn to the methods of heating the ovens, and the Coppée oven was introduced, bringing about considerable improvement in this respect. The Coppée oven is of the retort shape, the charge being heated on both sides simultaneously. Thus the heat had to penetrate a much-reduced thickness of coal, and the carbonisation was much more rapid. The yield of coke was likewise increased as the surface of the charge exposed to the air was in small proportion to the whole mass. In 1873 thirty of these ovens were in operation near Sheffield, and in 1874 sixty more were built at Ebbw Vale Ironworks. Hard metallurgical coke was made in these ovens, and the advantages of the retort-shaped oven began to be realised. Thus, from a combination of the Pernolet type of oven, with its enclosed chamber and external heating, and the Coppée oven, with its narrow chamber rapidly heated, we arrive by gradual stages at the modern by-product retort oven. The first attempt at this combination was in the Knab oven modified by Carvès, and it is interesting to note that in these early stages Dr. Angus Smith strongly advised the adoption of the Knab-Carvès oven, and he described the coking processes of his day as "having all the appearance of roughness and savagery which extravagance always possesses."[12] In 1881 the Carvès oven, modified by Mr. Simon, of Manchester,[13] was introduced into this country, and the first Simon-Carvès plant thus came into being. From the by-product point of view the results were very encouraging, the yields being 6·12 gallons of tar and 28 lb. of sulphate of ammonia per ton coal.[14]

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[1] Eng. Pat. No. 2158, 1859.
[2] Chemical Technology, Groves and Thorpe, Vol. 1. p. 180.
[3] Eng. Pat. 1954, 1863.
[4] Eng. Pat. 1181, 1868.
[5] Eng. Pat. 4644, 1883.
[6] Eng. Pat. 1947, 1882.
[7] Steavenson, Trans. N. of Eng. Inst. of Mining and Mech. Eng. (xxii.).
[8] Aitken, Trans. N. of Eng. Inst. of Mining and Mech. Eng. (xxiv.).
[9] Jameson Tran. Inst. Mech. Eng. 1883, Part 2.
[10] Richards, Treatise on Gas Manufacture, 1877.
[11] Lunge, Coal Tar and Ammonia.

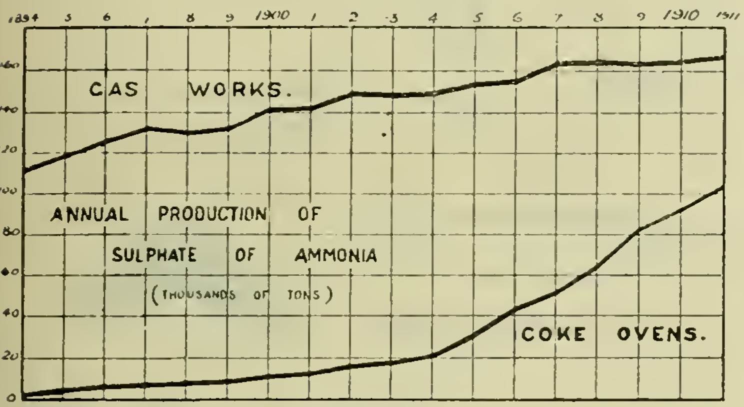

FIG. 4.

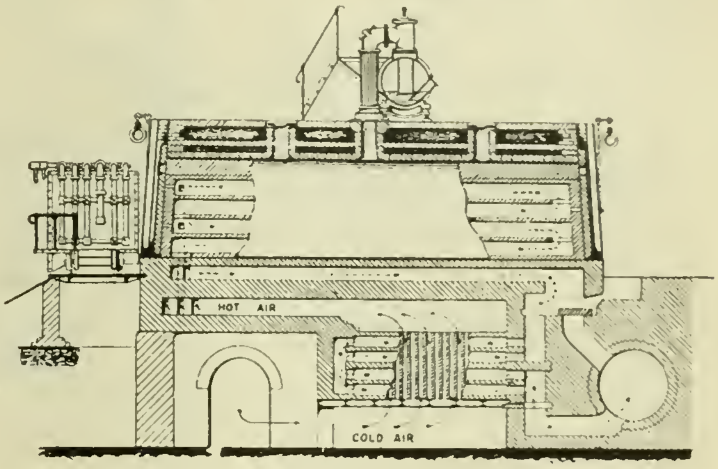

FIG. 7.

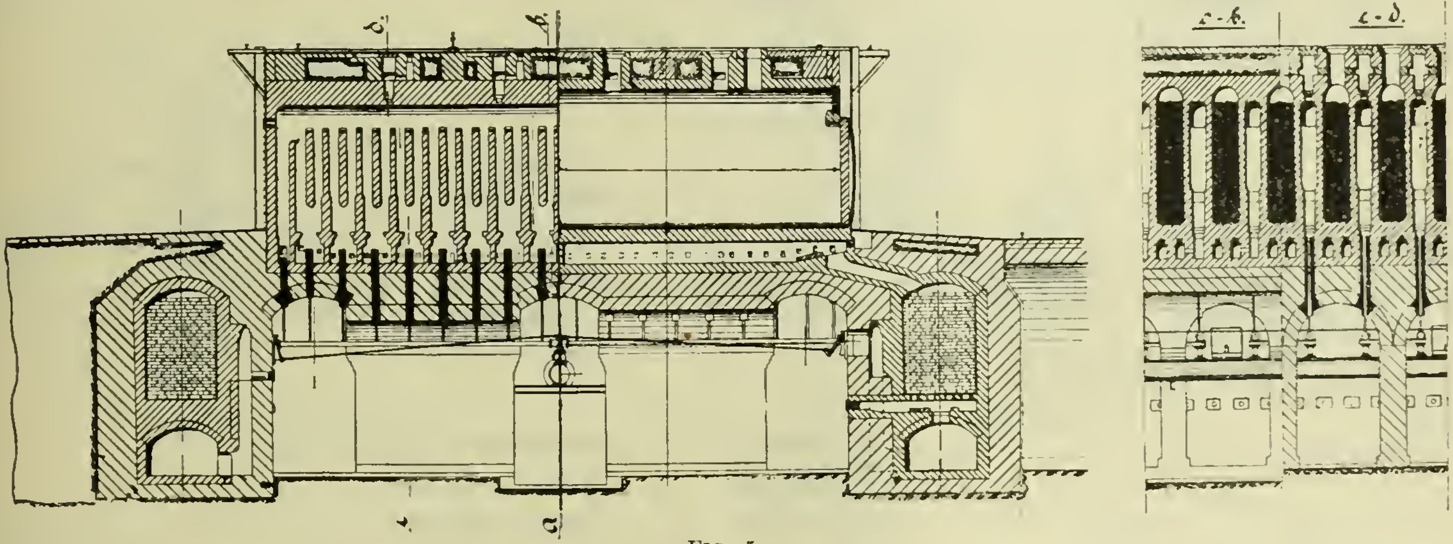

FIG. 5.

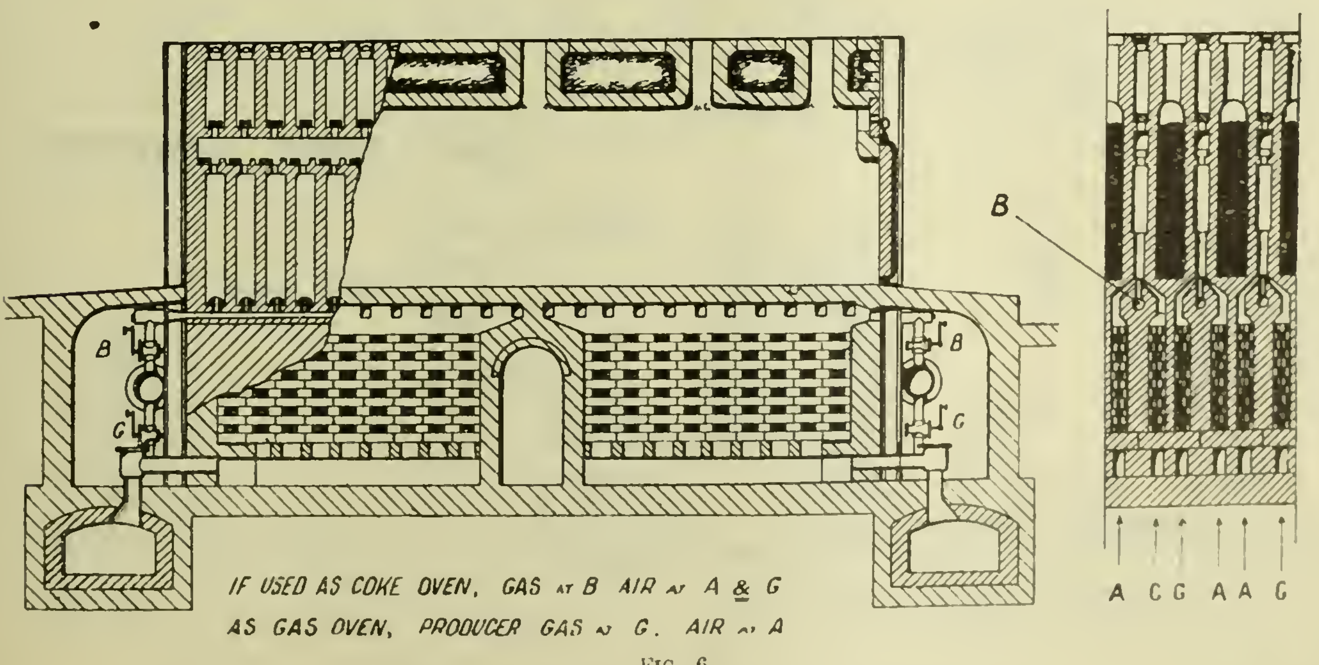
B
C
B
G
B
A C G A A G
IF USED AS COKE OVEN, GAS AT B AIR AT A & G
AS GAS OVEN, PRODUCER GAS AT G. AIR AT A

FIG. 6.

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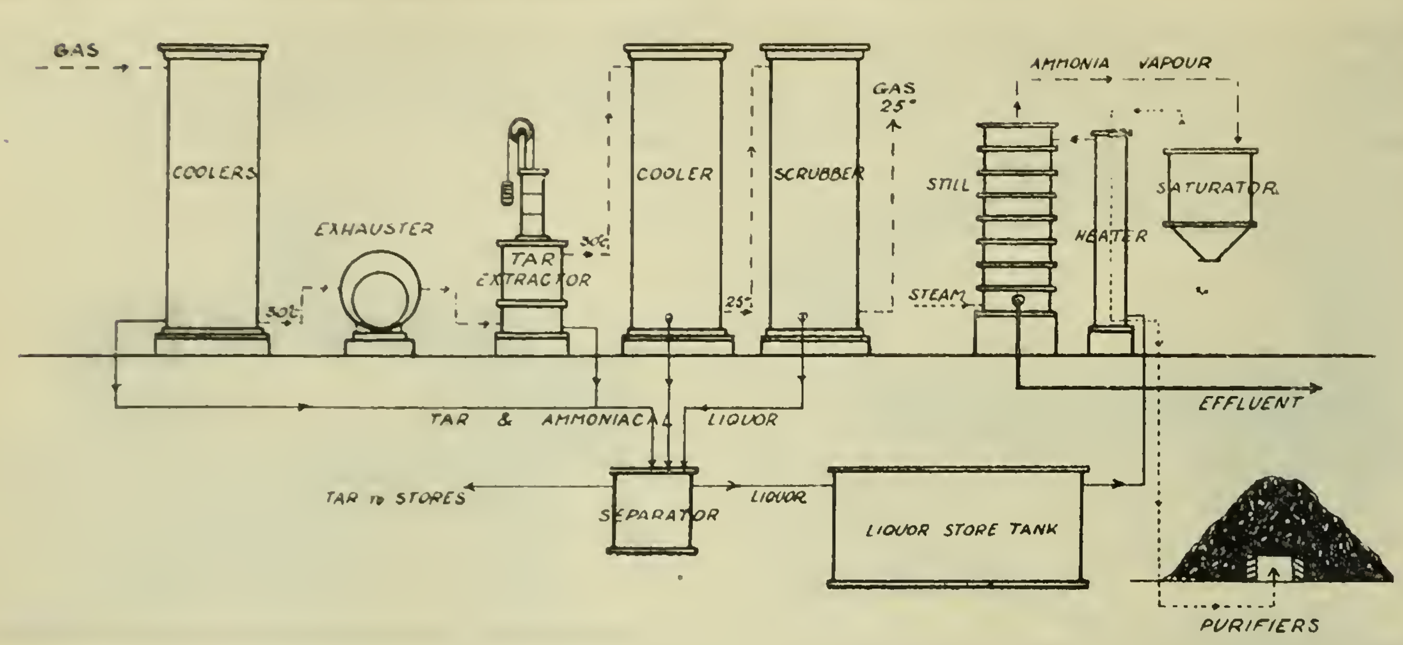
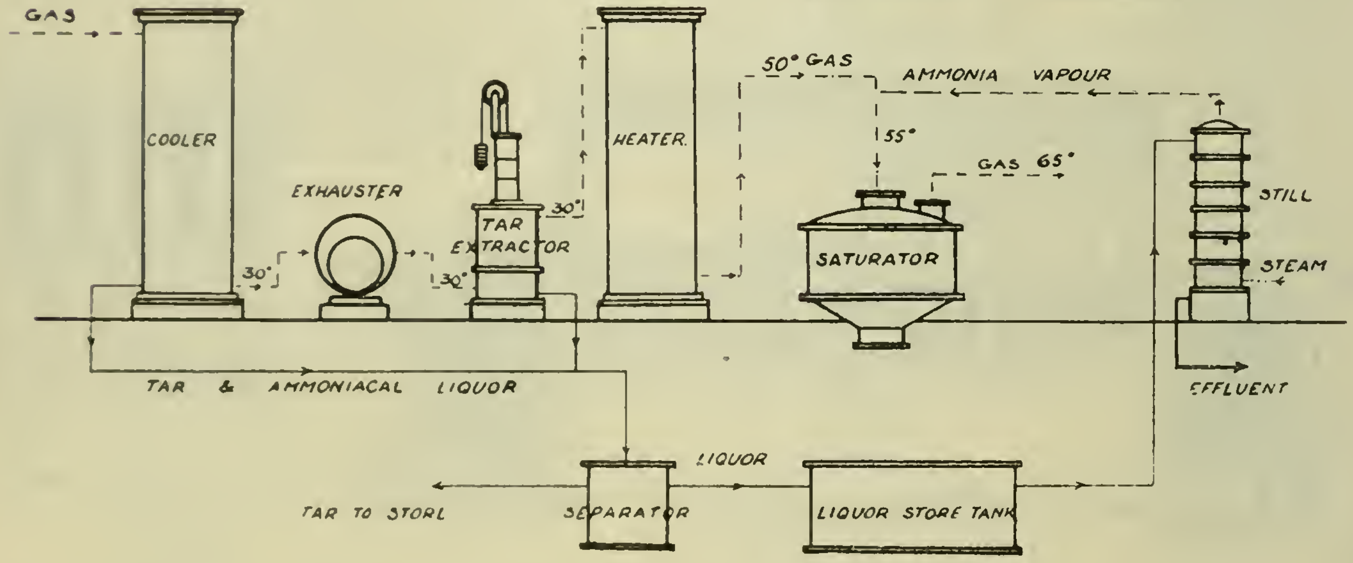
[12] Annual Reports on the Alkali Acts, 1877 and 1878.
[13] Eng. Pat. 2616, 1879.
[14] J. Iron and Steel Inst., 1884.



KOPPERS PROCESS.



MONT CENIS PROCESS.

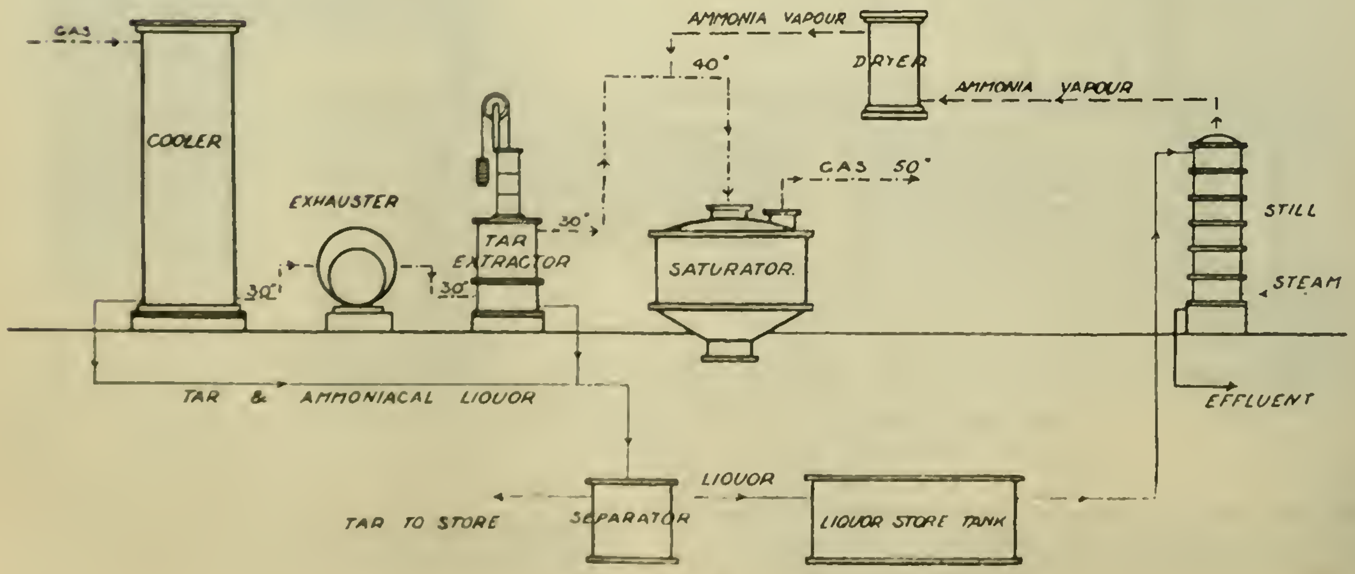
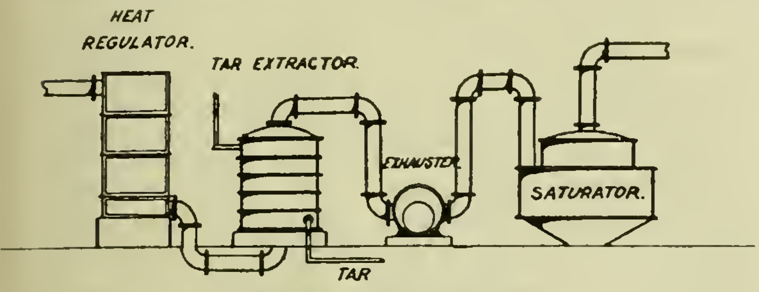
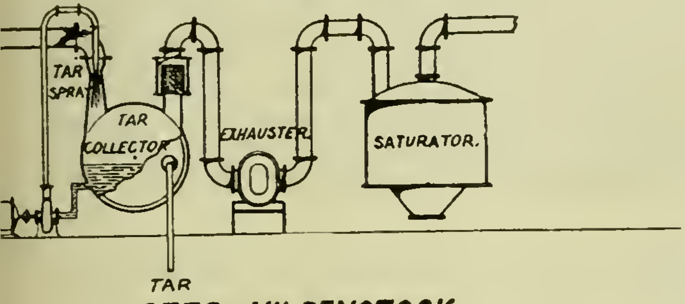


Fig. 8.

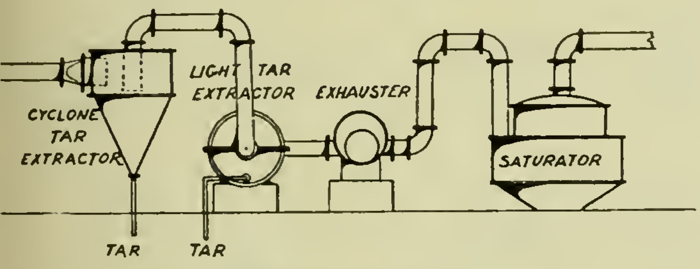
Shortly after this the Semet-Solvay oven[15] was brought out, but for some time the by-product oven made little progress owing to the prejudice of the ironmasters against the appearance of the coke, but once this prejudice was overcome the by-product oven made phenomenal progress. This progress is best shown by Fig. 4, based on the Annual Reports under the Alkali Acts. Most of the modern ovens have already been well described in this journal by Mr. Short, of Newcastle, [16] and [17], but Figs. 5, 6, and 7 show types of ovens not illustrated in the foregoing paper and show the Otto-Hilgenstock regenerative oven (Fig. 5), the Koppers regenerative oven with individual regenerators for each oven (adapted for producer gas if necessary) (Fig. 6), and the Semet-Solvay with the continuous regenerator system (Fig. 7), somewhat on the lines of gas-works recuperation systems. Some of the latter type of oven are now being built in the United States, holding up to 16 tons of coal per charge, 5 and 6 flues high, and carbonising this quantity well under the twenty-four hours. Referring now to the actual plant for the recovery of by-products from any of the modern coke ovens, the general system up to quite recently has been one of cooling by air and water-cooled condensers, tar extraction by impact or washing, and absorption of the last traces of ammonia by means of water in ammonia scrubbers. The object is to bring the temperature of the gas down gradually to 25° C. before passing through the ammonia scrubbers. The bulk of the tar is deposited by simple cooling, leaving a comparatively small proportion to be dealt with by the tar extractor proper. The ammoniacal liquor is worked up into sulphate of ammonia or concentrated to a strength up to 17 per cent. In this "water absorption" process the whole of the moisture mechanically held in the slack is condensed, along with the water produced by the combination of its elements in the coal. This forms the basis of the ammoniacal liquor, which is further increased in bulk by the addition of cold water to the scrubbers. Taking the average of 11 coke plants as given in the Alkali Reports,[18] we find the total quantity of ammonia in the liquors to be 0·859 per cent. If we take a basis of 1·0 per cent. nitrogen in the coal and a conversion of 16 per cent. of this into ammonia, we should find that this percentage represents a total weight of liquor of $22\frac{1}{2}$ per cent. of the weight of coal charged into the ovens, or approximately double the amount produced unavoidably from the moisture in the coal. The cooling of the gas down to 25° C., as well as the distillation of this added water, represents a serious disadvantage in the economy of the process. A further loss (amounting to 3 to 5 per cent.) is entailed in the exposure of liquor to the atmosphere.[19] These disadvantages have been partially or completely eliminated in the newer forms of ammonia plants, which may be classed as semi-direct and direct. In the semi-direct processes (Fig. 8) the moisture in the slack and the water of formation is condensed and treated in the usual ammonia still. The ammonia vapours evolved are led into the gas main and the mixed gas and ammonia are drawn or forced through sulphuric acid in a specially designed saturator.



SEMET-SOLVAY.



OTTO-HILGENSTOCK.



SIMON-CARVES.

FIG. 9.

In the Koppers process the gas is heated slightly before being admitted to the saturator to prevent condensation of water vapour in the bath. In the Mont Cenis process, as now adopted by the Semet Solvay Company, and the Coppée Company, this object is attained by drying the ammonia vapours from the still in a dephlegmator. The tar in these processes is finally removed by a Pelouze tar extractor. The semi-direct processes, as far as economic conditions are affected, do not compare with the truly direct processes, but they offer the great advantage of being more readily adapted to existing plants.

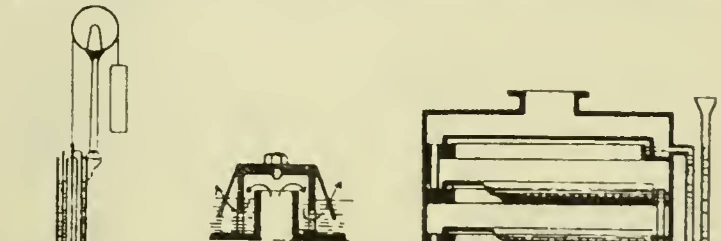


FIG. 10.

In the direct processes, Fig. 9, the gas is maintained at a temperature sufficiently high to prevent condensation of water vapour. This temperature varies with the moisture contents of the coal, so that in coke works practice it is in the vicinity of 80° C., whilst in gas works practice this dew point is nearer 70° C. At this temperature the tar is removed by (Fig. 10) (*a*) tar spray (Otto process) (*b*) bubbling through hot tar (Semet-Solvay process) or centrifugalising (Simon-Carvês process). The writer has seen the first two processes in operation in Germany and Belgium and in all cases the sulphate would pass muster as good grey salt. The Simon-Carvès process is on the lines of the original direct process of Brunck (1903), in which a centrifugal fan was used to extract the tar. The Simon-Carvès system aims at a primary removal of the heavier tars in a cyclone extractor, without any moving parts, leaving the lighter tars only to be dealt with frictionally. This appears to be on the right lines when we consider the difference in the tars produced by cooling coke oven gases to various temperatures, as shown in Fig. 11. These truly direct processes offer tempting advantages as far as thermal losses are concerned, and where the gases are kept above the dew-point of water up to the point of combustion at the ovens, no condensation and, consequently, no effluent, is produced. Under such conditions the direct processes are at their best, but no account of the benzol side of the question is included in these conditions, and the aspect somewhat changes where benzol is to be recovered. For benzol recovery the gases must be reduced in temperature to about 25° C., and the water vapour condensing would give an effluent which would, however, be clear and only half the bulk of the older water absorption systems. The following diagram (Fig. 12) has been prepared for comparative purposes only, the results for each type of plant being calculated from the same tables and formulæ, etc. Tar distillation is now receiving more attention at the hands of the coke oven designers, and several coke oven firms are also erectors of tar plants. In a coke works plant of the Evence Coppée Company a saving of fuel is brought about by driving off the water and light oils in a primary still heated by the vapours from the latter portion of a distillation. A new type of tar distilling plant is shown in Fig. 13, the Hennebutte process now being put down by the Coke Oven Construction Company, Sheffield, to whom the writer is indebted for particulars. Several plants of this type exist on the Continent, but as yet only one in this country. The tar receives a primary heating from an enclosed steam coil, and passes on to the still, into which air is injected under such conditions that some of the hydrocarbons are partially deprived of hydrogen

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[15] Eng. Pat. 4733, 1880.

[16] Coke Manufacture, Andrew Short, this Journal, 1910, **29**, 921.

[17] Modern Coking Practice (Byrom and Christopher).

[18] Forty-second Annual Report under the Alkali Act.

[19] Annual Reports on the Alkali Act (1911).

FIG. 11.

	A	B	C	D	E	F
Specific Gravity ..	1·16	1·15	1·12	1·08	1·08	0·99
To 170° C.	2	1	1	6	8	25
,, 270° C.	17	15	32	36	38	57
,, 360° C.	20	32	27	33	31	
Pitch	61	52	40	25	23	18

A Sample from final store tank.
B ,, ,, first air condenser.
C ,, ,, last ,, ,,
D ,, ,, first water ,,
E ,, ,, washer.
F ,, ,, after exhauster.

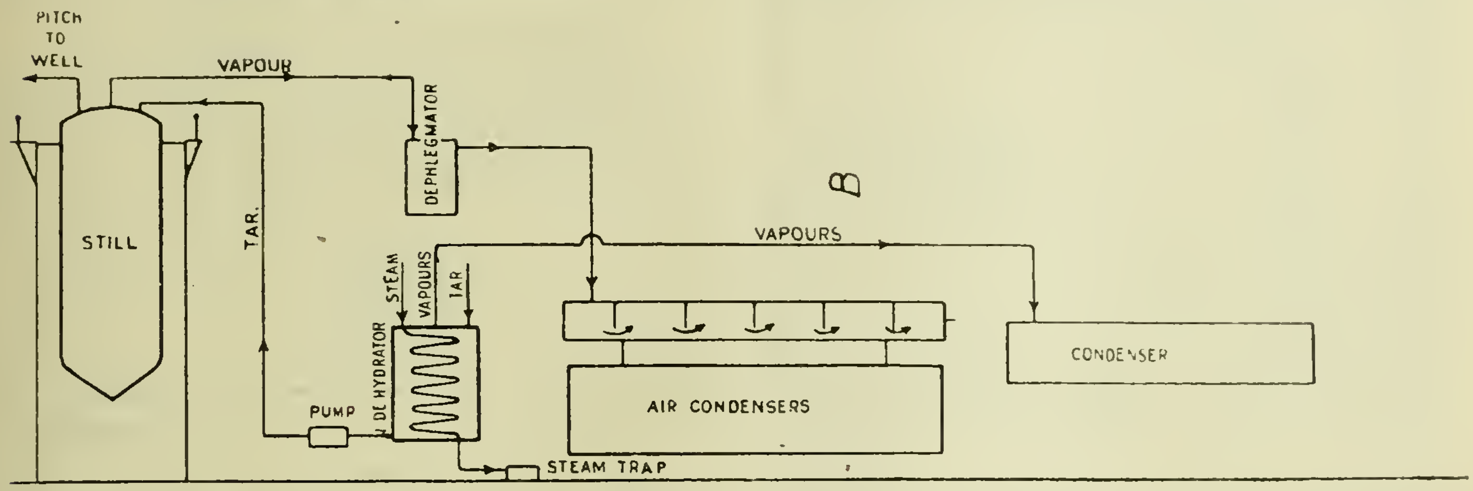
FIG. 12.

Comparative Working Costs, etc., of Various Types of Ammonia Recovery Plants. (500 *tons coal per day, Moisture* 10 *per cent.*)

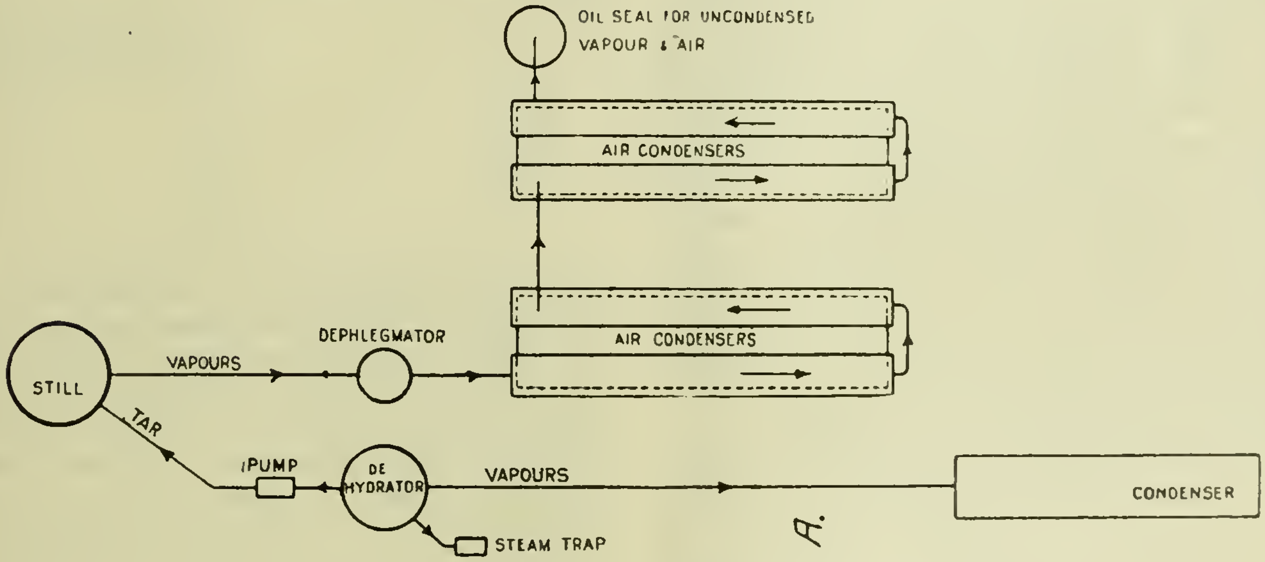
A. Effluents.	Water absorption.	Semi-Direct.		Direct.	
		With benzol recovery.	Without benzol recovery.	With benzol recovery.	Without benzol recovery.
Total liquor from :—					
1. Moisture in Coal	50	50	50	50	0
2. Water of Formation	13 } 113 tons	13 } 63 tons	13 } 63 tons	13 } 63 tons	0 } nil
3. Water added in Scrubbers	50	0	0	0	0
4. Steam added in Stills	28 tons	16 tons	16 tons	nil.	nil
Total Effluent	141 tons (Limey)	79 tons (Limey)	79 tons (Limey)	63 tons (Clear)	nil —
B. Thermal Losses :—					
1. Gas cooled to............	25° C.	25° C.	50° C.	25° C.	80° C.
2. Water vapour in gas	condensed	condensed	condensed	condensed	Not condensed
3. Liquor to be heated from 25° to 100° C. ...	113 tons	63 tons	63 tons	nil	nil
Equivalent of heat units lost calculated to tons of coal per day .... (1)	0·422	0·422	0·282	0·422	0·112
.... (2)	4·347	4·347	4·347	4·327	nil
.... (3)	1·089	0·607	0·607	nil	nil
Total	5·858 tons	5·376 tons	5·236 tons	4·769 tons	0·112 tons
C. Plant :—					
1. Exhausters	1	1	1	2	2
2. Air Condensers, etc.	20	20	20	20	nil
3. Water ,, ...	4	4	3	4	2 tar washers
4. Scrubbers	3	nil	nil	nil	nil
5. Ammonia Stills	1 for 113 tons	1 for 63 tons	1 for 63 tons	nil	nil
6. Superheater............	1	nil	nil	nil	nil
7. Saturators	2 (*a*)	2 (larger than *a*)	2 large	2 large	2 large
8. Settling Pools............	for 141 tons	for 79 tons	for 79 tons	nil	nil
9. Purifiers	2	nil	nil	nil	nil
Total cost (comparative)	£7800	£5600	£5300	£5700	£3600
D. Working Costs :	s. d.	s. d.	s. d.	s. d.	s. d.
1. Steam for Exhausters	19 3	19 3	19 3	38 6	38 6
2. Water in Scrubbers	2 0	nil	nil	nil	nil
3. Pumping Liquor	2 0	1 0	1 0	1 0	nil
4. Steam for Stills	42 0	24 0	24 0	nil	nil
5. Interest on "C"	21 4	15 4	14 6	15 7	9 10
Total daily cost (comparative)	86s. 7d.	59s. 7d.	58s. 9d.	55s. 1d.	48s. 4d.

which combines with the oxygen of the air employed, the heat liberated in the reaction being amply sufficient to supply the necessary heat for distillation.

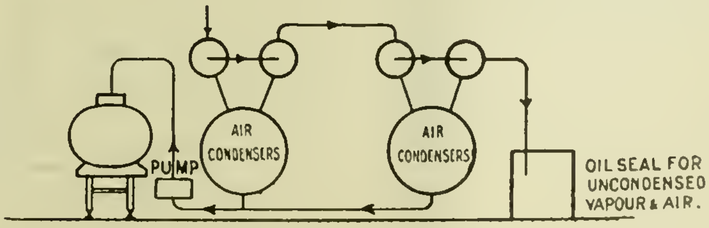
Little change may be observed in the design of benzol plants. The tendency at the present time leans towards the production of the refined products at the coke works. Benzol has attracted considerable interest in the motor industry and a large quantity of the washed product is annually exported for this purpose. Repeated trials have shown no serious obstacle to the use of the refined product which gives a greater mileage per gallon. The distillation curves of various spirits are shown in Fig. 14 indicating that whilst benzol requires a slightly higher initial temperature, its range of vaporisation is not so extended as with petrol.



-ELEVATION.-



· PLAN -



-SECTION THR° A.B.-

FIG. 13.

The outlets for the sundry by-products are of vital importance. In 1900 the world's output of sulphate of ammonia was under half a million tons. It is now over a million, and it would be natural to expect that with this rapid rate of increase the price would be materially affected. However, prices have been maintained in spite of this increased output, and in spite of the quantity of rival fertilisers made artificially from atmospheric nitrogen or calcium carbide. The use of sulphate of ammonia in this country does not appear to have made headway in comparison to the quantity used by our Continental neighbours, but the Sulphate of Ammonia Committee is carrying on active and useful propaganda work to encourage the home farmers in the use of this home manufactured product. There is plenty of scope for this work when we consider that out of our production of 369,000 tons, only 70,000 tons are used in this country, whilst practically the whole of the German production is used on German soil.[20] An average wheat crop removes 48 lb. of nitrogen from an acre of soil per annum. On this basis the wheat alone grown in the country extracts annually from the soil nitrogen equivalent to more than half our total output of sulphate of ammonia. The outlets for tar also appear promising. The advent of the motor car has introduced a demand for harder surfaced and dustless roads, and large quantities of prepared tar are sold for the tar macadam and for waterproofing roads, etc. The Diesel engine also presents possibilities of expansion in the demand for tar products. The present output of tar (in 1910) is approximately:—Great Britain 990,000 tons, Germany 822,617 tons, United States, 331,516 tons. Benzol is in good demand at the present time and apart from its use in the aniline and solvent industries, its outlet must lie in the direction of motor spirit. The following figures represent the imports of petroleum spirit into the United Kingdom:—1905, 19,459,010 gallons; 1906, 26,335,120 gallons; 1907, 33,180,480 gallons.[21] Assuming an average yield of one gallon of motor benzol per ton of coal, the by-product coke works of this country could turn out 19 million gallons annually, so that the field for exploitation of benzol as motor spirit is extensive and offers reasonable possibilities for expansion in this direction.

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[20] W. P. Bloxam. Sulphate of Ammonia Committee.

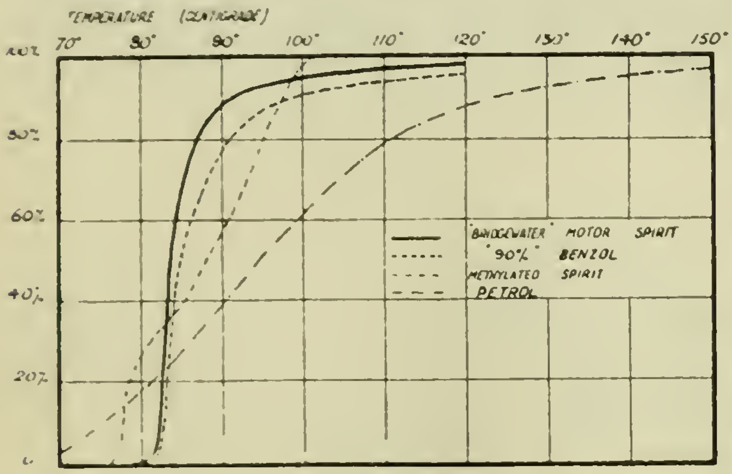

FIG. 14.

We now come to the question of surplus gas. Modern ovens may be divided into the "waste heat" and "regenerative" classes, the former giving a yield of spare gas varying up to 30 per cent., the latter rising to 60 per cent., these figures being dependent on the amount of volatile matter in the coal. This gas up to recently has been largely burnt under boilers, giving a lower efficiency than could be obtained by using it in gas engines.

The comparison in efficiency is generally quoted about 2 to 5, but with the latest developments of surface combustion introduced by Dr. Bone along with the modern types of steam engines the efficiencies would be nearly equal. Where a plant is well situated for the sale of power, a regenerative type of plant would be advantageous, but with a plant somewhat isolated a waste heat type is more serviceable. The following is an average analysis of coke oven gas based on results from four types of coke ovens:—

	Per cent.
Illuminants	2·4
Methane	28·8
Hydrogen	54·1
Carbon monoxide	5·0
Carbon dioxide	2·0
Oxygen	0·4
Nitrogen	7·3 [22]

The above figures all represent the average right through a charge and the calorific value averages 510 B.Th.U. net.

Fig. 15 shows the gradual change in composition of coke oven gas (averaged from various sources) and it will be seen that the gas from the first half of the coking period is much richer than that from the latter, and by taking the rich gas in a separate main, there would be no difficulty in supplying gas to meet the required standards, but it is the writer's opinion that a modern coke plant, given the same quality of coal as supplied to gas works, could with reasonable care turn out regularly an average gas suitable for the modern conditions of gas lighting.

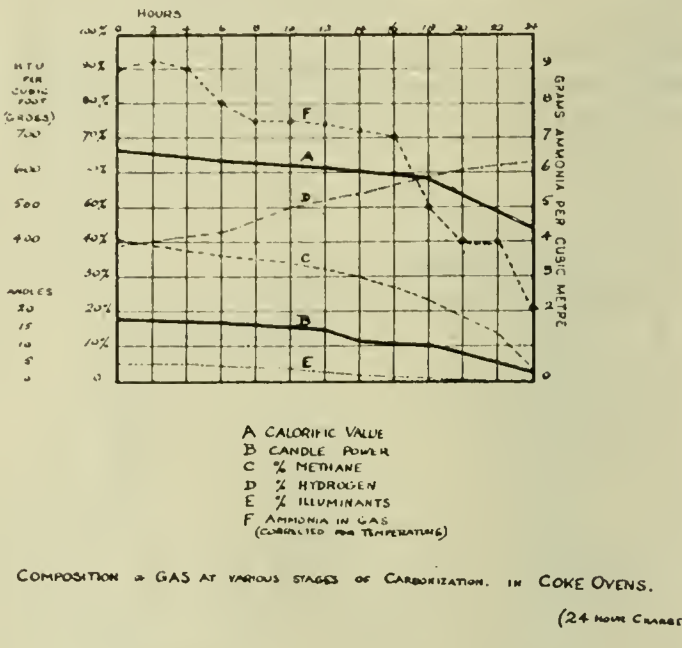

FIG. 15.

On the Continent, owing to less stringent statutory conditions this branch of modern coke manufacture has made considerable headway, as shown by the following figures:—

	Gas produced at coke ovens (Ruhr District), Germany.
1903	13 million cubic feet
1905	24½ ,, ,, ,,
1907	77 ,, ,, ,,
1908	400 ,, ,, ,,
1909	843 ,, ,, ,,
1910	1472 ,, ,, ,,
1911	3020 ,, ,, ,, [23]

In the United States the quantity of spare gas sold from coke ovens amounted to 12,000 mill. c. ft. in 1910, representing 23 per cent. of the total output.[24]

A company has been formed and contracts made for the supply of coke oven gas to the existing municipal gas works at Ghent, Belgium. The gas is to be supplied from ovens of the Semet-Solvay system and the contract is for 105 to 210 million cubic feet per annum at a price equivalent to 5·4d. per 1000 cub. ft. whilst power is also to be supplied at 0·33d. per kilowatt hour for a guaranteed consumption of 3 to 6 million kilowatt hours.[25] It is not suggested by the writer that gas manufacture in coke ovens will ever displace the modern vertical retort with its advantages of continuous carbonisation but an attempt has been made to show the value of coke oven gas as a by-product pure and simple. The writer concludes with the diagram Fig. 16 showing the relative values of products

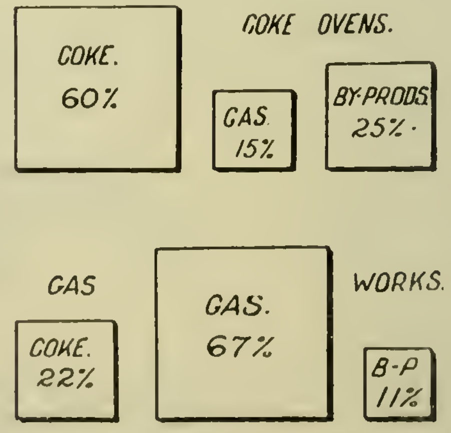

FIG. 16.

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[21] This Journal, 1908, **27**, 786.

[22] Iron and Steel Inst., 1904, C. Lowthian Bell (Huessener). S. Wales Inst. Eng., 1908, E. M. Hann (Koppers). Inst. of Gas Eng., 1907, E. Bury (Semet Solvay). This J., 1907, 921, A. Short (Otto Hilgenstock), T. H. Byrom, 1907 (Semet-Solvay).

[23] Glückauf and Rhine and Westphalia Journal.

[24] W. S. Blauvelt. American Gas Institute.

[25] Times, Engineering Supplement, Dec., 1912.

obtained at a modern coke plant and gas works respectively. The writer desires to thank Mr. W. H. Hewlett, of the Wigan Coal and Iron Co., Ltd., for the right of access to valuable plans and information throwing light on the earlier attempts at by-product recovery. He also desires to acknowledge the kindly co-operation of Messrs. T. H. Byrom, F.I.C., chief chemist to the above Company, and H. J. Bailey, F.I.C, his Majesty's Inspector for this district under the Alkali Act. The writer also thanks the firms of coke oven builders for information on their respective types of ovens, etc.

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Discussion.

Mr. H. J. **Bailey** said that the author in the early part of his paper, referred to the fact that in former times coke was of very poor quality, and suggested as a reason that the gas did not give up its graphitic carbon in decomposition because it was drawn through the colder portions of the coke. He himself rather thought that the whole question of coking coal was to get the coal properly fluxed. The old idea was that the coking of coal depended upon the decomposition of the volatile hydrocarbons, it being supposed that they represented the sap of the parent plants, and that the fixed carbon, or coke, represented the woody fibre. That idea was somewhat exploded by the fact that there were coals in this country and in other countries of very high volatile content, over 30 per cent., which it was impossible to coke, and if coking were dependent upon the amount of volatile hydrocarbons one would quite expect that those coals would coke equally as well as those in the South Wales district with only 16 per cent. of volatile hydrocarbons. It was all a question of the quality of the coal and a sort of critical temperature at which the melting-point could be obtained. If the coal did not cohere in the first instance a hard coke could not be obtained. He remembered an instance when by accident an oven was discharged before it was ready, that was to say, before the coking process was complete, and although thereby some five or six tons of coke were wasted, he took advantage of the occurrence to take various samples to investigate what had gone on in the centre of the oven, which was a side-flue heated oven. In the result he was able to obtain samples of coal or sticky tarry material containing quite 8 per cent. of volatile hydrocarbons more than the coal that was put into the oven. He also obtained coal which seemed to have begun to coke, which he then cooled and broke abroad, and then tried to coke, and found it practically impossible to get coke out of it, although the volatile constituent had not varied more than half per cent. from the original coal put into the oven. He was thus rather led to the impression that if there were not a proper binding of the coal together by the critical temperature being reached it was not possible to obtain a good coke from the point of view of structure and hardness. It did not seem possible in coke-oven practice to obtain a yield of sulphate of ammonia generally much above one per cent. In the paper the percentage of nitrogen available as sulphate of ammonia had been given as about 16 per cent., and the figure for nitrogen as about one per cent. In his opinion one or other of the figures was too low. If the figures were worked out the average yield would be somewhere between 17 and 18 lb. of sulphate per ton of dry coal coked, and he thought that generally throughout the country the yield was nearer 20 lb., at any rate in the North. Even in South Wales the yield worked out in some cases above 18 lb., though the coals had very low volatile constituents.

Mr. W. H. **Coleman** understood that the import of petrol or motor spirit into this country in 1912 approximated 68 million gallons. He thought it would not be possible to obtain anything like this quantity of benzol. If all the metallurgical coke were made in by-product ovens 29 million gallons of motor spirit would be an outside figure for the quantity that could be produced and that was assuming that the whole of the coal would yield benzol equivalent to the yield of benzol from Durham, Yorkshire, and Lancashire coals. In 1906 approximately 17 per cent. of the total coke used for metallurgical purposes was made in by-product ovens. In 1910, the last year for which figures could be obtained, the percentage of coke made in by-product ovens was 34, so that it had practically doubled in quantity in something like three or four years. In the course of a few years they hoped to have the bulk of the coke in this country made in by-product ovens as it was in Germany at the present moment. He thought Mr. Bailey's criticism of the ammonia yield scarcely went far enough. He was aware that at one or two coke works it was claimed they obtained 30 or 32 lb. of sulphate of ammonia per ton of coal.

Mr. R. H. **Clayton** enquired what power was required to drive the fans for getting out the tarry matter in the centrifugal process. Such apparatus had to be driven at a high speed. How did that matter stand as against the recovery of ammonia simply by condensation, and by plant in which there were no moving parts? With respect to recovery by means of water-washing, the figure given in the paper showed that 36 parts came out of the coal and 50 parts were used to wash out the remaining traces of ammonia from the gas: 50 parts seemed to be an excessive amount. From his experience of gasworks practice, the amount of added water to finish the extraction of the last traces of ammonia was very much less, and he asked whether that figure represented a modern plant. The flash point of benzol was really the determining factor as to what spirit could be used in motors. The flash point of benzol, of course, was a very low one. and the use of the spirit in motor cars had been thoroughly justified. He also desired information with respect to the comparison to the gas engine and the steam engine in the utilisation of the gases. It had been stated that the utilisation by steam was as two is to five by a gas engine and that by the surface combustion of the boiler it became approximately equal. He could not understand how that enormous economy resulted which the statement seemed to represent. The efficiency of an ordinary Lancashire gas boiler was about 70 per cent. By surface combustion not more than 90 per cent. would be obtained, so that he could not understand how the figure would be reduced from 2 is to 5 as 5 is to 5.

Mr. **Holton** was surprised to hear of the low yields of ammonia. He had been informed by a manager of a coke-oven works in the Midlands that he was getting 30 lb. sulphate per ton of coal. Everything was sealed up and there was no outlet for any ammonia vapours. For the previous six months he had been specially interested in seeing that the pipes which led the ammoniacal liquors to the liquor well were trapped or had a hood put on them at the top so as to prevent any ammonia vapours ascending the pipe. By adopting this practice the ammonia yield had been greatly increased. He was not cognisant of the custom in coke-oven practice with regard to dealing with ammoniacal liquor.

Mr. E. N. Ardern said that the direct process with the non-recovery of benzol, appealed to him personally for the reason that there was no effluent to be discharged either into the sewers or water-courses. He gathered from the paper, however, that this process had been practically abandoned, because the recovery of benzol was a profitable process. In regard to the effluent produced in the semi-direct process, was the reduction in the volume of resultant waste-liquor, as compared with that produced in the original water absorption plant, accompanied by a corresponding increase in strength, or were the effluents obtained in the two cases more or less of similar composition? In other words, did one process possess any advantage over the other in so far as regards the possibilities of pollution?

Mr. John Bond inquired whether the author had had any experience of inclined ovens with regard to the cost of discharging coke from these ovens as compared with horizontal ovens. In one of the tables it was shown that the ammonia made in gasworks practice was equivalent to about 16 lb. of ammonium sulphate per ton of coal carbonised. He believed that the figures now stood at an average of about 24 lb. of sulphate per ton of coal. He anticipated that when the gas industry used the vertical retort more generally, this yield would be considerably increased.

Mr. E. Wheeler thought some of the speakers had forgotten that different percentages of nitrogen existed in different samples of coal, and were rather inclined to treat coal as being a sort of standard substance. In analysing many samples of coal from different parts of the world, he had sometimes experienced great difficulty in obtaining an average sample. In some cases he had found a large percentage of shale with varying amounts of nitrogen in the shale, and also varying amounts of nitrogen in samples of coal which came from the same district or even from the same colliery.

The Chairman said they were aware it was possible to have a very clear effluent from an ammonia recovery works which was by no means harmless, even if all the lime was taken out of it. What was the composition of the effluent, and could it be used, for example, for coke-washing? At the present time about 4,000 gallons of effluent per day were being purified at the Bradford Chemical Works, but the expense was rather high, and they would be glad if the quantity could be reduced without correspondingly deteriorating the quality, so that it would be possible to recover the benzol, and at the same time dispose of the effluent fairly easily and without too great cost. The agricultural problem mentioned by the author of the paper was one of very great moment.

Mr. T. H. Byrom said that unquestionably the amount of nitrogen differed considerably in various coals from different districts, but that, in his experience, coal from a particular district was fairly constant as regards nitrogen. He was rather surprised to hear that one of the speakers had noticed such wide differences in the same coals. Possibly that was due to the presence or absence of the shaley matter to which the speaker had referred.

Mr. J. Thorp said it had been found that in the use of benzol for motors there was a certain amount of gummy matter deposited in the cylinder, this being a disadvantage.

Mr. Jas. Baddiley said that one important point was the possible competition of synthetic ammonia. He was informed that the Badische Company now had a plant which was expected to turn out 25,000 tons of ammonia per annum, and they were prepared to double that plant in the immediate future.

Mr. Arthur Johnson thought that the difficulty in the semi-direct plants was to deal with the amount of water formed upon the condensation of the gases. Could not something be done by drying the coal before it went to the ovens, so that there would not be such a large amount of liquor to deal with?

Mr. J. E. Christopher in reply, referred to Mr. Bailey's point as to what really constituted the coking of the coal. With regard to the instance shown on the screen, the coke was unfit for use in the blast furnace and the process was discontinued. According to Professor V. B. Lewes coal treated up to something like 300° C. lost its coking power entirely. His (the speaker's) experience was that the amount of nitrogen varied very considerably, and scarcely two coke-plants dealt with the same percentage of nitrogen. He had known instances of nitrogen of less than one per cent. to down to 0·8, and other instances where it went up to 2 per cent. He knew of yields which varied from 16 lb. per ton of coal up to 39. He was much obliged to Mr. Coleman for supplying the later figure with regard to the importation of motor spirit, and he agreed that if the whole of the coke in this country were made in by-product ovens 29 million gallons of benzol could be obtained. Mr. Coleman had stated that the amount of coke made in ovens of the by-product principle in this country in 1910 was 34 per cent. of the whole. In Germany in 1900, 33 per cent. of the coke was made in by-product ovens and in 1909 it was 80 per cent. Mr. Holton had spoken about the claims for certain coke ovens obtaining 30 lb. of sulphate of ammonia per ton, but he thought that had been already sufficiently explained. The losses from evaporation were considerable, and he was afraid that in the case of coke-plants this point was not regarded with the interest it ought to be. The figure given by Mr. Sheard, of the Sheffield Gas Company, quoted in the "Alkali Inspector's Report," showed that the loss on a clear day amounted to from three up to five per cent. of the ammonia. The observation about keeping the pipes and the tanks closed referred to gasworks liquor, which was usually two or three times as strong as coke-oven liquor. The average strength of coke-oven liquor was 0·859 per cent. ammonia. The effluent from the semi-direct or direct processes contained most of the impurities in a concentrated form. There were plants which dealt with the liquor and then dealt with the spent liquor by evaporation, and under such conditions if the volume was reduced the cost of evaporation would certainly not be so expensive, and there was also the possibility, he did not know how far it would work out, of heating up the effluent in order to drive off some of the products in a volatile form. The amount of gas available for power was up to 30 per cent., the remaining 70 per cent. being used in the coke-oven flues. He was not aware of any coke-oven gas that contained dust, but if it was to be used in gas engines it certainly ought to be passed through purifiers, as was done on a very extensive scale in a South Wales coke plant, where a gas engine had been running for five or six years continuously. The purifiers took up sufficient quantities of sulphur from the gas to be converted into sulphuric acid for the sulphate plant, thus creating a very high point of efficiency. As to the area of cooling surface, the nine square feet, strictly speaking, was the total, representing mains as well. He had seen a figure given of six square feet of air condensing surface and three square feet of water cooling surface in addition. He did not think it possible to go below the figure he had stated with satisfactory results in the case of coke-ovens. Touching upon the point of drying the coal before it was put into the ovens, he had had experience of coal coming from the washers, and he thought it stood as long as most plants, in some cases up to three days, and even then there was 8 to 10 per cent. of water in it. He thought the drying process would require some external heat in order to obtain any real advantage from it. He had heard it stated that the power required to wash out the tar in the direct processes amounted to 40 h.p. per hour, calculating on about the same amount of coal. The Simon-Carvès principle removed a good share of the tar by the cyclone extractor, without any moving parts, the above figure being then considerably reduced. As to the excessive amount of water used on a coke plant, the average he had given was the average of eleven coke plants, and he thought it could be taken as fairly representative. With respect to the comparison between gas and steam the average worked out as two is to five. Oftener than not the steam was with Lancashire boilers, and with an engine consuming perhaps 24 lb. of steam per horse-power. In the case of one particular car he knew a certain amount of "gumminess" occurred in the cylinder through the use of benzol motor spirit, but it did not prove a serious drawback, and the average chauffeur ought to be able to deal with the matter quite easily. As to the storage of coal, he had definite figures from a German gasworks, showing that the loss of ammonia, after eight weeks' storage, amounted to eight per cent. The effect of storage was very severe on the amount of spare gas. This point would also affect gasworks as they would have a less turn-out of gas. With coal that had been stored for any length of time it was quite possible to get no spare gas at all.

Obituary.

ARTHUR CROZIER CLAUDET.

Arthur Crozier Claudet, A.R.S.M., the eldest son of Frederick Claudet, of London and Cannes, the founder of the well-known firm of assayers and metallurgists, was born on June 9th, 1855, and died after a few days' illness on January 17th, 1913. He was educated privately and at the Royal School of Mines, where he took the Associateship in Metallurgy, in 1878. After the death of his father in 1906, he continued in business alone, and also succeeded his father as assayer to the Bank of England and the Royal Mint Refinery. He was an original member of the Society of Chemical Industry, and a member of its Publication Committee from 1895 to 1899. He contributed a paper on "The Relation of Chemical Industry to Metallurgy," to the London Section of the Society as recently as 1910 (this J., 1910, 1421). In 1906-7 he was President of the Institution of Mining and Metallurgy of which he had been treasurer from its foundation in 1892, he served on the councils of the Institute of Chemistry and the Faraday Society for various periods, and he was also an active member of the Executive Committee of the Bessemer Memorial Fund from which the Bessemer Laboratory at South Kensington was equipped. Conjointly with Mr. Hennen Jennings, of Washington, D.C., he established a "post-graduate grants fund," under the auspices of the Institution of Mining and Metallurgy, to supplement the scholarships of the Institution, and to aid in assisting young graduates to take practical courses in mines and works in the chief mining centres of the world. He was a man of amiable and generous disposition who was much esteemed by a large circle of friends.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Prime movers. S. Z. de Ferranti. The James Watt Lecture, Greenock, 1913.

THE author states that he has succeeded in devising a turbine which at the highest temperatures, and with great and rapid variations of temperature, is quite free from mechanical troubles. The blading is formed of mild steel, electrically welded throughout, and with a thin coating of pure sheet nickel electrically welded on to the surface. The steam is worked as a gas at high temperature throughout the turbine, being superheated initially and after the first expansion, then re-superheated before it does its work in the second stage of the turbine, and exhausted in a superheated condition through a regenerator to the condenser. A 5000 H.P. turbine of this kind, which has been running for some time, when tested at a load of two-thirds full power on 7 lb. of steam, gave results corresponding to a consumption of 0·625 lb. of oil per shaft-horse-power, with the steam supplied by an oil-fired boiler superheater system of 85 per cent. efficiency. The results now being obtained indicate that when run at full load under favourable conditions, this turbine will take less than 6 lb. of steam per shaft-horse-power and that the system will have a thermal efficiency of over 24 per cent., corresponding to an oil consumption of about 0·55 lb. of oil per shaft-horse-power.—A. S.

PATENTS.

Scale; Process of removing ——. F. E. Coombs, Au Sable Forks, N.Y. U.S. Pat. 1,049,054, Dec. 31, 1912.

THE surface covered with scale is first treated with water to remove soluble matter and then subjected to the action of a solution of caustic soda (of sp. gr. greater than 1·10, and at a temperature above 100° C.), whereby, it is claimed, the scale is softened and rendered easy of removal by known means.—W. E. F. P.

Gaseous fluids; Treating ——. H. C. Anderson, Hampton Township, Pa. U.S. Pat. 1,049,796, Jan. 7, 1913.

THE gases are made to traverse a series of vertical alternating up-take and down-take flues, being drawn from the upper part of one up-take and forced into the lower end of another up-take, by the action of a liquid falling in finely divided condition through the down-take flue. The cross-sectional area of the falling liquid is approximately equal to the cross-sectional area of the down-take flue, whereby the falling liquid has a propulsive action on the gas.—B. N.

Starch, clay, etc.; Process and apparatus for stirring and transporting materials such as ——. V. Taschl und Co. Fr. Pat. 446,008, July 12, 1912.

THE apparatus, which is for use in settling troughs, includes a carriage on which are mounted two cylindrical brushes rotating in opposite directions and extending across the trough. These brushes (one of which may be replaced by a barrier) are situated a certain distance apart, and, with the walls of the trough, form a space from which the suspension of starch or other material is withdrawn by a pump. A strong spray of water, directed into this space, aids in stirring the material. The carriage is moved along the trough by a cable. An apparatus for use in settling vats differs from the preceding in that the ends of the two brushes are joined by lateral walls which serve the same purpose as the wall of the trough in the former case, and in that the carriage is made to move laterally each time it reaches a side of the vat.—L. E.

Evaporating sea water; Apparatus for —— *and for generating steam.* P. R. J. Willis, Kingston on Thames. From C. Mykolashek, Raymond, Wash., U.S.A. Eng. Pat. 272, Jan. 3, 1912.

SEE U.S. Pat. 995,629 of 1911; this J., 1911, 879.—T.F.B.

Mixing machine. R. Tiedtke, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,048,763, Dec. 31, 1912.

See Eng. Pat. 4849 of 1908; this J., 1908, 674.—T. F. B.

Separating solid matters from liquids; Apparatus for ——. A. Müntzing, Stockholm. U.S. Pat. 1,048,853, Dec. 31, 1912.

See Fr. Pat. 430,589 of 1911; this J., 1911, 1308.—T.F.B.

Raising and forcing liquids; Apparatus for ——. J. Koerver, Crefeld, Germany. U.S. Pat. 1,049,494, Jan. 7, 1913.

See Eng. Pat. 17,283 of 1911; this J., 1912, 522.—T. F. B.

Gases and vapours; Apparatus for treating —— to the action of liquids. C. H. Fowler and E. A. Medley, Great Crosby. U.S. Pat. 1,050,013, Jan. 7, 1913.

See Eng. Pat. 23,864 of 1911; this J., 1912, 1167.—T.F.B

Filtering apparatus. J. M. Neil. Fr. Pat. 445,617, July 1, 1912.

See Eng. Pat. 14,388 of 1912; this J., 1912, 1169.—T.F.B.

Drying pasty or granular materials; Apparatus for ——. R. Petri. Fr. Pat. 446,154, April 27, 1912. Under Int. Conv., April 27, 1911.

See Ger. Pat. 217,450 of 1911; this J., 1912, 803.—T. F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Hydrocarbon [and ether] flames; The inner cone of divided ——. F. Hiller. Z. physik. Chem., 1912, **81**, 591—625.

In the author's experiments, the division of the flame was effected in a manner similar to that described by Epstein and Krassa (Z. physik. Chem., 1910, **71**, 28). A porcelain tube about 30 cm. long (8 mm. diam. for the ether flame and 20 mm. diam. for the illuminating gas flame) served as burner. The outer tube of the flame divider consisted of a Jena glass cylinder of 52 mm. diam., drawn out at the upper end to 21 mm. diam. for the ether flame and to 32 mm. for the illuminating gas flame. In confirmation of Haber and Richardt (this J., 1904, 976) it was found that the temperature (not quite 1600° C.) of the tip of the inner cone of a divided illuminating gas flame, as measured with a thermo-couple, agreed, with that calculated, with the aid of the reaction constant of the water-gas equilibrium, $CO_2+H_2\rightleftarrows CO+H_2O$, from the composition of the gases withdrawn therefrom. At a point 30 cm. above the tip of the inner cone the temperature measured directly was about 1000° C. lower than at the tip, but the reaction constant calculated from the composition of the gases withdrawn at this point did not differ greatly from that found for the tip of the inner cone, *i.e.*, the equilibrium was not displaced while the gases cooled by about 1000° C. It was found, however, that the ratios, $H_2O:CO_2$ and $CO:H_2$ for the gases withdrawn some distance (30 cm.) above the tip of the inner cone were not in stoichiometrical agreement with those for the gases withdrawn from the tip itself, and this was traced to a difference in composition of the gases at the tip and the outer edge (about half-way down) respectively of the inner cone; the ratio, $CO:H_2$ was practically the same in both cases, but the ratio, $H_2O:CO_2$ (and hence, also the reaction constant) was higher in the gases at the edge than in those at the tip. Experiments were also made with a divided ether flame, and analogous results as to the agreement of the calculated and observed temperatures were obtained, except that in this case the temperatures as measured directly and as calculated with the aid of the reaction constant of the water-gas equilibrium agreed not only at the tip of the inner cone (temp., 1600° C.), but also at a distance 7 cm. above the tip (temp. 1250° C.). The author has previously pointed out that the temperature of the inner cone of the illuminating gas flame as calculated from the heats of combustion and specific heats of the gases is higher than that measured directly, and the same has now been found to hold good in the case of the ether flame. The reason for this discrepancy has not yet been elucidated. No difference in temperature between the tip and the outer edge of the inner cone of the illuminating gas flame could be detected by means of a thermo-couple, but in the case of the ether flame, the temperature of the outer edge was 50° C. higher than that of the tip of the inner cone. (See also this J., 1903, 1038; 1906, 211; 1910, 205.)—A. S.

Hydrogen and saturated hydrocarbons (methane, ethane, and propane); Analysis of mixtures of ——. P. Lebeau and A. Damiens. Comptes rend., 1913, **156**, 144—147.

Ethane and propane have practically no vapour pressure at the boiling point of liquid air, so that a mixture of these gases with methane and hydrogen can be separated by passing it into a receiver surrounded by liquid air, and then pumping out the uncondensed gases. If all four gases are present, the volatile portion contains hydrogen and methane, while the residue contains the ethane and propane. The two fractions may then be separately analysed by combustion.—W. H. P.

Roumanian petroleum and petroleum products; Specific heat of ——. A. Scheller and V. Gheorghiu. Petroleum, 1913, **8**, 533—534.

A weighed quantity of naphthalene, the heat of combustion of which was known, was ignited in a Berthelot-Mahler bomb, the calorimeter vessel of which was filled with the oil under examination, and the specific heat of the oil was calculated from the observed rise in temperature. The determinations were made at temperatures between 14° and 20° C. In this way the following results were obtained:—*Crude oils:* Policiori, 0·4724; Campina (rich in paraffin wax), 0·4675; Campina (poor in paraffin wax), 0·4667; Bustenari, 0·4625; *Unrefined products:* Light benzine (sp. gr. 0·7215), 0·484; heavy benzine (sp. gr. 0·7464), 0·4679; petroleum oil (sp. gr. 0·8142), 0·4652; gas oil (sp. gr. 0·8642), 0·4619; light spindle oil (sp. gr. 0·9143), 0·4597; refined lubricating oil I (sp. gr. 0·9100), 0·4579; II (sp. gr. 0·9100), 0·4567; and naphthenic acid (technically pure), 0·4630.—C. A. M.

Coal and lignite. Production and consumption in the principal countries of the world. Board of Trade J., Jan. 30, 1913. [T.R.]

The following particulars relating to the production and consumption of coal in the principal countries of the world are extracted from a Return [Coal Tables, 1911, H.C. 103/12] recently issued by the Board of Trade:—

Production.—The production of coal in the five principal coal-producing countries of the world in 1909, 1910, and 1911 was as follows, tons in every case being the English ton of 2240 lb.:—

Countries.	1909.	1910.	1911.
	Tons.	Tons.	Tons.
United Kingdom	263,774,000	261,433,000	271,899,000
Germany	146,397,000	150,372,000	158,164,000*
France	36,519,000	37,030,000	38,023,000
Belgium	23,140,000	23,532,000	22,683,000*
United States of America	111,432,000	117,854,000	143,025,000*

* Provisional figures. † Including lignite.

In the United Kingdom, Germany, and France the production in 1911 exceeded that of any previous year, while in Belgium it was less than in any of the five preceding years. The average annual output in the above-mentioned countries was 870 million tons in the five years 1906-10, an increase on the average for the previous quinquennium of over 170 million tons. Of the remaining countries included in the tables, Russia alone has a production exceeding 20 million tons yearly. The total known coal production of the world (exclusive of brown coal or lignite) in 1911 was about 1050 million tons.

The following statement shows the production of coal in the principal parts of the British Empire in the years 1909, 1910, and 1911 (the amounts are in every case stated in tons of 2240 lb.) :—

Country.	1909.	1910.	1911.
	Tons.	Tons.	Tons.
British India	11,870,000	12,047,000	12,716,000
Australia	8,186,000	9,759,000	10,550,000*
New Zealand	1,911,000	2,197,000	2,066,000*
Canada	9,376,000	11,526,000	10,082,000*
Union of South Africa	5,534,000	6,351,000	6,780,000

* Provisional figures.

Consumption.—The consumption of coal in 1911 in some of the chief consuming countries is as follows :—United States (including lignite) 425,422,000 tons, United Kingdom 184,859,000 tons, Germany 133,437,000 tons, France 57,133,000 tons, Russia 28,298,000 tons, Belgium 24,126,000 tons.

Lignite.—The statistics of lignite production show that the principal producing countries are Germany, Austria, and Hungary, which in 1910 produced 68,430,000 tons, 24,729,000 tons, and 7,610,000 tons respectively; in 1911 the output in Austria was 24,859,000 tons, whilst the provisional figures available show a production of 72,575,000 tons in Germany in the same year. The quantity of lignite produced in the United States is included in the figures for coal.

Petroliferous sandstone near Newark. Chem. and Drugg., Jan. 18, 1913. [T.R.]

Borings made during the past three years at Kelham, near Newark, have resulted in the discovery of a thick band of sandstone charged with crude petroleum below the level of the coal-measures. The oil which permeates the sandstone is apparently under pressure. Sir Boverton Redwood, to whom a sample of the oil was submitted, reports that it is a true normal petroleum of excellent quality.

Patents.

[*Water-gas.*] *Gas; Process of generating* ——. D. D. Barnum, Worcester, Mass. U.S. Pat. 1,039,479, Sept. 24, 1912.

In a vertical, cylindrical generator for the production of water-gas, the fuel is supported upon a series of rocking grate-bars, where by the ash is removed automatically and continuously. The ignited fuel is brought to a state of incandescence by means of an air-blast, which latter is subsequently replaced by a powerful, vertical steam jet (of inverted conical shape) from a nozzle centrally disposed beneath the grate. For the purpose of preventing overheating and clinkering of the outer, annular portion of the incandescent mass during the operation of both air- and steam-blasts, steam is simultaneously injected from a series of regulable jets radially disposed within the walls of the fuel chamber.—W. E. F. P.

Gas-washing apparatus. H. E. Theisen, Munich, Germany. U.S. Pat. 1,049,317, Dec. 31, 1912.

The apparatus consists of a stationary casing composed of three communicating, drum-like chambers arranged end to end about a horizontal axle, the latter also passing through the central passages, or necks, by which the chambers are connected. The interior of each of the end chambers is provided with two series of disintegrator-members, one secured to the casing and the other adapted to rotate within it; and provision is made whereby both series may be removed together as a single unit.—W. E. F. P.

Coke ovens. R. S. Moss. Fr. Pat. 446,403, May 7, 1912.

See U.S. Pat. 1,025,419 of 1912; this J., 1912, 526.—T.F.B.

Gas-furnace. A. Folliet, Brussels. U.S. Pat. 1,049,569, Jan. 7, 1913.

See Eng. Pat. 1645 of 1911; this J., 1912, 16.—T. F. B.

Retort; Vertical —— for carbonising coal, etc. Comp. Gén. de Construction de Fours. Fr. Pat. 446,373, July, 23, 1912. Under Int. Conv., Jan. 17, 1912.

See Eng. Pat. 1347 of 1912; this J., 1912. 632.—T. F. B.

Retort; Vertical —— for the carbonisation of coal. Comp. Gén. de Construction de Fours. Fr. Pat. 446,374, July 23, 1912. Under Int. Conv., Dec. 21, 1911.

See Eng. Pat. 28,852 of 1911; this J., 1912, 675.—T. F. B.

Peat; Process and apparatus for drying and utilising natural —— to produce gas and to recover the nitrogen as ammonium sulphate. Soc. per l'Utilizzazione dei Combustibili Italiani, and D. Civita. Fr. Pat. 446,212, June 24, 1912.

See Eng. Pat. 17,436 of 1911; this J., 1912, 805.—T.F.B.

Petroleum; Process for distilling —— by introduction of steam. H. Büchler. Fr. Pat. 445,932, June 13, 1912. Under Int. Conv., June 16, 1911.

See Ger. Pat. 245,545 of 1911; this J., 1912, 526.—T.F.B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Mantles for incandescent gas lighting; The manufacture of ——. C. R. Böhm. J. Gas. Lighting, 1913, 121, 33—36, 100—101, 181—183.

Knitting. The different kinds of web produced on the round knitting machine possess the drawback of not having the pliability of the ordinary web. While cotton mantles appreciably decrease in brilliancy after use, those of ramie fibre are very constant, but the mantles of artificial silk now coming largely into use, combine the high and well-maintained illuminating power of ramie fibre with a great elasticity of the ash skeleton. Cuprammonium-cellulose, Chardonnet and viscose silks are all used for the manufacture of mantles.

Washing. Both cotton and ramie mantles require washing before impregnating, in order to remove the fat and mineral matter; this was formerly done by using first a 3 to 5 per cent. solution of soda, followed by a 1 to 3 per cent. solution of hydrochloric acid. Recently however, the process has been simplified: the mantles are soaked overnight in a 2 per cent. solution of nitric acid and the next morning they are centrifuged, treated with a weak solution of ammonia and then thoroughly washed. first with condensed and afterwards with pure distilled water.

Drying. The mantles are next dried in a current of hot air, and any imperfect ones sorted out. From this point forward, scrupulous cleanliness in handling the mantles is imperative.

Impregnation. The mantles are impregnated by being soaked in a 25 to 33 per cent. aqueous solution of thorium and cerium nitrates in the proportion of 99 : 1, to which very small amounts of beryllium and magnesium nitrates are added, in order to harden and give greater strength to the ash skeleton. After soaking in the impregnating liquid for a period. the duration of which varies from one to two minutes in the case of cotton or ramie mantles, and takes five hours for mantles of artificial silk, the superfluous liquid is got rid of by passing the mantles through a wringing machine. The quantity of salts left in the mantles can be varied by adjusting the rollers of the wringing machine. The mantles are next dried at a temperature not exceeding 30° C., for which purpose the cotton and ramie mantles, which are cut into short lengths before impregnating, are stretched over glass cylinders, and the artificial silk mantles, which are impregnated in lengths, are run over wooden rollers. The upright mantles are next fitted with a sewn on tulle head, or with a patent head and the latter is fixed by treatment with a 50 per cent. aqueous solution of aluminium and magnesium nitrates. The asbestos loop, by which the mantles are suspended, is next sewn on. The inverted mantles are drawn together with impregnated cotton, to form the "spider" and are then fastened on to the supporting ring.

Burning-off. If it be desired to have a trade mark on the mantle, this is stamped on with a solution of didymium nitrate, dissolved in a mixture of alcohol, distilled water, and glycerin, to which a little Methyl Blue has been added. The mantle is next shaped on a wooden shaper, and is then burned off. The burning-off is effected with a bunsen flame, beginning at the top of the mantle to prevent deformation, and the mantle is then shaped by being held over the flame. It is afterwards hardened by increasing the pressure of the gas for a period of from $1\frac{1}{2}$ to 15 minutes. The operations of fixing the heads and loops and burning-off were formerly performed by hand, but recently machines have been introduced. The mantles now consist of a skeleton of ash and are ready for use, but will not bear transport. They are, therefore, next dipped into a collodionising solution, consisting generally of 100 parts of 4 per cent. collodion solution, 40 parts of ether, 6·5 parts of camphor and 3·5 parts of castor oil. After drying rapidly at a temperature of from 50° to 60° C. the mantles are trimmed to the proper length, sorted out into different qualities, and the imperfect ones rejected.

The author gives a list of the various defects to which mantles are liable, together with the causes to which these defects are to be attributed.—W. H. C.

Petrol air-gas [for lighting]. E. Scott-Snell. J. Gas Lighting, 1913, 121, 183—186.

THE author stated that with a properly designed plant petrol air-gas systems were quite safe, and that with the small inverted burners in general use, a much more brilliant light and one with less green in its composition, could be obtained than with low-pressure coal gas. Where large units are required it is best to group several small burners. In cases where the mains had been too small, a reduction in lighting effect had occurred when all the lights were in use. Petrol air-gas not being a true gas is liable to be affected by changes of temperature. It had been found best to use air containing about 5 per cent. of petrol vapour, as there was then no danger of explosion in the mains if the burners lighted back and no more petrol was consumed than with weak gas of $1\frac{1}{2}$ per cent. This, however, was only possible if a very light spirit with a sp. gr. not above 0·695 were used. With heavier spirit it was necessary to use a poorer mixture or there was danger of the petrol condensing in the mains, and leaking from the burners. As the average of a number of tests the author stated that a gallon of petrol gave 6800 candle-hours and with petrol at 1s. 9d. per gallon this worked out at 3·1d. per 1000 candle-hours.—W. H. C.

Progress in by-product recovery at coke ovens. J. E. Christopher. *See* Manchester Section, p. 115.

PATENTS.

Wood-spirit and furfural [from sawdust, etc.]; Process of simultaneous manufacture of —— and apparatus for separating acetic acid therefrom. V. Raisin. Fr. Pats. 446,871, Oct. 12, 1911, and 446,878, Oct. 13, 1911.

(1) CELLULOSIC material, *e.g.*, sawdust, wood-waste, etc., is subjected to the action of a hydrolysing acid, such as sulphurous acid, at a temperature of about 150° C., in presence of steam. The vapours produced comprise acetic and formic acids, furfural and methyl alcohol, in proportions varying with the material used, together with some sulphurous acid. (2) These vapours are passed into a condenser which is divided into two compartments. The lower compartment through which the vapours are first conducted contains a concentrated solution of sodium acetate, whilst the upper compartment contains a less concentrated solution of the same. These solutions, absorbing the heat from the vapours, are progressively concentrated, whilst the vapours and liquid, passing through the coils, are finally condensed and separated in an auxiliary condenser. Towards the end of the digestion, when the discharge of vapours diminishes, the vapours are condensed directly by means of cold water in a special condenser. The pyroligneous acid collected is distilled in a suitable rectifying column, the wood spirit and furfural being thus separated from the acetic acid. The latter is collected on its discharge from the still, neutralised with soda and the solution concentrated in the manner described above.—J. F. B.

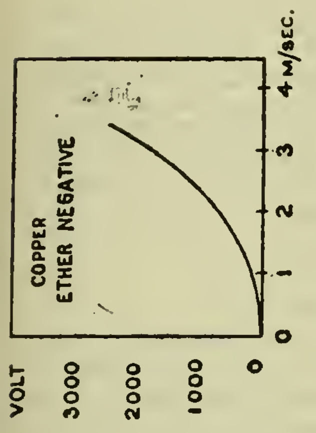
Arc electrode; Luminous or flaming ——. Electrode. J. L. R. Hayden, Schenectady, Assignor to General Electric Co., New York. U.S. Pats. 1,049,854 and 1,050,019, Jan. 7, 1913.

SEE Eng. Pat. 710 of 1911; this J., 1912, 65.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Liquids [benzene and ether]; Electrification of —— on flowing through pipes. F. Dolezalek. Chem. Ind., 1913, 36, 33—38.

EXPERIMENTS were made to determine whether benzene and ether when forced through pipes constructed of different metals (copper, brass, iron, lead and aluminium) may become electrified to such a degree as to lead to danger of the ignition, by means of sparks, of the explosive gas mixture above the liquid. The benzene or ether was forced from a reservoir, by means of carbon dioxide under pressure, through the coil of pipe to be tested and allowed to drop into an insulated receptacle connected with an electrostatic voltmeter; the reservoir and the coil of pipe were connected with the earth. The metal pipes were used in the condition in which they are found in practice, *i.e.*, covered with a film of oxide. The experimental results are plotted in curves (see figs.) showing the relation between the velocity (in metres per second) of the benzene or ether and the electrification (volts) (*see* curves) produced in pipes of the different metals. For 90 per cent. benzol, iron is the most dangerous metal, and aluminium and lead, the least dangerous; it should be possible to prepare a brass, with a higher content of copper than the normal, which will not induce electrification of 90 per cent. benzol. Also, by adding to pure benzene a quantity of 90 per cent. benzol (10 c.c. to 1 litre of pure benzene in the case of the samples used by the author) a liquid is obtained which is not electrified when forced through a brass pipe. For pure benzene, lead is the safest metal. Anhydrous ether (distilled over sodium) becomes electrified much more strongly than moist ether; brass pipes are the safest, and iron pipes the most dangerous. A spark capable of igniting an explosive gas mixture can be produced by a potential of 300 volts under very favourable conditions, but usually 500—1000 volts are necessary. It may be accepted that it is quite safe to force liquids through pipes at velocities capable of developing not more than 500 volts, and the permissible velocities for the different metals in the case of benzene and ether can be ascertained from the curves. If a metal receptacle connected with the earth is used to receive the liquid issuing from the pipe, the risk is less, and under such conditions no danger is to be apprehended in the case of ether, but benzene is such a bad conductor, that even with a conductive metal receptacle, dangerous charges may accumulate on the surface of the liquid. With ether, dangerous conditions may arise, if it become strongly electrified by passing through pipes, cocks, or the like, and is then received in glass carboys or funnels, or in metal vessels resting on an insulating support. On forcing the last portions of benzene or ether out of a vessel by means of pumps, or compressed air, the liquid may be converted into spray; under these conditions, benzene does not become dangerously electrified, but a charge of several thousand volts may be produced in the case of ether.—A. S.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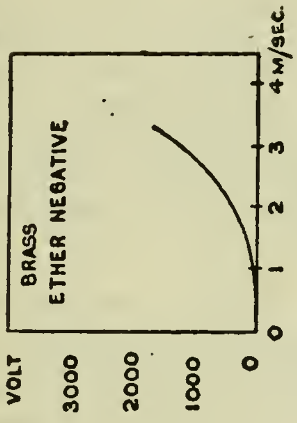
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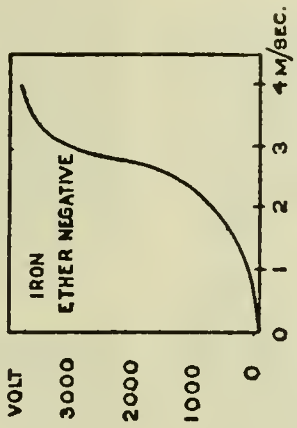
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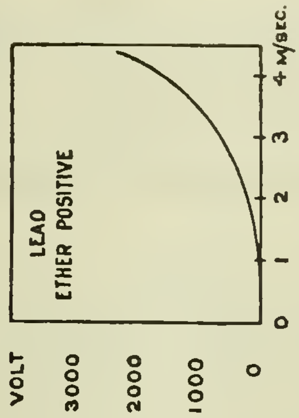
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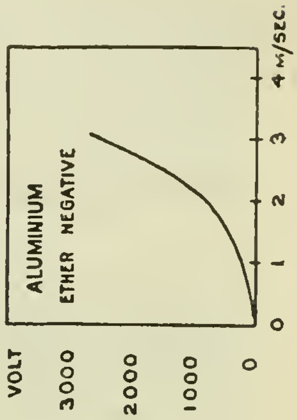
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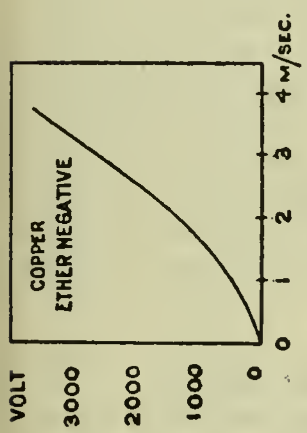
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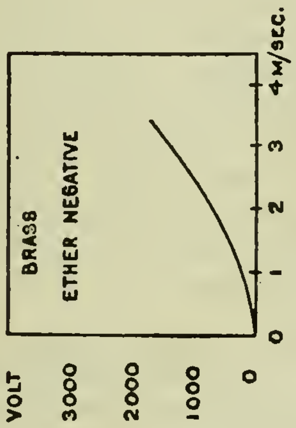
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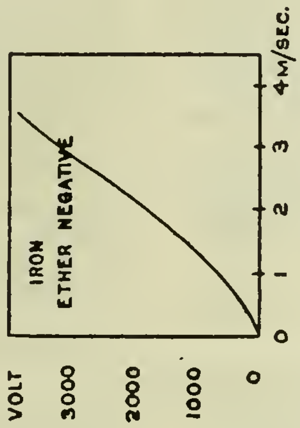
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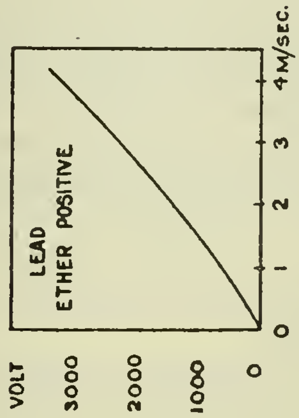
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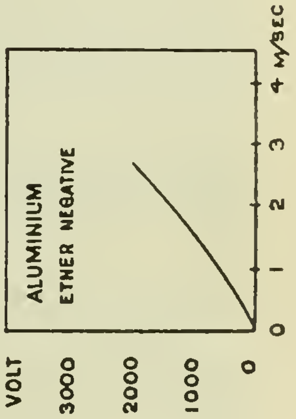
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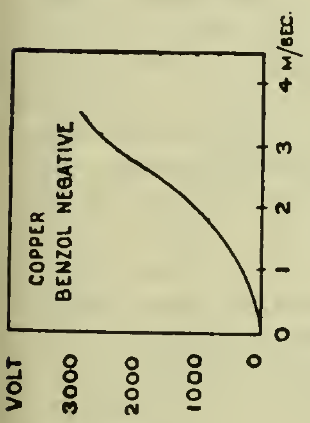
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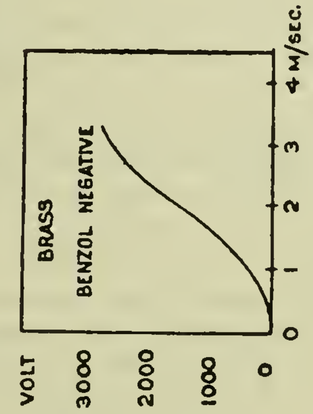
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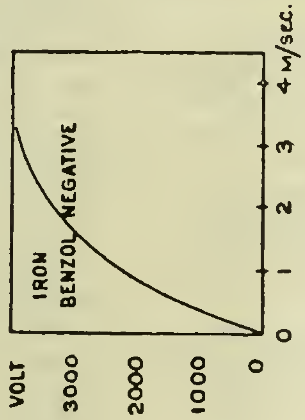
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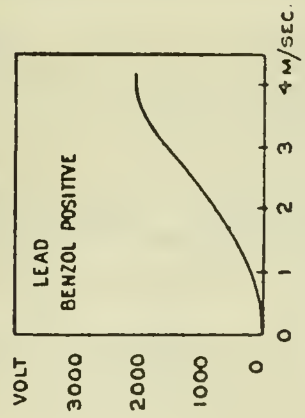
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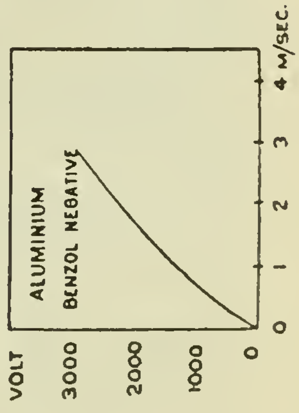
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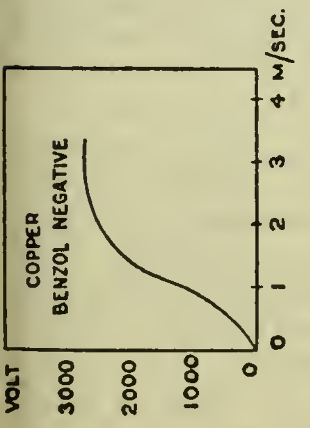
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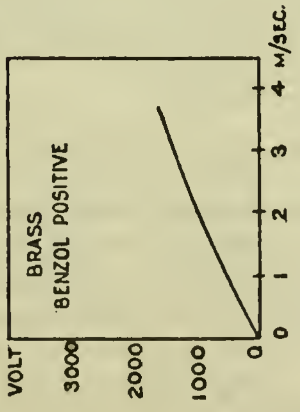
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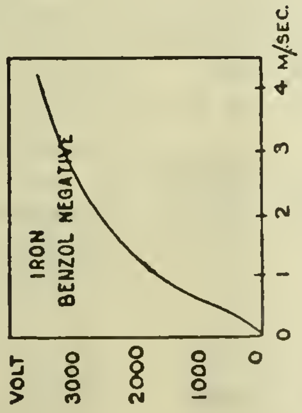
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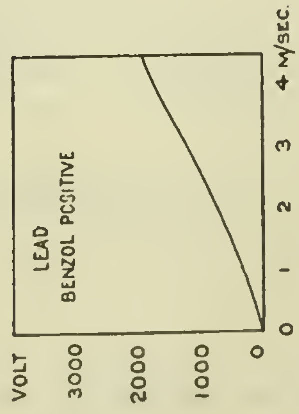
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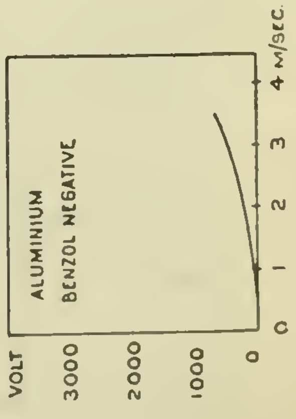
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α-β-Naphthazine ; New methods for preparing asymmetric ——. F. Reitzenstein and F. Andre. J. prakt. Chem., 1913, **87**, 97—118.

α-β-Naphthazine is obtained in theoretical yield when sulphuryl chloride reacts with β-naphthylamine in pyridine solution. Sulphur chloride may also be used as a condensing agent, but less advantageously on account of the sulphur formed, this being very difficult to separate. A third method is to sublime β-naphthylamine with peroxides. The same product (identical with that of Ger. Pat. 165,226 ; this J., 1906, 369) is obtained in each case. —J. B.

Patents.

Ortho-aminobenzoyl-o-benzoic acid and its derivatives ; Manufacture of inner anhydrides (lactams) of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 22,440, Oct. 2, 1912. Under Int. Conv., Jan. 10, 1912.

When *o*-aminobenzoyl-*o*-benzoic acid or a derivative thereof of the general formula, $HOOC.C_6H_4.CO.C_6H_2(NH_2)X.Y$ $(CO : NH_2 : X : Y = 1 : 2 : 4 : 5$; X and Y may be hydrogen or any substituent, especially methyl, carboxyl, or halogen), is heated, either alone or in presence of a solvent or diluent of high boiling point, or with an acid, it is converted into the corresponding lactam. The products may be used for the purification and separation of *o*-aminobenzoyl-*o*-benzoic acid and its derivatives, especially from the isomerides ; they may also serve for the manufacture of anthraquinone derivatives. They are converted into the salts of the original acids by means of strong alkalis. —T. F. B.

α-Chloro-anthraquinones ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 446,323, Sept. 29, 1911.

α-Chloro-anthraquinones may be obtained by heating the corresponding anthraquinone-α-sulphochlorides, in the free or nascent state, and with or without addition of a solvent or catalytic agent. Thus, the sulphochlorides may be heated at or above their melting points, or at lower temperatures in presence of chlorides or other catalysts.—T. F. B.

Tar-paint and process of manufacturing same. F. Raschig, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,049,916, Jan. 7, 1913.

See Fr. Pat. 416,177 of 1910 ; this J., 1910, 1368.—T. F. B.

Coal tar ; Method of treating —— *[to make paint for ships].* J. Petersen. Fr. Pat. 446,161, May 7, 1912.

See Eng. Pat. 10,958 of 1912 ; this J., 1912, 1190.—T. F. B.

Sulphurised hydrocarbons [thiophen, etc.] from acetylene ; Process for making ——. W. Steinkopf and G. Kirchhoff. Fr. Pat. 446,136, July 18, 1912. Under Int. Conv., July 19, 1911.

See Ger. Pat. 252,375 of 1911 ; this J., 1912, 1201.—T.F.B.

Phenylglycine-o-carboxylic acid and ethylenedianthranilic acid or their esters ; Process for making nucleus nitroso derivatives of ——. J. D. Riedel A.-G. Fr. Pat. 446,425, June 19, 1912. Under Int. Conv., June 19, 1911.

See Eng. Pat. 14,341 of 1912 ; this J., 1912, 914.—T. F. B.

Anthracenemonosulphonic acids ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 446,918, Aug. 5, 1912. Under Int. Conv., Aug. 23, 1911.

See Eng. Pat. 3318 of 1912 ; this J., 1912, 914.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

The analysis of organic dyestuffs.

Sub-Commission XI. of the International Commission of Analysis have come to the conclusion that the unification of the methods employed in the analysis of organic colouring matters is not possible in the present state of the industry, and would not be of any practical use. However, an international agreement might be advantageous in certain cases, such as that of those organic dyestuffs which are taken as a standard in the levying of customs duties. The Sub-Commission would, therefore, be glad to hear of any case in which it is considered that such an international agreement would be desirable. Communications may be addressed to the President, Prof. Frédéric Reverdin, 44, Avenue Gare des Eaux-Vives, Geneva, or to Prof. Ed. Knecht, The University, Manchester, or Mr. C. Rawson, 22, Cumberland Street, Manchester.

Indigo ; Valuation of ——. J. Barnes. J. Soc. Dyers and Col., 1913, **29**, 10—11.

The author describes a comparative colourimetric method for the valuation of indigo, which was found to be reliable and serviceable, during many years. Half a grm. of the finely-ground sample is sulphonated with 15 c.c. of just slightly fuming sulphuric acid, in a glass bottle with about 15 grms. of broken glass. The whole is well shaken, allowed to stand 12 hours, well shaken and allowed to stand a further 12 hours, diluted to 500 c.c., and allowed to stand overnight. 5 c.c. of the supernatant solution are mixed with 100 c.c. of distilled water and compared in a colourimeter with a standard, an average quality of indigo sulphonated in a similar manner. The instrument is set at the mark 20 in the case of the sample, and is matched with the standard, the "comparative value" being obtained by dividing the scale reading by the price in pence per lb. The method has an error of not more than 5 per cent. and was found to be in fair agreement with the permanganate method.—G. H. F.

Azo-dyestuffs ; Halogen substituted ——. S. Weber. Monats. Chem., 1913, **34**, 243—254.

By diazotising the various halogen-substituted anilines and combining with β-naphthol-8-sulphonic acid, α-naphthol-2-8-disulphonic acid, and 1.8.6-aminonaphtholsulphonic acid, the influence of the nature, position, and number of the entering halogen atoms upon the shade and properties of the dyes formed was studied. With the ortho-, meta-, and para-chloro-anilines, bromo-anilines, and iodo-anilines, it was found that the iodo-derivatives give colours of darker shade and slightly less solubility than the bromo-derivatives, which again are darker and slightly less soluble than the chloro-derivatives. Combination takes place most slowly in the case of the iodo-derivatives, and is quickest for the chloro-derivatives. The halogen substituted dyes, compared with the unsubstituted dyes, equalise much better, have better fastness to light and washing, and incomparably greater tinctorial power. The position of the halogen influences the shade in that the ortho derivatives are slightly redder, the meta yellower, and the para slightly bluer. Again the ortho and para derivatives are superior to the meta derivatives, being faster to light and washing, better equalising, and having better tinctorial power. The bromo- and iodo-derivatives are superior to the chloro-derivatives, giving deeper, slightly redder colours, dyeing slower, and having very good equalising properties. Di-bromo substituted dyes give darker and fuller shades having good equalising properties.—G. H. F.

Congo Red. F. I. Bogojavlenski and V. G. Schaposchnikov. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1813—1844.

The action of either strong or weak acids (even carbonic acid) on Congo Red results in the replacement of the sodium by hydrogen. With strong acids the action proceeds rapidly and yields a dark-blue precipitate, which when washed gives a blue colloidal solution ; the latter cannot be freed from admixed impurities by washing and dialysis. This solution of Congo Blue exhibits electrical conductivity, but this is probably conditioned by the impurities present. The action of weak acids gives the same product, but in a crystalline condition. Very small crystals of Congo Blue are capable of forming suspensions, which closely resemble the colloidal solutions : both the colloidal particles and the crystals carry negative charges, both are coagulated without change of structure by acids or acid salts, and both the colloidal solution and the filtered crystalloidal suspension show Brownian movement under the ultramicroscope, the crystals passing through the filter. The theoretical considerations lead to the following conclusions. The change in colour of substantive tetrazo-dyes is conditioned by change in their intramolecular structure. The red forms of amino- and hydroxy-tetrazo-dyes of the Congo Red type correspond with the azoid configuration of the molecules, whilst the blue forms correspond with the quinonoid structure. The instability of these forms and their ready interconversion are regarded as due to the agency of so-called "suspensive" linkages and of mobile hydrogen.—T. H. P.

Dyestuffs; Comparison of the methods for the quantitative determination of ——. H. Salvaterra. Monats. Chem., 1913, **34**, 255—281.

The author has compared the methods for the quantitative estimation of dyestuffs, using dyes which are generally employed in silk dyeing. *e.g.*, Malachite Green, Crystal Violet, Magenta, Naphthol Yellow S, Martius Yellow, Crystal Ponceau, Fast Ponceau, and Cotton Scarlet extra. Results obtained by Knecht's process of titrating with titanous chloride (see this J., 1905, 154) agree very well with those obtained by titrating with another dyestuff and finding the end-point by spotting upon filter paper, as was first suggested by Knecht and Rawson and improved by Pelet and Garuti (see this J., 1904, 1047). The colourimetric method was found to be not so reliable; and it is recommended to employ Knecht's titanous chloride method by direct, and not indirect, titration whenever possible, as it gives better results. Of the two methods Knecht's is more useful as it is applicable to nearly every class of dyestuffs. The two methods were used for estimating the amount of the above dyes taken up by silk from a dye-bath, and no relation between the amount taken up and the molecular weight of the dye could be found. It is noted that with an increasing number of sulphonic groups, the affinity of colours for silk decreases.—G. H. F.

Action of protective colloids on developed dyes. Lichtenstein. *See* VI.

Determination of stannous chloride and of chlorates by means of Methylene Blue. Atack. *See* XXIII.

Patents.

[*Azo*] *dyestuffs fast to acid; Manufacture of substantive* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated June 29, 1912 (under Int. Conv., Aug. 14, 1911), and Third Addition, dated July 30, 1912, to Fr. Pat. 376,888, April 18, 1907.

(1) Dyestuffs similar to those obtained according to the principal patent (Eng. Pat. 9548 of 1907; this J., 1907, 960) and the first Addition (this J., 1907, 1083), may be produced by combining diazo or diazoazo compounds with *p*-aminobenzoyl-2.8.6-aminonaphtholsulphonic acid, diazotising the products, and combining with 2.5.7-aminonaphtholsulphonic acids or with their acidyl compounds substituted in the amino group. (2) In place of using aminobenzoyl-2.5.7- or -2.8.6-aminonaphtholsulphonic acids for the first combination, the aminobenzoyl derivatives of other aminonaphtholsulphonic acids may be used, *e.g.*, the 1.8.4- or the 1.8.5-acid, H-acid, etc. Further, in the final combination, the 2.5.7-aminonaphtholsulphonic acid may be replaced by other aminonaphtholsulphonic acids or their acidyl or aryl derivatives.—T. F. B.

Disazo dyestuffs; Process for making violet to greenish-black basic ——. Farkwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 446,611, Oct. 5, 1911.

See U.S. Pat. 1,029,639 of 1912; this J., 1912, 678: 1.5- or 1.8-diaminonaphthalene may be used in place of the heteronuclear aminonaphthols.—T. F. B.

Sulphide dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 446,566, July 26, 1912. Under Int. Conv., Aug. 31, 1911.

Dyestuffs which dye cotton green shades fast to washing and light, are obtained by heating with alkali polysulphides and copper or copper compounds, the indophenols or leuco-indophenols prepared by condensing perimidine and its derivatives with *p*-aminophenol or its derivatives.
—T. F. B.

Vat dyestuffs of the anthraquinone series. Badische Anilin und Soda Fabrik. Fr. Pat. 446,751, Aug. 1, 1912. Under Int. Conv., Jan. 2, 1912.

A new series of vat dyestuffs, differing materially from the aminoanthraquinone-acridones described in Fr. Pat. 427,479 (this J., 1911, 1111), is obtained by nitrating anthraquinone-acridones containing halogen substituents in the benzene nucleus, and then reducing the products, *e.g.*, by alkaline hydrosulphites. They dye cotton blue to greenish blue shades, and may also be used in the preparation of colour lakes.—T. F. B.

Cotton [*azo*] *dyes; Violet* ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,049,109, Dec. 31, 1912.

See Eng. Pat. 18,648 of 1912; this J., 1912, 1073.—T.F.B.

Anthraquinone derivatives; Manufacture of sulphurised —— [*dianthraquinonyl sulphides*]. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 13, 1912, to Fr. Pat. 441,772, March 26, 1912. Under Int. Conv., June 20, 1911.

See Eng. Pat. 12,865 of 1912; this J., 1912, 1025.—T.F.B.

Anthracene series; Production of new derivatives of the —— [*dianthraquinonyl thio-ethers*]. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 446,492, July 24, 1912. Under Int. Conv., July 26, 1911.

See Ger. Pat. 252,530 of 1911; this J., 1912, 1117.—T.F.B

Azo dyestuffs and process for making them. H. Levinstein, J. Baddiley, and Levinstein, Ltd. Fr. Pat. 446,170, May 21, 1912. Under Int. Conv., May 22, 1911.

See Eng. Pat. 12,281 of 1911; this J., 1912, 634.—T. F. B.

Azo dyestuffs; Process for making brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 446,502, Oct. 3, 1911.

See Eng. Pat. 22,691 of 1911; this J., 1912, 380.—T.F.B.

Vat dyestuffs of the anthraquinone series; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 446,838, Oct. 11, 1911.

See Eng. Pat. 23,110 of 1911; this J., 1912, 326.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Humidity; Influence of —— *on* (*a*) *the count of yarn and* (*b*) *the strength of cloth.* F. W. Barwick. J. Soc. Dyers and Col., 1913, **29**. 13—18.

Tests of yarn for "count in condition received," vary according to the moisture in the sample and the humidity of the atmosphere at the time of testing. Thus it was found that for a sample of normal grey cotton yarn tested throughout a period of three months the moisture present varied from 6 to 10 per cent. Assuming the yarn to have been 40's, this corresponds to an apparent variation between 41's and 39's. As regards influence of humidity on strength tests on wool, cotton, and linen cloths, showed that the strength depends to a considerable extent upon the conditions of the atmosphere to which the cloth is exposed

prior to testing. Pieces were cut into six strips in the direction of the warp, and tested in the direction of the warp under recorded variations of the relative humidity of the atmosphere, the average strength of samples from the six strips being taken. An ordinary grey cotton drill and a flax canvas showed an increase or decrease in strength, according as an increase or decrease in the relative humidity of the air took place, the differences in strength varying as much as 12 and 18 per cent. respectively. A wool cloth (serge) showed a decrease or increase in strength according as the relative humidity of the air increased or decreased, the results varying as much as 14 per cent. The author emphasises the necessity of adopting some uniform conditions of humidity, and possibly also of temperature, under which tests should be carried out, and goods should not be rejected as not agreeing with specification unless reliable tests have been made under stated and agreed conditions of humidity.
—G. H. F.

Mechanical wood pulp [hemlock and jack pine]; Effect of variable grinding conditions on the quality and production of ——. J. H. Thickens. Papierfabrikant, 1912, **10**, 1483—1488; 1913, **11**, 7—8. (See also this J., 1912, 869.)

THE scarcity and rise in price of spruce wood in the United States has led the Forest Service to institute experiments with a view to the production of pulp of sufficiently good quality for "news" paper from inferior woods, principally hemlock and jack pine. An experimental grinding station with electrically driven and indicated machinery is in operation at Wausaw, Wis. Among the experimental results established, the following comparative table of yields may be quoted:

Species of wood.	Weight per 100 cub. ft. abs. dry.	Yield per 100 cub. ft. of solid wood.	Efficiency of conversion.
	lb.	lb.	per cent.
Spruce	2840	2480	87·3
"	2270	2000	88·2
Hemlock	2480	2100	84·8
Jack pine ..	2540	2200	86·7

100 cub. ft. of solid wood fairly represents the amount of wood in a rossed cord, and as a basis of yield, eliminates the variable loss in barking. Of the grinding losses, 6 per cent. can be accounted for in the waste waters and 1 per cent. in the screenings; the remaining losses are not yet accounted for. Among the factors of grinding, speed and pressure affect quantity rather than quality of product, and for a given speed there is a corresponding pressure which will yield the maximum production with minimum consumption of power. The most efficient grinding condition of the stone is when there is a maximum amount of grinding surface and still a sufficient depth between the ridges to carry away the pulp as fast as it is ground. The best results were obtained with a 3-to-the-inch solid straight-cut burr, topped with a 12-to-the-inch spiral-cut burr. The fibres were long and fine, free from shives. When the surface of the stone is properly dressed, the principal factor influencing the quality of the pulp is the grain of the stone. The temperature of grinding affects the production, which was greater when a high temperature was reached; the influence of temperature upon the quality was not apparent, but was not fully investigated. No difficulty was experienced in running the papers, except in the case of jack pine, the resin of which gave a little trouble; the quality of the papers compared well with standard "news" quality, with the exception of one composed of 25 per cent. of hemlock sulphite pulp and 75 per cent. of jack pine mechanical pulp.—J. F. B.

Asparagus plant; Production of cellulose from the ——. O. Reinke. Chem.-Zeit., 1913, **37**, 81.

THE sheaths peeled off the asparagus shoots in preparing them for market amount to about 30 per cent. by weight; these quickly decompose and are of little value for fodder. The plant itself must be removed and burnt at the end of the season, on account of the danger of fungus infection. Both these materials may serve for the production of fibrous cellulose of good quality. The sheaths may first be boiled for the preparation of soup extracts and the residues subjected to chemical treatment for the preparation of cellulose. The green plant itself gives a better yield than the sheaths; it should be chopped into short lengths and digested with an 8—12 per cent. solution of sodium hydroxide for 1—3 hours under a pressure of 4—6 atmospheres. The cellulose, after washing, is bleached most advantageously with dilute permanganate followed by sulphurous acid. The author considers that in the asparagus districts of Germany the erection of simple cellulose plant might afford a profitable branch-industry. One hectare (about 2½ acres) of asparagus land yields 128 cwts. of crude asparagus, equivalent to 30 cwts. of sheaths with 3·6 cwts. of dry substance, yielding 0·54 cwt. of cellulose. The same area at the end of the season yields about 88 cwts. of green plants or 72 cwts. of dry plants, yielding 7·92 cwts. of cellulose. Thus from a cultivated area of 12,000 Morgen (about 7650 acres) there would be available about 81 tons of cellulose from the sheaths and 1190 tons from the plants.—J. F. B.

Cellulose; Contributions to the study of ——. [Viscosity of nitrocellulose solutions.] C. Piest. Z. angew Chem., 1913, **26**, 24—30.

SOLUTIONS of nitrocellulose in acetone become less viscous on standing, and the change cannot be attributed to the settling of matter in suspension. In mixing solutions of low and high viscosity respectively, it was found that the more viscous the solutions the more the viscosity was lowered beyond the calculated viscosity of the mixture. Mixtures of solutions of different strength of the same nitrocellulose in the same solvent, possessed viscosities differing little from the calculated values. In general, nitro cellulose solutions become less viscous the more the cotton used has been bleached and the higher its copper number. These results indicate that the fall of viscosity is due to the presence of impurities, such as esters of oxycellulose. The impurities in question are derived from the "β-oxycellulose" formed during bleaching, etc., this name being a collective one for all the products soluble in sodium hydroxide solution. Normal cottons contain similar oxidation products, but to a smaller amount. The experiments described by the author show that treatment of cellulose with oxidising agents, acids, and strong alkali solutions, in each case yields products soluble in dilute alkali solutions (oxycellulose, hydrocellose, and alkali-cellulose, respectively), which have acid properties, and vary in composition according to the strength and nature of the reagent. They are precipitated from the alkali solutions by the addition of acids. The residue undissolved by the alkali (α-oxycellulose, α-hydrocellulose, α-cellulose) must be regarded as unaltered cellulose, which however, retains small quantities of the "β-" products.
—T. ST.

PATENTS.

Flax; Preparation [retting] of ——. O. Silberrad, Buckhurst Hill, Essex. Eng. Pats. 1372 and 6033, Jan. 17 and Mar. 11, 1912.

FLAX retted by the aerobic bacterial process described in Eng. Pat. 10,812 of 1911 (this J., 1912, 871) presents the disadvantage that it readily undergoes a secondary retting action causing rapid deterioration during storage. This difficulty is overcome by sterilising the flax, after retting, by treatment with a liquid or gaseous disinfecting agent, *e.g.*, a solution of salicylic acid or the fumes of formaldehyde in a closed chamber.—J. F. B.

Aeroplane wings and other purposes; Treatment of fabrics for ——. Leduc, Heitz et Cie. Fr. Pat. 446,627, June 29, 1912.

FABRICS filled with a film of cellulose acetate are protected by the application of one or two coats of linseed or poppy oil varnish in combination with opaque pigments of any desired colour.—J. F. B.

Artificial silk, and other products from nitrocellulose ; Process of producing ——. J. Duclaux. First Addition, dated July 17, 1912, to Fr. Pat. 439,721, Feb. 5, 1912 (this J., 1912, 714).

The vapours of methyl or ethyl formate need not necessarily be absorbed in a solution of a strong alkali, such as caustic soda or lime, as originally specified ; any solution of a salt with an alkaline reaction, *e.g.*, phosphate, carbonate, borate, etc., will serve, also suspensions of sparingly soluble bases, such as magnesia or zinc oxide. Moreover, the absorption of the vapours may equally be effected by contact or surface absorption in towers, instead of by passage through the solutions. Lastly the same alkaline absorbing liquid as is used for decomposing the formic ester may be utilised for the absorption of the alcohol vapours resulting from this decomposition. —J. F. B.

Celluloid ; Manufacture of a hard ——. Düsseldorfer Celluloïd-Fabrik. Fr. Pat. 446,270, July 19, 1912. Under Int. Conv., Aug. 3, 1911.

Under ordinary circumstances a good commercial celluloid can only be made with a proportion of camphor amounting to at least 20 per cent. of the nitrocellulose. When nitrocellulose steeped in alcohol is incorporated with a normal celluloid mixing, containing about 25 per cent. of camphor, the fresh nitrocellulose is imperfectly absorbed by the mass. It is now found that if this further quantity of nitrocellulose be previously reduced to the finest possible state of division, or better, if it be added in a freshly precipitated form or in the form of a solution, the incorporation with the normal body of celluloid, in presence of much alcohol, is complete. In this way celluloid containing as little as 8 per cent. of camphor may be made, which is harder than normal celluloid.—J. F. B.

Viscose solutions ; Process for manufacturing threads, filaments, films, bands, etc., from ——. Chem. Fabr. von Heyden A.-G. Fr. Pat. 446,449, July 12, 1912.

In the manufacture of threads, etc., from viscose with coagulating baths of ammonium salts it is customary to age the viscose before spinning until the cellulose thiocarbonate, by spontaneous hydrolysis, has reached what is known as the " C_{24} stage." It is stated, however, that such aged viscose, when coagulated in saline baths containing free acid, is decomposed too rapidly and that the physical qualities of the product thereby suffer. It is now proposed to take the viscose for spinning after only a short period of ageing, when the cellulose compound possesses the molecular dimensions corresponding to between C_{12} and C_{18}. Viscose at this stage of ripeness is coagulated in baths composed of a saturated solution of sodium sulphate or chloride and a suitable proportion of a free acid, such baths being utilisable at temperatures up to 50° C.—J. F. B.

Vine stems ; Paper pulp from —— *and process of manufacture.* L. E. Chaptal and J. J. J. Gaïsset. Fr. Pat. 446,382, July 24, 1912.

The stems produced in pruning vines yield about 30 per cent. of paper pulp of excellent quality. The vines are chopped into pieces 8—10 cm. long and placed in a chest with perforated walls in which they are thoroughly washed with a stream of water. They are then digested in a caustic soda lye of 7° Bé. (sp. gr. 1·049), in the proportion of about 400 litres per 200 kilos. of raw stems. Digestion is carried out for 24 hours under a pressure of 6 kilos. per sq. cm. The resulting mass is broken-in, washed in the ordinary way, and freed from undigested lumps by means of a rotary screen. The pulp bleaches easily with 15 per cent. of bleaching powder and is utilised in admixture with about 25 per cent. of ordinary wood pulp.—J. F. B.

Waste paper ; Process for re-manufacture of ——. J. Schimek. Fr. Pat. 446,095, July 16, 1912. Under Int. Conv., Nov. 14, 1911.

The process for treating old printed or written papers for the manufacture of paper pulp, equal in colour and strength to the original material, consists in subjecting the papers without any preliminary breaking or milling to the action of a hot solution of alkali hydroxide at a temperature which must not reach the boiling point, washing the material so treated, and preparing it for the paper machine.—J. F. B.

Paper ; Application of spars in the manufacture of ——. D. Tornero. Fr. Pat. 446,893, Aug. 3, 1912. Under Int. Conv., March 6, 1912.

As mineral loading in place of china clay in the manufacture of paper it is proposed to employ finely ground spar. The spar is reduced to small pieces of uniform dimensions and then ground in a ball or tube mill, the product being separated in the form of an impalpable powder by means of pneumatic apparatus.—J. F. B.

Cellulose ; Process for making derivatives of —— *and the products of their transformation.* H. Dreyfus, Basle. Eng. Pat. 20,977, Sept., 22, 1911. Under Int. Conv., July 5, 1911.

See Fr. Pat. 432,046 of 1911 ; this J., 1912, 24. Reference is directed to Eng. Pats. 19,330 of 1905, 26,657 of 1909, and 24,382 of 1910.—T. F. B.

Films, coatings, artificial silk, celluloid-like masses, and other objects and products from cellulose esters ; Process for the manufacture of ——. H. Dreyfus, Basle. Eng. Pat. 20,979, Sept. 22, 1911. Under Int. Conv., July 15, 1911. Addition to Eng. Pat. 20,977, July 5, 1911.

See Addition of July 15, 1911, to Fr. Pat. 432,046 of 1911 ; this J., 1912, 225.—T. F. B.

Cellulose esters or their conversion products ; Process for producing ——. H. Dreyfus, Basle. Eng. Pat. 21,376 of 1912, date of Appl., Sept. 22, 1911. Under Int. Conv., July 5, 1911.

See Addition of July 7, 1911, to Fr. Pat. 432,046 of 1911 ; this J., 1912, 225. Reference is directed under Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 21,628 of 1901, 7346 and 10,243 of 1903, 24,083 of 1904, 19,330 of 1905, and 24,067 of 1906.—T. F. B.

Cellulose or like products ; Manufacture of —— *from vegetable fibres* [*hop runners*]. C. A. Muller and D. Wolf, Turn-Teplitz, Bohemia. Eng. Pat. 5659, March 6, 1912.

See Fr. Pat. 443,133 of 1912 ; this J., 1912, 1029.—T. F. B.

Copper ; Process for recovering —— *from the wash liquors employed in the cuprammonia-cellulose process.* E. Bronnert, Niedermorschweiler, Assignor to Verein. Glanzstoff-Fabriken. A.-G., Elberfeld, Germany. U.S. Pat. 1,049,201, Dec. 31, 1911.

See Fr. Pat. 423,104 of 1910 ; this J., 1911, 615.—T. F. B.

Cellulose plates and films ; Hopper for producing ——. J. E. Brandenberger, Thaon-les-Vosges, France. U.S. Pat. 1,049,658, Jan. 7, 1913.

See Eng. Pat. 4066 of 1912 ; this J., 1912, 1119.—T. F. B.

Cellulose compound ; Non-inflammable —— *and method of making same.* W. G. Lindsay, New York, Assignor to The Celluloid Co. U.S. Pat. 1,050,065, Jan. 7, 1913.

See Fr. Pat. 415,517 of 1910 ; this J., 1910, 1299.—T. F. B.

Ethyl alcohol from waste sulphite liquor ; Process for making ——. Aktiebolaget Ethyl. Fr. Pat. 446,717, July 31, 1912. Under Int. Conv., Jan. 4, 1912.

See U.S. Pat. 1,042,332 of 1912 ; this J., 1912, 1075.—T.F.B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Spots and stripes in bleached and dyed cotton piece goods; Cause of ——. E. Jentsch. Färber-Zeit., 1913, **24**, 29—31.

The cause of spots and stripes in dyed cotton piece goods is usually to be found in the bleaching. In one case goods which had been boiled with lime, soured, boiled with soda, then chemicked and soured in the usual way, were found to show dark spots after dyeing a drab fast to light with a mixture of Diamine colours. Grey-brown stains were noticed after the second boiling, and it was found that the parts thus affected were the ones that showed the spots after dyeing. The trouble was due to those parts of the cloth which touched the walls of the kier getting overheated during the running off of the liquor, oxycellulose being formed; this was prevented by pumping in water as soon as the outlet was opened, thus keeping the goods covered with water until the kier had become cold. In another case where dark stripes appeared across the piece, the cause was insufficient souring after chemicking. The cloth had passed through the "embroidery" bleach, having been tied up with string, and where the bands were too tight the acid had not penetrated sufficiently. Further souring prevented the trouble. White spots on cloth dyed with substantive colours may be due to oxycellulose caused by a too powerful chemicking occurring locally during the replenishing of the bath with strong solution. The affected places show up darker on dyeing with basic colours. By admitting caustic soda liquor to the kier in too concentrated a state, slight local mercerisation is sometimes caused, which results in dark stripes appearing after dyeing. Light or dark spots may be due to uneven mercerisation; the only remedy for this is to repeat the mercerising.—J. B.

Developed dyes; Action of protective colloids on ——. L. Lichtenstein. Färber-Zeit., 1913, **24**, 21—23.

Although sodium benzylsulphanilate ("Solution salt") is not colloidal, yet its action in vats and in printing pastes prepared with vat dyestuffs is similar to that of the protective colloids, *i.e.*, colloids which can prevent the precipitation of hydrosols by electrolytes, or of colloids by one another. This latter class of substances is found to include many of the assistants and thickening agents used with vat dyestuffs to aid solution or prevent precipitation of the reduction product. The products of alkaline hydrolysis of egg albumin, lysalbinic acid and protalbinic acid (this J., 1902, 996), were especially investigated, and by combining *p*-nitrodiazobenzene with sodium-β-naphtholate in the presence of the sodium salt of the latter acid a colloidal solution of Para Red was obtained, which was not precipitated by salt and did not pass through animal membranes. By careful evaporation, solid colloidal Para Red was obtained in the form of a dark-red powder, soluble in water.—J. B.

Patents.

Dyeing, washing, and the like; Machines for ——. J. Calvert, Huddersfield. Eng. Pat. 29, Jan. 1, 1912.

The machine comprises a cistern, divided into upper and lower compartments by a perforated plate or plates, the position of the latter being such that the lower chamber is not less than one-ninth of the total capacity of the cistern. A central tube is attached to the perforated plate, and the liquor is forced by steam or centrifugal action into the central tube from which it is delivered to the top of the upper chamber, returning to the lower compartment through the perforated plate.—B. N.

Dyeing machines. The Psarski Dyeing Machine Co., U.S.A. First Addition, dated July 30, 1912, to Fr. Pat. 436,936, Nov. 28, 1911 (this J., 1912, 430).

The apparatus is employed for dyeing permeable material. Dye-liquor is passed through the material by means of a shaped piece at the bottom of the receptacle, the piece being flat on the outside but forming a conical dome towards the centre and pierced with holes for distributing the liquor. The receptacle is provided with a cover also pierced with holes, the two perforated pieces being so disposed that the path of the liquid through the mass is uniform in length. In the conical portion of the distributor, where the path is shorter, the holes are smaller, thus offering a resistance to the passage of the liquid, and the openings in the cover are similarly smaller and fewer in number towards the centre.—B. N.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonia; Technical preparation of —— *from its elements.* F. Haber and R. Le Rossignol. Z. Elektrochem., 1913, **19**, 53—72.

Ammonia in the form of commercial 25 per cent. ammonium sulphate possesses a value of 89 Pf. per kilo. (4·75d. per lb.), whilst the nitrogen and hydrogen of which it is composed may be valued at 2½ Pf. and 17½ Pf. respectively (1·07d. for the nitrogen and hydrogen in 1 lb. of ammonia). The nitrogen is preferably obtained from air by liquefaction, as the gas obtained in this way is relatively free from argon. It may also be obtained by the alternate action of air and producer gas on heated copper. Large quantities of nitrogen are obtained as a by-product in the manufacture of formic acid from producer gas and caustic soda. The hydrogen may be obtained by the decomposition of distillation gases, by the alternate action of steam and reducing gases on iron, by the electrolysis of water, or by the action of water-gas on calcium hydroxide (Ber., 1880, **13**, [1], 719). It is produced in large quantities also in the electrolytic manufacture of alkali and in the manufacture of oxalates from formates. The synthesis of ammonia from nitrogen and hydrogen depends upon the equilibrium represented by the expression:

$$K = \frac{p_{NH_3}}{p_{N_2}^{\frac{1}{2}} \cdot p_{H_2}^{\frac{3}{2}}},$$

where p represents the partial pressures of the respective gases and K is the reaction constant. Haber and van Oordt (this J., 1905, 131, 545) have studied this reaction, and found that at incipient red heat, equilibrium is attained when only traces of ammonia have been formed, and even under increased pressure, which favours the formation of ammonia, the conditions are very unfavourable at incipient red heat or higher temperatures. The yield of ammonia corresponding to the condition of equilibrium increases as the temperature falls, but the reaction velocity also falls off very rapidly. Haber and van Oordt's results (*loc. cit.*) indicated that in order to be able to work at atmospheric pressure, a temperature of about 300° C. must not be exceeded, but up to the present no catalyst has been found which is active at so low a temperature. The most active catalyst found by Haber and van Oordt was manganese, but the present authors have found osmium and uranium to be much more effective. The limits of temperature for practical working are between about 500° and 700° C. Above 700° C. any advantage accruing from increased reaction velocity is more than counterbalanced by the low yield of ammonia. At a little below 500° C. it is possible, at a pressure of 125 atmospheres, to obtain 0·5 grm. of ammonia per hour per c.c. of space in the contact chamber, and since in high-pressure work the size of the apparatus must be limited, it is not advisable to work at a lower temperature and hence with a lower reaction velocity. The results obtained are better the higher the pressure. Curves are given showing that at (1) 100 atmospheres and (2) 200 atmospheres pressure respectively, the theoretical yields of ammonia at different temperatures are approximately: 500° C., (1) 10·7, (2) 18·1 per cent.; 550° C., (1) 7, (2) 12·2; 600° C., (1) 4·5, (2) 8·3; 650° C., (1) 3, (2) 5·8; 700° C., (1) 2·1, (2) 4·1 per cent. It will be seen that in no case is the yield so high that it would prove remunerative to absorb the ammonia from the reaction products, and allow the residue to go to waste. A continuous process must therefore be adopted, the ammonia being removed and the residual gases, after addition of fresh nitrogen and hydrogen, being again passed over the contact substance. The simplest method of separating the ammonia is by liquefaction by cooling. Temperatures down to —75° C. may be used for this purpose, but below —75° C. there is risk of solidification of the ammonia, leading to stoppages. The regeneration of heat and cold in gas-liquefying apparatus with gases under high pressure has proved surprisingly efficient. However low the temperature, a certain fraction of the ammonia always remains in the gaseous condition and this fraction is somewhat higher than would be expected from the vapour-pressure table.

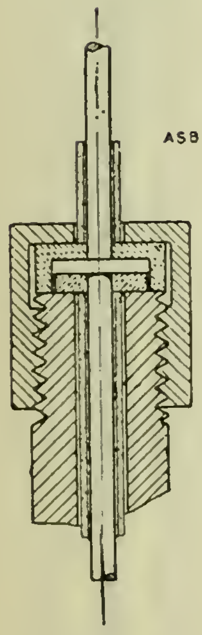

Fig. 2

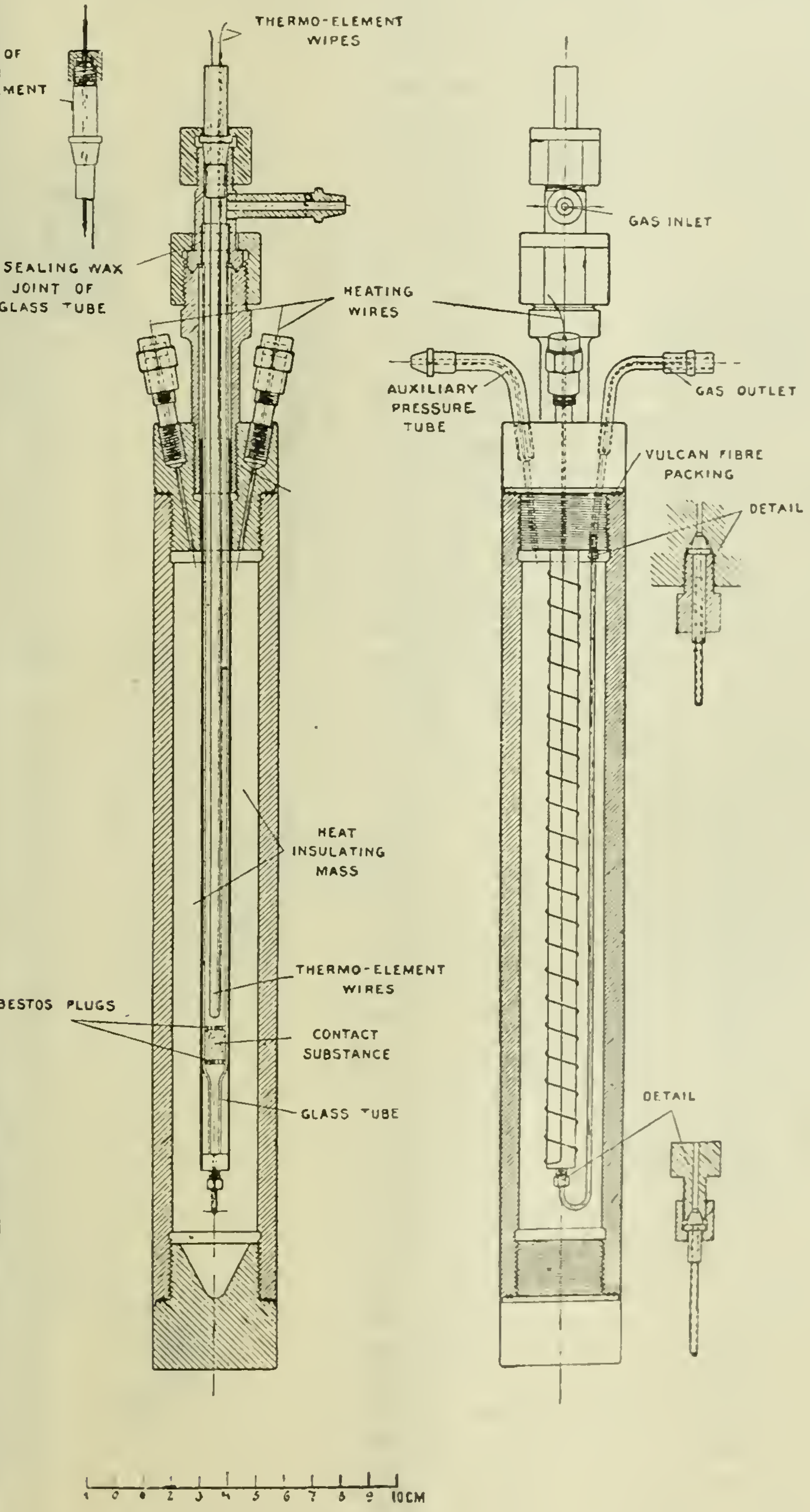

Fig. 1

The apparatus used for comparing the efficiency of different catalysers consisted, in its simplest form, of a strong steel cylinder with a bore of 6 or 7 mm. diam., opening above into a conical enlargement into which fitted the conical lower portion of a steel cover. The joint was formed here, and also wherever possible in the apparatus described subsequently, in the manner described in D.R.G.M. 376,829, the conical portion of the cover having a more acute angle (16°) than the conical portion of the bore

(20°); a hollow screw-threaded plug, fitting over a flange on the cover, was screwed on to the upper portion of the cylinder, thus bringing the two conical portions into effective contact. This apparatus was heated by means of a bath of fused saltpetre. Another form of apparatus (see Fig. 1) for comparing the efficiency of catalysts consisted essentially of a thin iron tube (0·6 mm. thick, 9—13 mm. diam.) wrapped in asbestos paper and wound with nickel wire (0·4 mm. thick) so that it could be heated electrically. The contact substance was contained between asbestos plugs in an inner quartz or glass tube sealed at the upper end, in which also was a quartz capillary, enclosing a thermo-couple. The lower end of the tube containing the contact substance was flush with the end of the heated iron tube, and the latter was fastened by screwing and soldering to a steel capillary through which the gases were withdrawn. The whole was enclosed in an outer strong steel cylinder as shown. In order to prevent deformation of the heated iron tube by the high pressure, an auxiliary pressure tube was provided through which the gas mixture was introduced also into the space filled with heat-insulating material (asbestos paper) surrounding the tube. All joints in this apparatus were of the type described above, except in the case of the plugs closing the outer steel cylinder, and the insulated joints for the electrical heating wires. The joints of the steel cylinder were made gas-tight by means of discs of "Vulcan fibre," and the joints for the heating wires in the manner shown in Fig. 2, the wires being soldered to a small metal plate, about 2 mm. thick, which fitted into a recess in a disc of "Vulcan fibre" and was covered by another disc of "Vulcan fibre," both discs having central openings through which the wire passed. It is stated that in this furnace, with correct adjustment of the heating coil, a field of constant maximum temperature of 4—5 cm. length can be obtained. The largest furnace, which was used in the experiments with circulation of the gas, is shown in Fig. 3. In this furnace there is a heating coil in the gas space so that the mixture of nitrogen and hydrogen is heated before it reaches the contact substance, and cools gradually in passing over the latter; the formation of ammonia thus sets in at a relatively high temperature and hence with a high velocity, and further quantities of ammonia are formed during the gradual cooling, owing to the displacement of the equilibrium in a favourable direction. This furnace is also fitted with a heat regenerator, formed by a bundle of 127 steel capillaries, wound with iron wire, and supported by two hexagonal iron plates, perforated as shown in Fig. 3a, the capillaries passing through the perforations and projecting a short distance beyond the plate, which is provided with a rim. A powdered alloy of 40 per cent. of silver and 60 of copper is melted, with exclusion of air, around the ends of the capillaries and fixes these in position. The bundle of tubes is enclosed in a hexagonal pipe. As shown in Fig. 3, the mixture of nitrogen and hydrogen entering at the bottom of the furnace, flows upwards through the hexagonal pipe, along the outer walls of the capillaries, then along the outside of the tube containing the contact mass, next downwards along the outside of the magnesia heating tube, and over the contact substance, and finally through the capillaries of the heat regenerator to the outlet. The magnesia heating tube is of 16 mm. outer and 9 mm. inner diameter and 15 cm. long, and is supported on an iron tube. Inside this is a thin iron tube extending down through the contact chamber and serving as a sheath for the thermo-element, which consists of a platinum-rhodium and three platinum wires arranged as shown in Fig. 3b. The length of the outer steel cylinder is 75 cm., the contact chamber is of 25 mm. diam., and the tube enclosing the contact chamber and heat regenerator is of 32 mm. diam.; the space between the latter and the outer steel cylinder is filled with a stamped-in mixture of *magnesia usta* and finely-divided asbestos. The contact chamber was 25 cm. long and only a very small part of the space therein was actually filled by the contact substance. The covers of the outer steel cylinder were fastened by means of bolts, the joints being made tight by copper washers; the other joints were made as described before. In the experiments with circulation of the gas, the apparatus

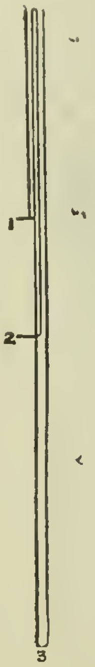

FIG 3b
ARRANGEMENT OF THERMO ELEMENT WIRES

FIG 3a

END VIEW OF HEAT REGENERATOR

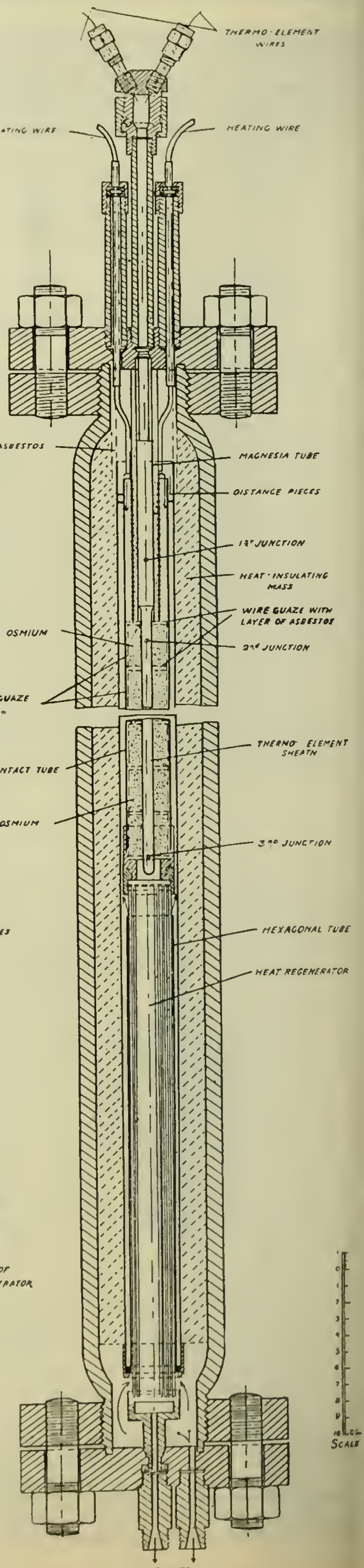

FIG 3

was arranged as shown in Fig. 4. A small double-acting steel pump was used, with a stroke of 3·6 cm. and a piston of 19 mm. diameter. The piston rods consisted of steel wire, 1·5 mm. diam., and the stuffing-box packing consisted of alternate layers of brass and cotton impregnated with paraffin, to a total length of 1·5 cm. At 300 revolutions per minute and a pressure of 200 atmospheres, the capacity of the pump was 72 cb. m. per hour (at atmospheric pressure and temperature), but the actual amount of gas circulated was somewhat less, owing to the leather packing of the piston proving not quite satisfactory; the stuffing-box packing answered very well. The ammoniacal gases from the furnace pass through a copper capillary to a drier charged with soda-lime and then to a heat-exchanger (cold regenerator) consisting of three copper capillaries united at the inlet and outlet; the capillaries are wound into coils as shown, and are contained in a strong steel cylinder. From the cold regenerator, the strongly cooled gas passes into the liquefier, and the liquefied ammonia is drawn off as necessary; or by opening the outlet valve to a suitable extent, the ammonia could be blown off as a uniform current of gas. The gases leaving the liquefier, pass through the cold regenerator to the pump, and thence again to the furnace, a fresh quantity of nitrogen and hydrogen being added on the way through a valve. Through another valve samples of gas could be withdrawn. For determining the ammonia content of the gas mixture, Rayleigh's gas interferometer as supplied by Zeiss was used, the gas being examined before and after passage through sulphuric acid (compare this J., 1906, 802). The

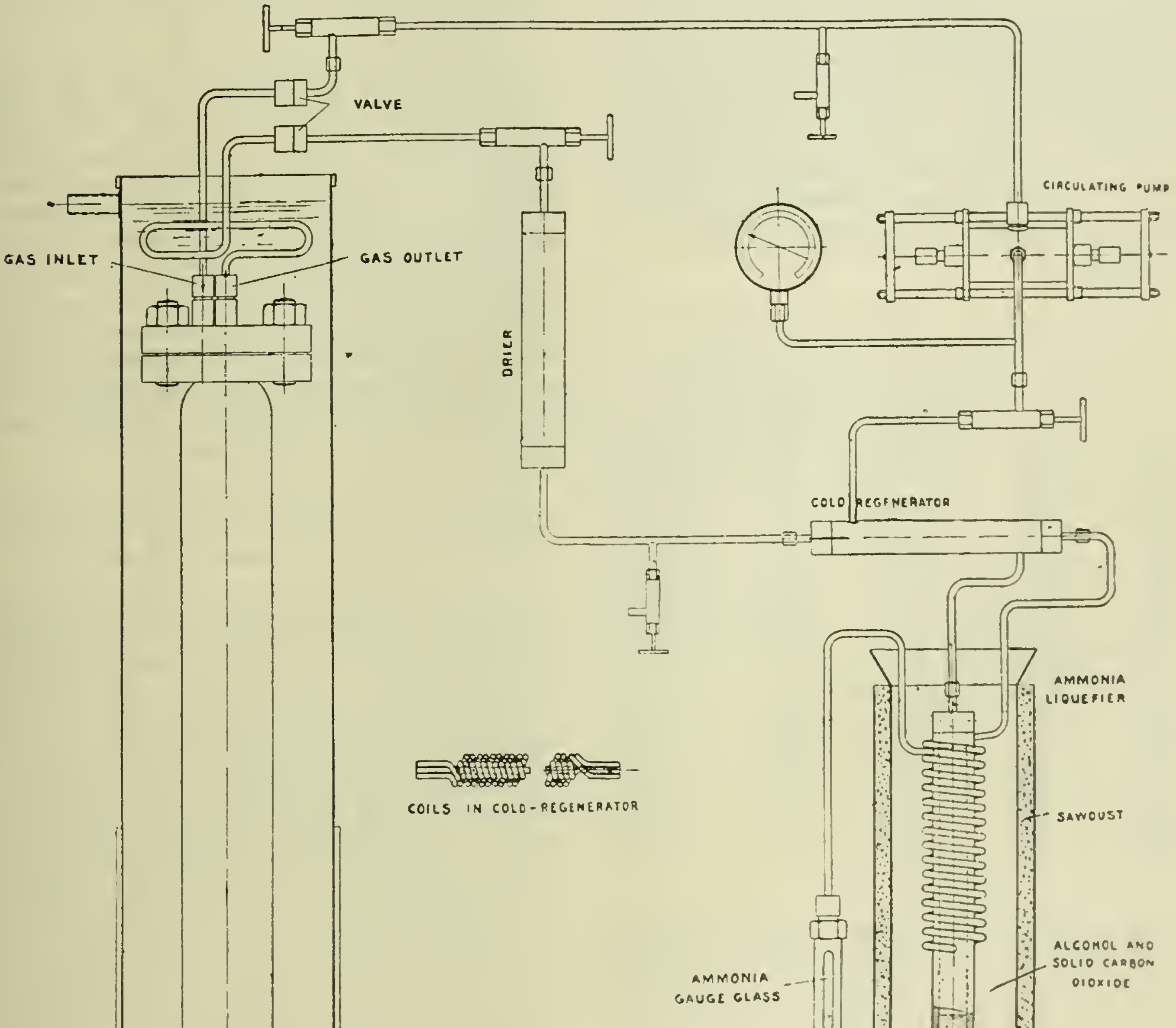

Fig. 4.

results of experiments with cerium and allied metals, manganese, tungsten, uranium, ruthenium, and osmium as contact substances are described.

Uranium. The commercial metal, broken up with a hammer, was used in a column of 4—5 mm. diam. and 3—3·5 cm. long. At about 600° C. vigorous formation of ammonia began. At 190 atmospheres pressure and the gas mixture flowing at a velocity of 20 litres per hour (measured at atmospheric temperature and pressure), the issuing gas contained 5·8 per cent. of ammonia constantly during 1½ hours. With a velocity of 3 litres per hour at 580° C., the ammonia content rose to above 7 per cent. and liquefaction of ammonia occurred at the valve. At a pressure of 120 atmospheres and a velocity of 3 litres per hour at 580° C., 4·8 per cent. of ammonia was obtained, falling to 3·5 per cent. on increasing the velocity to 20 litres per hour. With a velocity of 3 litres per hour at 550° C. (120 atm.), 5·6 per cent. of ammonia was obtained, rising to 5·85 per cent. on reducing the velocity to 2 litres per hour. Good results were also obtained with uranium prepared by Moissan's method. An experiment extending over a long time with the commercial metal gave the following results :—

Time.	Temperature.	Pressure.	Velocity.	Ammonia.
mins.	° C.	kilos. per sq. cm.	litres per hour.	per cent.
0	590	121	11	2·8
70	592	121	11	3·05
133	589	119·5	11	3·1
180	591	118	11	3·13
240	591	117	11	3·15
300	591	115·5	11	3·09
360	590	114	11	3·05
420	591	112·7	11	3·02
460	591	112	11	3·02
515	590	166	20	*2·85
613	594	157	20	*2·70
714	590	145	20	*2·50
823	(quite low at times)	131	20	*1·97
1093	ca. 590	118–115	20	*2·00
1118	590	156	20	2·68
1323	593	166	20	2·74
1333	590	165	10	3·60
1340	610	165	10	3·80
1348	609	164	20	3·00
1358	630	163	20	3·15
1365	608	162	5	5·05
1398	609	160	3	5·50
1428	590	158	3	5·50

The values marked with an asterisk were obtained not by determining the ammonia content at the given time with the interferometer, but by passing the gas during the interval between one test and the next through acid ; they represent the yields corresponding to the mean of the values given in the same and in the succeeding horizontal series for the experimental conditions. It is important to heat up quite gradually in order to maintain the contact substance in an active condition. Experiments with uranium (pieces of the size of a pin-head) were also made in the simple steel cylinder, at a pressure of 125 kilos. per sq. cm. With a velocity of about 32 litres per hour at 570° C., 5·65 per cent. of ammonia was obtained ; 6·54 per cent. at 505° C. and 25·7 litres her hour, 9·1 per cent. at 496° C. and 9·5 litres her hour, and 11—11·9 per cent. at 503°—493° C. and 2 litres per hour.

Osmium. Finely divided osmium proved a very effective catalyst. (In both the iron and chromium groups of metals, the metals of highest atomic weight possessed catalytic properties far superior to that of the metals of lower atomic weight.) In a series of experiments with a layer of osmium 14 mm. long and 4·5 mm. diam., 4·75 per cent. of ammonia was obtained at 592° C. and 156 atmospheres pressure and a velocity of 20 litres per hour. At the same pressure, 5·91 per cent. was obtained at 572° C., and 10 litres per hour ; 7·9 per cent. at 174 atmospheres, 550° C., and 1·5 litres per hour ; and over 9 per cent. at 521° C., 174 atmospheres, and 1·5 litres per hour. In a prolonged experiment with a small quantity of osmium (a layer 4 mm. diam. and 1 cm. long), 34 grms. of ammonia were obtained, and the contact substance was more active after 58 hours than after 3 hours. An experiment with gas circulation was carried out with osmium as catalyst. After pumping out air from the apparatus (see Fig. 4) the mixture of nitrogen and hydrogen was introduced up to a pressure of 185 atmospheres, and the circulating pump set working. A current was now sent through the heating wire (17—18 ampères at 56 volts). The temperatures registered by the three junctions of the thermo-element varied from 580°—635° C. at that next to the heat regenerator, from 750°—825° C. at the intermediate junction and from 880°—1000° C. at the first junction. At first the liquefier was not cooled, and the ammonia content of the gas-mixture rose to 5·4 per cent. The liquefier was then cooled with a mixture of alcohol and solid carbon dioxide and kept at —25° to —39° C., mostly —30° C. The experiment was continued for 4 hours, the pressure ranging from 193 to 163 atmospheres. The ammonia content of the gas varied from 2·4 to 3·1 per cent., mostly 2·6—2·9 per cent. (Higher figures would have been obtained with a larger quantity of contact substance.) About 500 c.c. of liquefied ammonia (corresponding to 336 grms. or 475 litres of gas at ordinary temperature and pressure) were obtained in the 4 hours. The heat- and cold-regenerators acted very efficiently. The copper capillary through which the gases left the furnace could be held comfortably in the hand quite close to the furnace. The cold regenerator had a thick coating of ice on the side where the gases entered from the liquefier, whilst on the other side it was at the ordinary temperature. At the end of the experiment the residual gas mixture contained 30 per cent. of nitrogen plus argon.—A. S.

Ammonia ; Anodic oxidation of —— in an acid medium in presence of silver salts. G. Scagliarini and A. Casali. Atti R. Accad. dei Lincei, Roma, 1912, **21**, II., 726—729.

Solutions of ammonium sulphate of from 10 to 50 per cent. concentration, saturated with silver sulphate at 15° C., were subjected to anodic oxidation in a porous cell immersed in sulphuric acid of 9—10 per cent. concentration. Platinum electrodes were used, the current intensity was 2·5 ampères, and the potential difference 15 volts. Experiments were made at 0°, 10°, 15°, 45°, 57°, 72°, and 90° C. respectively, and for periods of from 3 to 9 hours. Under these conditions it was found that nitric acid but no nitrous acid was formed by oxidation of the ammonia. The amount of nitric acid produced increases with rise of temperature, but is diminished by increasing the concentration of the ammonium sulphate. The largest quantity formed was nearly 3·5 grms. from 100 grms. of ammonium sulphate in 3 hours at 90° C. The yield of nitric acid does not increase regularly during the process, probably owing to impoverishment of silver salt at the anode in consequence of migration to the cathode ; the action of the silver salt does not appear to be entirely catalytic, but depends also, in some degree, upon the quantity present.—A. S.

Ammonia ; Determination of —— by means of formaldehyde. Gaillot. Ann. Chim. analyt., 1913, **18**, 15—17.

A solution of the substance in which the ammonia is to be determined is neutralised and treated with a slight excess of neutral formaldehyde solution. The ammonia combines with the aldehyde to form hexamethylenetetramine and the acid of the ammonium salt is liberated. This acid is then titrated, its quantity being a direct measure of the amount of ammonia present.—W. P. S.

Lime, phosphoric anhydride, silica ; The system ——. O. Nielsen. Ferrum, 1913, **10**, 97—112.

Tricalcium phosphate, and mixtures containing it, with one molecule of tricalcium phosphate, one, two, three, and four molecules of silica, were heated up to their melting-points, which were determined, and their cooling curves were observed. The conclusions drawn were that :—Tricalcium phosphate is not reduced by carbon monoxide ; charcoal begins to reduce it at 1400° C. The melting-point of tricalcium phosphate is 1550° C. ; admixture of silica lowers the melting-point to 1440° (10 per cent.), after which it rises to a maximum of 1500° (27·9 per cent.), falls to 1445° (30 per cent.), rises rapidly to a maximum of 1630° (36·8 per cent.), and falls till at 43·7 per cent. of silica (the highest percentage used) it is 1470° C. Silica does not expel phosphoric anhydride from tricalcium phosphate by heat; but the thermal phenomena show that chemical reaction between the two substances begins at 1150° C. The results point to the existence of a compound of formula $Ca_3Si_3P_2O_{14}$, completely reducible by carbon. Two compounds of silica and phosphoric anhydride were also indicated, having formulæ, $2SiO_2,P_2O_5$ and $3SiO_2,P_2O_5$; the latter melts unchanged in the oxyhydrogen flame. —J. T. D.

Hypophosphoric acid; Formation of ——, in Corne's reaction. F. Tauchert. Z. anorg. Chem., 1912, **79**, 350—354.

Corne (J. Pharm. Chim., [5], **6**, 323) found that when yellow phosphorus reacts with copper nitrate solution there are formed phosphoric, phosphorous, and hypophosphoric acids, besides metallic copper, copper phosphide, nitric oxide, and ammonia. Rosenheim and Pinsker (Ber., 1910, 43, 2003) found that other metallic nitrates gave no hypophosphoric acid under these circumstances, and suggested that Cu-ions rather than NO_3-ions were essential to the reaction. The author finds that copper sulphate, chloride, formate, oxide, hypophosphate, and phosphate, substituted for the nitrate, all yield hypophosphoric acid, in larger quantity than the nitrate does, and that little or no phosphorous acid is formed. The proportions of phosphoric acid and hypophosphoric acid are about 5 to 2. The other products in the case of the nitrate are due to secondary reactions of the nitric acid formed.—J. T. D.

Chromium hydroxide; Complete solubility of —— in ammonia. M. Z. Jowitschitsch. Monats. Chem., 1913, **34**, 225—242.

Chromium salts, like copper salts, give a precipitate with ammonia which is completely soluble in excess to a ruby red solution, not precipitated by a large excess of ammonium chloride. A compound isolated from this solution was previously given the formula $(NH_3)_3Cr_2(OH)_2Cl$. From solutions of chromium hydroxide in ammonia the author prepared a chromium base, agreeing in general properties with that described by Werner and Klein (Ber., 1902, 35, 280), but containing one atom of chromium more, as $(NH_3)_2Cr_2(OH_2)_4(OH)_3$. By dissolving chromium hydroxide in ammonia in presence of ammonium sulphate and of ammonium nitrate, condensation products were obtained of the formulæ, $Cr_4(NH_3)_6O_2(SO_4)_2$ and $Cr_4(NH_3)_7O_2(NO_3)_3$. The salt formed in presence of ammonium chloride would hence probably be $Cr_4(NH_3)_6O_2Cl_2$, and all these would be derived from the hypothetical "oxyhydrate" of Colson (Ann. Chim. Phys., 1907, [8], 12). The compounds are not addition products of chromium and ammonium salts, because in the one containing chlorine the chlorine is not precipitated by silver nitrate solution; and by merely warming the aqueous solutions all the ammonia, in so far as it is not combined with the acid split off, is driven off. A solution of the normal hydroxide of chromium in ammonia is unknown, and the fact that in the author's work the light blue precipitate first obtained is converted into a light grey one, is in support of the formation of the "oxyhydrate." The proportion of hydroxyl to ammonia groups in chromium ammonia nitrate cannot well be reconciled with the normal hydroxide formula, but agrees with the more complex "oxyhydrate" formula.—G. H. F.

Tungsto- [and molybdo-] acids; Basicity of ——. H. Copaux. Comptes rend., 1913, **156**, 71—75.

The conclusions given are based on measurements of the electric conductivity of aqueous solutions of the acids. Silicotungstic acid, $H_4H_4Si(W_2O_7)_6+29H_2O$, tungstosilicic acid, $H_4H_4Si(W_2O_7)_6+20H_2O$, and silicomolybdic acid, $H_4H_4Si(Mo_2O_7)_6+29H_2O$, are strong tetrabasic acids, not appreciably hydrolysed at extreme dilution. Borotungstic acid, $H_5H_4B(W_2O_7)_6+29H_2O$, is pentabasic and metatungstic acid, $H_6H_4H_2(W_2O_7)_6+22H_2O$, hexabasic, but the latter is considerably hydrolysed in dilute solutions. All these basicities correspond with the composition of the soluble salts of the acids. In the insoluble mercurous and silver salts, the metals replace additional hydrogen atoms which are probably alcoholic rather than acid in function. Judging by the composition of the ordinary salts of phosphotungstic acid, $H_3H_4P(W_2O_7)_6+27H_2O$, and phosphomolybdic acid, $H_3H_4P(Mo_2O_7)_6+27H_2O$, and also by analogy, these two acids must be tribasic, but both are strongly hydrolysed in aqueous solutions. On this account no constant value, independent of concentration, could be obtained for the molecular conductivity of phosphotungstic acid. In the case of phosphomolybdic acid, the molecular conductivity approached, with increasing dilution, a value corresponding to tetrabasicity, but this is probably due to the hydrolytic formation of two dibasic acids, thus—

$$H_3H_4P(Mo_2O_7)_6+2H_2O=$$
$$H_2H_5P(Mo_2O_7)_5(OH)_2+H_2Mo_2O_7.$$

—J. H. L.

Cerium compounds, Analysis of ——. E. Strohbach. Mitt. Techn. Versuchsamtes, 1912, **1**, 45—56.

The method devised by the author is based on the fact that cerous salts are oxidised quantitatively to ceric salts by potassium chlorate in sulphuric acid solution, and that the results are not affected by the presence of hydrochloric or nitric acid or organic matter. If the prescribed conditions be adhered to, the method is quite safe, and it is stated that more than 300 determinations have been made without the slightest accident. The oxidation is carried out in two stages in a modified Bangel distilling flask. This consists of a round-bottom flask of 7 cm. diam., provided with a sealed-in air-inlet tube. The outlet tube leading from the neck of the flask first ascends and then descends and is connected with a water pump; it is provided with a safety-bulb. In carrying out the determination, 25 c.c. of the concentrated cerium chloride solution (about 200 grms. per litre) are treated with about 3 c.c. of dilute hydrochloric acid (1 : 10), to prevent precipitation of basic salts, and diluted to 500 c.c. 25 c.c. of the diluted solution are placed in the distilling flask, together with 15 c.c. of potassium chlorate solution (a cold saturated solution), and a current of air, which has been led through cotton wool and then through several towers fed with a concentrated solution of potassium permanganate, is forced through the mixture so as thoroughly to agitate it. 15 c.c. of concentrated sulphuric acid are now introduced, about 2 c.c. at a time, and the flask is connected with the pump. The open flask is now warmed with a small flame, and when the main reaction is over, a further quantity of 15 c.c. of sulphuric acid is introduced. The temperature should now be about 100° C., and the liquid should have become colourless. 10 c.c. of the chlorate solution are introduced in order to ascertain whether the cerium chloride is completely converted into sulphate; if this be not the case the liquid becomes coloured yellowish green by chlorine. The introduction of chlorate solution is repeated until the liquid remains colourless. The flask is now heated with a full flame until the thermometer registers 160° C., when the flame is removed and the liquid allowed to cool to 100° C. Any deposit adhering to the stem of the thermometer or the neck of the flask is rinsed off with 1—2 c.c. of concentrated sulphuric acid. In this stage of the process, most of the cerium chloride is converted into ceric sulphate. In the second stage the oxidation is completed and the excess of chloric acid is decomposed (Experiments have shown that chloric acid is decomposed completely at 150° C., whilst perchloric acid is not appreciably decomposed below 140° C.). A mixture of 10 c.c. of the chlorate solution and 15 c.c. of water is introduced into the flask and the mixture is heated for 2—3 mins. at 133°—135° C., then cooled to 90° C., the current of air being continued the whole of the time, diluted with cold water, cooled, rinsed into a beaker, made up to 400 c.c. and titrated with hydrogen peroxide solution (0·6075 grm. per litre, with the addition of 5 per cent. of sulphuric acid to increase the stability), a slight excess of the latter being added, and this titrated back with permanganate solution (1·1296 grms. per litre; 1 c.c.=0·005 grm. of cerium). The reactions upon which the process is based are as follow:—

$$
\begin{aligned}
&4Ce_2(SO_4)_3+4H_2SO_4+3HClO_3= \\
&8Ce(SO_4)_2+HClO_4+Cl_2+5H_2O; \\
&5HCl+HClO_3=3H_2O+3Cl_2; \\
&2Ce(SO_4)_2+H_2O_2=Ce_2(SO_4)_3+H_2SO_4+O_2.
\end{aligned}
$$

—A. S.

Rare earth metals; Salts of the —— with hydroxy-carboxylic acids [glycollic acid]. G. Jantsch and A. Grünkraut. Z. anorg. Chem., 1912, **79**, 305—321.

The authors have prepared and examined the glycollates of several of the rare earth metals, especially as to their solubilities in water. The following results were obtained for the solubilities at 20° C.:

Glycollate.	Grms. of salt dissolved by 1 litre of water.
Lanthanum	3·328
Cerium	3·563
Praseodymium	3·578
Neodymium	4·609
Samarium	6·373
Godolinium	14·147
Yttrium	2·447

The glycollates hence lend themselves to the fractional separation of these earths, and an example of the good results of such a separation is given in the experimental part of the paper, where also are details of the preparation, analysis, and properties of the individual salts.—J. T. D.

Nitric oxide; Determination of ——. Koehler and Marqueyrol. Bull. Soc. Chim., 1913, **13**, 69—72.

Baudisch and Klinger (this J., 1912, 1178) in using solid potassium hydroxide to absorb the nitrous anhydride formed by the oxidation of nitric oxide, have not chosen the best reagent; it will absorb any carbon dioxide present in the gas, and the large amount of solid potash present causes difficulties in the accurate collection of the residual gas. The authors use liquid ethylaniline. Into a measuring tube over mercury are passed about 80 c.c. of the gas to be analysed, then 0·6 c.c. of ethylaniline. Now oxygen is added, bubble by bubble, till in sufficient excess (0·285 times the volume of the gas and 5 c.c. additional). The remaining gas is separated from the liquid and measured. The carbon dioxide is then absorbed by potash solution, and measured, the oxygen removed by alkaline pyrogallol, and the residual gas analysed as desired. The excess of oxygen lessens the absorption of carbon dioxide by the ethylaniline. This substance absorbs at atmospheric pressure rather more than its own volume of carbon dioxide, and the error due to this is lessened in proportion as the partial pressure of the carbon dioxide present is decreased.—J. T. D.

Hydrogen peroxide; Rate of decomposition of —— under the influence of heat. G. Lemoine. Bull. Soc. Chim., 1913, **13**, 5—12.

In the case of dilute solutions of hydrogen peroxide the decomposition on heating is practically a monomolecular reaction, whilst with concentrated solutions (above 300 vols.) and at different temperatures (100°, 80°, 68°, 35°, 15° C.), the rate of decomposition is changed. For dilute solutions, if p be the weight of hydrogen peroxide, y the weight of hydrogen peroxide decomposed, and t the time, the curve expressing y/p as a function of t is convex, but for very concentrated solutions the curve is at first concave and later becomes convex. There is thus an acceleration as the proportion of water increases owing to the decomposition. Water plays the part of a catalyst in the decomposition, and the velocity of the reaction is dependent on the proportion of water present at any given moment in the solution. This is in agreement with the fact already known that concentrated hydrogen peroxide decomposes very slowly: for instance, at 16° C. gas is not given off by 98 per cent. hydrogen peroxide within 12 days, but if catalytic substances, other than water, be added, decomposition proceeds very rapidly.—W. P. S.

Selenic acid and sodium selenate for use as reagents in the determination of bromine in haloid salts; Preparation of ——. P. L. Blumenthal. Amer. J. Sci., 1913, **35**, 93—96.

Selenic acid and sodium selenate suitable for use in the determination of bromine by the method of Gooch and Blumenthal (see following abstract) may be prepared in the following manner. *Selenic acid.* A mixture of 10 grms. of selenium dioxide dissolved in 75—100 c.c. of water, 6 grms. of potassium bromate, and 4 c.c. of strong nitric acid is heated on the water-bath until colourless. Bromine is evolved in two stages, and after the second liberation of bromine a little more bromate is added and heating is continued. When further addition of bromate causes no evolution of bromine, the solution is heated to boiling and treated with a hot dilute solution of barium nitrate. The precipitated selenate is filtered off, washed with hot water, and dried at low redness; it is then heated for about 2½ hours on the water-bath with 5 c.c. of strong sulphuric acid and 20 c.c. of water, after which the mixture is diluted and filtered. *Sodium selenate.* An intimate mixture of powdered selenium and sodium peroxide (105 grms.: 500 grms.) is fused in portions containing 10—15 grms. of selenium, in a nickel crucible, and, after cooling, the melt is treated with cold water. The solution is filtered by means of a platinum cone lined with asbestos, the opaque filtrate evaporated to a pasty condition, and as much alkali as possible removed by repeated extraction with alcohol (97—99 per cent.). The residue is carefully neutralised with sulphuric acid and the mixture of sulphate and selenate crystallised, the crystals being dried at 108° C. Sodium selenate may also be prepared by fusing barium selenate, obtained as above, with an amount of sodium carbonate less than that required to decompose the barium salt completely. The product is extracted with water and the sodium salt crystallised from the filtered solution.—F. Sodn.

Bromine associated with chlorine in haloid salts; Use of selenic acid in the determination of ——. F. A. Gooch and P. L. Blumenthal. Amer. J. Sci., 1913, **35**, 54—62.

The determination of bromide in presence of chloride by differential oxidation with selenic acid may be carried out as follows:—The haloid salt, dissolved in 30 c.c. of water, is heated in a slow current of carbon dioxide with 5 c.c. of 40 per cent. selenic acid solution or a mixture of 1·8 grms. of sodium selenate (see preceding abstract) and 3 c.c. of sulphuric acid (1 : 1), diluted with 20 c.c. of water, the mixture being added from a tap funnel. The evolved vapours are led through a second flask, containing 2·5 c.c. of selenic acid solution and 10—15 c.c. of water, or 0·2—0·3 grm. of selenate, 1—2 c.c. of sulphuric acid (1 : 1), and 10—15 c.c. of water (this flask being heated in an oil bath kept at 115°—120° C.), and then pass into a receiver standing in cold water and charged with 3—4 grms. of potassium iodide dissolved in 200—250 c.c. of faintly acid water. The reaction mixture is gently boiled until reduced in volume to 10—15 c.c., and the flasks are then allowed to cool in a slow current of carbon dioxide, and the liberated iodine is titrated. With selenic acid, under the above conditions, a determination may be made with 0·25 grm. of potassium bromide associated with 0·15 grm. of sodium chloride, and, using sodium selenate and sulphuric acid, 0·10 grm. of bromide mixed with 0·05 grm. of chloride, may be employed. The conditions for larger amounts of the salts have not been ascertained. A determination may be completed in 40—50 minutes.—F. Sodn.

Bromine; Detection and determination of very small quantities of free —— by means of Schiff's reagent. G. Denigès. Ann. Chim. analyt., 1913, **18**, 8—11.

The test described previously by the author (this J., 1912. 1078) and independently by Guareschi (this J., 1912, 1149) may be rendered more sensitive by the addition of hydrogen peroxide to the reagent. This prevents the interfering action of the sulphurous acid when only traces of bromine are present and renders the test from 15 to 20 times more sensitive than it was as described originally.—W. P. S.

Bromine and chlorine; Detection of free and combined —— and the determination of bromine. G. Denigès and L. Chelle. Ann. Chim. analyt., 1913, **18**, 11—15.

The reagent employed is prepared by mixing 10 c.c. of a fuchsin solution (1 grm. per litre) with 5 c.c. of dilute sulphuric acid (5 c.c. diluted to 100 c.c. with water) and 5 c.c. of water. This mixture becomes colourless in about 1 hour; 25 c.c. of it are then mixed with 25 c.c. of glacial acetic acid and 1 c.c. of sulphuric acid. To 5 c.c. of this latter solution are added a few drops of the solution to be tested and 2 c.c. of chloroform, and the whole is shaken. If chlorine be present, the chloroform layer is coloured yellow and exhibits an absorption band in the yellow portion of the spectrum. The presence of bromine is shown by a red-violet colouration in the chloroform and the solution gives two absorption bands, one in the yellow and the other in the blue portion of the spectrum. Bromides may be determined in a mixture of halides by first removing iodides by treatment with iron, and then liberating the bromine by means of sulphuric acid and potassium bichromate; the liberated bromine is collected and treated with the above-mentioned reagent, its quantity being ascertained by comparison with known amounts of bromine under the same conditions. After the removal of the bromine, the chlorine may be liberated by the addition of potassium permanganate, collected, and tested as described.—W. P. S.

Ozone; Reactions of —— with certain inorganic salts. Y. Yamauchi. Amer. Chem. J., 1913, **49**, 55—68.

From a quantitative study of the oxidation of arsenious acid, stannous chloride, sodium thiosulphate, thallous nitrate, mercurous nitrate, and ferrous ammonium sulphate, the author finds that the decomposition of ozone proceeds in accordance with the equation, $O_3=O_2+O$, except in the case of stannous chloride, for which the decomposition is expressed by the equation, $O_3=3O$. The reaction with sodium thiosulphate appears to take place in two stages; in the first, the salt is decomposed catalytically into sulphite and sulphur, and in the second the sulphite is partially oxidised to sulphate. With tellurous oxide and titanium dioxide, no oxidation was observed. The apparatus employed in the investigation consisted of twin tubes in which the sample of ozonised oxygen could be divided into equal parts; the concentration of the ozone was then determined in one tube, while the other was utilised for the reaction to be examined. The formation of thallic oxide from a thallous salt by means of ozone is very rapid and complete, and direct weighing of the precipitated oxide is suggested as a method for the gravimetric determination of ozone.—F. Sodn.

Determination of stannous chloride and of chlorates by means of Methylene Blue. Atack. *See* XXIII.

Ammonia production in the United States. Chem. Trade J., Feb. 1, 1913. [T.R.]

According to preliminary figures, the production of ammonia in the United States during 1912, reduced to its sulphate equivalent, was 155,000 short tons, against 127,000 tons in 1911. The increase of 28,000 tons is due solely to the larger operations of the coke by-product industry, as the bone-black and coal-gas sources of ammonia appear to be on the decline. At the beginning of 1912 there were 4624 by-product coke ovens in operation in the United States, and 698 building. During the year a number of new projects were announced for both the United States and Canada, so that it can be reasonably expected that the domestic recovery of ammonia will be prosecuted on a still larger scale hereafter. It is probable that the total imports during the year will reach 55,000 or 60,000 short tons, and that the total consumption of sulphate in the United States during the year will amount to 210,000 or 215,000 tons, against 221,633 tons in 1912.

French Customs duties on potassium sulphites. Board of Trade J., Jan. 23, 1913. [T.R.]

A French Law, dated the 4th January, and promulgated in the "Journal Officiel" for the 9th January, raises a new heading in the Customs Tariff for *sulphite, bisulphite, or metabisulphite of potash* (*No.* 275 *bis*), with a duty of 15 francs per 100 kilos. under the "General" Tariff, and 10 francs per 100 kilos. under the "Minimum" Tariff.

The manufacture of calcium carbide. R. A. Witherspoon. *See* Canadian Section, p. 113.

Patents.

[*Sulphurous*] *gases produced by the burning or roasting of sulphur-containing materials; Manufacture and purification of* ——. H. B. P. Humphries, London. Eng. Pat. 10,810, May 7, 1912.

Sulphur-containing materials, preferably previously dried by waste heat from the kilns, are burnt with dried air, whereby the resulting sulphur dioxide is free from mist or fog, and is rendered more amenable to efficient filtration and to oxidation by the contact process.—O. R.

Acetic acid; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron. Frankfort-on-the-Maine, Germany. Eng. Pat. 8076, April 3, 1912. Addition to Eng. Pat. 17,424, July 31, 1911 (this J., 1912, 772).

In the manufacture of acetic acid from acetaldehyde, instead of using acetic acid or one of its chlorine derivatives to start the reaction, as in the principal patent, a small quantity of the aldehyde is first oxidised as completely as possible by means of an excess of oxygen, after which fresh aldehyde is added and a more powerful current of oxygen is admitted for the production of acetic acid. —O. R.

Formic acid; Method of making ——. W. H. Walker, Assignor to Merrimac Chemical Co., Boston, Mass. U.S. Pat. 1,048,609, Dec. 31, 1912.

A formate, "substantially free from water," is treated with concentrated sulphuric acid, whereby the reaction proceeds without loss of formic acid owing to any injurious rise of temperature.—O. R.

Cleaning-powder. E. W. Oldham, Assignor to The Hygienic Products Co., Canton, Ohio. U.S. Pat. 1,048,575, Dec. 31, 1912.

A cleaning powder "including a mixture of sodium bisulphate and sodium chloride."—O. R.

Tungstic acid; Process of obtaining pure ——. T. Ban, Tokyo, Japan. U.S. Pat. 1,049,193, Dec. 31, 1912.

Powdered wolframite is heated with concentrated hydrochloric acid until the greater part of the soluble constituents are dissolved; the mixture is cooled, the clear solution poured away, and the residue washed; the latter is then successively treated, with constant stirring, with a concentrated solution of bleaching powder, hydrochloric acid, and a small quantity of citric acid solution, after which it is washed and dried.—O. R.

Vanadic acid from insoluble copper vanadate; Process of extracting ——. W. F. Bleecker, Boulder, Colo., Assignor to The Rare Metals Mining and Milling Co., Colo. U.S. Pat. 1,049,330, Jan. 7, 1913.

Insoluble copper vanadate is decomposed with sulphuric acid, the insoluble vanadium oxide separated, copper extracted from the copper vanadate solution by electrolysis, and the remaining solution of vanadic acid is evaporated.—O. R.

Nitrogen oxides from atmospheric air; Process for obtaining ——. F. I. Du Pont. Fr. Pat. 446,269, July 19, 1912. Under Int. Conv., July 24, 1911.

In a hot-air motor, similar to a four-cycle gasoline engine, the first movement of the piston causes air to be aspirated through an inlet valve; the second movement of the piston compresses the air and closes an electrical circuit, which forms an arc inside the cylinder; the intense heat of the arc causes the formation of nitrogen oxides and the simultaneous expansion of the enclosed gases; this expansion imparts the third movement to the piston, and by converting the heat into mechanical energy, serves to counteract the tendency to decomposition possessed by heated nitrogen oxides. The mechanical energy thus produced. may be utilised either to furnish a portion of the electrical energy required for the arc, or for compressing the air of a previous cycle in another apparatus. The fourth and last movement of the piston operates an outlet valve and directs the air containing nitrogen oxides to a place where the latter are utilised or converted into other products. A series of such motors are conveniently mounted in series and driven by a common horizontal shaft from an electromotor; suitable contact-breakers are provided for the free running of the engines, whilst mechanical energy is being generated by them, and for regulating the establishment and duration of the electric arcs.—O. R.

Chlorides of the alkali or alkaline-earth metals ; Process of electrolysing the ——. Badische Anilin und Soda Fabrik. Fr. Pat. 446,640, July 29, 1912. Under Int. Conv., Dec. 13, 1911.

In the electrolysis of the chlorides mentioned in the title, the passage of hydroxyl ions into the anode compartment is prevented by the insertion of two or more diaphragm-filters, which are traversed by the electrolyte in the same direction, say from anode to cathode. In carrying out the electrolysis it is not necessary to circulate the electrolyte through all the filters, but the greater portion of it may conveniently be directed into the intermediate compartment between the filters, and thence into the cathode department. To prevent the exhaustion of the anode liquor, the anode compartment is constantly charged with fresh saline solution.—O. R.

Oxygen ; Process of manufacturing ——. H. L. Doherty, New York. U.S. Pat. 1,048,812, Dec. 31, 1912.

In the manufacture of oxygen by the igneous decomposition of a metallic peroxide, a portion of the evolved oxygen is continuously withdrawn, re-heated, and re-admitted into contact with the peroxide, which is undergoing decomposition. The proportion of oxygen, which is thus circulated, and the temperature, to which it is re-heated, are such as to impart to the oxygen a quantity of available heat approximately equal to the heat lost by the peroxide in the course of its decomposition.—O. R.

Oxygen and nitrogen by means of liquid air ; Process of preparing ——. "Industriegas" Ges. für Sauerstoff- und Stickstoff-Anlagen, m. b. H. Fr. Pat. 446,560, July 26, 1912. Under Int. Conv., Aug. 30, 1911.

A slow current of liquid air is passed down a tube or tubular system, the upper part of which is maintained at the temperature of liquid air (—190° C.), whilst the lower part is kept at the boiling point of oxygen (—183° C.). In its downward passage the liquid gradually becomes richer in oxygen, until it reaches the outlet at the bottom, where it emerges in the form of oxygen, more or less pure, according to the dimensions of the apparatus. The latter may take the form of a number of helicoidal tubes surrounding a central, vertical tube, all of which communicate with a common reservoir at the top and lead to a common receiver at the bottom. The latter is heated in a suitable manner, and the escaping vapours supply the heat necessary for the maintenance of the temperature gradient in the tubular system, there being thus no contact between the escaping oxygen and the liquid air or its vapours.—O. R.

Hydrogen or gases which contain it ; Process for carrying out operations employing ——. Badische Anilin und Soda Fabrik. First Addition, dated July 26, 1912 (under Int. Conv., Sept. 5, 1911), to Fr. Pat. 441,695, March 23, 1912 (this J., 1912, 922).

The interior walls of the vessels, described in the principal patent, may be constructed of a material, which is neither impermeable nor chemically resistant to hydrogen, such as for instance ordinary, commercial iron.—O. R.

Sulphuric acid ; Manufacture of ——. W. Fulda, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,048,953, Dec. 31, 1912.

See Fr. Pat. 406,641 of 1909 ; this J., 1910, 487.—T. F. B.

Nitric acid ; Manufacture of ——. M. Moest and R. M. von Berneck, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,049,754, Jan. 7, 1913.

See Eng. Pat. 19,032 of 1911 ; this J., 1911, 1381.—T. F. B.

Sulphuretted hydrogen and sulphurous acid ; Effecting the mutual reaction of —— *and the obtainment of sulphur.* W. Feld, Linz on Rhine, Germany. Eng. Pat. 157, Jan. 2, 1912.

See Fr. Pat. 432,590 of 1911 ; this J., 1912, 128.—T. F. B.

Nitrate of lime ; Process for effecting the solidification of liquefied ——. F. J. Brougham, London. From Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. Eng. Pat. 15,934, July 8, 1912.

See Fr. Pat. 445,826 of 1912 ; this J., 1912, 1179.—T. F. B.

Calcium cyanamide ; Process for treating ——. C. F. Carlson. Fr. Pat. 445,542, June 28, 1912. Under Int. Conv., Sept. 11, 1911.

See U.S. Pat. 1,042,746 of 1912 ; this J., 1912, 1125.—T. F. B.

Alumina ; Recovering pure ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. Reissue No. 13,509, Jan. 7, 1913, of U.S. Pat. 1,007,495, Oct. 31, 1911.

See Eng. Pat. 13,088 of 1910 ; this J., 1911, 361.—T. F. B.

Sodium phosphate waste liquors ; Process of purifying ——. H. Ley, Elberfeld, Germany. U.S. Pat. 1,049,740, Jan. 7, 1913.

See Fr. Pat. 418,870 of 1910 ; this J., 1911, 80.—T. F. B.

Potash [*from felspar, etc.*] ; *Processes for extracting* ——. Chemical Products Co. Fr. Pat. 446,959, Aug. 6, 1912. Under Int. Conv., Oct. 17, 1911.

See U.S. Pat. 1,034,281 of 1912 ; this J., 1912, 816.—T. F. B.

Electric revolving furnace [*for manufacture of nitrides*]. Fr. Pat. 446,978. *See* XI.

VIII.—GLASS ; CERAMICS.

Leadless enamel and faience with reduced content of tin oxide. A. Berge. Sprechsaal, 1913, **46**, 17—19.

For producing opacity in enamels, the proposed substitutes for tin oxide, which is effective but costly, are cryolite, "artificial cryolite" (sodium silicofluoride, a by-product in the manufacture of superphosphate), antimony oxide, titania, zirconia, and frits containing fluorides—none of which solve the problem, while "tin ashes" contain lead oxide and are poisonous. Instead of dispensing entirely with tin oxide, the author proposes to reduce it to a minimum by fritting with sodium phosphate, the molecular formula recommended being: $2{\cdot}4SiO_2,0{\cdot}1SnO_2,0{\cdot}2\ Al_2O_3,0{\cdot}45\ B_2O_3,0{\cdot}2\ P_2O_5,0{\cdot}4MgO,0{\cdot}2\ K_2O,0{\cdot}4\ Na_2O$.—H. H. S.

Pottery ; Manufacture and decoration of —— ; *Regulations dated January* 2, 1913, *made by the Secretary of State under Section* 79 *of the Factory and Workshops Act*, 1901. Statutory Rules and Order, 1913.

Patents.

Glass threads, felted glass or the like ; Manufacture of ——. E. Pick, Jungbunzlau, Bohemia. Eng. Pat. 28,521, Dec. 18, 1911.

In order to avoid the manual labour necessary to reproduce each broken thread and place it on the reel which serves the double function of drawing and delivering the continuous thread, a number of drawing or tapping tools are employed to produce simultaneously several threads of limited length. As it is only necessary to obtain relative motion of the tappers and the molten glass, the threads may be produced by movement of the tappers or by centrifugal action of the revolving vessel containing the melt. Glasses of different composition melted in separate vessels may be forced through a common outlet. Machinery, which may have the form of an endless band for conveying, is provided to sort and lay the threads. A device for laying the threads not in parallel but crosswise, and for enabling the threads thus laid to be stuck together by varnish, glue or inorganic binding substances, in order to make glass felt, is also provided.—H. H. S.

Glass ; Continuous process for manufacture of ——. M. Neef. Fr. Pat. 446,390, July 24, 1912.

A continuous sheet of glass is produced by so arranging the outlet of the furnace that the molten glass is delivered between a pair of rollers from which it descends vertically on to a moving table which leads into the annealing oven. —H. H. S.

Clay or other wet material ; Drying of articles moulded from ——, more especially intended for use in connection with the drying of multiple channel conduits for electrical conductors. R. Lawton, Burton-on-Trent. Eng. Pat. 2348, Jan. 29, 1912.

Moulded articles of thickness varying in different parts are liable to crack by unequal drying. The means of retarding drying is obtained by a shield placed over those parts most likely to dry too quickly, and supplemented if necessary by the application of a damp piece.—H. H. S.

Abrasive matter ; Composition of ——. A. F. Blouin, Springfield Township, Pa., Assignor to Abrasive Material Co., Philadelphia. U.S. Pat. 1,042,878, Oct. 29, 1912.

Alumina is fused with silicon, boron, chromium and carbon, the proportion of none of these elements exceeding 3 per cent. The crystalline product has the recommended composition : alumina 92·35, silicon 2·93, boron 2·45, chromium 0·12, carbon 1·39 per cent. It is extremely hard but possesses just enough toughness to allow particles to break away when used for grinding.—H. H. S.

Electric conductors ; Manufacture of moulded bodies refractory to fire and good ——. Gebr. Siemens und Co. Fr. Pat. 446,142, July 18, 1912. Under Int. Conv., July 20, 1911.

Silicon and carbon are mixed with a binding agent such as colophony or paraffin and heated in an atmosphere of carbon monoxide or dioxide to 1450° C., and then to 1700° C. The reactions are expressed by the equations : $Si+CO+C=SiCO+C=SiC+CO$, the silicon carbide being the desired product.—H. H. S.

Vitrifiable materials ; Firing with simultaneous continuous pressure of powdered —— on refractory supports. M. Demongeot. Fr. Pat. 446,218, July 3, 1912.

By subjecting the material to be fused to pressure during firing, the softening point is lowered sufficiently to eliminate risk of chemical action between the melt and the supports, thereby avoiding the necessity of the intermediate chalk layer mentioned in Fr. Pat. 365,096, April 11, 1906. —H. H. S.

Ceramic products ; Process for avoiding efflorescence in the manufacture of ——. Soc. de Produits Céramiques de Massy. Fr. Pat. 446,875, Oct. 13, 1911.

The efflorescence caused by calcium and magnesium salts in the clay is said to be eliminated by adding easily soluble salts such as iron chloride or sulphate to the mixing water. By this means the solubility of the calcium and magnesium salts is so diminished that they are to a large extent deposited within the body, and only a mixture of the soluble iron salt, with a very small proportion of calcium or magnesium salts arrives at the surface ; on firing, the iron salt is converted into an insoluble compound.—H. H. S.

Silica glass ; Manufacture of ——. J. F. Bottomley, Wallsend, R. S. Hutton, Manchester, and R. A. S. Paget, London, Assignors to The Thermal Synd., Ltd., Wallsend. Reissue No. 13,504, Jan 7, 1913, of U.S. Pat. 812,399, Feb. 13, 1906.

See Eng Pat. 10,670 of 1904 ; this J., 1905, 670.—T. F. B.

Process and apparatus for stirring and transporting materials such as starch, clay, etc. Fr. Pat. 446,008. *See* I.

IX.—BUILDING MATERIALS.

Silica [in cements] ; The determination of ——. T. Bauer. Tonind.-Zeit., 1913, 37, 89—90.

The author describes the various methods recommended for the separation of silica in the analysis of silicates, with special reference to the treatment with hydrochloric acid, and the temperature to which the residue is subsequently heated. In 25 analyses he found differences of from 0·3 to 0·7 per cent., the average being 0·46 per cent. For the accurate determination of silica in cements, the author obtained satisfactory results with the following method : 2—5 c.c. of concentrated hydrochloric acid are added to the cement, which has been previously moistened with warm water and well stirred with a glass rod ; the mixture is evaporated to dryness on the water-bath, thoroughly moistened with $N/10$ hydrochloric acid, taken to dryness again, moistened with distilled water, and heated on an asbestos board over a well-regulated burner, until a cover-glass, moistened with silver nitrate solution, shows no further signs of clouding when brought into contact with the escaping vapours ; the residue is then completely dried in a hot-air bath, which is slowly brought up to a temperature of 100°—110° C. After cooling, the residue is taken up with water and a little dilute hydrochloric acid, boiled, washed by decantation until the filtrate is practically free from chlorides, and ignited in a covered platinum crucible to prevent any loss of silica as dust. 25 analyses, carried out in this way, showed a maximum divergence of 0·25 per cent. and an average difference of 0·18 per cent. (Compare this J., 1912, 724.)—O. R.

Patents.

Wood ; Manufacture of artificial ——. P. Hoering, Berlin. Eng. Pat. 21,327, Sept. 27, 1911.

Artificial wood is prepared from reed-plants in the manner described in Eng. Pat. 20,312 of 1911 (this J., 1912, 975), and the material obtained is moulded in a press, adapted to produce continuous bars or boards, by means of a reciprocating piston having in its face numerous shallow grooves or indentations.—O. R.

Wood product ; Impts. in [manufacture of]—— A. W. Mathys, London. From F. A. Palen, New York. Eng. Pat. 94, Jan. 1, 1912.

Undried wood is gradually heated in a vacuum up to 300° F. (149° C.). The vacuum is then cut off and the wood is subjected to either dry or moist heat at just below the above-mentioned temperature, until its entire mass has become uniformly heated, after which it is again subjected to the combined action of a vacuum and dry heat at a temperature not exceeding the above. It is claimed that under these conditions the resins are distilled without decomposition and uniformly deposited on the hardened fibres of the wood throughout its thoroughly dried mass.—O. R.

Concrete ; Composition for waterproofing ——. A. C. Horn, New York. U.S. Pat. 1,048,695, Dec. 31, 1912.

THE composition comprises an oily body or drying oil such as Chinese wood oil, calcium stearate or other soap insoluble in water, casein, a preservative agent and water.—H. H. S.

Cement ; Special binding ——. M. J. and G. H. Langlois. Fr. Pat. 446,380, July 20, 1912.

CEMENT is intimately mixed with finely powdered granite, felspar or pegmatite in such proportions as, by the aid of the potassium compounds present in the minerals, to favour chemical action which should result in the formation of a substance of the molecular formula: $(SiO_2.CaO)_2.SiO_2.2CaO$, a substance which is said to have great cohesive properties and to be suitable for use in making roads and pavements.—H. H. S.

Asbestos ; Process of purifying ——. W. C. Arsem, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,049,972, Jan. 7, 1913.

ASBESTOS, containing difficultly soluble iron oxide, is soaked for 24—72 hours in a 50 per cent. solution of orthophosphoric acid, and is then washed free from adhering acid.—O. R.

Asphalt industry ; Manufacture of a viscous, streaky and gluey mass specially intended for the ——. J. Goepper and O. Geiger. First Addition, dated July 26, 1912, to Fr. Pat. 434,065, Sept. 8, 1911 (this J., 1912, 232).

To the resinous raw material is added strong sulphuric or other mineral acid, and the mass is then heated to 270° C. in order to drive off free mineral acids, thereby avoiding the necessity of neutralisation by soda.—H. H. S.

Waterproof mortar. A. Prée. Fr. Pat. 446,375, July 23, 1912. Under Int. Conv., July 24, 1912.

IMPERMEABLE aluminium and calcium salts are formed in mortar by mixing it in the dry state with a soap, such as sodium oleate, and a soluble aluminium salt, and by afterwards moistening.—H. H. S.

Wood ; Process for preserving and fireproofing ——. Grubenholz-Imprägnierung G.m.b.H. Fr. Pat. 446,018, July 12, 1912. Under Int. Conv., July 29 and Dec. 13, 1911.

SEE Ger. Pats. 247,694 and 248,065 of 1911 ; this J., 1912, 985.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnace ; Studies on the proportions maintained between the iron ore and the gases in the ——. N. Metz. Stahl u. Eisen, 1913, 33, 93—104.

BY means of a specially constructed water-cooled tube the temperature was ascertained and the gases abstracted from different zones up the shaft, at the boshes, and just above the blast of a blast-furnace. Different zones at different times, all the zones simultaneously and from the side of the furnace, and each zone from the middle and the side at the same time, were examined. About 500 gas analyses were made, the results being tabulated. The character of the deposits at the sides of the furnace was also investigated. It is concluded that :—1. The decomposition of calcium carbonate only occurs in a certain zone. 2. The separation of graphite is probably not a cause but the result of the formation of scaffolding. 3. The formation of hydrogen is intimately connected with the dryness of the blast, and four zones can be distinguished. These zones are (a) the top of the shaft, where the reaction, $CO+H_2O=CO_2+H_2$, occurs, the water being derived from the moisture and hydrate water of the charge, (b) at the bottom of the shaft, where the formation of hydrogen is small, (c) in the boshes, where the last residue of hydrate water becomes dissociated, (d) in the hearth, where hydrogen is produced from the moisture of the blast and from leakages in the cooling arrangement. 4. Changes in the blast temperature produced in the Cowper stoves make themselves felt up to just above the boshes, and it is suggested that the temperature of the air should be ascertained by means of a pyrometer and its variations kept as low as possible.—A. H. C.

Cast-iron ; Constitution of ——, *and the effects of superheated steam.* W. Campbell and J. Glassford. Proc. Int. Assoc. for Testing Materials. Trans. Amer. Foundrymen's Assoc., 1912, 597—619.

IN corroded cast-iron from a superheater oxidation was observed following the planes of the graphite plates of the metal. To investigate this, a series of specimens presenting different carbon conditions were heated in superheated steam at 425° C. and 95 lb. pressure for 30 and 90 days respectively, and subsequently examined. With white cast-iron, steel, and malleable cast-iron, only surface oxidation had occurred, whereas with cast-iron low in silicon, oxidation had penetrated the metal somewhat, following the coarsest of the graphite plates. The depth of penetration increased with the silicon content of the metal, the micro-structure of the specimen containing 5·5 per cent. of silicon being completely altered by the treatment ; the original ground-mass of silico-ferrite was split up with planes of oxidation following the original graphite, and a new constituent was deposited as a border to the oxidation planes. Alternate heating and cooling of a similar series of specimens in air resulted mainly in the surface oxidation of the metals.—W. E. F. P.

[*Iron and steel.*] *Metals ; Breakdown tests of* ——. O. Boudouard. Proc. Int. Assoc. for Testing Materials. Trans. Amer. Foundrymen's Assoc., 1912, 489—499.

THE author has investigated the method of testing metals, in which the free portion of a rod, fixed at one end, is subjected to continuous vibration until rupture occurs. The tests were made upon a series of metals ranging from puddled iron to crucible steel containing about 1 per cent. of carbon, the stresses to which the rods were exposed being well below the respective elastic limits of the metals. As it was found easily possible to ensure the same experimental conditions in every test and to obtain concordant results with the same metal, the author considers that this method of testing (by studying the damping of the vibratory movement) admits of useful application for determining the resistance of metals to alternating stress. The ratio of the numbers of vibrations necessary to effect rupture in the case of the semi-hard and hard steels tested varied inversely as the ratio of the carbon contents of the metals ; steels containing 0·3 per cent. of carbon (of the same composition but different origins) required from about 1·3 to 1·5 million vibrations (corresponding to a testing period of 12½—13¼ hours), whether the samples were tested in the annealed or the hardened condition. In the case of hard steel, the time during which the vibrations had to be maintained to effect rupture was considerably diminished by hardening the metal, but greatly increased by re-heating it after hardening ; for example, a steel (containing 1 per cent. of carbon) which broke after 3 hours 25 mins. in the annealed state and after 5 mins. in the hardened state was not broken after 26½ hours in the hardened and annealed condition. With annealed steels generally the damping of the vibratory movement was found to diminish as the carbon content increased. A marked difference, as regards the length of time required to effect rupture, was observed between puddled iron and extra-soft steel having nearly the same composition (apart from the manganese content, which ranged between 0·05 and 0·40 per cent.) and mechanical constants, the former being much more resistant than the latter ; the elastic limit of both was much greater after than before the test. (See also Arnold, this J., 1904, 937 ; also 1911, 688, and 1912, 492.)—W. E. F. P.

Phosphorus in vanadium steels; Determination of ——. E. W. Hagmaier. Met. and Chem. Eng., 1913, **11**, 28—29.

The steel is dissolved in *aqua regia*, the solution evaporated to dryness and the residue "baked," taken up in strong hydrochloric acid and the silica filtered off. The filtrate is reduced with sulphur dioxide. When reduction is complete, 5 c.c. of 90 per cent. acetic acid and 10 c.c. of a saturated solution of cerium chloride are added. Ammonia solution (one part of concentrated ammonia to three parts of water) is added drop by drop, with constant stirring, until turbidity is shown. The solution is then boiled, allowed to settle, and filtered. The cerium phosphate precipitate is washed five or six times with hot water and then dissolved off the paper with hot (1 : 1) nitric acid. The phosphorus is precipitated as usual with ammonium molybdate, the phosphomolybdate being weighed on tared filters. If too much ammonia is added, it has been found best to filter off the precipitate, redissolve it in hydrochloric acid, pass in sulphur dioxide, and reprecipitate the cerium phosphate. When more than 0·5 per cent. of vanadium is present, the cerium phosphate should be reprecipitated once, or twice if the amount of vanadium exceeds 1 per cent. The method is stated to be accurate as well as rapid, and figures given show good results on materials containing from 0·025 to 0·6 per cent. of phosphorus, in presence of vanadium.—R. W. N.

[*Copper, iron and steel.*] *Micrographical studies; a memoir on certain micrographical observations of practical interest for valuing and testing and for working metals by different methods.* Atelier des Essais de Métaux de la Cie. des Chemins de Fer P.L.M. Proc. Int. Assoc. for Testing Materials. Trans. Amer. Foundrymen's Assoc., 1912, 581—590.

(1) *Rapid estimation of arsenic in red copper.*—By etching the polished metal with pure nitric acid (at 22° C., for 5 or 6 secs.) black spots are developed, the abundance of which—it is stated—bears a direct relation to the arsenic content of the metal. By comparing the metal under examination with a prepared scale of standard specimens of known arsenic content, the percentage of arsenic present may be estimated (it is claimed) to within about 0·06 per cent.

(2) *Cutting steel with the oxy-acetylene blowpipe.*—When sheet or forged steel is cut by means of the oxy-acetylene blowpipe, a zone of higher carburisation is produced around the cut edges of the metal. Since in the cases examined the width of this zone was about 5 mm., the authors consider that the edges of all plates, etc., so cut should be removed for a depth of 10 mm. to ensure the absence of affected metal from the finished articles.

(3) *Effect of cold work on steel.*—As regards the effects, upon steel, of cold work due to threading screws of large diameters, the metal was found to be much harder in the neighbourhood of the thread than in the middle, the depth of the stratum affected being about 3 or 4 mm.; the ferrite present in this zone was found to be crushed and disseminated in fine needles. It is recommended that, after threading, all coupling-screws should be re-annealed at about 700° C.

(4) *Adulteration of wrought-iron* by the insertion of rolled cast steel in the "fagots" may be readily detected micrographically (it is stated), the pearlitic zones being better defined and more marked than when puddle steel has been introduced.—W. E. F. P.

Copper-zinc alloys; Tensile strength of ——. J. M. Lohr. J. Phys. Chem., 1913, **17**, 1—25.

The cast brasses investigated were prepared from the pure metals and contained from 47·5 to 100 per cent. of copper. The tensile strength of the quenched alloys was found to vary with their constitution: the highest values were obtained with the β brasses, but the maximum of these values did not occur on a boundary curve; in one case a tensile strength of 137,000 lb. per sq. in.—as taken from the fractured ends of the test-piece—was recorded. The tensile strength of the α brasses was almost constant, a maximum value of about 71,000 lb. per sq. in. being obtained with an alloy containing about 55 per cent. of copper. As regards ductility, a maximum elongation of about 36 per cent. was regularly obtained during the investigation: in one case the elongation exceeded 60 per cent., but this result could not be duplicated. It was found possible to produce cast brass having either (1) an ultimate tensile strength of 71,000 lb. per sq. in. and an ultimate elongation of 14·8 per cent.; or (2) a tensile strength of over 36,000 lb. per sq. in. and an elongation of 35·6 per cent. The influence of the temperature of pouring upon the tensile strength of the casting was also investigated and the most favourable pouring temperature found to be generally 100°—200° C. above that of the liquidus of the alloy.—W. E. F. P.

Copper and zinc; Electrical conductivity of alloys of ——. N. A. Puschin and V. N. Rjaschski. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1905—1918.

Investigation of the electrical resistance and its temperature-coefficient for alloys of copper and zinc gives results in general agreement with Shepherd's conclusions based on the melting-point diagram and on the micro-structure (see this J., 1905, 241). The system forms (1) the solid solutions: α, 0—36 atom. per cent.; β, 59—67 atom. per cent.; ϵ, 80—85·7 atom. per cent. and η, 91—100 atom. per cent. of zinc; (2) the mixed crystals: $\alpha+\beta$, 36—50; $\beta+\gamma$, 50—59; $\gamma+\epsilon$, 67—80 and $\epsilon+\eta$, 85·7—91 atom. per cent. of zinc. The existence of the solid solution β within narrow limits is regarded as a sign of the definite compound, ZnCu, slightly dissociated at the ordinary temperature. The results also indicate the probable existence of the two compounds, Zn_2Cu and Zn_6Cu.
—T. H. P.

Blast-roasting of sulphide ores. J. H. Levings. Inst. Min. and Met., Jan. 16, 1913. [Advance copy.]

From 1900 onwards satisfactory results were obtained with the Huntington-Heberlein process at Zeehan, Tasmania, where it was first used outside Europe. The ores contained lead and zinc. It was found that coarser limestone, up to 12 mm. size, could be used without detriment, and further experiments in connection with the Carmichael-Bradford process showed that iron and manganese oxides could be substituted for limestone with equally good results. Roasting was performed by lighting a fire in the pot and then filling with the mixture of ironstone and ore. It was found advantageous to give a preliminary roasting in mechanical furnaces, before pot-roasting, in the case of ores containing much over 10 per cent. of sulphur. The constituents of the ore mixture should be in the approximately correct proportions to form a slag. The shape of pot seems to exert a marked influence on the process. In one case, at another plant, attempts at roasting an ore consisting mainly of iron pyrites in silicious gangue, and containing 31 per cent. of sulphur, were made, after mixing the ore with 15 per cent. of iron and manganese oxides. The Mount Lyell type of pot was found to work well, while in Huntington-Heberlein pots very poor results were obtained, the product being soft, with much "fines," and containing 16·5 per cent. of sulphur, while the Mount Lyell pots yielded an almost solid cake with an average sulphur content of 8 per cent., a six-ton charge taking 12 hours to finish.—R. W. N.

Vanadium-aluminium alloys. N. Czako. Comptes rend., 1913, **156**, 140—142.

The author has obtained alloys with 30 to 80 per cent. of vanadium by reducing vanadic acid with aluminium in crucibles lined with magnesia. Alloys with a lower percentage of vanadium have been obtained by melting these products with aluminium in suitable proportions. Micrographic study of the alloys suggests the existence of the compounds, Al_3V, AlV, and AlV_2. The two former have been isolated from alloys of which they formed the main portion, by the regulated action of acids. It is not yet certain whether AlV_2 is a definite compound. Up to 10 per cent. of vanadium the alloys are still malleable.

From 20 to 25 per cent. they may be pulverised in a mortar. Up to 53 per cent. they contain numerous cavities which make it difficult to obtain a polished surface. The hardness increases with the percentage of vanadium up to 53 per cent., when it is between 6 and 7. With from 60 to 80 per cent. of vanadium the alloys are less hard and free from cavities.—W. H. P.

The system lime, phosphoric anhydride, silica. Nielsen. *See* VII.

Patents.

Steel or iron surfaces; Treatment of —— for hardening or otherwise, and apparatus therefor. W. S. Simpson, London. Eng. Pat. 20,917, Sept. 21, 1911.

In a process for alloying surfaces of steel or iron with other metals, hardening compounds, etc., to any required depth, the surface of the steel plate or other article, previously coated with the requisite quantity of alloying material in suitable form, is electrically fused in a high vacuum. Or, the alloying material may be fused in a separate chamber and then introduced into the vacuum furnace. Uniform heating of the surface is attained by moving the plate backwards and forwards beneath the electrodes, without breaking the vacuum, the under surface of the plate being water-cooled during the operation, if necessary.—W. E. F. P.

Steel ingots and the like; Casting ——. F. Kohlhaas, Düsseldorf, Germany. Eng. Pat. 19,657, Aug. 28, 1912.

With the object of preventing the formation of cavities in ingots of cast steel, etc., the casting-funnel employed is provided with a vertically-elongated slit-like discharge opening, and is of such construction that the molten metal issues from it (into the mould) in the form of a wide and thin stream which subsequently divides into a number of fine streams.—W. E. F. P.

Alloy of iron for electro-technical applications and process of preparation. W. Rübel. First Addition, dated July 10, 1912, to Fr. Pat. 429,758, May 16, 1911 (this J., 1911, 1219). Under Int. Conv., July 11, 1911.

The alloy of iron, for use in dynamos, is produced by adding small quantities of alkaline-earth metals or magnesium for the purpose of de-oxidation, the metals being added in the form of an alloy with copper.—B. N.

Iron and steel; Process and means for tempering ——. J. W. Boyd. Fr. Pat. 445,988, July 11, 1912.

The iron or steel to be treated is heated in a bath of molten potassium cyanide to which animal charcoal has been added. The latter is preferably prepared from leather and is added to the heated cyanide in small quantities at a time, until bubbles begin to be disengaged from the mixture. The quenching liquid is composed of a mixture of crude and refined mineral oil, palm oil and "Atlantic Red," and forms a layer floating on cold water. Variations in the degree of hardening are obtained by passing the steel quickly through the oil into the water on the one hand, and keeping it stationary in the oil on the other. —T. St.

Iron; Composition for quenching ——. P. Ledent and D. Wehrlin. Fr. Pat. 446,284, Sept. 27, 1911.

The quenching liquid consists of a dilute solution of nitric acid or a nitrate, in which are suspended china clay and lampblack, and containing in solution either arsenic, or a mixture composed of equal parts of potassium ferrocyanide (prussiate) and potassium bicarbonate.—T. St.

Iron; Manufacture of electrolytic ——. Soc. "Le Fer." Fr. Pat. 446,614, Oct. 6, 1911.

Currents of high density are employed, producing iron which is compact, smooth, of great purity, and with a maximum yield, the secondary reactions in the electrolyser being entirely suppressed. The electrolyte, of a ferrous salt such as the chloride, is preserved from contact with the air, and receives periodic additions of ferric oxide which acts as a depolariser, this substance neither during nor after its transformation having any action on the electrolyte.—B. N.

Ore concentration. G. A. Chapman and S. Tucker, London. Eng. Pats. 28,929, Dec. 22, 1911, and 12,171, May 22, 1912.

In a process for the concentration of metalliferous ores —especially those containing (earthy) carbonates—the ore is agitated with water containing a selective or frothing agent and an alkali bisulphate to effect the separation of the metalliferous portion by flotation. A mixture of normal alkali sulphate and sulphuric acid may be used instead of the bisulphate and, in either case, the solution is regenerated after use by a further addition of acid and also of the selective or frothing agent if necessary. —W. E. F. P.

Lead and zinc; Process for the treatment of sulphide ores, tailings and other residues containing ——. A. Richards, London. Eng. Pat. 3951, Feb. 16, 1912.

A mixture of the material with a reducing agent and a small quantity of sodium chloride and/or a suitable bromine-containing substance is subjected to a temperature sufficient to expel the zinc and/or lead as haloid compounds.—W. E. F. P.

Zinc; Manufacture of —— from low-grade ores and tailings. G. Evans. Fr. Pat. 446,713, July 31, 1912. Under Int. Conv., Aug. 3, 1911.

The tailings are first heated to redness on the hearth of a calcining furnace, and are then placed directly on the incandescent fuel which is fed with an upward draught. The volatilised zinc is condensed as oxide, and is prepared for further treatment in the usual way, either by compressing it into briquettes, or by agglomerating it with moist clay.—T. St.

Metallic packings; Manufacture of plastic ——. Fried. Krupp. Akt.-Ges., Essen, Germany. Eng. Pat. 17,648, July 30, 1912. Under Int. Conv., Oct. 25, 1911.

The metal to be employed (*e.g.*, an alloy of white metal and lead) is melted and poured out in a thin stream against which a current of compressed air or steam is directed; the stream is thus broken up into drops which, being forcibly propelled against a cool metal wall (flat or corrugated) become solidified in the form of thin flexible leaflets. The metal thus prepared is employed as usual in conjunction with suitable lubricating and binding agents. —W. E. F. P.

[*Copper, gold and silver.*] *Ores; Process for the treatment of ——.* J. Irving, Salt Lake City, Utah. U.S. Pat. 1,048,541, Dec. 31, 1912.

The process consists in agitating copper ores with dilute sulphuric acid while injecting steam into the mixture, passing the resulting solution through filters, sand and iron pyrites in succession and then over scrap iron to precipitate the copper, and re-oxidising the barren liquor by agitating and passing the same through a steam injector. The re-oxidised solution is employed as solvent for copper ores containing precious metals, these ores being mixed with sodium chloride before the solvent is applied, and the mixture of ore and solution agitated and heated by the injection of steam as before. From the solution thus obtained the copper and precious metals are precipitated (after filtration) by means of iron, the residual liquor being subsequently re-oxidised and strengthened by the addition of sulphuric acid for further use. —W. E. F. P.

[*Gold and silver.*] *Materials; Process of precipitating ——, from solutions.* D. Bosqui, Monahan, Wash., Assignor to Merrill Metallurgical Co. U.S. Pat. 1,049,560, Jan. 7, 1913.

In a continuous process for precipitating gold and silver from cyanide solutions, the two receiving vessels employed are alternately charged with the solution, the arrangement being such that the charging of one vessel and the discharge of the other occur simultaneously. The operating mechanism is actuated by means of floats within the vessels, and during the charging of the latter a predetermined quantity of zinc dust or other precipitant is automatically added, the mixture being subsequently agitated without materially disturbing the surface of the liquid.—W. E. F. P.

Zinc, lead, silver, gold and copper; Treatment of complex ores of ——. A. J. and R. J. Merle. Fr. Pat. 446,576, Oct. 4, 1911.

The crushed ore is melted with suitable fluxes in a furnace provided with powerful aspirators. The lead and zinc are volatilised and are thus separated from the other metals which are subsequently treated in the usual manner. By injecting a solution of glucose into the aspirators the lead and zinc salts contained in the gases from the furnace are retained. The glucose solution is run into settling tanks where the insoluble lead salts separate as a mud. The decanted solution is used again and again until sufficiently rich in zinc salts, which are then precipitated by the addition of lime.—T. St.

Metals; Apparatus for atomising ——. J. M. Neil, New York. U.S. Pat. 1,049,314, Dec. 31, 1912.

The apparatus consists of a furnace divided into two separately heated compartments by a horizontal partition upon which the melting-crucible is disposed; a vertical tube extends from the bottom of the crucible into the lower compartment and is bent upwards at its lower end, means being provided whereby a jet of atomising fluid is directed against the upward stream of metal issuing from the tube.—W. E. F. P.

Metal and mineral bearing materials; Process of treating ——. J. L. Malm, Denver, Colo. U.S. Pat. 1,049,746, Jan. 7, 1913.

While passing in a continuous stream through a suitable receptacle, the dry ore is subjected to the action of a halogen or other salt-forming gas. A cooling agent is introduced with the latter and the conditions are so adjusted that, during a single passage of the ore through the vessel, only a portion of the contained metal is attacked, the resulting salt being in the "-ous" condition.
—W. E. F. P.

Galvanising baths containing aluminium, and arrangements for the mechanical displacement of the plates during galvanising. C. Pletsch. Fr. Pat. 446,215, June 29, 1912.

When the feeding rolls are situated on the surface of the molten zinc, the floating scum is caused to adhere more or less to the plates, resulting in defective galvanising. This difficulty is overcome by having the feeding and withdrawing rolls placed above the bath, another pair of rolls being situated within the molten zinc if desired. Suitable curved guiding rods are suspended longitudinally in the bath. As the plates leave the bath a current of cold air is made to play upon them in order to cause the zinc to solidify quickly.—T. St.

Metals; Process and apparatus for preparing easily oxidisable ——. A. Zavelberg. Fr. Pat. 446,298, July 20, 1912.

In extracting zinc and similar metals in the furnace described in Eng. Pat. 16,821 of 1911 (this J., 1912, 591), the reaction chamber is heated to bright redness, the source of heat is withdrawn, and the ore charge is introduced.
—T. F. B.

Iron or steel; Treatment of —— *to prevent oxidation or rusting.* F. R. G. Richards. Fr. Pat. 446,701, July 31, 1912. Under Int. Conv., Aug. 2, 1911.

See Eng. Pat. 17,563 of 1911; this J., 1912, 1184.—T F. B.

Flue dust; Process of briquetting —— *and product of said process.* R. Hübner, Arlington, Vt., U.S.A. Eng. Pat. 16,092, July 9, 1912.

See U.S. Pat. 1,038,370 of 1912; this J., 1912, 992.—T.F.B.

Anode-mud resulting from the electrolytic refining of tin; Process of treating the ——. H. Wehrlin, Steglitz, Germany. U.S. Pat. 1,049,013, Dec. 31, 1912.

See Eng. Pat. 25,179 of 1911; this J., 1912, 591.—T. F. B.

Radium ores; Process of treating ——. S. Radcliff, Bairnsdale, Vic., Australia. U.S. Pat. 1,049,145, Dec. 31, 1912.

See Fr. Pat. 429,368 of 1911; this J., 1911, 1220.—T. F. B.

Zinc-furnace. A. Folliet, Brussels. U.S. Pat. 1,049,570. Jan. 7, 1913.

See Fr. Pat. 430,942 of 1911: this J., 1911, 1393.—T. F. B.

Zinc sulphide ores; Process and apparatus for treating ——. E. A. Ashcroft. Fr. Pat. 446,755, Aug. 1. 1912. Under Int. Conv., Aug. 28, 1911.

See Eng. Pat. 19,257 of 1911; this J., 1912, 931.—T. F. B.

Zinc; Metallurgy of ——. Imbert Process Co. Fr. Pats. 446,833 and 446,834, Oct. 11, 1911.

See Eng. Pats. 19,973 and 20,913 of 1911; this J., 1912, 542, 729.—T. F. B.

Cleaning the surfaces of articles made of silver and other metals; Method of and means for ——. A. Rosenberg, London. U.S. Pat. 1,049,603, Jan. 7, 1913.

See Eng. Pat. 17,150 of 1911; this J., 1912, 1185.—T. F. B.

Galvanisation process; Cold ——. E. Ballegeer. Fr. Pat. 446,112, July 17, 1912.

See Eng. Pat. 11,271 of 1912; this J., 1912, 882.—T. F. B.

Aluminium; Process for the direct nickel plating of ——. M. Chirade and J. Canac. Fr. Pat. 446,949, Oct. 14, 1911.

See Eng. Pat. 24,019 of 1911; this J., 1912, 394.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Electric heating; Use of resistances of metallic chromium in granular form, for ——. O. Dony-Henault. Comptes rend., 1913, **156**, 66—68.

Refractory metals such as chromium and probably molybdenum and tungsten, in the form of granular powders, may be used as substitutes for platinum in electric resistance furnaces. Platinum cannot safely be heated beyond 1600° C., whereas chromium may probably be carried to 2000°, molybdenum to 2500° and tungsten to 2900° C. The author has carried out experiments with chromium prepared by the alumino-thermal process, and then crushed, ground to a granular state, freed from iron by magnets, and finally sifted. Various means may be employed to render the metal conductive in this condition. If a layer of the granular chromium is covered with a thin layer of powdered Acheson graphite and the extremities are connected with an electric supply of 110 volts, a current will soon be set up through the metal. Again, if a quartz tube containing granulated chromium between two carbon plugs acting as electrodes, is connected with a 110 or 220 volt supply, no current passes: but if the walls of the tube are moderately heated by a Bunsen burner, a current starts suddenly after a short time and traverses the metal. Granulated chromium may be very satisfactorily applied to the heating of crucibles to very high temperatures. The crucible is embedded in a hole of the same shape in a refractory block of magnesia, with a fairly uniform layer (2—4 mm. thick) of powdered chromium between. The exposed surface of the metal is covered with an annular layer of graphite, and two carbon brushes are embedded in the metal, one on either side of the crucible, to serve as electrodes. With this arrangement the author heated a silica crucible of 100 c.c. capacity, to softening point. The current used was 15 amp., and the difference of potential between the electrodes 8—10 volts, but a higher E.M.F. was necessary to start the current through the metal (the author used 110 volts, but this may have been unnecessarily high). It was also found possible to raise to white heat a silica tube 50 cm. long and 28 mm. wide, enclosed in a similar but wider tube. The annular space between the tubes was filled with granular chromium, held in position by two carbon plugs. The difference of potential between the plugs was 15—50 volts. Another arrangement, very convenient for certain purposes, is to have the metal in the inner of two co-axial silica tubes, and use the intermediate space for the material (*e.g.* gases) to be heated.—J. H. L.

Anodic oxidation of ammonia in an acid medium in presence of silver salts. Scagliarini and Casali. *See* VII.

Patents.

Ozonifying; Process [and apparatus] for ——. C. S. Bradley, Assignor to R. B. Wilson, New York. U.S. Pat. 1,041,421, Oct. 15, 1912.

A combination of electrodes and dielectrics is arranged to form a number of condensers in series, in each of which a pair of ozonising spaces is provided for the passage of air or oxygen. The apparatus is enclosed in an air-tight casing fitted with an inlet and an outlet hood, the former containing a fan-like appliance, which is driven by atmospheric pressure, and the latter containing an air-pump, which is so operated as to cause the gases inside the apparatus to be maintained at a reduced pressure. The electrodes consist of thick aluminium plates containing perforations, through which a current of cold air may be passed; the dielectrics are preferably in the form of mica sheets, and spacing strips, also of mica, enclose the upper and lower edges of the dielectric sheets and extend some distance beyond the upper and lower edges of the electrodes, to prevent sparking from one electrode to another. In this way narrow ozonising spaces, closed above and below but open at the two ends, are formed between each pair of electrodes and the dielectric sheet, four surfaces being present in the spaces between each pair of electrodes, namely two electrode surfaces and two dielectric surfaces. Consequently the gases are exposed to a much greater ozonising surface than in the forms of apparatus in which the electrodes are secured upon the outer surfaces of the dielectrics. The cooling arrangement, rendered possible by the perforated electrodes, allows a high electromotive force to be used without rise of temperature, and the increased ozonising surface, the nearness of the electrodes to one another, and the reduced pressure of the gases under treatment, all tend to increase the amount of bombardment of the charged gaseous particles against the electrode surfaces, with resulting increase in the amount of ozonisation taking place. —O. R.

Electric furnace lining. Electric furnace member and process of making it. F. M. Becket, Assignor to Electro Metallurgical Co., Niagara Falls, N.Y. U.S. Pats. 1,049,801 and 1,049,979, Jan. 7, 1913.

The furnace lining or member comprises a refractory body of carbon having an adherent facing consisting essentially of tungsten or ferrotungsten. The facing is produced by coating the carbon with a tungsten compound, or with a fused mixture of tungsten and iron compounds, the latter being then caused to react with the carbon; or it may be formed by depositing the metal or alloy on the carbon from a molten bath and simultaneously cooling the body.—B. N.

Furnace; Electric transformer ——. J. Bally. Fr. Pat. 446,028, July 12, 1912.

The secondary circuit is composed of vertical wells or retorts, connected together by horizontal or approximately horizontal channels or by solid connecting pieces. These wells or retorts, as well as the channels or solid connections are arranged on a cylindrical surface, or on several concentric cylindrical surfaces, at the interior of which is the primary circuit. The latter is composed of several bobbins disposed radially around a central axis, and the whole of these bobbins may have a conical form so that they fit into a central cavity of the secondary. —B. N.

Furnace; [Electric] Resistance —— with alternating current. Ges. für Elektrostahlanlagen m. b. H. Fr. Pat. 446,355, July 23, 1912.

The sole of the furnace is of a continuous elongated form, the surfaces having a plane or concave contour, and the electrodes are embedded in the walls of the base. A biphase current, produced directly from the triphase current by means of the "Scott coupling," is employed, a greater density of current being thus obtained in the material to be melted. The conversion into biphase current is effected with the transformers of the same furnace. Three or four electrodes, in which the "Scott coupling" is utilised, may be employed for the production of arcs for the auxiliary heating of the furnace.—B. N.

Furnaces [for manufacture of nitrides]; Electric revolving ——. Leflaive et Cie. Fr. Pat. 446,978, Aug. 7, 1912.

The invention relates to a system of establishing tight joints between the fixed and movable parts of revolving electric furnaces. The side, opposite to the one where the gas enters the furnace, is subjected to the greater heat, and the joint is formed by two hollow steel crowns, water being circulated through one which is fixed, whilst the movable one is cooled by jets of water. The joint at the opposite side of the furnace is composed of two crowns provided with ribs or fillets, the latter being dovetailed and pressed together to form a gas-tight joint.—B. N.

Electrode; Multiple —— for electric furnaces supplied with polyphase current. C. A. Keller. Fr. Pat. 446,069, Sept. 21, 1911.

Several electrodes, arranged in juxtaposition, are insulated one from the other by a refractory filling, and bound respectively to the different phases or to the return conductor as the case may be. They thus form a single block easily manipulated, either for lowering, elevating, or inclining the electrode where it is necessary to increase the resistance of one and diminish that of the other. The multiple electrode is suspended by means of a metallic plate, flexible conductors being fixed above and rigid conductors below the plate, the latter conductors being bound to the electrodes in such a manner that these may be easily dismounted. Two cables, each passing round a separate windlass, serve to raise, lower, or incline the electrode.—B. N.

Electric furnaces; Induction ——. J. Bally, Grenoble, France. Eng. Pat. 16,040, July 9, 1912. Under Int. Conv., July 11, 1911.

See Fr. Pat. 432,151 of 1911; this J., 1912, 32.—T. F. B.

Carbon electrode for electric furnaces. B. Redlich, Assignor to Planiawerke A.-G. f. Kohlenfabr., Ratibor, Germany. U.S. Pat. 1,048,581, Dec. 31, 1912.

See Eng. Pat. 14,267 of 1912; this J., 1912, 1188.—T. F. B.

Electrodes; Means for joining ——. E. Viertel, Treptow, and H. Viertel, Assignors to Gebr. Siemens und Co., Lichtenberg, Germany. U.S. Pat. 1,049,624, Jan. 7, 1913.

See Eng. Pat. 6248 of 1912; this J., 1912, 691.—T. F. B.

Insulating composition and process of making the same. C. P. Steinmetz, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,049,005, Dec. 31, 1912.

See Eng. Pat. 21,987 of 1911; this J., 1912, 782.—T. F. B.

Chemical reactions in gases by means of an electric discharge; Process for effecting ——. H. Andriessens and J. Scheidemandel. Fr. Pat. 446,229, July 18, 1912.

See Eng. Pat. 16,296 of 1912; this J., 1912, 1083.—T. F. B.

Electric accumulators; Manufacture of ——. P. Marino. Fr. Pat. 446,750, Aug. 1, 1912. Under Int. Conv., Oct. 21, 1911.

See Eng. Pat. 23,265 of 1911; this J., 1912, 396.—T. F. B.

Process of electrolysing the chlorides of the alkali or alkaline-earth metals. Fr. Pat. 446,640. *See* VII.

Manufacture of moulded bodies refractory to fire and good electric conductors. Fr. Pat. 446,142. *See* VIII.

Alloy of iron for electro-technical applications and process of preparation. Addition to Fr. Pat. 429,758. *See* X.

XII.—FATS; OILS; WAXES.

Linseed oil; Detection of adulteration in ——. G. D. Elsdon and H. Hawley. Analyst, 1913, **38**, 3—7.

THE relationship between the iodine value and the oxygen absorption of oils has been previously pointed out. By determining the proportion of an oil remaining soluble n ether after oxidation under constant conditions, and considering the result in conjunction with the original odine value, it is possible to draw conclusions as to the purity of the oil:—Five c.c. of a solution of 2·5 grms. of he oil in 25 c.c. of ether are distributed over an Adams' coil, which is first allowed to stand over-night, and is hen placed on edge on a shelf near the bottom of a large team-oven. After 2 hours' drying the strip is extracted or 3 hours with ether (sp. gr. 0·720) in a Soxhlet apparatus, he extract evaporated, a little alcohol added to the residue, and the flask dried for 2 hours in the steam-oven. Ten samples of linseed oil thus examined yielded rom 14·0 to 19·2 per cent. of extract; colza oil, 100·6 per cent.; linseed oil with 20 per cent. of colza oil, 21·0 per cent.; and with 20 per cent. of seal oil, 31·6 per cent. The following equation has been calculated for he maximum permissible extract for linseed oil:

$$\text{Extract} = 81{\cdot}9 - 0{\cdot}35\ \text{I},$$

where I represents the iodine value (Wijs).—C. A. M.

Cocoanut oil; Alcoholysis and composition of ——. G. D. Elsdon. Analyst, 1913, **38**, 8—11.

COCOANUT oil was fractionated by a modification of Haller's process (this J., 1907, 328; 1908, 234), the arious constituents being separated as methyl esters, which were identified by physical and chemical tests. Complete separation of methyl stearate from methyl leate, by Haller's method of cooling the mixture in ice, ollowed by filtration of the solid stearate, was found to be mpossible. The process is too long for ordinary laboratory ork, and only gives approximately quantitative results within 5 to 10 per cent. of the true amounts). The esults obtained indicated that the fatty acids of the ample of cocoanut oil examined had the following approximate composition:—Caproic acid, 2; caprylic acid, 9; apric acid, 10; lauric acid, 45; myristic acid, 20; almitic acid, 7; stearic acid, 5; and oleic acid, 2 per nt.—C. A. M.

nseed oil. Chem. and Drugg., Jan. 25, 1913. [T.R.]

URING 1912 the price of Calcutta linseed fluctuated tween 72s. 9d. and 48s. 4d. per quarter, and that of oil tween £47 and £25 5s. per ton. During the last few weeks the price of oil has dropped to about £23. The distribution of the world's linseed shipments is shown in the table below:—

Year.	World's seed shipments.	Distribution.	
		U.K.	Cont. and U.S.A.
	tons.	tons.	tons.
1903	1,178,150	385,954	592,196
1904	1,523,426	505,519	1,017,907
1905	1,110,773	345,412	795,361
1906	1,080,883	286,140	794,743
1907	1,368,311	372,537	995,774
1908	1,432,186	382,169	1,050,017
1909	1,293,836	303,237	990,599
1910	1,153,923	236,066	917,857
1911	1,101,690	243,338	858,352
1912	1,127,424	257,294	870,130

This season's Argentine exportable surplus promises to be about double that of each of the previous two years, but practically the whole of this will be diverted to Europe, as well as the great bulk of the Indian supplies, apart from a considerable tonnage from Russia. The production of linseed for the last ten years is returned as follows:—

Year.	Argentina.	India.	U.S.A.	Canada.	Russia.
	tons.	tons	tons	tons	tons
1903 ..	937,601	481,367	682,513	21,100	461,314
1904 ..	740,000	571,832	585,013	13,388	471,836
1905 ..	591,912	347,400	711,944	18,342	421,000
1906 ..	825,764	353,400	626,500	25,588	540,500
1907 ..	110,710	425,200	646,275	43,301	550,590
1908 ..	1,048,852	163,200	645,125	79,133	500,339
1909 ..	716,515	297,700	487,817	120,829	558,360
1910 ..	595,000	527,600	317,950	100,974	650,000
1911 ..	572,000	563,600	484,250	196,675	670,000
1912 ..	1,130,000	641,200	701,825	528,505	650,000

There is thus an abundance of supplies to be dealt with this season, and it may be assumed that as supplies increase prices will decline yet further.

Wood oil; New sources of ——. U.S. Cons. Rep. Ch. of Comm. J., Feb., 1913. [T.R.]

WOOD oil is produced from the nuts of the "tungshu" tree (*Aleurites fordii*) of China, and at present practically the entire supply comes from that country. The normal price of this oil is 2s. 6d. per gallon, and in the fiscal year ended June 30, 1911, the United States imported about 5,000,000 gallons. The wood oil tree will grow along the Pacific coast, south of Sacramento, and in the Gulf States, possibly up into Georgia and South Carolina. As yet, however, there are no groves of these trees in the United States from which data as to the possibility of producing this oil in commercial quantities in that country can be obtained. Another possible source of supply is the kukui nut (*Aleurites moluccana*, or candlenut), which grows abundantly in Hawaii and the Philippines. These nuts yield an oil having the same properties and uses as wood oil, which was formerly exported in large quantities. If the nuts can be gathered and the oil extracted profitably, this oil should compete in the American market with Chinese wood oil.

Chinese wood oil; Methods of investigating —— W. Hoepfner and H. Burmeister. Chem.-Zeit., 1913, **37**, 18—19, 39.

ATTENTION is called to the widely differing figures recorded by previous investigators as analytical constants for Chinese wood oil; these variations are considered to be due to the inclusion of results referring to impure or adulterated oils or to oils which had undergone change during manufacture or storage. The authors have examined a number of samples of this oil, chiefly from

Hankow, and obtained the following results with oils which they consider to be genuine.

	Max.	Min.	Mean.	No. of samples examined.
Sp. gr. at 15° C.	0·9422	0·9365	—	—
Saponif. value	199	189	192	5
Iodine value (Hübl, 18 hrs.)	171	156	164·6	24
Refractive index at 20° C.	1·5202	1·5110	1·5175	24

Tables are given showing the effect upon these constants of the addition to the genuine wood oil of known quantities of likely adulterants such as tea-seed oil and soya bean oil. The authors are of the opinion that estimations of specific gravity and saponification value are of minor importance, but that the iodine value, refractive index and behaviour of the oil in the polymerisation test will afford valuable evidence as to the purity of samples of the oil. The authors recommend that the iodine value should be determined by the Hübl method (18 hrs.) as somewhat unreliable results are stated to have been obtained with the Wijs or Hanus methods (cf. A. C. Chapman, this J., 1913, 32). The refractive index was determined by an Abbé refractometer (as the figure obtained falls outside the Zeiss butyrorefractometer scale). The polymerisation test was carried out by Bacon's method (this J., 1912, 782) except that it is recommended the oil be heated for 12 minutes at 310° C.—R. G. P.

Plant fats ; Contribution to our knowledge of ——. C. Thomae. J. prakt. Chem., 1913, **87**, 144.

By direct vacuum distillation of the fat and wax-yielding parts of plants these constituents are obtained in a state of greater purity than by ether extraction. The peel or outer skin of apples, grapes, peaches, potatoes, lemons, cucumbers, oranges, also rose blooms and yeast can be treated in this way.—J. B.

Fatty acid mixtures ; Experiments on the fractional precipitation of ——. [*Detection of rape oil in mixtures.*] H. Kreis and E. Roth. Chem.-Zeit., 1913, **37**, 58.

A method of detecting rape oil, and possibly cocoanut oil, in admixture with other fats and oils, consists in treating an alcoholic solution of the mixed fatty acids with about one-tenth the quantity of lead acetate required for combination with the whole of the acids, and separating the fatty acids from the lead precipitate thus obtained. The fatty acids are then examined ; in the case of rape oil they will melt at about 30° C., have a mean molecular weight of about 340, and consist chiefly of erucic acid. Cocoanut oil yields a mixture of acids from the lead fraction having a melting point of about 37·5° C. and a molecular weight of 236. With other fats and oils the melting point of the fatty acids is above that of the two instances mentioned.—W. P. S.

Patents.

Hydrocarbons ; Process for the manufacture of saponifiable substances from —— *and of products obtained therefrom.* B. Benedix. Fr. Pat. 446,909, July 12, 1912. Under Int. Conv., July 12, 1911.

A hydrocarbon such as vaseline oil is intimately mixed in the presence of water with sodium peroxide or hydrogen peroxide diluted with alkalis or alkaline salts. After being stirred for some time the mass thickens and part of the hydrocarbon is transformed, apparently by oxidation, into acids which combine with the alkali present to form soaps. The reaction is promoted by the addition of alcohol to the mixture, and, if necessary, may be completed by heating the mixture under pressure at, *e.g.*, 80° C. The resulting products are in the form of soft pastes, which may be readily distributed in water and possess great detergent power.—C. A. M.

Soaps ; Cooling and solidification of ——. J. Mor Fr. Pat. 446,898, Aug. 3, 1912.

The soap is cooled and partially or completely solidifi in closed chambers into which air is admitted by mea of fans, pumps, etc., the rate of cooling being controll at will by regulation of the supply of air.—C. A. M.

Solutions of organic compounds giving emulsions wi water ; Liquid or solid ——. R. Vidal. First Additio dated Sept. 23, 1911, to Fr. Pat. 445,053, July 8, 19 (this J., 1912, 1190).

Organic compounds are dissolved in concentrated sol tions of alkali compounds of castor oil, with addition of higher alcohol or geraniol.—T. F. B.

Oils insoluble in water ; Process for incorporating —— *emulsions or in compounds soluble in water.* J. Smith. Fr. Pat. 446,570, Oct. 4, 1911.

Oils insoluble in water may be emulsified or formed in solutions with soluble compounds, by the aid of o soluble in water, such as Turkey red oil. The insolub oil and the soluble oil may be first mixed, and then t solution or emulsion added, or the soluble oil and t solution may be mixed, and the insoluble oil added la The process is particularly applicable to the bleach o process of colour photography, in which it is desira to use volatile oils as sensitisers for the dyestuffs ; t present process enables such oils to be incorporated wi gelatin solutions or emulsions.—T. F. B.

Oil from oleaginous stone fruits ; Method of and apparat for extracting ——. F. Krupp A.-G. Grusonwer Magdeburg-Buckau, Germany. Eng. Pat. 15,2 June 29, 1912. Under Int. Conv., June 30, 1911.

See Fr. Pat. 445,587 of 1912 ; this J., 1912, 1190.—T. F.

Internally coating vessels suitable for containing oil a oleaginous products ; Process for ——. C. Wenz burger, Antwerp. U.S. Pat. 1,049,626, Jan. 7, 191

See Eng. Pat. 781 of 1912 ; this J., 1912, 594.—T. F.

XIII.—PAINTS ; PIGMENTS ; VARNISHES RESINS.

Ultramarine compounds. L. Wunder. Z. anorg. Chem 1912, **79**, 343—349. (See also this J., 1912, 998.)

Ultramarine red, heated in the air, leaves a grey whitish ash ; but if air be rigidly excluded the product h a fine blue colour. There is a loss of weight of 7·43 p cent., due to the escape of water ; but this evolution water accompanies a change of constitution of the su stance, for the new blue gives off hydrogen sulphi when treated with acids, and sulphur is precipitate whilst ultramarine red under this treatment gives sulphur dioxide. Ordinary ultramarine turns viol when heated in hydrochloric acid gas containing chlori but the new blue is unchanged ; the author calls it bl of the second order. Heated with phosphorus a carbon tetrachloride in sealed tubes to 130°—140° C., it not reduced to white, but gives a dirty blue substan which regains its original colour when heated on charc before the blow-pipe. Treated with mercurous nitrate, yields a substance like that from the blue of the first ord but which on heating turns bright blue instead of yell The stability of ultramarines towards acids, alum solutio and "neutral" alum seems to be proportional to the sili content, and the new blue is hence much more resista to acids and alum than the blue of the first order ; it quickly destroyed, however, by boiling with neutral alu Heating the new blue in sealed tube to 180° C. with mercuro nitrate effected complete replacement of sodium mercury, and the resulting compound was canary-yell a confirmation of the author's view that the blue colo of ultramarines is dependent on the presence of sodiu

Ultramarine violet with silver nitrate gives a "loam-yellow" silver derivative free from sodium, which in turn is converted by potassium iodide into a dusky blue potassium-derivative, or by lithium chloride into a similar lithium-blue. No violet could be obtained from the silver derivative by treatment with water and sodium chloride or potassium iodide, but water and lithium chloride did yield a violet. The cadmium, lead, and ferrous derivatives all gave the same potassium blue as the silver derivative, and are hence doubtless all substitution-derivatives. Ultramarine red also yields metallic substitution derivatives, which show no trace of red when the sodium is completely displaced. The brown-grey silver derivative yields blues of the second order with haloid salts of potassium, lithium, or sodium. Melted with anhydrous boron trioxide it gives a yellow glass, sulphur dioxide being evolved. From the whole work the conclusion is drawn that the blue colour depends on three conditions:—1. There must be an alkali metal present. 2. Part of the sulphur must be directly combined with metal. 3. Part of the sulphur must be present in a low stage of oxidation. —J. T. D.

Red lead; Physico-chemical and technical studies on ——. J. Milbauer. Chem.-Zeit., 1913, **37**, 97. (See also this J., 1912, 193; 1913, 97.)

Though in most equilibrium-reactions there is an optimum temperature at which the equilibrium is pushed farthest in a given direction, rise of temperature giving a less favourable result, yet the reaction-speed is so greatly increased by rise of temperature that in a given case a result may be more quickly reached by reacting at first above the optimum temperature and afterwards lowering the temperature thereto, than by regulating the temperature so as never to rise above the optimum. Thus with commercial litharge at 460° C. a product containing 89·9 per cent. of Pb_3O_4 was obtained in 30 hours; practically the same (87·6 per cent.) product was obtained by 4 hours' heating at 500° C. followed by 5 hours at 460° C. Again, heating for 2 hours at 490°—500° C. gave a product with 52·4 per cent. of Pb_3O_4, whilst 8 hours at 460° C. gave one with only 45·0 per cent. Again, whilst increase of pressure of the oxygen has no effect on the ultimate equilibrium, it greatly increases the rate of absorption of oxygen by litharge; and experiments similar to these in the former paper (this J., 1913, 97) but in which commercial litharge was used, and compressed air passed through the apparatus at a rate of 10 litres per hour, showed that after one hour at 460° C., the product at 2, 4, 8, 12 atmospheres pressure contained 4·1, 15·1, 36·9, 60·2 per cent. of Pb_3O_4 respectively, whilst at atmospheric pressure the content was 1·2 per cent.—J. T. D.

Patents.

Vegetable albumin; Process for dissolving —— *in formic acid.* G. Diesser. Fr. Pat. 446,349, July 23, 1912.

The vegetable albumin, *e.g.*, gluten, is dissolved in an alkaline liquid and precipitated by the addition of an acid, and the resulting precipitate washed and dissolved in hot or cold formic acid. The solutions may be used for the production of films, etc., or for impregnating purposes or the like.—C. A. M.

Substances obtained by dissolving albumin in formic acid; Process for increasing the elasticity of ——. G. Diesser. Fr. Pat. 446,348, July 23, 1912.

An addition of formaldehyde is made to the formic acid solution (which may also contain other substances such as triacetin, diethylaniline, etc., used for the same purpose), with the object of preventing articles of albumin subsequently prepared from the solution from being brittle. —C. A. M.

Zein [Protein of maize]; Process for the industrial utilisation of ——. J. J. Geistdorfer. Fr. Pat. 446,840, Aug. 2, 1912. Under Int. Conv., Aug. 4, 1911, and Jan. 2, 1912.

An alcoholic solution of zein (the protein of maize) leaves on evaporation of the solvent a plastic layer which offers resistance to the passage of an electric current and is suitable for coating electric wires, cables, etc., and for the preparation of insulating plates, etc. The alcoholic solution may also be incorporated with other bodies such as a resin fused with naphthalene in a common solvent, with or without the addition of inert substances, or a certain proportion of oil may be added to render the products waterproof. If desired, the zein may be mixed with an oil and sulphur and vulcanised at 120° to 150° C. Strips of paper may be dipped in the solution (preferably containing resin and naphthalene) to obtain transparent films, which may be superposed to form plates of any thickness, or may be cut up and moulded into any desired shape, with or without the addition of inert colouring matters. Or the solution may be ground up with inert substances containing up to 15 or 20 per cent. of moisture and then pressed in moulds. In another modification the zein and other substances are precipitated by adding water to the solution, and the precipitate drained and pressed in the cold, with or without previous powdering. Or an addition of gums, etc., which soften when heated, may be made, and the mixture pressed in hot moulds to obtain products which harden on cooling.—C. A. M.

Enamelling of metallic pieces. P. Lapertot and J. Montabut. Fr. Pat. 446,859, July 31, 1912.

In order to obtain a uniform thick coating of enamel, in one operation, the pieces to be enamelled, such for example as the framework of a bicycle, are placed in revolving drums in the furnace.—H. H. S.

Paints or colours; Manufacture of [ready-mixed] ——. F. F. Bradley. Fr. Pat. 446,813, July 15, 1912.

See U.S. Pat. 1,032,652 of 1912; this J., 1912, 828.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Patents.

India-rubber; Process of and means for sheeting ——. W. Coulter, Manchester, and R. Bridge, Castleton. Eng. Pat. 29,057, Dec. 23, 1911.

The masticated rubber, or rubber dough, is spread by means of an adjustable gauge on to the surface of a smooth roller, from which it is removed by simple stripping, or by doubling, on to a spreading "apron," or on to an adhesive first-coated textile fabric. The apparatus described for effecting this purpose consists of a two-bowl calender, the top roller of which is fitted with a spreading-gauge; two auxiliary doubling rollers, which are movable and can also be employed as guide rollers; and the necessary batching rollers. It is claimed that a more uniform, more solid (air-free), and cleaner sheet is obtained than by either spreading direct or calendering direct on to a fabric or apron; that the amount of solvent required is less; and that the risk of damaging the valuable "apron" by nipping between gauge and roller is avoided.—E. W. L.

Resilient composition. C. H. Wilkinson, Huddersfield. Eng. Pat. 4944, Feb. 28, 1912.

A solution or paste of commercial rubber is dredged with powdered aluminium, aluminium alloy, or equivalent powdered metal, and the mixture is treated with a vulcanising liquid or other suitable liquid medium whereby the particles of metal become coated with vulcanised rubber. A part or the whole of the solvent is allowed to evaporate, and the vulcanised mixture is then blended with a suitable proportion of indiarubber or elastic substance or composition for producing commercial resilient articles and vulcanised or subjected to pressure in the usual way.—E. W. L.

Caoutchouc: Process for the production of substances similar to ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated July 12, 1912, to Fr. Pat. 434,989, Oct. 7, 1911 (see Eng. Pat. 1125 of 1911, this J., 1912, 241). Under Int. Conv., July 14, 1911.

In subjecting erythrene, its homologues, and analogous substances to the action of the alkali- or alkaline-earth metals, or mixtures, alloys or amalgams of these, as described in the principal patent (*loc. cit.*), it has been found advantageous to allow the whole or the greater part of the metal to come in contact only with the vapour of the hydrocarbon. Polymerisation is thereby accelerated.—E. W. L.

Caoutchouc; Production of substances similar to ——. Badische Anilin und Soda Fabrik. Fr. Pat. 446,600, July 27, 1912. Under Int. Conv., Jan. 26, 1912.

Butadiene or its homologues, or analogous compounds, or mixtures of these, are submitted to the action of organo-metallic compounds, in particular the alkyl derivatives of the alkali or alkaline earth metals or of magnesium. For example, 20 kilos. of isoprene are agitated with 4 to 5 kilos. of the crystalline compound of sodium-ethyl and zinc-ethyl. Contraction and thickening become evident within a few hours, and the product is isolated in the usual manner when these are at a maximum. Or, 20 kilos. of isoprene, 1 kilo. of sodium wire or ribbon and 3 kilos. of zinc-ethyl are agitated in contact in a closed vessel. In a short time, the sodium disappears and zinc separates, and the mixture becomes greenish-yellow in colour and solidifies or becomes very viscous. Or. 20 kilos. of 2·3-dimethylbutadiene are treated with 1 to 2 kilos. of metallic potassium and 1·5 to 3 kilos. of zinc methyl according to the second method.—E. W. L.

Chewing gums and composition of matter for same. P. M. Justice, London. From The International Chewing Gum Co., New York. Eng. Pat. 105, Jan. 1, 1912.

Chewing gums are prepared containing an extracted resin of rubber gum (*e.g.*, "pontianac"). Such rubber resins should be freed from objectionable impurities by washing and boiling with soda and sugar, heating, and sometimes blowing with superheated steam. To the purified resins may be added fatty substances, wax, flavouring and sweetening substances. and the composition may be used in combination with natural gums such as "chicle" or spruce gum.—J. F. B.

Caoutchouc articles; Process for the manufacture of cellular ——. H. Dogny and V. Henri, Paris. Eng. Pat. 173, Jan. 2, 1912. Under Int. Conv., Jan. 17, 1911.

See Addition of Jan. 17, 1911, to Fr. Pat. 422,118 of 1910; this J., 1911, 909.—T. F. B.

Rubber; Process for manufacturing ——. G. Reynaud. Fr. Pat. 446,244, Sept. 26, 1911.

See Eng. Pat. 27,802 of 1911; this J., 1912, 1087.—T. F. B.

Rubber; Process for extracting the resin from raw ——. M. Kochnitzky and A. Friedl. Fr. Pat. 446,742, Aug. 1, 1912. Under Int. Conv., Aug. 3, 1911.

See Eng. Pat. 17,726 of 1911; this J., 1912, 291.—T. F. B.

Caoutchouc; Process for making a substance analogous to ——. Ges. f. Teerverwertung m. b. H. Fr. Pat. 445,951, July 10, 1912. Under Int. Conv., Nov. 20, 1911.

See Ger. Pat. 248,178 of 1911; this J., 1912, 939.—T. F. B.

Vulcanised rubber; Process for making a product similar to ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 446,598, July 27, 1912. Under Int. Conv., Aug. 7, 1911.

See Eng. Pat. 2312 of 1912; this J., 1912, 651.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

[Hides;] Salt-stains [on ——]. A. Seymour-Jones. Collegium, 1913, 4—5.

At the London Congress of the International Association of Leather Trades Chemists, a sub-committee of the International Commission for the Preservation, Cure and Disinfection of Hides and Skins, was appointed to elucidate the problems of the so-called salt-stains. The author (Chairman of the International Commission) points out that the word salt-stains has been loosely applied to all defects and stains on salted hides and skins, irrespective of whether the defect or stain has been produced by the salt or by influences which may occur before or after the process of salting, and he suggests that clear and well-defined terms, which will cover and convey the correct definition of the particular form of stain produced, are to be desired. One important point to be determined by the sub-committee is a formula for an approved method of denaturing salt.—J. R. B.

[Hides.] Salt stains. J. H. Yocum. J. Amer. Leather Chem. Assoc., 1913, **8**, 22—28.

Skins salted in the winter months with clean salt seldom have stains, while those salted with clean salt in the summer are frequently stained. Pelts once packed, then taken up and repacked, are almost always stained, even if great care be taken. If the stains which appear after unhairing are touched with filter-paper moistened with strong acetic acid, the paper on removal will give a reaction for iron. The same test may frequently be obtained on stained leather, but on unstained portions no iron will be found. The conditions under which salting is conducted should be such that with clean salt the hæmoglobin or oxyhæmoglobin (of any blood remaining on the skins) will not be changed into hæmatin, which acts as a tanning agent and fixes the iron as an organic compound in the hide or skin, subsequently causing staining. When skins have been saturated with haemoglobin and subsequently salted with pure salt, stains develop on tanning similar to salt stains, and the same result occurs when sodium phosphate and calcium phosphate are contained in the salt. The author is of the opinion that the stains investigated by Abt (this J., 1912, 735) and Becker (this J., 1912, 829) are the result of improperly cured skins or of denatured salt or of skins being improperly prepared for salting. In the United States and Canada the salt is not denatured and there is no tendency to under-salt the skins, so it is probable that the stains are entirely due to the action of hæmoglobin owing to the blood not being properly washed out, or the use of too high a temperature during curing.—D. J. L.

Hides; Relation between the conductivity [and molecular weight] of acids and their absorption by ——. A. Brochet. Comptes rend., 1912, **155**, 1614—1617.

A series of experiments was made by shaking 10 grms. of hide powder with 200 c.c. of a solution containing 100 grms. of sodium chloride and 0·1 grm.-mol. of the acid per litre, for four hours, and the amount of acid absorbed was determined by titration. It was found that the acids of high conductivity, *viz.*, mineral acids, oxalic acid, and trichloro- and tribromo-acetic acids, were absorbed in proportion to their chemical equivalents, the amount absorbed per kilo. of dry hide powder varying between 0·80 and 0·89 grm.-mol. A similar proportion was observed in the case of the acids of medium conductivity (monochloro- and monobromo acetic, tartaric, lactic, citric, and formic acids) and those of low conductivity (acetic, succinic, valeric, and butyric acids), but in these cases the ratio was somewhat smaller, *viz.*, 0·69 to 0·80 and 0·54 to 0·65 grm.-mol., respectively. There is no exact relation between the conductivity of the acid and its absorption.—T. F. B.

Tannins; Analysis of ——. L. E. Levi and A. C. Orthmann. J. Amer. Leather Chem. Assoc., 1913, **8**, 40—42.

In a former article (this J., 1911, 1269) the authors gave results obtained by use of a reagent of the probable formula, $Cr_2(SO_4)(C_2H_3O_2)_2CrO_4$, as a precipitant for tannin, and comparative analyses of leached barks, etc., with this reagent and with the hide powder method are now given. Apart from the fact that the reagent does not precipitate non-tannin (gallic acid), it was found that it also does not precipitate the sulphite-cellulose extracts such as "Muskegon" and "Spruce." It was also observed that the addition of sulphite cellulose extract to tanning extracts increases the amount of insoluble matter.—D. J. L.

Tannin extracts [*mangrove and quebracho*], *Qualitative analysis of vegetable* ——. R. Lauffmann. Collegium, 1913, 10—14.

FOR the differentiation of mangrove and quebracho and for the detection of mangrove extract in quebracho extract, the author recommends the "molybdate figure" obtained as follows :—The tan solution is made to contain 4 grms. of tannin in 250 c.c., and 10 c.c. of this solution are mixed with 10 c.c. of the molybdate reagent (equal volumes of a 10 per cent. ammonium molybdate solution and a 15 per cent. ammonium chloride solution). The mixture is allowed to stand for 2 hours, filtered, and 10 c.c. of the filtrate are evaporated to dryness and the residue weighed. The precipitate on the filter paper is washed with hot water, in which it is soluble, and the washings collected along with the remainder of the original filtrate, evaporated to dryness and the residue weighed. The difference in weight between the two residues gives the weight of the precipitate. The amount of precipitate which corresponds to 100 parts of the tannin is calculated, and is called the "molybdate figure." For untreated quebracho extracts the figure varied from 28·7 to 37·3, and for sulphited quebracho extracts from 5·0 to 36·9, being lowest for the most highly sulphited extracts. For mangrove extracts the figure varied from 111·3 to 144·5. A quebracho extract which has a "molybdate figure" higher than 40 (higher than 30 for a sulphited extract) is concluded to be adulterated with mangrove provided that it does not contain pyrogallol tannins or sulphite cellulose liquors. The presence of the cellulose extract would be detected by the aniline test, and of a pyrogallol tannin by the formaldehyde-hydrochloric acid test.—J. R. B.

Alkali sulphides [*in lime liquors*] ; *Determination of* ——. D. McCandlish and J. A. Wilson. J. Amer. Leather Chem. Assoc., 1913, **8**, 28—33.

BLOCKEY and Mehd (this J., 1912, 369) proposed to replace zinc ammonium sulphate, used for the titration of sulphides in lime liquors, by a zinc sulphate solution containing ammonium chloride, and obtained the same results both in pure aqueous solution and in a saturated calcium hydroxide solution. In titration of standard sodium sulphide solutions in water and also in saturated lime water and using sodium nitroprusside as indicator, the authors found divergences from the theoretical quantity of solution required, amounting in some cases to 40 per cent. In pure aqueous solutions there was a considerable evolution of hydrogen sulphide, and as the indicator is unaffected by the latter the results obtained are low. When some of the standard zinc solution was added to a clear saturated lime solution there was a distinct precipitate of zinc hydroxide, which proves that the amount of free ammonia formed by the interaction of the lime and ammonium chloride is insufficient to prevent precipitation of zinc hydroxide. The zinc solution must be sufficiently alkaline and yet not contain too great an excess of ammonia. If enough ammonia be added to prevent the precipitation of zinc hydroxide, no error can result from this source, and only a minimum error will result from the removal of free zinc ions. This solution will give correct results with aqueous sulphide solutions. It is not an ideal solution for use with lime liquors, but has the advantage over the one containing ammonium chloride that it gives the same result for a given amount of sulphide with widely differing concentrations of calcium hydroxide. Abnormal results are obtained in strong sulphide solutions when using either the ammonium chloride or ammoniacal zinc solutions, owing to a coloured compound being formed from the sodium nitroprusside by zinc sulphide. As the reaction does not take place at concentrations less than $N/60$ the solution must be diluted to that concentration ; 25 c.c. of the strong solution are titrated to completion, to another 25 c.c. of the solution is added three-fourths of the amount of zinc solution required. The solution and precipitate are diluted to 100 c.c., filtered, and the titration completed with 25 c.c. of the filtrate, the last result being multiplied by 4 and added to that obtained for the first three-fourths of the solution. Neither the addition of ammonium chloride nor of ammonia to zinc sulphate furnishes a solution which will give correct results under all conditions.—D. J. L.

Tannery effluents ; Purification of ——. F. P. Veitch. J. Amer. Leather Chem. Assoc., 1913, 8, 10—22.

THE preliminary work for the installation of the sewage disposal plant at Gloversville, N.Y., U.S.A., led to the conclusion that about half the weight of hides and chemicals used in the making of leather found its way into the effluent, the quantity lost being at the rate of 30,000 lb. per day, or 9,000,000 lb. per year. Gloversville sewage, which contains 26 per cent. of tannery effluent, yields 2200 parts of dry sludge per million. Morrison (this J., 1911, 910) gives the quantity of suspended solids in tannery effluents at 800—3240 parts per million, of which 430—3080 parts consist of volatile matter, and the solids in solution as 840—2560 parts per million, of which 270—2600 parts consist of volatile matter. Figures from American sole-leather tanneries show, for tanneries handling 250—400 hides per day, a daily output of effluent of 14,000—25,000 gallons, containing 4400—7330 lb. of total solids, of which 1980—4350 lb. are from spent tan liquors, 600—1540 lb. from waste bleaches, and 380—860 lb. from beamhouse waste. The quantity of effluent to be purified and disposed of per day appears to be 8000—15,000 gallons per 100 hides worked in daily, being proportionately somewhat less for multiples of 100 hides. The average effluent from a 250-hide yard making sole or harness leather will vary around 25,000 gallons per day. The following recommendations for the disposal of sewage at Gloversville are of particular value, as this sewage contains a large proportion of tannery effluent : (1) That sedimentation be adopted as a preparatory method of treating the sewage. (2) That the effluent from the sedimentation process be filtered through sprinkling filters, either 7 or 5 feet in depth, at the rate of one million gallons per acre per day. (3) That the effluent from the sprinkling filters be passed through secondary sedimentation basins sufficient in capacity to reduce the quantity of suspended solids to 30 parts per million. (4) That if the filters are constructed 5 feet in depth the effluent from secondary sedimentation basins be filtered through sand filters at the rate of one million gallons per day. The systems of treating tannery effluents abroad are of two classes.—(1) mechanical and mechanico-chemical, and (2) oxidation and biological methods. The effluents are nearly always treated, before filtration, with ferrous sulphate, iron, alum, or aluminium salts or peat, and are then filtered through sand and finally through clarifying towers, basins, or wells. In Germany the process most used is that of König and Degener, in which peat is employed in a finely divided state and also lime, iron, or aluminium salts. Of the biological processes that of Dunbar is most used, but these methods can only be used when the mineral matter is low. The sludge from the settling tanks or the filter beds may be dumped on waste land, burnt or buried, or disposed of to farmers. Of the various systems of disposal the cost for sludge containing 90 per cent. of water is: covering land, 4 cents (2d.); dumping at sea, 10 cents (5d.); trenching in soils, 10 cents (5d.) ; pressing less than 10 cubic yards per day, 12 cents (6d) : pressing and burning, 36 cents (1s. 6d.). By pressing or centrifuging, the water in the sludge may be reduced from 80—90 per cent. to 60 per cent. The cost of drying by centrifuging, is given as 5—7 cents (2½d.—3½d.) per cubic yard, and the sludge may then be burnt in a destructor or further treated and used as a fertiliser. The dried sludge containing 50 per cent. of volatile matter and 1—3 per cent. of nitrogen should be worth 2—5 dollars

(8s. 4d. to £1 0s. 10d.) per ton in bags. In the discussion opinions were expressed that the estimate of effluent discharged was too low. Instead of 100 gallons per day per hide, it was estimated that the quantity was nearer 300—500 gallons.—D. J. L.

Patents.

Skins and hides ; Treatment of —— for the removal of fat, etc. F. H. E. Lehmann, Eilenburg, Germany. U.S. Pat. 1,048,709, Dec. 31, 1912.

See Eng. Pat. 4488 of 1909 ; this J., 1909, 1151.—T. F. B.

Tanning by means of iron salts ; Process for ——. J. Bystron and K. von Vietinghoff. Fr. Pat. 445,934, June 17, 1912.

See Eng. Pat. 13,952 of 1912 ; this J., 1913, 99.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soils : Mineralogical analysis of ——. W. H. Fry. J. Ind. Eng. Chem., 1913, **5**, 30—32.

In making a mineralogical analysis, a preliminary separation of the quartz, by means of heavy solutions, such as methylene iodide, is effected, and also of minerals containing magnetic elements. The component minerals are separated according to size of grain and the optical constants, etc., determined with a petrographic microscope. To obtain quantitative results a count of the minerals on the slide is made.—E. F. A.

Humus [in soils] ; Proposed modification of the official (U.S.A.) method of determining ——. O. C. Smith. J. Ind. Eng. Chem., 1913, **5**, 35—37.

In determining the humus content of soils it is found that if the sediment be shaken well and all of the soil possible transferred to the filter paper, a perfectly clear solution is obtained, without any addition. At first the filtrate may be turbid, but in time a clear filtrate is obtained. usually within 5 or 6 hours.—E. F. A.

Soil analysis ; Significance of the lime-magnesia ratio in ——. P. L. Gile and C. N. Ageton. J. Ind. Eng. Chem., 1913, **5**, 33—35.

Loew's statement that a ratio of CaO to MgO of 1/1 to 4/1 is the most favourable for plant life is not confirmed by observations on the soils of Porto Rico planted with pineapples and sugar cane. Soils with an exceedingly wide ratio may be exceptionally fertile.—E. F. A.

Nitrification ; Action of calcium sulphate on ——. S. Dezani. Staz. sperim. agrar., 1911, **44**, 119. Biedermann's Zentr., 1913, **42**, 65.

Calcium sulphate does not influence nitrification in liquid cultures and in artificial soil mixtures, it only accelerates nitrification in presence of an excess of clay. —E. F. A.

Phonolite meal ; Use of —— as a potash fertiliser. F. Schucht. Landwirtsch. Jahrbucher, 1912, **42**, 323. Biedermann's Zentr., 1913, **42**, 34—35.

This meal contains only 3·5 per cent. of potash soluble in acid, and cannot compete commercially with other potash manures.—E. F. A.

Calcium cyanamide [nitrolim] ; Behaviour of commercial —— on keeping and also in contact with naturol soils and colloids. G. Henschel. Diss. phil., 72 pp., Leipzig, 1912. Biedermann's Zentr., 1913, **42**, 33—34.

In dry sterilised earth cyanamide decomposes more quickly than it does in non-sterilised natural soil ; amongst the decomposition products are urea and dicyandiamide but no ammonia. In a number of different soils there was parallelism between the intensity of the decomposition of cyanamide in the sterilised soil and the rate of formation of ammonia in the unsterilised soil. A soil rich in humus afforded an exception. Cyanamide partly decomposes into urea on storage, without loss of nitrogen.—E. F. A.

Uranium and lead ; Influence of —— on vegetation. J. Stoklasa. Comptes rend., 1913, **156**, 153—155.

The author has studied the stimulating effects of small quantities of the nitrates of uranium and lead on the growth of green plants. In the case of *Melilotus albus* (white melilot) it was found that a quantity of uranium salt corresponding to 2·5 kilos. of uranium per hectare (2·2 lb. per acre) produced an increase in dry matter of 24 per cent. The favourable effect diminished as the amount of uranium salt was increased; even as much as 20 kilos. per hectare (17·8 lb. per acre) was not toxic, the improvement then being 9 per cent. With lead nitrate the crops investigated were *Avena sativa* (oats) and *Polygonum fagopyrum* (buckwheat). With the former the effect of the lead salt was at a maximum with 2·7 kilos. of lead per hectare (2·4 lb. per acre), giving an increased of 115 per cent. in the grain and 35 per cent. in the straw. With 8·2 kilos. per hectare (7·3 lb. per acre), the maximum quantity applied, lead was poisonous to oats, but not to buckwheat, which is less sensitive to lead salts. The maximum effect (58 per cent. increase in the grain and 16 per cent. in the straw) is obtained with 4·5 kilos. of lead per hectare (4 lb. per acre). These results have been confirmed by field trials.—W. H. P.

Patents.

Calcium cyanamide non-dusting ; Process of rendering ——. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,049,953, Jan. 7, 1913.

Calcium cyanamide is finely ground and briquetted with an organic binding agent having a manurial value, such as "stick water" ; the briquettes are crushed to the desired fineness and granulated by screening.—O. R.

Artificial manure [from leather] ; Manufacture of ——. O. E. Heschkel, London. U.S. Pat. 1,049,482, Jan. 7, 1913.

See Eng. Pat. 12,844 of 1910 ; this J., 1911, 1079.—T.F.B.

Treatment of night-soil. Fr. Pat. 446,613. *See* XIXb.

XVII.—SUGARS ; STARCHES ; GUMS.

Sampling [sugar cane] mill juices. W. C. Nieboer. Intern. Sugar. J., 1913, **15**, 17—19.

A sand-and-mud catcher, 5 ft. long, 5 ft. wide, and 3½ ft. deep, containing a partition reaching to 1½—2 ft. from the bottom, is interposed in the juice-gutter, whereby not only is the juice rendered homogeneous, but also largely freed from solid matter which might form a source of error in analysis or of inconvenience in working. In the sampling of the different mill juices sterilised vessels should always be used. (1) *First mill juice :* A sampling paddle-wheel, placed just after the sand-and-mud catcher, and very lightly constructed of tin or copper, is used. It has a hollow spindle, open at one end. This open end of the spindle projects outside the gutter, and under the opening is placed the container to receive the average sample. Two or three of the paddles, depending upon the quantity of juice to be collected, are fitted with a raised edge, and for their spokes hollow pipes are used. In this way a small and regular amount of juice is collected from the gutter and passed into the container. Since the juice contains some fine cane and bagasse, which may obstruct the passage of the liquid through the hollow spokes, a modification of the sampling wheel may be used. Instead of the juice passing by way of the hollow spoke of the paddle, that which is thrown up by the paddles is caught by a sloping channel placed across the juice gutter, which forwards it to the container. (2) *Mixed juice :* Two samples are taken : the first is collected by means of the sampling wheel, and the second is obtained by removing a fixed amount from each measuring or weighing tank, as these are filled. The two samples thus collected are analysed separately, and the average figures obtained are accepted as representing the true composition of the mixed juice. (3) *Last mill juice:* When maceration with the last mill juice is practised, and a pump is used for returning the liquid to the carrier between the first and second mills, an aspirator is used in the manner advised by Deerr; but when the juice is sent to the measuring or weighing installation by way of an open gutter, a sampling wheel is employed, as already described.—J. P. O.

Sugar in bagasse and cane; Determination of ——. Determination of water in bagasse. H. Pellet. Bull. Assoc. Chim. Sucr., 1912, **30**, 305—312.

For the determination of sugar in bagasse the author has found the apparatus of Zamaron (this J., 1898, 75) satisfactory, but when the bagasse is not sufficiently subdivided the extraction is incomplete and it is advisable to make an occasional final control extraction, and further to test for sugar in the water pressed from the exhausted bagasse. In using the apparatus described by Norris (this J., 1910, 1219) there is a loss of water during the digestion which necessitates a weighing after the operation. To obviate this the author arranges a cover on the digester, fixed by three screws, and made to fit tight with rubber. With this modification, the loss of water is only 1 or 2 c.c., which does not affect the final result. The bagasse is placed in a perforated copper basket as in Zamaron's apparatus, so that the whole may be placed in a small screw press fitted with a metal plate of the same diameter as the interior of the basket. The same apparatus may also be used for the determination of the sugar in fresh cane. The indirect determination of the fibre in the bagasse is sufficient in practice, but it may also be found directly by drying the residue after extracting the sugar as above. For this purpose special metallic dishes are used, thin at the bottom but with stout sides.—L. J. de W.

Beet sugar works; Determination of the polarisation of the products of —— by acid double polarisation. Comparison between the use of urea and hydrochloric acid and that of sulphurous acid. H. Pellet. Bull. Assoc. Chim. Sucr., 1912, **30**, 335—337.

Comparison was made between the polarimetric readings obtained (1) in the ordinary way with basic lead acetate, (2) with sulphurous acid (Pellet's method), and (3) with urea and hydrochloric acid, on a beet juice of 90 degrees of purity, a raw sugar, and a residual molasses containing 6·8 per cent. of ash. In each case the use of urea and hydrochloric acid did not allow of a precise and fixed reading being obtained. The highest reading was obtained when sulphurous acid was used, and this reading remained constant for a long time, thus showing the suitability of this method for comparison with the acid polarisation after inversion.—L. J. de W

Patents.

Saccharine juices, etc.; Process for purifying ——, especially in the preparation of lactose and other sugars, salts, etc., contained in solution. L. Bochet. Fr. Pat. 446,814, July 17, 1912.

The liquid is first heated in a vessel provided with a stirrer, and is then transferred to a second vessel in which it is heated under pressure so as to precipitate the coagulable matter without decomposing the sugar, etc. The heating in this second vessel is effected by steam introduced through a hollow shaft to a number of hollow discs mounted thereon, or the vessel may be fitted with vertical tubes which contain the liquid under treatment and are heated by steam externally; in either case the heating surface in contact with the liquid is rubbed by scrapers to prevent deposition of the coagulated matter. The heated liquid passes from the second vessel to a steam-heated vertical column at the same pressure; the coagulum settles to the bottom of this column, and the supernatant liquid is drawn off to a second column, which is not heated and in which a further deposition of solid matter takes place. Both columns are provided with helical or conical partitions to facilitate subsidence of the suspended matter. The liquid withdrawn from the top of the second column is subsequently concentrated *in vacuo*, and the pasty mass withdrawn from the bottom of both columns is transferred to a filter-press, the filtrate being added to the decanted liquid. The steam produced by heating the liquid in the second vessel, above mentioned, is utilised in heating the first vessel, the first column, and the evaporating apparatus.—L. E.

Sugar making products and processes of making the same. E. C. R. Marks, London. From The Simmons Sugar Co., Kenosha, Wis., U.S.A. Eng. Pat. 1736, Jan. 22, 1912.

See U.S. Pats. 1,040,561 and 1,040,562 of 1912; this J., 1912, 1089.—T. F. B.

Process and apparatus for stirring and transporting materials such as starch, clay, etc. Fr. Pat. 446,008. *See* I.

Process and apparatus for the extraction of materials in the distillery, sugar-house, etc. Fr. Pat. 445,976. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Production of acids by —— in the course of alcoholic fermentation. A. Fernbach. Comptes rend., 1913, **156**, 77—79.

A beer yeast and a wine yeast were cultivated in sugar solutions and in grape must in presence of different quantities of added tartaric acid (0—8 grms. per litre). The production of acidity by the yeast during fermentation was found to be dependent, in a very marked way, on the original acidity of the culture liquid; the higher this original acidity was, the less acid did the yeast produce.
—J. H. L.

Fermentation; Boiling ——. W. Windisch. Woch. Brau., 1913, **30**, 15—17.

The malts prepared from the barleys of 1911 have been found, in some cases, to yield worts which exhibit the phenomena of boiling fermentation and an abnormally high primary attenuation. In one brewery, in which boiling fermentation occurred with some regularity, the phenomenon was only observed in the case of weakly hopped worts, and the author suggests that it may be due, in part, to weak hopping. Owing to the deficiency of hop resins in the wort, a less compact and less durable yeast head is formed; this head settles long before fermentation is complete, and the boiling fermentation, which is normally hidden by the head, is exposed to view. Another cause contributing to the boiling fermentation may be the composition of the worts prepared from the 1911 malts. These worts appear to be characterised by high proportions of amides and amino-acids and low proportions, of peptones and albumoses. According to Fernbach, yeast utilises complex proteins for growth (cp. also H. T. Brown, this J., 1907, 884), and amides and amino-acids for the formation of zymase. Hence, the worts in question would tend to undergo a high primary attenuation and to yield a small crop of yeast which, owing to the nature of the wort and the deficiency of hop constituents, would settle prematurely.—L. E.

Fusel oils: Amyl alcohol content of raw ——. G. Heinzelmann. Z. Spiritusind., 1913, **36**, 14.

The author has applied the method of fractionation recently described (this J., 1912, 1142) to the analysis of four samples of fusel oil, I and II from yeast factories, III from a potato-spirit distillery, and IV from a sulphite cellulose factory. Their specific gravities were 0·8495, 0·8385, 0·8479, and 0·8408 respectively. On shaking with 3 vols. of calcium chloride solution of sp. gr. 1·225, the volumes absorbed were 33, 30, 18 and 14 per cent., whilst on shaking with 1 vol. of 15 per cent. sodium chloride solution, the volumes absorbed were 20, 20, 10 and 6 per cent. in the respective cases. Their amyl alcohol-contents were 52, 52, 77·8 and 60 per cent. by volume. Samples I and II yielded (from 1500 c.c.) 550 and 560 c.c. of distillate (chiefly ethyl alcohol) between 85° and 90° C., whereas III and IV yielded only 210 and 180 c.c. From these results it is evident that samples I and II had not been washed with water to remove ethyl alcohol. Sample IV (from sulphite cellulose liquors) differed from the others in possessing a very marked odour of turpentine, and on distillation it yielded a residue (b. pt. above 132° C.) of 148 c.c., whereas the other samples only yielded 41—55 c.c. In determining the amyl alcohol-content by this method, the results are not appreciably affected by variation in tho rate of distillation; if the latter process is rapid, a smaller amyl alcohol fraction is obtained by the first distillation, but a correspondingly larger amount is obtained on redistilling the earlier fractions after they have been salted out (*loc. cit.*).—J. H. L.

Citric acid; Formation of —— from glycerol by action of moulds [*Citromyces*]. C. Wehmer. Chem.-Zeit., 1913, **37**, 37—39.

Glycerol solutions (3—20 per cent.) with the addition of the usual quantities of nutrient mineral salts (ammonium nitrate, potassium phosphate, magnesium sulphate) were sterilised and inoculated with pure cultures of two kinds of *Citromyces*—A, isolated from an oxalic acid solution and used in previous citric-acid-fermentation experiments; and B, obtained from a solution of sulphuric acid (containing about 0·5 per cent. of free acid) used in the hydrolysis of cotton wool. Calcium carbonate was added to the cultures which were then kept at 25° C.: a green coating soon formed and a copious formation of calcium citrate in the form of a white crust at the bottom of the vessel was obtained in from 4 to 6 weeks. No evolution of carbon dioxide was observed and no formation of free acid took place in solutions not containing calcium carbonate. From the consideration that citric acid contains twice the number of carbon atoms that glycerol does, the author concluded that the citric acid can only be formed by synthesis, but was unable to identify the intermediate products, and, although substances reducing Fehling's solution were formed in some of the experiments, the author was unable to obtain any free citric acid by allowing *Citromyces* to act upon various sugars and throws doubt upon the results of previous investigators who state that citric acid is formed under these conditions. It appeared that calcium citrate was not formed by the direct action of citric acid upon the calcium carbonate, but the exact method of its formation is still obscure.—R. G. P.

Patents.

Distillery, sugar house, etc.; Process and apparatus for the extraction of materials in the ——. V. Raisin. Fr. Pat. 445,976, July 11, 1912.

The apparatus includes a trough divided into a number of compartments by transverse partitions which do not however, extend to the bottom. Each compartment is provided with a rotatable blade for conveying the material through the trough. The material is introduced into a compartment near to, but not at, one end of the trough, a sieve, situated below the surface of the extracting liquid, serving to retain portions of excessive size. The material is withdrawn from the other end of the trough by an elevator, and is sprayed at the time of its withdrawal by the extracting liquid, previously heated if desired. The liquid travels in the opposite direction, and since it is liable to entrain some of the material, the compartments succeeding that into which the material is introduced are fitted with blades of progressively decreasing size and working with progressively decreasing speed. These compartments hence serve as settling chambers; the clear liquid overflows and the entrained material which settles out is returned by the blades to the compartment into which the fresh material is charged. If required, a number of troughs may be arranged in series. —L. E.

Yeasts; Process for increasing the fermenting power of ——. A. Pollak. Fr. Pat. 446,903, Aug. 5, 1912. Under Int. Conv., Dec. 27, 1911.

One hundred kilos. of yeast are treated with a solution or suspension of 500 grms. of a preparation of hexamethylenetetramine and phosphoric acid or phosphates in 100 litres of water, or the yeast may be treated with a solution of hexamethylenetetramine alone. The yeast thus treated, which may be left in contact with the liquid until required for use, is much improved in respect of fermenting power and is much more resistant to autolysis. The hexamethylenetetramine preparation (250 grms.) may, alternatively, be added to the liquid to be fermented (100 litres).—L. E.

Alcohols, phlegms, wines, and other volatile liquid products; Apparatus for the continuous rectification of ——. E. Gazagne and M. Pingris. Fr. Pat. 446,746, Aug. 1, 1912.

The apparatus used for treating phlegms includes a regulator for the supply of liquid to be treated (see Fr. Pat. 420,666 of 1910; this J., 1911, 380) and two columns through which the phlegms are caused to descend in succession; the head products are removed in the first column, and the liquid is freed from alcohol and tail products in the second. The head products pass through concentrating and fractionating columns to a condensing coil, and means are provided (1) for returning any excess of condensed liquid to the head of the concentrating column, and (2) for withdrawing esters from the middle zone of the concentrating column. The vapours of alcohol and tail products pass to the bottom of a purifying column situated beneath a rectifying column and above a cistern containing a cooling coil or tubes. Between the purifying and rectifying columns is a plate on which the liquid condensed in the rectifying column collects; this liquid is conducted to the cooling cistern and returned to the top of the purifying column. The alcohol vapours pass from the top of the rectifying column through two fractionating vessels (*loc. cit.*), and the condensed alcohol from the second of these passes to another purifying column. The lower part of this last column contains a heating coil for freeing the alcohol from esters which are subsequently concentrated by passage through the second fractionating vessel and are then condensed. The apparatus used for treating wine differs from that above described in that the column which serves for removing the head products is directly superposed on that which serves both as a distilling column and for removing the tail products. Part of the vapour from this lower column serves to heat the upper one and to remove the head products, whilst the remainder passes to the purifying column and thence to the rectifying column; the liquid condensed in the two last-mentioned columns is returned to the distilling column.—L. E.

Water for brewing and malting purposes; Process for improving ——. E. Jalowetz, E. Richter, and A. Schückher, Vienna. Eng. Pat. 7669, March 29, 1912. Under Int. Conv., April 1, 1911.

See Fr. Pat. 444,962 of 1912; this J., 1912, 1196.—T. F. B.

XIXa.—FOODS.

Corn ensilage; Volatile aliphatic acids of ——. A. W. Dox and R. E. Neidig. J. Amer. Chem. Soc., 1913, **35**, 90—93.

The following are the average results obtained in the investigation of fifteen samples of corn ensilage. Of the total volatile acids present, 1 per cent. was formic, 87 per cent. acetic, 8·7 per cent. propionic, 3 per cent. butyric, and 0·3 per cent. valeric acid. Butyric acid was present in considerable quantities only in samples in which slight indications of spoiling were otherwise apparent. The only alcohols present were ethyl and propyl alcohols, in the proportion 10 : 1. Hart and Willaman (J. Amer. Chem. Soc., 1912, **34**, 1619—1625) found relatively large quantities of formic acid and methyl alcohol. They, however, distilled in steam an aqueous suspension of 100 grms. of the sample containing 10 c.c. of concentrated sulphuric acid, until 3 litres of distillate were obtained. Under these conditions lactic acid passes into the distillate, and the sulphuric acid present is liable to decompose cellulose and pentosans, thereby vitiating the results. The authors accordingly modified the method by (1) using ensilage-juice obtained by means of a Buchner press, instead of a suspension of the sample, (2) reducing the amount of sulphuric acid added, and (3) carrying out the steam distillation under reduced pressure at 80°—85° C.—J. H. L.

Copper; Determination of ——, in foods, by the spectrophotometer. E. Tassilly. Bull. Soc. Chim., 1913, **13**, 72—74.

The food is charred, the char digested on the water-bath with 2—5 c.c. of sulphuric acid for an hour, triturating occasionally; water is added, the mass filtered, and the residue washed. The copper is precipitated by thiosulphate, the washed precipitate calcined to oxide, this is taken up by 1—1·5 c.c. of sulphuric acid and a drop or two of nitric acid, and evaporated to dryness. The residue is dissolved in water, 2 c.c. of a solution of potassium ferrocyanide added (0·07 grm. of the crystallised salt per c.c.), made up to 100 c.c., and examined in the spectrophotometer, the instrument having been calibrated by a solution of copper of known strength.—J. T. D.

Apple constituents; Contribution to our knowledge of ——. C. Thomae. J. prakt. Chem., 1913, **87**, 142—144.

A wax similar to beeswax, melting at 68·5° C., is obtained by extracting with ether, apple peel which has been treated with dilute sodium carbonate solution. Another substance of high melting-point, insoluble in cold ether, is also extracted. A crystalline substance with an apple-like odour is obtained by extracting the peel not previously treated with sodium carbonate and distilling the crude extract *in vacuo*. The wax, along with other substances, can also be obtained by distilling apple peel under reduced pressure.—J. B.

Plant fats. Thomae. *See* XII.

Patents.

Beverage extracts. Grape Nuts Co., Ltd., London. From W. H. Post, Battle Creek, Mich., U.S.A. Eng. Pat. 3010, Feb. 6, 1912.

Cereals or cereal products, such as bran, are mixed with saccharine materials (molasses, sugar, etc.) and roasted until the sugar is caramelised. The product is then extracted with water, the infusion is concentrated under reduced pressure at about 50° C. until it contains from 30 to 50 per cent. of solids, and is finally dried on rotating drums at 60° C., the drums being mounted in a chamber from which the air is exhausted. The dry product is then removed from the surface of the drums and ground; it forms a beverage when mixed with water.—W. P. S.

Chocolate; Process for the manufacture of porous ——. R. Dierbach, Hamburg. Eng. Pat. 15,120, June 28, 1912.

A mixture, consisting of sugar, 70, water, 5 to 10, and cocoa mass (containing from 50 to 55 per cent. of fat), 30 parts, is worked up in a roller grinding mill: the resulting thin sheets of chocolate are then scraped from the rollers and collected in a receptacle wherein they unite to form a mass of porous chocolate.—W. P. S.

Milk; Process of desiccating ——. L. C. and I. S. Merrell, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,048,463, Dec. 24, 1912.

Milk is concentrated under reduced pressure at a temperature below 212° F. (100° C.) until it forms a viscous liquid; the latter is then dried completely by conducting it in the form of a thin layer on to the surface of rotating cylinders heated above 212° F. (100° C.), the dry milk being, finally, removed from the cylinders.—W. P. S.

Albumin; Process of producing a soluble, digestible, and easily assimilated ——. C. U. Dahle, Fredriksvaern, Norway, Assignor to Nyegaard & Co., Christiania, Norway. U.S. Pat. 1,048,949, Dec. 31, 1912.

Casein is heated for some time to a temperature of 105°—125° C. in the presence of sodium chloride, one or more glycerophosphates, and moisture.—W. P. S.

Coffee-substitute; Preparation of a —— from soya beans. H. Buer. Fr. Pat. 446,237, July 18, 1912.

Soya beans are washed with cold water and passed into a continuous roaster at 160° rising to 190° C., when the water contained in the beans is evaporated and the kernel begins to turn brown. They are then rapidly cooled and heated again to 210°—230° C., when they swell up and become porous. Then they are passed into a rotatory sifting drum to remove tarry matter, moistened with steam, and dried by an exhauster which prevents the formation of an extract by the condensed steam. This is repeated three times, when all the tar is removed. Finally the beans are dried at about 165° C.—J. H. J.

Butter; Making and preserving ——. J. M. W. Kitchen, East Orange, N.J., and O. von Bernuth, New York. Eng. Pat. 8311, April 6, 1912.

See Fr. Pat. 442,281 of 1912; this J., 1912, 947.—T. F. B.

Milk; Process of desiccating ——. E. Passburg, Berlin. U.S. Pat. 1,049,141, Dec. 31, 1912.

See Fr. Pat. 378,051 of 1907; this J., 1907, 1106.—T. F. B.

Milk, cream, and the like; Process for extracting lecithin from —— to obtain an increased yield of butter. Fricke und Witte. First Addition, dated May 6, 1912, to Fr. Pat. 410,819, Dec. 30, 1909.

See Eng. Pat. 10,972 of 1912; this J., 1912, 835.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Lead, copper and zinc; Detection and colourimetric determination of —— in tap-water. L. W. Winkler. Z. angew. Chem., 1913, **26**, 38—44.

The colourimetric sulphide test for small quantities of lead as usually carried out in acetic acid solution is interfered with by the presence of copper. In alkaline solution the addition of potassium cyanide will prevent any colouration by copper or iron. In both cases, but particularly in acid solution, the colouration is much intensified by the presence of a moderate quantity of an electrolyte, such as ammonium chloride. The best sulphide reagent is a 10 per cent. solution of crystallised sodium sulphide ($Na_2S.9H_2O$) which will keep perfectly in a bottle closed with a well-fitting paraffined cork. Not more than 2 or 3 drops of this to 100 c.c. of water should be added as the sulphur which separates when larger quantities are used interferes with the reaction. If too much potassium cyanide is used, the reaction is not so delicate. 2 or 3 drops of 10 per cent. solution to 100 c.c. of water are usually sufficient, and the solution must then be allowed to stand for a short time, till all the iron is converted into ferrocyanide. When quantitative determinations are being made the colour comparison is best carried out by adding from a burette a lead nitrate solution of known concentration to a blank preparation until the colour is matched. This is much better than preparing a series of standards. The author recommends that the determination of lead should be carried out twice as follows: (*a*) 100 c.c. of water are treated with 10 c.c. of a solution containing 20 per cent. of ammonium chloride and 2 per cent. of acetic acid. The sodium sulphide is then added, and the colour matched in a similar preparation from distilled water with lead nitrate (1 c.c. = 1 mgrm. of lead.). (*b*) 100 c.c. of the water, which must be quite clear, are treated with 2 or 3 drops of potassium cyanide (10 per cent.) and after 2—3 minutes, 10 c.c. of a solution containing 20 per cent. of ammonium chloride and 5 per cent. of ammonia are added. The colour comparison is then made and if the value from (*b*) is less than that from (*a*), copper is present, and the lower value is correct. When the water is not clear or if it has been allowed to stand, there are certain irregularities in the determination of lead. Any precipitate which settles on standing will carry down lead, and if the solution is filtered through paper some of the dissolved lead is retained. In such cases the whole of the water sample is filtered through a small plug of cotton wool, and the residue dissolved by washing the vessel and the filter with warm dilute hydrochloric acid. If the volume of the original vessel is known, the quantity of lead obtained in the precipitate can be added to that determined in a portion of the filtrate. The carrying down of lead by colloidal precipitates such as ferric hydroxide or aluminium hydroxide suggests such a precipitation as a method of removing small quantities of lead from drinking water. For the determination of small quantities of copper, about 0·2 grm. of potassium bicarbonate and one or two drops of potassium ferrocyanide (1 per cent.) are added to 100 c.c. of water. The red colour is matched by adding a copper sulphate solution of known concentration from a burette. If copper and lead are present together, 2 or 3 drops of potassium cyanide (10 per cent.) are then added to both solutions, which turns the red colour to greenish yellow $\{Cu_2Fe(CN)_6 + K_4Fe(CN)_6 + 4KCN = 2KCu(CN)_2 + 2K_3Fe(CN)_6\}$. These solutions are then treated as in method (2) above for lead. The blank test becomes colourless, and the one containing lead gives the lead sulphide colouration which can be matched by adding the necessary quantity of lead nitrate to the blank. In this way quantities of the order of 1 mgrm. per litre can be detected. For still smaller quantities, 500 c.c. of water are treated with 1 grm. of ammonium chloride, 2 drops of sodium sulphide, and 0·1 grm. of alum, and warmed on the water-bath. The aluminium hydroxide carries down all the lead and copper sulphides, and the ammonium chloride prevents the separation of calcium or magnesium. The liquid is filtered through a small cotton wool plug (0·2 grm.), the precipitate dissolved in warm dilute hydrochloric acid containing a little bromine. The solution is evaporated, and the residue treated with 0·5 grm. of tartaric acid to dissolve any zinc sulphide, and 0·1 grm. of sodium acetate dissolved in 5 c.c. of water. After standing for a day in a small corked flask the mixture is filtered through cotton wool (0·02 grm.) washed with hydrogen sulphide solution, and the precipitate again dissolved in hydrochloric acid and bromine water. After evaporating with a little (0·1 grm.) potassium nitrate it is dissolved in 10 c.c. of water and the colourimetric tests for lead and copper made as described above. If the reagents are all pure, as little as 0·01 mgrm. of copper or lead can be determined in this way using a litre of water. Distilled water which had run through a brass tap was found to contain 0·055 mgrm. of copper per litre. To detect small quantities of zinc, 1 litre of water is treated with ammonium chloride, sodium sulphide, and alum as above, potassium bicarbonate being added if the water is very soft. The precipitate is filtered off and dissolved in the same way, and the solution evaporated with a few drops of nitric acid. It is again moistened with hydrochloric acid and evaporated. The residue is dissolved in 1 c.c. of *N*/1 hydrochloric acid and washed into a small flask with 10 c.c. of concentrated hydrogen sulphide solution. After standing a day the solution is filtered from the lead and copper sulphides through a small paper filter. After washing with hydrogen sulphide 2 c.c. of concentrated acetic acid and 2—3 c.c. of 15 per cent. ammonium acetate are added which gives in the presence of zinc a cloudy solution. As little as 0·1 mgrm. can be detected. For quantities of zinc of 1 mgrm. or greater, the author has found it feasible actually to separate and weigh the zinc as oxide, checking its purity by dissolving in concentrated hydrochloric acid and evaporating on the water bath. This converts the oxide into the normal chloride in which the chlorine can be determined by titration. If the quantity of zinc is very small the opalescence is compared with those obtained in distilled water samples containing varying quantities of zinc. The zinc solution is added to the standard tests before the ammonium acetate. In this way water taken from the mains through a brass tap was found to contain 0·15 mgrm. of zinc per litre.—W. H. P.

Iron in waters ; Determination of ——. E. Tassilly. Bull. Soc. Chim., 1913, **13**, 34—37.

One hundred c.c. of the water are treated with 20 c.c. of hydrochloric acid and about 0·5 grm. of potassium chlorate, and boiled until chlorine ceases to be evolved ; the mixture is then cooled, 20 c.c. of a 1·7 per cent. potassium thiocyanate solution are added, and the whole is diluted to a volume of 100 c.c. The coloured solution obtained (if iron be present) is examined in a Féry spectro-photometer and the quantity of iron present is found by comparison with solutions containing known amounts of the metal. In the presence of a large excess of the thiocyanate the absorption measured in the spectro-photometer is proportional to the amount of iron in the coloured solution. —W. P. S.

Water analysis ; Use of potassium palmitate in ——. C. Blacher, P. Grünberg, and M. Kissa. Chem.-Zeit., 1913, **37**, 56—58.

In the determination of the hardness of water by means of potassium palmitate solution (see this J., 1912, 555), a 1 per cent. solution of dimethylaminoazobenzene in alcohol is recommended as the indicator in the preliminary titration of the hardness due to bicarbonates. Sulphates in water may be determined by adding a known excess of *N*/10 barium chloride to 100 c.c. of the neutralised water, removing the barium sulphate by filtration, and titrating the filtrate with the potassium palmitate solution, as described ; the amount of the latter required corresponds with the total hardness of the water *plus* the excess of barium nitrate solution, and the quantity of sulphate precipitated may thus be calculated. The hardness due to magnesium salts may be determined by treating the neutralised water with a known quantity of lime-water, removing the precipitate, and titrating the solution with potassium palmitate solution.—W. P. S.

Purification of tannery effluents. Veitch. *See* XV.

Patents.

Water ; Apparatus for purifying —— *or for like purposes.* W. Paterson, London. Eng. Pat. 28,179, Dec. 14, 1911.

In apparatus for treating water under pressure with a reagent solution, compressed air is admitted to the reagent tank so that the contents of the latter are placed under approximately the same pressure as the water to be treated. The air may be admitted at the bottom of the tank in order to mix the reagent. A pump, controlled by the water-measuring device, is provided for introducing the reagent into the water.—W. P. S.

Waters ; Purification and filtration of potable and industrial ——. G. C. E. Liot. Fr. Pat. 446,383, July 24, 1912.

The water is led into the lower part of a cylindrical tank with a conical bottom and carrying a cover containing the purifying solution under air pressure. As soon as the water enters the cylinder it meets the appropriate amount of purifying liquid brought down from the cover by an interior pipe, when immediate precipitation takes place, the precipitate being led away by a pipe at the bottom of the cone. The purifying agents used may be oxalates, permanganates, carbonates, etc. The clarified water passes upwards through a thin layer of filtering material, to remove organic matter, into a second compartment of the tank, from which it passes again upwards into a third compartment containing another thin layer of filtering material, after passing through which it is led away by a pipe to another tank which forms the first filter tank proper. This is a cylindrical tank with conical bottom and with an annular basket of filtering material in its upper portion. The water passes horizontally through the filtering material, which may be charcoal or the like, into the central space, from the bottom of which it is led by a pipe into a second similarly constructed tank with the filtering material of finer grade. The treatment completely removes the impurities from the water.—J. H. J.

Sewage sludge ; Apparatus and method for the obtainment of concentrated ——. J. Grossmann, Manchester. Eng. Pat. 28,328, Dec. 16, 1911.

Ordinary sewage sludge is conducted daily from a settling tank into a secondary tank, layers being formed in the latter corresponding with each day's supply. At the end of a certain period, say seven days, the bottom layer is removed by means of a screw conveyor or other device fitted at the bottom of the tank ; this layer will consist of concentrated sewage sludge. The tank is used continuously, a top layer being added daily after the lowermost layer has been removed. Drainage may be provided for at the upper part of the side of the tank and chemicals may be added to the sludge, if desired.—W. P. S.

Organic liquids ; Purification and decolourisation of ——. A. D. Devos. Fr. Pat. 446,549, July 26, 1912.

For the decolourisation of organic liquids of vegetable or animal origin, the use of aluminium amalgam or other amalgam, is claimed. A sufficient quantity of the amalgam is put into the liquid at 50°—60° C., when rapid decomposition of the water present takes place, and the nascent hydrogen reduces the organic impurities, while the nascent oxygen oxidises the metals of the amalgam. The oxides of the metals carry down the gelatinous precipitate of organic matter formed. The liquid is now easily filterable. —J. H. J.

Night-soil ; Treatment of ——. H. Simonin Fr. Pat. 446,613, Oct. 6, 1911.

The night-soil is passed through a rotatory grate into a mixer and has added to it a salt of zinc or iron to fix the hydrogen sulphide, and also sufficient acid to neutralise it. The mixture is heated to 80° C., and allowed to settle. The liquid portion is then filtered, concentrated, and converted into a solid manure. At the same time, the deposit is dried in the same manner, or is mixed with peat to form a manure. In a modification of the process, the addition of acid is omitted, and in the concentration the ammonia given off is recovered. The solid manure thus obtained, although containing phosphates and potash as before, is poor in nitrogen.—J. H. J.

House-refuse and night-soil ; Combustion of ——, *and utilisation of the gas in the production of steam.* Maschinenbau-Anstalt Humboldt and A. Fried. Fr. Pat. 446,709, July 31, 1912.

The furnace has a chamber in communication with it, into which the refuse is drawn after gasification has taken place. The furnace is immediately recharged and at the same time fresh air is sent over the incandescent material, so that the gases produced pass over the clinker and are mixed in the chamber with the heated fresh air and both burn together. The combustion gases then pass to the steam-raising chamber. The furnace may have attached also a chamber for cooling the clinker and heating the air, and a pair of blowers for admitting a regulated quantity of air which mixes with the burned air and deposits the dust before passing to the chimney. In the blowers admitting the air is a valve worked by a non-circular disc. There is also an arrangement for utilising the heating value of the gases by passing them around a vertical bundle of water tubes connecting upper and lower horizontal boilers.—J. H. J.

Insecticides, sheep-dip, vermifuges, and the like. I. S , J., and S. McDougall, Manchester. Eng. Pat. 8322, Apr. 6, 1912. Addition to Eng. Pats. 3204, Feb. 8, 1911, and 10,215, Apr. 27, 1911 (this J., 1912, 601, 658).

In place of an aqueous extract, a powder prepared by grinding the roots, barks, or other portions of the plants mentioned in the previous patents (*loc. cit.*), is mixed with the other ingredients to form the insecticide or sheep-dip.—W. P. S.

Disinfecting composition ; Solid ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 1,048,815, Dec. 31, 1912.

The disinfectant consists of a mixture of Russian turpentine, cresol, mineral oil, rubber resin sodium stearate, sodium resinate, and water.—W. P. S.

Purifying liquids by centrifugal action ; Method and apparatus for ——. A. Dahlhaus, Dortmund, Germany. Eng. Pat. 22,406, Oct. 2. 1912.

See Fr. Pat. 445.216 of 1912 ; this J., 1912. 1198.—T. F. B.

Sea-water evaporator. W. Weir, Glasgow. U.S. Pat. 1,049,014, Dec. 31, 1912.

See Eng. Pat. 2812 of 1912 ; this J., 1912. 792.—T. F. B.

Refuse ; Apparatus for destroying ——. O. Uhde. Hamburg, Germany. U.S. Pat. 1,049,947. Jan. 7, 1913.

See Eng. Pat. 16,781 of 1911 ; this J., 1912, 252.—T. F. B.

Sterilisation of fermentable liquids ; Apparatus for the ——. D. L. V. Browne. Fr. Pat. 446,001. Sept. 19, 1911.

See Eng. Pat. 21,332 of 1911 ; this J., 1912. 744.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Cinchona ; The root bark of ——. L. Rosenthaler. Apoth.-Zeit., 1913, 28, 33—34, 41—42.

Botanical descriptions, including the microscopical appearance, are given of the root bark of the following species : *Cinchona succirubra, C. robusta, C. ledgeriana, C. ledgeriana succirubra.* Determinations were made of the moisture, total alkaloid, crude fibre, starch, total nitrogen, extract (soluble in alcohol), average molecular weight of extract, ash (including solubility in hydrochloric acid, and alkalinity), and the metals present in the latter. These determinations were also made upon the bark from the stem of *C. succirubra.* The results led to no satisfactory method of distinguishing between dried bark obtained from either the root or the stem.—F. Shdn.

Sparteine ; Constitution of ——. C. Moureu and A. Valeur. Comptes. rend., 1913, 156. 108—109. From Ann. chim. phys., Nov. and Dec. 1912).

The results of the extended work of the authors lead to the definite formula of $C_{15}H_{26}N_2$ for sparteine. It is a bi-tertiary base, not methylated. Each atom of nitrogen is held by its three valencies in a double closed chain. The discovery of isosparteine has led to the recognition that sparteine contains a piperidine nucleus, while isosparteine has a pyrrolidine nucleus.—W. H. P.

Epinephrine [adrenaline] ; A new colourimetric method for the determination of ——. O. Folin, W. B. Cannon, and W. Denis. J. Biolog. Chem., 1913, 13. 472—483.

The suprarenal glands were extracted with $N/10$ hydrochloric acid and water, the mixture being finally heated to boiling. After the addition of sodium acetate solution and further boiling, the mixture was diluted with water and filtered or centrifuged to obtain a clear extract. As a rule 100 c.c. of extract were obtained for 2 grms. of gland. 5 c.c. of the clear extract were put in a 100 c.c. flask and 1 c.c. of fresh uric acid solution containing 1 mgrm. of the acid were put in another 100 c.c. flask. A special reagent was then made as follows : 100 grms. of sodium tungstate and 80 c.c. of 85 per cent. phosphoric acid were boiled gently with 750 grms. of water for nearly two hours and made up to a litre. 2 c.c. of the reagent and 20 c.c. of saturated sodium carbonate solution were added to each of the 100 c.c. flasks, which were allowed to stand for a few minutes, shaken, and filled up. The colours of the deep blue liquids were compared in a Duboscq colourimeter. The amount of adrenaline can be calculated from the fact that it produces three times as much colour as an equal weight of uric acid.—F. Shdn.

Emulsin; Resistance of —— in contact with strong alcohol (70, 80, 90, 95, *and* 100 *per cent.*) *to the action of heat.* E. Bourquelot and M. Bridel. J. Pharm. Chim., 1913, **7**, 65—67.

It has already been found that the temperature at which emulsin is destroyed in presence of alcohol decreases as the concentration of the latter is increased to 50 per cent., and then increases with the concentration (*loc. cit.*, 1913, **7**, 27). It is now found that if emulsin is heated with 70 or 80 per cent. alcohol at such a rate that the temperature rises by 1° C. in 4 minutes, the action of the enzyme (on salicin) is not entirely destroyed until a temperature of 60° C. is attained: with 90 per cent. alcohol a temperature of over 65° C. is required, and with 95 per cent. alcohol the enzyme is not completely destroyed in 4 minutes at 70° C. The resistance of emulsin to the action of heat under these conditions is attributed to the diminished proportion of water. This view is supported by the observation that if dry emulsin is heated with absolute alcohol and kept at the boiling point for 2 minutes, its activity, compared with that of a preparation left in contact with cold alcohol, is not appreciably affected. It is concluded that for sterilising plants (*i.e.* prevention of enzyme action) 60 per cent. alcohol is most suitable. In the process, which consists in introducing the fresh plant into boiling 95 per cent. alcohol, the requisite dilution is effected by the plant juices: for dried plants, or organs of low water-content, alcohol of not more than 80 per cent. concentration should be used.—L. E.

Terpenes and essential oils. 113th Communication. The occurrence of auto-reduction in the formation of hydro-aromatic compounds. O. Wallach. Annalen, 1913, **395**, 74—86.

When methylheptenone and zinc chloride were warmed on the water-bath, the temperature rose spontaneously to 140° C., and a vigorous reaction set in without the evolution of any hydrogen. In further experiments phosphorus pentoxide was used as a condensing agent in place of the zinc chloride, and the products of the reaction were mixed with water and distilled with steam, when a yield of about 50 per cent. of volatile oil was obtained boiling for the most part between 133° and 134° C. This was cautiously oxidised with dilute permanganate solution at 0° C. About half the oil resisted the oxidation and was separated and identified as *m*-xylene. The oxidised substance proved to be 1.3-*dimethyl*-3,4-*dihydroxycyclohexane*, $C_8H_{16}O_2$, which melted at 89° C. after crystallising from dilute alcohol, indicating the presence of 1,3-dimethylcyclohexanone-(4) in the mixture obtained after condensation. The hydrogen that would be left over in the formation of xylene from the methylheptenone has therefore exerted a reducing action. When the glycol obtained as a result of the permanganate oxidation was gently warmed with dilute sulphuric acid 1.3-dimethylcyclohexanone-(4) was formed. This boils at 179—179·5° C., has the sp. gr. 0·9066 at 21° C., and n_D 1·4464 at 21° C.; the semicarbazone melts at 189° C. after crystallising from alcohol, and the oxime at 98°—99° C. The ketone was oxidised with chromic acid and hypobromite, with the ultimate formation of β-methyladipic acid, m.pt. 91—92° C.—F. Shdn.

Geraniol and citronellal by acetylation; Determination of ——. J. Allan and C. W. Moore. Perfum. and Essent. Oil Rec., 1913, **4**, 13—14.

The standard test for Java citronella oil (this J., 1912, 950) has been subjected to further experiments. 10 grms. of geraniol were boiled for 2 hours with 10, 15 or 20 grms. of acetic anhydride, and quantities of sodium acetate between 1 and 3 grms. The acetylated oil was then washed with alkaline brine containing 1 per cent. of potassium hydroxide. In all cases concordant results were obtained. On working with citronellal in the same way there were variations. When the washing was performed with neutral, instead of alkaline brine, better agreement of the results was obtained.—F. Shdn.

Citric acid; Determination of —— in the presence of certain other acids. L. Gowing-Scopes. Analyst, 1913, **38**, 12—19.

Beau's modification of the method of Denigès (Ann. Chim. Phys., 1899, 18) is shown to give unreliable results owing to the action of the hydrogen peroxide (added to remove the manganese dioxide) upon the precipitated mercury dicarboxysulphoacetone. Other reagents tried for removing the manganese dioxide either oxidised or reduced the precipitate, which in hot solutions was also oxidised by manganese dioxide. A compound containing 72·5 to 74·0 per cent. of mercury and apparently similar to, if not identical with the compound of Denigès was obtained by the use of a reagent prepared by adding 68 c.c. of strong nitric acid to 51 grms. of mercuric nitrate and 51 grms. of manganese nitrate, diluting the mixture with 100 c.c. of water, and finally, making up the solution to 250 c.c. and filtering. For the determination of citric acid a quantity of the substance containing not more than 0·04 grm. nor less than 0·001 grm. of the acid is exactly neutralised with *N*/10 alkali, with phenolphthalein as indicator, and, after the addition of 10 c.c. of the reagent, the liquid is diluted to 200 c.c., and boiled for 3 hours beneath a reflux condenser. The precipitate is washed by decantation, collected in a weighed Gooch crucible, and again washed in the crucible, which is then dried in the water-oven until nearly constant in weight (about 5 hours). The residue should then be of a cream colour, any yellow colouration indicating the formation of basic salts, which will cause the results to be too high. One-sixth of the weight of the precipitate gives the amount of citric acid. In 16 test estimations with pure citric acid within the limits stated above, the maximum error was + 0·0003 and — 0·0004 grm. Good results were also obtained in the presence of tartaric, succinic, oxalic, benzoic, and phosphoric acids, but when malic, lactic or salicylic acids were present the results were too high. Salicylic acid gives a salmon-coloured precipitate, probably a nitro-derivative, with the reagent, whilst gallotannic acid gives an orange-brown precipitate. The precipitate given by citric acid decomposes suddenly when heated. It is very soluble in hydrochloric acid, in strong sulphuric or nitric acid, and in solutions of haloid salts.—C. A. M.

Formaldehyde; Method for the determination of ——. Gaillot. Ann. Chim. analyt., 1913, **18**, 17—18.

A definite volume of the formaldehyde solution is treated with neutral ammonium sulphate solution, and the acid liberated from the latter, owing to the combination of the ammonia with the aldehyde, is titrated. Each c.c. of *N*/1 alkali solution required for the titration is equivalent to 0·045 grm. of formaldehyde.—W. P. S.

Photolysis of ethyl alcohol, acetaldehyde and acetic acid. D. Berthelot and H. Gaudechon. Comptes rend., 1913, **156**, 68—71.

Of the three compounds studied, only acetaldehyde is decomposed by sunlight (wave-length greater than 0·3 μ). Light from a mercury lamp, screened by thin glass, which absorbs all rays of wave-length less than 0·3 μ, decomposes acetaldehyde in accordance with the equation, $CH_3.CHO = CO + CH_4$. Frequently the proportion of methane to carbon monoxide actually found is somewhat less than corresponds to this equation, for the light causes polymerisation of some of the aldehyde to paraldehyde, which is then photolysed to carbon monoxide and ethane or more complex substances: these latter reactions are most readily produced by the extreme ultraviolet rays. Direct rays from a mercury lamp, without any interposed screen, photolyse not only acetaldehyde but ethyl alcohol and acetic acid. Ethyl alcohol is decomposed primarily into acetaldehyde and hydrogen (see this J., 1911, 1086), but usually some carbon monoxide and ethane are formed by the further decomposition of the aldehyde. By the photolysis of acetic acid, the authors obtained a gas containing 44 per cent. of carbon dioxide, 17 of carbon monoxide and 39 per cent. of combustible gases (see this J., 1910, 1081). All the results described above relate to photolysis in absence of air. In presence of water the reactions take substantially the same course, but there is a tendency for the formation of acid products.—J. H. L.

Alcohol requirement of the pure food and drug law (*U.S.A.*) *and the accuracy of alcohol assays of pharmaceutical preparations.* C. H. Briggs. J. Ind. Eng. Chem., 1913. **5**, 29—30.

Under the pure food and drug law (U.S.A.) it is necessary to state on the label the percentage of alcohol in every pharmaceutical preparation. The first interpretation was that the maximum amount could be stated on the label, a later belief is that the actual percentage must be stated. To meet this requirement it is necessary either to assay every preparation for alcohol or to adjust each individual lot to a standard alcohol content. Sources of error in making alcohol assays are found in (1) measuring the sample, (2) loss on distillation, (3) error in taking the specific gravity, (4) temperature of the solution, (5) the presence of essential oils. Long experience has shown that the error may at times be as much as 1 or 1·5 per cent. of alcohol. The error allowed under the Act is not known. —E. F. A.

Electrification of liquids [*benzene and ether*] *on flowing through pipes.* Dolezalek. *See* III.

Patents.

Amino-substituted pyrazolones ; Manufacture of ω-methylsulphites of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 15,759, July 5, 1912. Under Int. Conv., Feb. 6, 1912. Addition to Eng. Pat. 15,658 of 1912, dated July 20, 1911.

The amino-derivatives of 1-phenyl-2.3-dimethyl-5-pyrazolone mentioned in the principal patent (this J., 1912, 1147) may be replaced by other amino-1-phenyl-2.3-dialkyl-5-pyrazolones or derivatives thereof substituted in the phenyl nucleus, such as 1-*p*-tolyl-2-ethyl-3-methyl-4-amino-5-pyrazolone, or 1-*p*-ethoxyphenyl-2-ethyl-3-methyl-4-amino-5-pyrazolone.—T. F. B.

Di[*hydr*]*oxyphenyl-α-propanolamine.* W. Grüttefien, Vohwinkel. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,044,778, Nov. 19, 1912.

1.2-Dihydroxyphenyl-4-*α*-propanolamine,

$$(HO)_2.C_6H_3.CH(OH).CH(CH_3)NH_2.$$

can be obtained by reducing the corresponding *α*-aminopropionylcatechol (m.pt. 212° C.) by means of hydrogen in presence of metals of the platinum group. The racemic product thus obtained may be resolved into the two optically active bases by aid of *d*- and *l*-tartaric acid. The new products have properties of raising the blood pressure similarly to adrenaline. The *dextro*-base melts at 217° C., $\alpha_D=33·75°$, and the *lævo*-base melts at 218° C., $\alpha_D=-30·00°$. The inactive compound melts at 204° C. and its hydrochloride at 177° C.—T. F. B.

Alkaloidal substance. J. U. Lloyd, Cincinnati. U.S. Pat. 1,048,711, Dec. 31, 1912.

Medicinal substances for internal application are claimed, consisting of mixtures of alkaloidal salts with aluminium silicates, such as powdered fuller's earth.—T. F. B.

Alkaloids and alkaloidal salts ; Process of extracting, purifying, or excluding ——. J. U. Lloyd, Cincinnati. U.S. Pat. 1,048,712, Dec. 31, 1912.

Alkaloids or alkaloidal salts may be precipitated from solutions by addition of aluminium silicates. They may also be rendered insoluble by mixing them with hydrated aluminium silicates.—T. F. B.

Arseno-preparation ; Manufacture of an ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 15,931, July 8, 1912. Under Int Conv., Jan. 16, 1912.

See Fr. Pat. 445,325 of 1912 ; this J., 1912, 1200.—T. F. B.

Urea ; Process of manufacturing ——. H. Immendorff and H. Kappen, Jena, Germany. U.S. Pat. 1,048,699, Dec. 31, 1912.

See Fr. Pat. 433,457 of 1911 ; this J., 1912, 257.—T. F. B.

Ketones ; Process for the manufacture of ——. J. Effront, Brussels. U.S. Pat. 1,048,814, Dec. 31, 1912.

See Fr. Pat. 439,683 of 1912 ; this J., 1912, 711.—T. F. B.

Diolefine hydrocarbons [*βγ-dimethylerythrene*] *; Process of producing* ——. F. Hofmann, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,048,967, Dec. 31, 1912.

See Addition of April 11, 1912, to Fr. Pat. 425,582 of 1911 : this J., 1912, 1007.—T. F. B.

Erythrene ; Process of producing ——. F. Hofmann, C. Coutelle, and L. Tank, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,050,077, Jan. 7, 1913.

See Eng. Pat. 448 of 1912 : this J., 1912, 409.—T. F. B.

Hydrocinchona alkaloids ; Manufacture of esters of the ——. H. Thron, Assignor to Verein. Chininfabr. Zimmer und Co., Frankfort on Maine, Germany. U.S. Pat. 1,049,172, Dec. 31, 1912.

See Eng. Pat. 27,952 of 1911 ; this J., 1912, 843.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Dyestuffs ; Process for increasing the solubility of —— *in supports soluble in water.* J. H. Smith. Fr. Pat. 446,571, Oct. 4, 1911.

The solubility of dyestuffs in supports soluble in water can be materially increased by mixing with the substance of the support concentrated solutions of sugars or gums. In preparing colour films for the bleach-out process of colour photography, cane sugar or gum arabic may be mixed with the gelatin emulsion used for making the supports, or the solid sheets of gelatin may be immersed in concentrated solutions of gum or sugar.—T. F. B.

Reproductions or images in colours ; Process for obtaining —— *by the bleach-out process, using a compensating screen.* J. H. Smith. Fr. Pat. 446,572, Oct. 4, 1911.

In order to compensate for the differences of sensitiveness of the dyestuffs used in the bleach-out process of colour photography, it is customary to use screens of the colour complementary to that of the print required. Even this method does not give good results, owing to the presence of ultra-violet and blue-violet rays in the sources of light used. It is therefore proposed to absorb the ultra-violet rays and to soften the effect of the blue-violet rays. For eliminating the ultra-violet rays, quinine or æsculin sulphate or Naphthol Green may be used, whilst a yellow screen serves to absorb the blue-violet rays.—T. F. B.

Toning of photographic images on paper ; Use of colloidal sulphur in the nascent state for the brown ——. Union Photographique Industrielle (Établ. Lumière et Jougla réunis). Fr. Pat. 446,692, Oct. 7, 1911.

Photographic prints on gelatino bromide, chloride, or chlorobromide papers are toned brown shades at the ordinary temperature by means of colloidal sulphur, precipitated from sodium thiosulphate in presence of gum, dextrin, or other colloid, by means of a mineral or organic acid, or by alum or a bisulphite or other salt having an acid reaction (see this J., 1913, 110).—T. F. B.

Process for incorporating oils insoluble in water in emulsions or in compounds soluble in water. Fr. Pat. 446,570. *See* XII.

XXII.—EXPLOSIVES; MATCHES.

Powders; Modern military —— in France. D. Florentin. Z. ges. Schiess- und Sprengstoffw., 1913, **8**, 6—8, 30—32.

The French service powder B consists essentially of a mixture of endecanitrocellulose, CP_1, and enneanitrocellulose, CP_2 (the former insoluble, and the latter soluble in ether alcohol), gelatinised with a mixture of alcohol and ether of sp. gr. 0·758, consisting of 9 parts of ether and 5 parts of 95 per cent. alcohol. The proportions of CP_1 and CP_2 vary according to the purposes for which the powder is required. After drying, the powder always contains a certain amount of solvent, varying from 1 to 6 per cent. according to the thickness of the sticks. Decomposition of the powder having been ascribed to the final loss of solvent, attempts were made to increase the stability by adding to the solvent from 2 to 8 per cent. of the higher boiling amyl alcohol. Much better results have been obtained by the use of diphenylamine, which, unlike amyl alcohol, does not form unstable compounds with the oxides of nitrogen produced by the decomposition of the guncotton. Diphenylamine has the further advantage that with its use the progress of decomposition can be easily followed. Mono-, di-, and trinitro-derivatives are successively formed and the trinitro-compound colours an alcoholic solution of potassium cyanide red. When the powder gives a positive result with this test, it is to be suspected. The materials used in the manufacture of the guncotton are obliged to conform to the following specified tests:—*Cotton.* Maximum ash, 0·4 to 0·6 per cent.; insoluble in dilute sulphuric acid (350 c.c. of pure concentrated acid and 215 c.c. of distilled water) not more than 1 per cent.; moisture determined at 100° C. not more than 10 per cent. Lately, also, a limit for the chlorine content has been specified. *Sulphuric acid.* Must contain not less than 92·75 per cent. of H_2SO_4: iron must be below 0·0003 and residue below 0·0005 per cent. *Nitric acid.* The sodium nitrate used in its manufacture must contain not less than 94 per cent. of the pure salt, and not more than 4 per cent. of water, 1 per cent. of insoluble, or 1 per cent of chlorides reckoned as sodium chloride. The nitric acid must contain not more than small quantities of oxides of nitrogen, no sulphuric acid and only traces of chlorine. *Alcohol and ether.* The alcohol must contain at least 94 per cent. by volume of ethyl alcohol, and 100 c.c. must not give more than 0·005 grm. of residue, which must be neutral to litmus. The ether must be chemically neutral, and give no residue on evaporation. *Diphenylamine* must be free from chlorine and must not contain more than traces of primary amines. Its melting point must be near the theoretical (53° C.).—T. St.

Explosive substance. Statutory rules and orders, 1912, No. 1861. Order in Council (No. 16B) under the Explosives Act, 1875 (38 and 39 Vict. c. 17), amending Order in Council of October 26, 1896 (No. 16), relating to the keeping of mixed explosives on registered premises.

It is prescribed that the maximum quantity of explosive allowed to be kept on premises registered for the keeping of mixed explosives shall be the following:—

(1) If the only explosive kept be one or more of the following: (a) Gunpowder; (b) small-arm nitro-compound; (c) ammunition of the 1st Division of Class 6. The maximum shall be: In Mode A. Gunpowder and small-arm nitro-compound, in all, 200 lb. And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb. In Mode B. Gunpowder, 50 lb., or in lieu of each pound of gunpowder not so kept, 2 lb. of small-arm nitro-compound. And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb.

(2) If the only explosive kept be one or more of the following:—(a) Fireworks; (b) ammunition of the 1st Division of Class 6. The maximum shall be: In Mode A. Fireworks, 200 lb.[*] And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb. In Mode B. Fireworks, 50 lb.[*] And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb.

(3) In any other case the maximum shall be:—In Mode A. Mixed explosives (including gunpowder), 60 lb. And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb. In Mode B. Mixed explosives (including gunpowder), 15 lb. And, in addition, of explosive contained in ammunition of the 1st Division of Class 6, 500 lb.

(4) Provided that in each of the three cases above mentioned the aggregate amount kept on the premises in Mode A and Mode B together may not in any case exceed the maximum amount which may be kept in Mode A.

Contribution to the study of cellulose. [*Viscosity of nitrocellulose solutions.*] Piest. *See* V.

Patents.

Blasting; Safety-powder for ——. G. M. Peters, Cincinnati, Ohio. U.S. Pat. 1,048,578, Dec. 31, 1912.

A safety blasting-powder contains the following ingredients incorporated into a homogeneous mass: ammonium nitrate, 75 per cent.; nitrated potato meal, 20; and a solution of about 4 parts of mirbane oil and 1 part of "asphalt," 5 per cent.—O. R.

Explosives and method of manufacturing the same. F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,974, Dec. 22, 1911.

See Fr. Pat. 440,625 of 1912; this J., 1912, 845.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Micropyrometer. G. K. Burgess. J. Wash. Acad. Sci., 1913, 3, 7—10.

An apparatus is described for determining through a microscope the melting points of minute specimens (0·001 mgrm. or less). This is constructed by mounting in the Huyghens eyepiece of a microscope a small incandescent lamp which is in series with a rheostat and ammeter. The substance is placed upon a strip of platinum foil, electrically heated, and the tip of the filament of the lamp is set to the same brightness as the platinum strip viewed from above at the instant of melting of the specimen on which the microscope is focussed. Thus the specimen, the platinum strip and the lamp filament are seen all in focus at once, and the current passing through the filament is taken as a measure of the temperature of the strip. In practice, the observer with one hand raises the temperature of the strip by increasing the current through it by means of a fine-step rheostat, and with the other hand adjusts the current through the lamp by means of the other rheostat. The eyepiece is covered with a slip of monochromatic glass. For temperatures above which the lamp should not be heated (about 1400° C.) an absorption glass is placed between the microscope objective and the window of the furnace. In the instrument constructed at the U.S. Bureau of Standards, the microscope has a 48 mm. single achromatic objective and a 6·4 × eyepiece. The tubular furnace in which the platinum strip is situated has a circular window immediately over the strip; the interior is blackened to prevent reflection and the exterior is cooled by a blast of air. Of the methods for calibrating the pyrometer, the more convenient and accurate consists in observing the melting points of two or more known pure substances. Certain errors are thus eliminated although it is not permissible to deduce results for unknown substances of one kind (metals or salts) from calibrations made with substances of a different kind. The combination of microscope and pyrometer enables changes occurring at the surface of refractory substances to be observed at various temperatures.—J. F. B.

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[*] By Order in Council of the 11th May, 1906 (No. 16a), these quantities are doubled if the only fireworks kept are "shop-goods" as therein defined.

Ammonium citrate [for analytical purposes]; Methods for the preparation of neutral solutions of ——. J. M. Bell and C. F. Cowell. J. Amer. Chem. Soc., 1913, **35**, 49—54 (see this J., 1911, 700).

The author proposes two methods for finding the exact volume of a strong solution of ammonia required to neutralise a solution of citric acid. The first is illustrated by the following example:—Several quantities of 100 c.c. of citric acid solution, containing 370 grms. per litre, were treated with different measured volumes of ammonia solution so that in all cases a slight excess of ammonia was present. This excess was in each case determined by diluting the liquid to 200 c.c., shaking 100 c.c. with 125 c.c. of chloroform, titrating 50 c.c. of the chloroform extract with $N/10$ hydrochloric acid after addition of 50 c.c. of water and some "methyl red," and finally multiplying the quantity of ammonia corresponding to the volume of acid required, by 105 (the ratio of distribution of ammonia between chloroform and water being 1 : 25 at ordinary temperatures). By plotting, for several such tests, the volume of $N/10$ acid required (or the excess of ammonia calculated therefrom), against the volume of ammonia solution employed, the volume of the latter required for exact neutralisation of 100 c.c. of the nitric acid solution can be readily found by extrapolation. The second method consists in adding the ammonia solution to 100 c.c. of the citric acid solution until the point of neutralisation is approached, then transferring the liquid to a Dewar flask and determining the rise in temperature (usually about 0·4° C.) produced by successive additions of 0·5 c.c. of the ammonia solution. After neutralisation has been attained, further addition of ammonia produces practically no change in temperature, and by plotting the temperature increments against the volumes of ammonia solution added, the point of neutralisation can be exactly determined. Both these methods are simpler than that formerly proposed, based on conductivity measurements at constant temperature (*loc. cit.*).—J. H. L.

Zinc; Rapid determination of ——. K. Voigt. Z. angew. Chem., 1913, **26**, 47—48.

The author's method (this J., 1911, 1390) has been subjected to criticism by Hassreidter (Z. angew. Chem., 1911, 2491 and 1912, 1005) on the ground that the silica which is separated by addition of ammonia will contain zinc, so that the method will yield low results. In order to rebut this criticism, the author has applied his method to monohydrated zinc silicate, and obtained the same results as by the ordinary method of analysis. Further investigation shows that the reason why no zinc silicate is precipitated is that this substance is fully hydrolysed in the presence of a sufficient quantity of ammonium chloride. This is provided by the neutralisation of the very large excess of acid which is prescribed by the author for the solution of the original ore or slag. If the acid should be removed by long boiling, it is necessary either to replace it or to add a considerable quantity of ammonium chloride.
—W. H. P.

Carbon and carbon dioxide; Determination of ——. A. Grégoire, J. Hendrick, E. Carpiaux, and E. Germain. Ann. Chim. analyt., 1913, **18**, 1—8.

For the determination of carbon in organic substances, the authors recommend that the substance be oxidised in a current of oxygen as in the ordinary method of combustion, and that the resulting carbon dioxide be collected in barium hydroxide solution contained in a Pettenkofer's tube. The barium carbonate formed is then collected on a filter (care being taken to exclude carbon dioxide), and is next transferred to a Scheibler's apparatus, and decomposed with nitric acid, the volume of the liberated carbon dioxide being measured. Particular attention is given to the correction for the volume of the gas which dissolves in the nitric acid, and a table is given showing the volumes dissolved at different temperatures. For instance, 10 c.c. of nitric acid of sp. gr. 1·20 dissolved, at 16° C., 10·67 c.c. of carbon dioxide (calculated to 0° C. and 760 mm. pressure). The process was found to yield accurate results when applied to oxalic acid, sucrose, and urea.—W. P. S.

Stannous chloride; Determination of —— *and of chlorates by means of Methylene Blue.* F. W. Atack. J. Soc. Dyers and Col., 1913, **29**, 9—10.

Solutions of stannous chloride, made strongly acid with chlorine-free hydrochloric acid, are titrated in an atmosphere of carbon dioxide with standardised $N/50$ Methylene Blue solution (*i.e.*, 4 grms. per litre). Below a certain concentration of acid no reduction of the Methylene Blue occurs, and a suitable concentration is obtained by adding an equal volume of concentrated hydrochloric acid to the portion of stannous chloride solution to be titrated. When checked with a sample of pure tin, results obtained were identical with those for the gravimetric estimation. Antimony, iron, zinc, manganese, lead, bismuth, and aluminium do not affect the process, but the method cannot be used in the presence of copper, titanium, tungsten, molybdenum, or vanadium. The Methylene Blue solution may be standardised in the usual way with titanous chloride (Knecht, this J., 1905, 154) or by reducing with titanous chloride solution, adding a portion of a solution of known strength of pure potassium chlorate (about 0·7 grm. per litre) then reducing the Methylene Blue formed with titanous chloride, and so finding the value of the Methylene Blue solution in terms of oxygen of the pure potassium chlorate solution. Where titanous chloride is not available, stannous chloride can be used, and these two processes constitute rapid methods for the estimation of chlorates. When Methylene Blue solution is slowly added to potassium perchlorate solution, a quantitative precipitation of the perchlorate takes place, and this is filtered off, washed, dried and weighed. These four methods for the standardisation of Methylene Blue solution give results which agree very well.—G. H. F.

Analysis of mixtures of hydrogen and saturated hydrocarbons [methane, ethane, and propane]. Lebeau and Damiens. *See* IIa.

Valuation of indigo. Barnes. *See* IV.

Comparison of the methods for the determination of dyestuffs. Salvaterra. *See* IV.

Determination of ammonia by means of formaldehyde. Gaillot. *See* VII.

Analysis of cerium compounds. Strohbach. *See* VII.

Formation of hypophosphoric acid in Corne's reaction. Tauchert. *See* VII.

Determination of nitric oxide. Koehler and Marqueyrol. *See* VII.

Preparation of selenic acid and sodium selenate for use as reagents in the determination of bromine in haloid salts. Blumenthal. *See* VII.

Use of selenic acid in the determination of bromine associated with chlorine in haloid salts. Gooch and Blumenthal. *See* VII.

Detection and determination of very small quantities of free bromine by means of Schiff's reagent. Denigès. *See* VII.

Detection of free and combined bromine and chlorine and determination of bromine. Denigès and Chelle. *See* VII.

Determination of silica [in cements]. Bauer. *See* IX.

Determination of phosphorus in vanadium steels. Hagmaier. *See* X.

Detection of adulteration of linseed oil. Elsdon and Hawley. *See* XII.

Fractional precipitation of fatty acid mixtures. [*Detection of rape oil in mixtures.*] Kreis and Roth. *See* XII.

Analysis of tannins. II. Levi and Orthmann. *See* XV.

Qualitative analysis of vegetable tannin extracts [*mangrove and quebracho*]. Lauffmann. *See* XV.

Determination of alkali sulphides [*in lime liquors*]. McCandlish and Wilson. *See* XV.

Mineralogical analysis of soils. Fry. *See* XVI.

Proposed modification of the official (*U.S.A.*) *method of determining humus* [*in soils*]. Smith. *See* XVI.

Determination of sugar in bagasse and cane. Determination of water in bagasse. Pellet. *See* XVII.

Determination of the polarisation of the products of beet sugar works by acid double polarisation. Pellet. *See* XVII.

Determination of copper in foods by the spectrophotometer. Tassily. *See* XIXA.

Detection and colourimetric determination of lead, copper and zinc in tap water. Winkler. *See* XIXB.

Determination of iron in water. Tassily. *See* XIXB.

Use of potassium palmitate in water analysis. Blacher and others. *See* XIXB.

Colourimetric determination of epinephrine [*adrenaline*]. Folin and others. *See* XX.

Determination of geraniol and citronellal by acetylation. Allan and Moore. *See* XX.

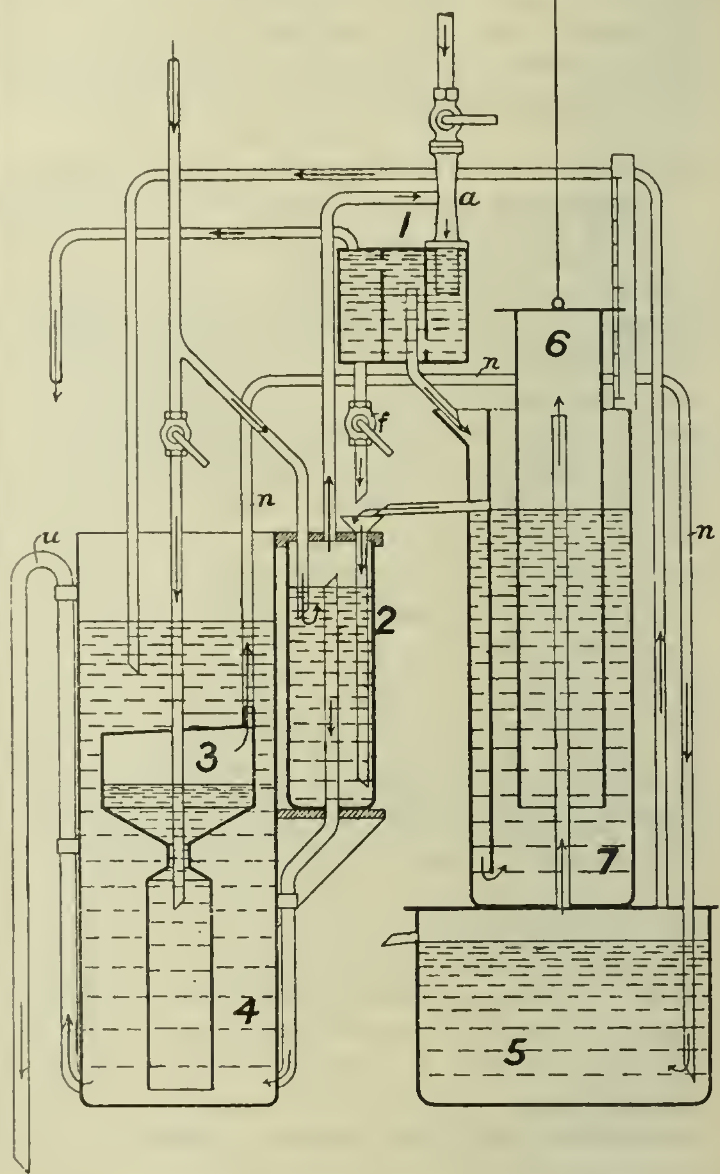
Determination of citric acid in presence of certain other acids. Gowing-Scopes. *See* XX.

Determination of formaldehyde. Gaillot. *See* XX.

PATENTS.

Gas analysis apparatus. J. F. Simmance and J. Abady, London, and F. Wood, East Sheen, Surrey. Eng. Pat. 11,664, May 16, 1912.

THE apparatus consists of a cistern, **1**, an impregnating chamber, **2**, a gas extractor chamber, **3**, a siphon tank, **4**, an absorbing reagent tank, **5**, a measuring bell, **6**, and a tank, **7**. A continuous supply of fresh water enters the cistern, **1**, through a filter pump nozzle, *a*, whereby gas is drawn from the same source as the sample to be analysed, through the water contained in the impregnating chamber, **2**, and into the cistern, **1**. The water with which the sample comes into contact is thus already impregnated with the gas. Water passes from the cistern, **1**, by way of a fixed pipe to the bottom of the tank, **7**, from which it overflows into the impregnating chamber. The level of the water in the tank, **7**, thus remains constant. Water also passes from the cistern, **1**, directly to the impregnating chamber, **2**, by way of the cock, *f*. The water in the impregnating chamber, **2**, overflows into the siphon tank, **4**, and, rising in the extractor chamber, **3**, forces the gas by way of the tube, *n*, through the absorbing liquid into the measuring bell, **6**, which rises by an amount proportional to the unabsorbed gas. When the tank, **4**, has become full, the water siphons off, and in so doing both draws a fresh sample of gas into the extractor chamber, **3**, and allows the gas in the measuring bell, **6**, to escape. The operation is then repeated. By controlling the speed of the water passing through the cock, *f*, the speed of the analyses can be varied. Owing to the manner in which the water circulates through the various tanks, the temperature of the gas is the same when remeasured after passing through the absorbent, as when collected. The measuring bell, **6**, is connected with a recording apparatus, by means of which the amount of the constituent absorbed is recorded on a chart. By using independent sets, each consisting of extractor, absorbing and remeasuring chambers, the rest of the apparatus being common to all, the same constituent may be determined simultaneously in samples of gas drawn from several different sources, and by suitably arranging the several recording pens the results may be recorded on the same chart. Similarly, by using suitable solvents in conjunction with such independent sets, different constituents of the same gas may be simultaneously measured, and the results so recorded on a chart that the composition of the gas is directly indicated.—T.ST.



Albumin; Reagent for precipitating ——. M. Claudius. Ger. Pat. 253,978, Dec. 21, 1911.

THE reagent contains a dyestuff which is not affected chemically or physically by the albumin-precipitant and possesses a strong affinity for the precipitated albumin. Special claim is made for a 2 per cent. aqueous solution of trichloroacetic acid to which is added 0·5 per cent. of tannic acid and 0·1 per cent. of Acid Magenta. After the albumin is precipitated and filtered off, the colour of the filtrate is compared with that of the original reagent; the diminution in the intensity of the colour is a measure of the quantity of albumin precipitated.—A. S.

Calorimeter. Sulzer frères. Fr. Pat. 446,472, July 24, 1912. Under Int. Conv., Sept. 18 and 19, 1911.

SEE Eng. Pat. 17,222 of 1912; this J., 1912, 1096.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Adsorption and saturated surfaces. R. Marc. Z. physik. Chem., 1912, 81, 641—694.

THE author has carried out a large number of quantitative adsorption experiments with substances of the most varied kinds. From 1 to 2 grms. of the adsorbent were mixed with 10 c.c. of a solution of the substance to be adsorbed, the mixture was shaken vigorously for 1 minute by hand and then for half an hour in a shaking machine; after standing for 24 hours, the clear liquid was siphoned off and allowed to stand for a further period of 24 hours before examination. The quantity of substance adsorbed was ascertained by determining the concentration of the solution before and after adsorption by means of the interferometer (this J., 1912, 559). The detailed experimental results are given in tables and curves, and from them the author draws conclusions which may be summarised as follows:—In general, colloids are adsorbed readily but crystalloids only to a very slight extent by crystalline substances. Crystalloids are adsorbed if they are capable of forming solid solutions with the adsorbent, *i.e.*, if they are isomorphous or homöomorphous with the latter. For example, potassium nitrate is adsorbed by barium carbonate, whereas sodium nitrate is not adsorbed to any appreciable extent; on the other hand, sodium nitrate is adsorbed to a considerable extent by rhombohedral calcium carbonate, whereas potassium nitrate is not appreciably adsorbed. The curves representing the adsorption of numerous colloidal solutions and colouring matters by varied crystalline adsorbents may be divided into three types: (1) The curve has a more pronounced curvature than corresponds with the usual exponential formula, and is quite smooth up to the saturation point, *i.e.*, the value of the fractional exponent (n) of the formula decreases continuously, finally to 0. (2) The curve can be represented satisfactorily by the exponential formula: the exponent remains constant up to high concentrations, and then quite suddenly its value falls to 0. (3) The curve rises steeply, but the saturation point is attained at very low concentrations: this curve is probably a modified form of type 2. The type of adsorption curve depends essentially upon the nature of the adsorbed substance. If for a given adsorbent, the saturation values for different adsorbed substances are as $a:b:c$, etc., then the same relation holds for these substances when a different adsorbent is used. This fact is of importance, as it opens the way for the quantitative experimental study of such questions as the action of catalyst-poisons (a surface which has been saturated by adsorption will no longer be capable of exerting contact action), the influence of colloids on electro-deposited metals, etc.—A. S.

PATENT.

Liquid films; Examination, treatment, or the like of ——. C. V. Boys, London. U.S. Pat. 1,048,801, Dec. 31, 1912.

SEE Eng. Pat. 16,732 of 1911; this J., 1912, 260.—T. F. B.

Book Received.

MINES AND QUARRIES: GENERAL REPORT, WITH STATISTICS, FOR 1911, BY THE CHIEF INSPECTOR OF MINES. PART III., —OUTPUT. [Cd. 6550.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 5d.

THIS return contains statistics of the quantity and value of various minerals raised in the United Kingdom. The value of the mineral output of the United Kingdom in 1911 was £124,579,313, an increase of £2,473,731 as compared with 1910; the increase is mainly accounted for by the increased value of coal. (See p. 91.)

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Butler*, E.: Evolution of the Internal Combustion Engine. Cr., pp. 237. C. Griffin, London. 1913. Net 2s. 6d.

IIA. *Engler*, C., and H. *Hofer* unter Mitwirkg. v. Drs. S. Aisinman, M. Albrecht u. E. Albrecht. Das Erdöl, seine Physik, Chemie, Geologie, Technologie u. sein Wirtschaftsbetrieb. In 5 Bdn.

Bd. II. u. III. Appeared already. 1909 and 1911. I. Bd. 2. Abtlg. Chemie u. Physik, Die, des Erdöls. Unter Mirwirkg. v. J. Berlinerblau, Prof. W. Ebstein, Drs. N. Hviid, H. Köhler u. Prof. L. Ubbelohde bearb. v. Prof. C. Engler. (XVII u. 593—856.) Nebst: Tab.-Beilage. (19 Tab. m. 1 Bl. Text.) 1913. M. 22 (I. Bd. complete half mor., M. 58).

Handbuch f. die internationale Petroleum-Industrie. Jahrg. 1913. Hrsg. v. H. Arends u. C. Mossner. (XXIV, 507 S. m. 2 Fig.) 8°. Berlin, Finanzverlag G. m. b. H. Cloth M. 12.

Siegfried, Dr. E.: Die Naphtalagerstätten der Umgebung v. Solotwina. Ein Beitrag zur Tektonik des Karpathenrandes in Ostgalizien. Mit 42 Abbildgn., 1 (farb.) geol. Karte u. 1 Profiltaf. (VIII, 72 S.) Lex. 8°. Berlin, Verlag. f. Fachliteratur. 1912. M. 6.

Haenig, A.: Die Steinkohle. Ihre Gewinng. u. Verwertg. Unter besond. Berücksicht. der national-ökonom. Bedeutg. der Steinkohle sowie der neuesten Anlagen zu ihrer Gewinng. u. Verwertg. f. Praxis u. Selbststudium erläutert. Mit 129 in den Text u. auf (1) Taf. gedr. Abbildgn. (329 S.) kl. 8°. Leipzig. Dr. M. Jänecke. 1912. Cloth M. 5.

Polster's Kohlen-Jahrbuch 1913. Ratgeber f. Gewinng., Handel u. Konsum v. Kohle, Koks, Briketts u. anderen Heizmaterialien. 13. Jahrg. 2 Tle. (XI, 272 S., Schreibkalender, 16 u. IV, 50 u. 19 S. m. Fig.) kl. 8°. Leipzig, H. A. L. Degener. Cloth M. 3.

V. *Korschilgen*, J. P., u. E. L. *Selleger*: Papierfabrikation. 64. Lfg. Berl., O. Elsner. 1913. 50 Pf.

VI. *Reiser*, N.: Die Appretur der wollenen u. halbwollenen Waren. Zum Gebrauche an Webschulen u. f. Praktiker. 2., verb. Aufl. (XVI, 695 S. m. 408 Abbildgn.). gr. 8°. Leipzig, A. Felix. 1912. Cloth M. 27.

Tiscornia, G.: Smacchiatura industriale e casalinga di abiti, biancherie, stoffe, lana, seta, merletti, ricami, tappeti. guanti, pellicce, piume, cappelli, cuoio, marmo, legno, ecc. (Bucato, decolorazioni, smacchiatori semplici e composti. liscive, saponi, stiratura a lucido). Milano, 16° fig., p. xii, 219. Hoepli. 1912. Lire 2.50.

VII. *Ehrhardt*, Dr. R.: Die Kaliindustrie. Mit 25 Fig. im Text u. 1 graph. Darstellg. (76 S.). kl. 8°. Leipzig. Dr. M. Jänecke. 1912. Cloth M. 1.80.

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Rutherford, E.: Radioactive Substances and their Radiations. 8vo, pp. 708. Cam. Univ. Press. London. 1913. Net 15s.

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VIII. *Kalender* f. die Eisen-Emailindustrie 1913. Fur den Fabrikanten. Emailchemiker. Email. u. Giessereitechniker, Betriebsleiter. Emailliermeister. Hüttenmann etc. bearb. v. Konsulent Dr. Jul. Grunwald. 2. Jahrg. (VIII, S., Schreibkalender u. 168 S. m. Fig.) kl. 8°. Leipzig, R. F. Stoll, jr. Cloth M. 2.10.

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Verblender, des Plattenversetzens u. -Legens unter Hinweis auf alle techn. Schwierigkeiten. Praktisches Handbuch f. das Plattenfach-, Töpfer- u. Baugewerbe. Leichtfasslich nach langjähr. Erfahrgn. dargestellt. (III, 79 S. m. 14 Abbildgn.) 8°. Glogau, Hellmann. 1912. Cloth M. 2.60.

X. *Adressbuch* der Fabriken u. Werkstätten der Hütten- u. Metallindustrie in Westdeutschland. Ausg. 1913. Hrsg. v. Dr. W. Ruhfus. (XIX, 286 S.) 8°. Dortmund, F. W. Ruhfus. M. 5.

Dittmarsch, A.: Die Gewinng. der nutzbaren Mineralien v. den Lagerstätten. (Grubenbaue, Gruben, Ausrichtg., Vorrichtg. u. Abbau, Tagebau, u. Gräbereien). (84 S. m. 79 Abbildgn.) kl. 8°. Leipzig. Dr. M. Jänecke. 1912. Cloth M. 1.60.

Freise, Dr. F.: Aufbereitung v. Erzen u. Kohle. (206 S. m. 195 Abbildgn.) kl. 8°. Leipzig. Dr. M. Jänecke. 1912. Cloth M. 3.20.

Jaffé, R.: Die Uranpecherzlagerstätten des sächsischen Edelleutstollen bei St. Joachimsthal. [Aus: "Ztschr. f. prakt. Geol."] (32 S. m. Abbildgn. u. 2 Taf.) Lex. 8°. Berlin. M. Krahmann. 1912. M. 3.

Jahrbuch f. das Berg- u. Hüttenwesen im Königr. Sachsen. Jahrg. 1912. (Statistik vom J. 1911.) Auf Anordng. des königl. Finanzministeriums hrsg. v. Geh. Bergr. C. Menzel. (VII, 9, 192, 306 u. 156 S. m. Abbildgn., 13 Taf., 1 Bildnis u. 7 Bl. Erklärgn.) Lex. 8°. Freiberg, Craz & Gerlach. 1912. M. 13.

Phillips, A. H.: Mineralogy. 8vo. Macmillan, London. 1913. Net 16s.

Potts: Mining Register and Directory for the Coal and Ironstone Mines of Great Britain and Ireland. 1912. 8vo. Simpkin. London. 1913. 10s. 6d.

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They, G.: Manuale teorico-pratico della saldatura autogena, taglio dei metalli coll'ossigeno e cenni sul processo alluminotermico. Torino. 8°. Fig., p. 127. 1912. Lire 2.50.

Weisbach, A.: Tabellen zur Bestimmung der Mineralien mittels äusserer Kennzeichen. 9. Aufl., bearb. v. Prof. Frdr. Kolbeck. (VIII, 121 S.) Lex. 8°. Leipzig. A. Felix. 1913. Cloth M. 4.60.

XVIII. *Taschenbuch* f. Brauerei- u. Mälzerei-Besitzer 1912/13 nebst Bezugsquellen-Buch f. die Brau-Industrie. 7 Jahrg. (III, 48 u 64 S.) kl. 8°. Leipzig (R., Wittstockstr. 5.), Weller & Winkler. Cloth M. 1.

XIXA. *Besselich*, N.: Die Schokolade. Ihre Fabrikation, aus der Praxis f. die Praxis dargestellt u hrsg. (88 S. m. Abbildgn.) 8°. Trier, N. Besselich. 1912. Cloth M. 5.

Richmond, H. D.: The Laboratory Book of Diary Analysis. Cr. 8vo. pp. 100. C. Griffin. London. 1913. Net 2s. 6d.

XIXB. *Cannon*, H. L.: A Textbook on Sewage Disposal in the United Kingdom. 8vo. St. Bride's Press. London. 1913. Net 7s. 6d.

XX. *Jahresbericht* über die Fortschritte der Thier-Chemie od. der physiologischen, pathologischen u. Immuno-Chemie u. der Pharmakologie. Begründet v. R. Maly. Fortgesetzt v. R. Andreasch, M. v. Nencki, K. Spiro. Hrsg. u. red. v. Proff. R. Andreasch u. K. Spiro. 41. Bd. Ueber d. J. 1911. 1. Abtlg. (704 S.) gr. 8°. Wiesbaden, J. F. Bergmann. 1912. M. 21.

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Kailan, A.: Ueber die chemischen Wirkungen der durchdringenden Radiumstrahlung. 4. Der Einfluss der durchdring. Strahlen auf einige organ. Verbindgn. auf Reaktionen. (17 S.) gr. 8°. Wien, A. Hölder. 1912. 52 Pf.

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XXI. *Kamera-Almanach*, Deutscher. Ein Jahrbuch f. die Photographie unserer Zeit. Begründet v. Fritz Loescher. Hrsg. v. K. W. Wolf-Czapek. 8 Bd. 1912/13. Mit 156 Reproduktionen. (248 S.) 8°. Berlin, Union Zweigniederlassg. Cloth M. 5.50.

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XXIII. *Materialprüfgn. d. Technik*, Mitteilungen d. internat. Verb. f. II. Bd. Nr. 11—13. 1913. Berl., Springer. M. 7.

XXIV. *Blücher*, H.: Auskunftsbuch f. die chemische Industrie. 8. Aufl. 1912—13. (XVI, 1392 u. 37 S.) gr. 8°. Berlin, F. Siemenroth. 1913. Cloth M. 15.

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Oppenheimer, Prof. C.: Grundriss der organischen Chemie. 8. Aufl. (VIII, 156 S.) 8°. Leipzig. G. Thieme. 1912. Cloth M. 2.80.

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Waals, Prof. J. D. v. d.: Lehrbuch der Thermodynamik in ihrer Anwendung auf das Gleichgewicht v. Systemen in gasförmig-flüssigen Phasen. Nach Vorlesgn. bearb. v. Dr. Ph. Kohnstamm. 2. (Schluss-)Tl. (XVI, 646 S. m. 205 Fig.) gr. 8°. Leipzig, J, A. Barth. 1912. Cloth M. 24.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Journal of the Society of Chemical Industry.

No. 4, Vol. XXXII. FEBRUARY 28, 1913. No. 4, Vol. XXXII.

Canadian Section.

Meeting held at Toronto, on Thursday, January 16th, 1913.

PROF. WALLACE P. COHOE IN THE CHAIR.

THE SCIENTIFIC ADVANCEMENT OF THE CANNING INDUSTRY.

BY R. T. MOHAN, M.SC.

The preserving of foods has its basis in the work of Pasteur (1822—1895), but even 70 years before his researches we have, in 1795, a process invented by a Frenchman, Appert, for preserving foods in hermetically sealed receptacles, and this process was awarded a prize of 16,000 francs by the French Government. This process consisted in placing the articles to be preserved in corked receptacles, and then subjecting these to the heat of boiling water for varying lengths of time dependent on the nature of the foods. Naturally this process of Appert was kept as secret as possible, but the information gradually leaked out, and in 1815 was brought from England to America. In 1819 an Englishman named Daggett had a canning factory in New York City, for packing lobster, salmon, and oysters, and in 1825 fruits and vegetables were canned.

In these early days glass jars only were used, but their cost, breakage, etc., led to the use of tin cans, the first patent for which was secured in England in 1823, and in America in 1825. The cans were made in the canning factory, and their manufacture was slow but interesting. The greatest difficulty was experienced in making the tops and bottoms, A weight was pulled up to the ceiling and allowed to drop on a sheet of tin ; a die was cast in the under side of the weight, and the opposite die was cast in a piece of metal below. In order to guide the weight so that the dies would strike in the proper place, two upright grooved guides were made, similar to those of a pile driver. The body of the can was made on a cylindrical form, the edges were butted together and soldered, and then the tops and bottoms soldered on.

Gradually, however, machinery was developed for canmaking, and to-day the process of production of finished cans from sheet tin plate is automatic and continuous, and the industry is entirely separate from that of canning, although many canning companies work their own canmaking plants.

In the original Appert process only boiling water was used for sterilisation of the foods. This was found insufficient for many products, so, later on, salt was added to the water to raise the boiling point, and this was afterwards supplemented by the addition of calcium chloride, so that temperatures up to 240° F. could be produced. In 1874 a Baltimore man invented a closed retort for cooking with superheated steam. This led to our modern retorts or autoclaves, which produce various temperatures from 212° F. up, depending on the steam pressure used.

Although the industry dates back to 1795, it was conducted for a long time entirely without any knowledge of the real scientific principles underlying the methods in use, and it is interesting to look at some of the early theories advanced. The first theory was that of the exclusion of air. This was recognised by Appert, who stated that it was the external air which caused spoilage and not the air in the jar. Guy-Lussac, who was instructed by the French Government to investigate Appert's process, reported that spoilage of food was caused by a series of oxidation changes, and by drawing out the air and preventing its getting in again these oxidations were prevented. This theory that the air must be excluded was followed up to recent times, in evidence of which we see, only a few years ago, that cans were sealed, heated, vented to allow the air to escape, resealed, and then cooked. Sometimes a second heating and venting was given before cooking.

The next theory was the vacuum theory, closely related to the first theory : that is, it was believed to be only necessary to get rid of the air by vacuumising, and mechanical methods were developed to produce a vacuum. Many losses were experienced by those who blindly accepted this theory, for the vacuum has no real value in preserving foods, except in special instances such as salt meats, peanut butter, jams, etc.

Pasteur was the first to associate spoilage with organisms. Russell, of Wisconsin, was one of the first to apply the theories and methods of Pasteur to the solution of spoilage problems encountered in canning, and in 1895 he showed that spoilage in canned peas was due to the presence of bacteria which had survived an insufficient sterilisation. Prescott and Underwood, of Boston, made studies of sour corn, and first explained to the Packers' Association Convention at Buffalo, in 1898, some of the causes for spoilage in canned foods, and they showed slides of bacteria they had isolated from sour corn.

Among the important early investigations on canned foods was the work of the Canadian Government in 1897 on the spoilage of canned lobster. The packers were troubled by so-called " black lobster," and the investigation showed it to be due to bacteria.

With the introduction of science into the industry the first step was to put the processing or sterilisation on a sound basis. This entailed a careful study of the organisms found on fruits and vegetables and in the air. By the introduction of these organisms into good cans the changes produced were noted. The temperatures necessary to kill these organisms were studied. The time necessary for heat to penetrate to the centre of cans of food of different consistency was found out. By adding to this time of penetration the time necessary to kill the bacteria the basis of a process was established.

One of the instruments, used very largely nowadays for determining the necessary time for heat penetration, consists of a can, procurable in any desired size, fitted with a gasket which is easily screwed to the can by means of the wrench. A self-registering thermometer is attached so that the bulb is in the exact centre of the can, for this is the point to which the heat must penetrate to ensure complete sterilisation. The mercury in the thermometer is shaken down, the can filled, sealed, and put through the process with the other cans. It is afterwards opened, and the maximum temperature reached is read on the thermometer. Another form of instrument is a can fitted with a thermo-couple. Wires lead to a recording instrument outside the can, and the progress of the temperature is recorded on a chart. By experimenting with these cans, valuable data may be obtained for different temperatures, times, etc. The processes which were successfully used years ago are now unsafe, because as time goes on larger numbers and more resistant kinds of organisms have to be dealt with.

During this study of micro-organisms it was discovered that weather conditions affected the bacteria on the crops, that uncleanliness and delay in handling raw materials meant the multiplication or the introduction of undesirable organisms which were very hard to kill. Hence processes are varied slightly with weather conditions, and every packer guards against bacterial multiplication by the rapid and careful handling of all his products, otherwise excessive temperatures would be required, and of course the longer and more intense the heat, the less presentable is the finished product.

By this careful study of organisms and the changes brought about by these organisms in different classes of canned foods, two distinct divisions have been made in sterilising. It was found that the spores of spore-bearing organisms are very difficult to kill ; in boiling water they could survive for hours, but that 10 to 15 minutes at 240° F. usually killed them ; it was also found that these spores would not develop in media having an acidity above 0·3 per cent. On the other hand, yeasts, molds, and some non-spore bacteria were able to grow in a moderately acid medium, but were easily killed in boiling water. Hence, when any foods of high acidity, such as fruits (and tomatoes), are canned, it is usually in boiling water for varying lengths of time, while the non-acid products (vegetables) receive temperatures above 212° F. in order to kill the spores. This then is the line of division between the use of the open bath (or boiling water) and the retort (or temperatures above that of boiling water).

When the packer became aware of the many possibilities of loss, he introduced a system of testing his products now known as the incubation test. A room is maintained at a constant temperature of 98° F., and from each cook a few cans are taken, carefully marked and placed in this room for about five days, when any unkilled organisms will have had time to develop. The cans are then examined physically and microscopically, and if anything abnormal is found, the corresponding batch, which will still be in good condition, is located in the warehouse and the goods are discarded or re-treated, depending on their condition and the cause of the trouble. Thus the packer is able to put his products on the market with a reasonable assurance that they will keep, but of course occasional cans may later develop a leak and the contents be spoilt. It is essential in this work to have the room maintained at 98° F., because most organisms with which we are concerned develop best at this temperature, while some develop only slowly at temperatures above or below this.

By testing the finished products in this way, many irregularities have been noticed, and arriving at the cause of all cases of spoilage has led to many improvements in methods of sterilising. Thus, it was sometimes found that the cans had been put in and never cooked, or else the time had been forgotten and the cook cut short. To overcome this, different forms of clocks which show the time, etc., on each cook are now used. Some of these are automatic, and shut off the steam at the proper time. In other cases where only part of a batch was spoiled, it was found that uneven temperature conditions existed, and hence the introduction of modern steam regulating and circulating devices.

One of the early difficulties encountered by the bacteriologist was the differentiation between a leak and a swell. To the layman this might seem simple, and of course in the case of a visible leak it is easy, but most of the leaks are so minute, and being on the seams or in the solder, they cannot be found. Organisms have entered these small holes, and the cans swell. The hole becomes cemented up with the contents of the can, and the foods or gases do not leak out. Sometimes a small hole will leak from the outside in, but not from the inside out; sometimes these holes are closed more firmly by the strain on the can. It became necessary then to make a bacteriological study to distinguish the cans spoiled by a leak and those spoiled by under-treatment, and we now have a very reliable distinction which was arrived at by a careful study of cans known to be under-treated, and those known to be leaking. I explained that in non-acid products it is necessary to not only kill the bacteria, but also the spores, which require a great heat in most cases. If therefore in a swelled can of food of low acidity we find only living spores or spore-bearing organisms, it is safe to say that the can has not been sufficiently sterilised; on the other hand, if we find lactic acid bacteria present we know that the can leaks. This conclusion is very sound; the lactic acid bacteria are very prevalent in the air, they are very minute and can pass through a very small hole, and they are the first organisms to seize on any matter containing sugar; hence if any air is drawn into the can through a small leak these lactic acid organisms will be present. There may be others too, but the presence of living lactic acid bacteria is proof of a leaky can.

In the case of the acid products, the differentiation is not so easy, and requires considerable experience and judgment. As I said, the spores do not develop in this class of foods, only the yeasts, moulds, and some non-sporing bacteria, and in an under-treated can we find some one of these present in pure culture, while in a leaky can there are several varieties of each or all.

These conclusions are drawn of course only when the cans have been subjected to a fair degree of heat, which is ascertained by a physical examination of the contents and the can. For instance, in tomatoes, when a fair amount of heat has been applied, the gelatinous envelope surrounding the seeds will be removed; in the case of fruits, the colour, softness, etc., is an indication of the degree of cooking. In the case of foods given a heavy treatment, as is necessary for vegetables, the inside of the can will have a bluish cast and galvanised appearance.

Besides the bacterial examination of swelled cans, it is customary to empty the can, clean in hot lye, reseal, and subject it to a pressure test under hot water. Very frequently minute holes are found in this way, but the method is not so reliable as the bacterial examination, for some leaks become cemented so firmly that they can withstand high pressure.

An examination of the gases present also aids in this work. In all cans there is a certain amount of head space, and the gas in this head space would be expected to consist of the constituents of the air, plus any other gases formed in the sterilising, but it has lately been shown that changes take place whereby practically all the oxygen in cans of fruit disappears, and only nitrogen, hydrogen, and carbon dioxide remain. This disappearance of oxygen is accounted for by the formation of oxides with the tin and iron; by the oxidation of iron and tin compounds; or by combination with hydrogen which is formed by the action of the acid on the tin plate. The hydrogen does not appear in this head space until all the oxygen is consumed. In the case of vegetables we may have sulphuretted hydrogen and phosphoretted hydrogen formed by the breaking up of the protein matter under the high heat, along with nitrogen and possibly some carbon dioxide and oxygen.

Now let us look at spoiled cans. In the case of a leak a large proportion of free oxygen would be found; in the case of a swell in fruits we would find the regular gases of alcoholic fermentation (carbon dioxide and hydrogen); in the case of swells in vegetables due to under-treatment we find large amounts of foul gases such as sulphuretted hydrogen, phosphoretted hydrogen, etc. You can see therefore that the examination of the gases in conjunction with the bacteriological examination is a valuable aid in determining the cause of spoilage.

An instrument for drawing off the gases from a swelled can consists of a hollow needle for puncturing the can. A rubber stopper makes a tight joint to prevent gases escaping at the hole. A screw presses the plate up and forces the needle through the can, the gas being led off through the needle to a collecting apparatus. A later type of instrument has an auxiliary tube to force water into the can, and thus drive all the gases out for quantitative work.

In the canning industry we use certain terms in describing spoiled cans, namely, leaks, hard swells, flat sours, and springers. A *leak* is one where the food is spoiled by the entrance of organisms through a small hole. Sometimes these holes are visible, especially if due to the faulty capping of the can, but more often the leak is invisible. By a *hard swell* is meant a can which is swelled out perfectly tight by the gases evolved in the spoilage, and no amount of pressure will force the can back to normal size and shape. This class represents an advanced stage of spoilage, and when the pressure generated inside becomes sufficient, the can bursts at the weakest part, usually on the seam. A hard swell in vegetables is usually foul smelling, due to the malodorous gases formed in the breaking down of the vegetable matter by the spore-bearing organisms; a hard swell in fruits does not give foul gases, but only the ordinary gases of alcoholic fermentation. Generally speaking, hard swells are the direct result of under-treatment.

By *flat sours* are meant cans which, to outward appearances, are perfectly normal, but when opened contain foods which are very sour or bitter. This occurs in corn, peas, beans, pumpkin, tomatoes, etc. They may have gone sour previous to being packed, but this condition is rare. The principal cause is under-treatment; the bacteria bringing about this result are spore bearing; they generate practically no gas; are anaerobic, and hence live on the carbohydrates, producing lactic acid. They are rather slow to develop, and therefore spoilage may not show for months, but if the incubator test is used, the spoilage will develop in about 10 days at 98° F. From the fact that the cans are outwardly of good appearance, this class of spoilage presents great difficulties to the packer. When parts of a pack get into this condition, it is a matter of careful and painstaking work to separate the good from the bad, and even when all care is exercised, the methods used are not entirely satisfactory. One method is to put the cans into boiling water, bottoms up. The expansion of the contents of the cans causes the ends to snap out, and of course the sour cans snap out first. By frequent cutting of the cans during the heating, a time is arrived at between the snapping out of the sour cans and of the good ones. Another method is to heat the cans until they all snap out, then cool them, and separate the good cans which snap back first. The success of either method depends largely on the operator, and is only approximately correct, because other factors, such as variations in filling, exhausting, etc., of the cans affect, the separation.

Springers are those cans where the vacuum is broken, the ends have sprung out, but may easily be pushed back again. This condition sometimes exists in vegetables, but in this class of foods a springer will likely develop into a hard swell. The most frequent trouble with springers is in fruits and tomatoes, so the term applies particularly to these. There are two subdivisions in springers: those in which are living organisms, and those in which no living organisms are found. If living organisms are found, the trouble may be due to a leak or under-treatment, and if the latter, a hard swell would probably develop later on. Some springers, however, have no living organisms. The action of the acids on the tin plate evolves hydrogen, and if there is very little space in the can, the gas when expanded by heat causes the ends to flip out, hence cans should not be filled too full; sufficient head space must be left to allow for the expansion of the gases present. Another cause may be insufficient exhaust, *i.e.*, the heating of the foods before or after they are in the can, and previous to capping. This is done to expand the contents and drive out the excess air. The cans are then sealed at once, heated, and after cooling there is a contraction, and the ends of the can are drawn back into place. If the exhaust is insufficient, the ends will not draw back properly. Another cause of springers is when fruit seeds or stones are present, and their seed life has not been killed, a development of the embryo will have taken place, with production of carbon dioxide in sufficient amount to cause the ends to flip out.

Discolourisation in canned foods.—Much trouble is encountered due to loss of colour or development of undesirable colours in fruits and vegetables, and many of these troubles have been accounted for. The colour of such fruits as strawberries, raspberries, and cherries is very delicate and easily destroyed. It was found that some of this was due to the action of the acid on the tin plate, iron compounds, which darkens the fruits, being formed. In other cases the fruits lose their colour altogether, and as far as I know, there is no explanation of this, except that the chemical compound constituting the colour is destroyed by the heat. Light coloured fruits, such as peaches, pears, and apples, sometimes turn pinkish or brownish. As this may develop in enamel cans, plain cans, or glass jars, the cause must be chemical: the brown colour is due to caramelisation of the sugar by overcooking, but what the pink colour is due to is unknown: it is probably an early stage of this caramelisation.

Another frequent cause of trouble in white fruits is the presence of black spots. In preparing fruits it is necessary to immerse them immediately in water or dilute salt solutions to prevent them from turning dark by exposure to the air. Sometimes a very dilute sulphite solution is used to retain the colour, this afterwards being washed off. However, sometimes a little sulphite remains on the fruit: then if there should be any appreciable amount of iron in solution, either from the tin plate, the knives used in peeling, or from the water, black iron sulphide is formed under the effect of heat, and hence the black specks.

In the case of vegetables the greatest difficulty is experienced with dark corn, and there are several reasons for this. This article is subjected to very high temperatures, as much as 250° F. for 60 minutes. If the corn is not cooled rapidly there will be a marked discolouration due to caramelisation of the sugar. The most frequent trouble, however, is from black iron sulphide formed by the combination of iron and sulphur. Discolouration of this kind is most frequent on the cap end or along the seams; the iron is usually derived from the tin plate by the action of the acids liberated from the flux by heat. The iron might also originally be present in the flux, or in the water. The sulphur is present as sulphuretted hydrogen, formed by the breaking up of proteid substances.

In the green vegetables such as peas, beans, etc., we have loss of colour due to the destruction of chlorophyll by the heat. To overcome this, the French usually treat the peas with copper sulphate, but this method is not used extensively in Canada or the United States. Other methods have been proposed for preserving the colour, and these aim to fix the chlorophyll as an insoluble compound on the vegetables. Such methods employ solutions of salts of calcium, barium, or strontium, but their value has not yet been proven.

The question of how to retain the natural colour of fruits and vegetables presents a good field for research, especially in the case of vegetables.

Canning of peas.—Last year's pack of peas ranked third in importance in the United States; the quantity packed amounted to a little over 7 million cases, or 168 million cans (the largest pack was tomatoes, 14 million cases; then corn, 13 million cases). Modern harvesting is done entirely by machinery, the vines being cut about the same way as hay. Special machines, called viners, handle the cut vines, removing the peas from the pods by beaters. The peas fall through perforations in a cylinder, large enough to allow the peas to pass through, but which retain the vines, pods, etc. Sometimes these viners are placed in the fields, but more often the farmer hauls the vines to the viners at the factory. The peas from the viners are next washed in cold water, in a revolving squirrel cage, to remove all the dirt and some of the mucous substance which adheres to the peas. The next step is the grading, which is also done in an inclined, revolving squirrel cage These cages are perforated in sections, with different-sized holes, the first 9/32 in. diameter, through which pass the "petit pois"; the second size, 10/32 in., giving the extra sifted peas; the third size, 11/32 in., the No. 3 or sifted pea; the fourth size, 12/32 in., the early June peas; those that pass out at the end are marrowfats or standards. Some packers, however, only produce three grades, and arrange the sections of the grader accordingly. There is also a method of grading peas for quality according to their density by using different strengths of salt solutions. The first grade floats in a solution of sp. gr. 1·040, the second grade sinks in this solution, but floats in a solution of sp. gr. 1·070, while the third grade sinks in the latter. This grading for quality coincides very well with the grading for size. After the peas are sorted or graded, they pass over a wide belt, on each side of which are seated women, who pick out the foreign material and the broken and defective peas. The next operation is the blanching, the object of which is to remove the mucous substance from the peas, and to drive water into the peas so that they will be soft and tender. This is done in boiling water for from 1 to 12 minutes, depending on the peas. It is one of the most important steps in the handling of peas, and requires experience and good judgment. The machines for blanching are of the squirrel cage type, revolving in water, and the speed can be varied to deliver the peas at the outlet in the proper time required. The water flows in the opposite direction to the motion of the peas, so that as the peas come out they receive clean water. The peas after blanching are washed with cold water, and then go to the filling machines, where they are automatically filled into the cans, the brine of salt and sugar being added at the same time. The cans are then capped by machinery, heated in retorts at 230° to 240° F. from 25 to 40 minutes, depending on the quality of the peas, then the cans are cooled and stored away. Delay may mean production of sour peas, or multiplication of bacteria, which would not be killed in the process, and would produce swells.

A most desirable quality in canned peas is to have them open up with a clear liquor. Very frequently the liquor is milky or cloudy.

Examination of this cloudy liquor shows it to have a high content of starchy material; that is, the starch has passed from the peas to the brine. This may come about by over-cooking, which would break the peas; by not properly cooking the peas after heating, which would allow a slow cook to go on; by improper grading, wher the smaller peas would be overcooked; by mashing at the filling machines, or overfilling the can, when the expansion would mash the peas. If the peas are not properly blanched to remove the mucilaginous matter, this will cloud the liquor. If there has been any heating (sweating) of the peas previous to canning, the liquor may be cloudy, because of the slime produced by the bacteria, and this slime is very difficult to remove by washing or blanching. A most frequent cause is the canning of over-mature peas, when the starch-content is higher than in young peas. All of these points, however, are dependent more or less on the skill and care of the processor.

Even with careful watching of all these points we may have cloudy liquor, but the causes are more of a chemical nature. For instance, if the water that is used is very hard, the lime and magnesia combine with the albumins, forming insoluble albuminates, which give the peas a thin hard shell which will not expand in the heating, but cracks and allows the starch to pass through into the liquor; the water itself might also become cloudy due to precipitation of the temporary hardness. It becomes necessary therefore to have a good supply of soft water, and in many places the water is purified to overcome these possibilities.

Some seasons, and in some districts, the peas are high in starch, and it is almost impossible to obtain clear liquor. A means for converting the starch into a soluble compound by means of an alkali such as sodium carbonate suggests itself. There is also the question of the solubility of protein matter in water, salt, and sugar solutions: the protein of the pea is more soluble in salt solution than in water. Experiments in Germany indicate that the use of excess of nitrates as fertilisers produces peas which tend to give cloudy liquor.

Tin plate. The canning industry calls for the use of large quantities of tin plate for can making. This plate must be of good quality, free from pin holes. The estimation of tin in tin plate presented many difficulties, but we now have reliable methods. A neat method for the detection of pin holes and imperfections in plate consists in coating the plate with a solution of gelatin, potassium ferricyanide, and sulphuric acid. At the end of thirty minutes the pin holes or scratches are located by the blue spots due to the interaction of the iron and potassium ferricyanide.

Some food laws not only specify the amount of tin on the plate per base box, but also limit the amount of tin which should be present in the foods. This, of course, entails frequent examinations for tin, which in the presence of so much organic matter is very difficult. This question of solution of tin by the contents of the can is very important. Many people believe that old canned foods are undesirable because they contain too much tin; but recent investigations show that such a procedure is unnecessary and of no value; if the contents remain in an opened can, very large amounts of tin go into solution, and for this reason cans should be emptied immediately after opening. The cause of this excessive solution of tin is the oxygen of the air. As already shown, in sealed cans the oxygen disappears in a short while, and along with this disappearance of oxygen the solution of tin practically stops. The maximum amount of tin goes into solution in about three months, and after that there is very little change. The U.S. Department of Agriculture is investigating in California the question of effect of age on canned foods, and their results show that canned foods which have been packed for some time are actually better than those only packed a short while, and therefore the dating of canned foods would not be of any great benefit.

Solder. The solder must be clean and free from dross, for the presence of the latter means pin hole leaks. It must also be free from excessive arsenic and antimony, which would affect the flow, and if introduced into the food would be harmful. At present there are two principal grades of solder used: 40 parts tin, 60 parts lead; and 45 parts tin, 55 parts lead. Until recently solder was supplied in the form of wire or cable, which was fed to the irons automatically. In the recently introduced solder-hemmed caps, the solder is in the form of a ribbon on the edge of the caps. This presents a great saving in solder and labour.

Flux. The requirements of a flux are that it must be free from iron, and it must not be acid; also sal-ammoniac in any quantity is not desirable. At present a neutral zinc chloride solution free from iron is found best; resin, dextrin, oils, and other organic substances are also used, but they are not very good as they gum up the cans.

Water. A very important item in the canning factory is the water. Nearly all the factories are in small towns or villages where the only supply is from wells. The water should be free from pathogenic organisms, because although any pathogenic organisms are killed in the sterilisation, still some non-pathogenic organisms which would be hard to kill might be introduced. The water should be free from iron; aeration of the water, with filtering or settling, is usually sufficient to eliminate it. Water high in lime and magnesia forms insoluble compounds with albumins, thus tending to harden vegetables, and where these waters are encountered a purifying system should be installed.

As regards the question of scale in the boilers, latest figures show that a one-sixteenth scale increases the coal consumption by 12 per cent.; so in the case of excessive scale-forming waters, boiler compounds are used. However, as so much live steam is used, coming in direct contact with the food, most boiler compounds are objectionable, and hence purification outside the boiler is resorted to.

Salt. Large quantities of salt are used for brines in vegetables, etc., and this salt must also be free from iron and much calcium and magnesium salts. Magnesia may also cause undesirable bitterness of the brine.

Paste. In the past, considerable trouble has been encountered with rusty cans, due to the paste used in attaching the labels. There are now good pastes which do not rust the cans nor soil the labels.

Sugars. Only pure granulated sugar is used in canning, and fortunately this is always offered in high grade. For syrups I do not think there is any appreciable difference between cane and beet sugar. If beet sugar is properly refined (freed from raffinose) there is no chemical difference between it and cane sugar. The only difference is in the grain and colour, but these are hardly sufficient to cause any trouble. Beet sugar usually forms more foam than cane, but this, I think, is due to the fineness of the grain rather than to anything else.

Miscellaneous. There are numerous miscellaneous products used such as coal, vinegar, spices, disinfectants, washing powders, etc., all of which are tested in the laboratory.

Gauges and thermometers must be regularly tested. The steam gauges must be correct to avoid explosions, and the thermometers must be correct to avoid losses in cooking.

Sewage disposal. In the past every effort has been made to eliminate any nuisance from this source, the solid particles being removed by screening, and returned to the land for their fertilising value, the screened effluent being run into a large body of water. This effluent consists of the washings from fruits and vegetables, and contains large amounts of nitrogenous matter; in dry seasons there may possibly be some putrefaction which is not harmful to health but may produce objectionable odours. Now that the Provincial Board of Health regulations prohibit all sewage or factory effluents from being poured into streams without purification, it will be necessary as time goes on and occasion demands it to put in purification systems, possibly on the lines of the septic tank and filter beds.

Utilisation of waste products is not overlooked in the canning industry. The small fruits, trimmings, etc., are sometimes extracted for their juice for fountain syrups.

The apple wastes such as peelings and cores are either dried and sold for wine and vinegar purposes, or else the juice is pressed out and sold as cider, or made into cider vinegar. Unfortunately the demand for cider vinegar in Canada is not sufficient to allow of the profitable treatment of apple waste for this purpose. However, it is very profitably turned into apple jelly to be used as the base for compound jams. When these wastes are properly handled, no objection whatever can be taken to their use.

In pea canning large quantities of pea vines are left over, which make very good ensilage. Some factories have their own silos, and sell the ensilage in the winter, while others allow the farmers to take the vines away free of charge; in other places it is necessary to pay to have them carted away.

In corn canning there are large quantities of corn silk, a small part of which is used to make extract of corn silk for medicinal purposes. The use is limited, however, but we hope some day to find a large and profitable outlet for corn silk. The corn stalks, corn cobs, and husks, make good ensilage. The question of production of alcohol has been investigated, but it was found that the recovery of alcohol would hardly pay for the cost of installing a plant.

Large quantities of seeds from tomatoes and pumpkins, as well as the stones, etc., from cherries, plums, and peaches, are now being utilised for their oil.

Many companies now have experimental farms, including several in Canada carried on by the Dominion Canners, the largest of which, situated near Brantford, is about 1000 acres, and is devoted entirely to seed production.

In the modern factory equipments the effect of the laboratory can be seen. The old retorts are being supplemented by ones in which the cans are agitated, thus shaking the contents and lessening the time of penetration of the heat, cutting down the time of sterilisation, and giving improved flavour and appearance.

No doubt the future will see the more general adoption of the intermittent system of sterilisation, that is, instead of sterilising in one operation at a high heat to kill the spores, the sterilising will be accomplished in two operations at lower temperatures; the first will kill all organisms except the spores, then in two or three days these spores will have developed, and a second heating will kill these developed organisms. This of course entails handling the product twice, and hence would be costly, but no doubt can be worked on a small scale, and the increased quality and appearance of the goods will bring a higher price.

In place of the old iron pipes and iron parts on cookers, filling machines, etc., there are now copper, brass, enamel, or silver. In place of the old wooden floors is concrete, and in place of the old wooden top tables, enamel or even glass tops; in fact, everything is arranged so that a hose can be turned on and the factory washed out very rapidly.

In Germany the canners subscribe to a large laboratory and experimental factory; in the United States there are many private laboratories, and now a laboratory under the Canners' Association is to be started. In Canada, the Dominion Canners are the largest corporation, and they have their own laboratory and experimental departments.

The canning industry makes it a practice to investigate all the reports as to alleged ptomaine poisoning due to canned foods, and in practically every case gets a denial of the charge. A ptomaine is described by Vaughan and Novy as "an organic chemical compound, basic-in character, and formed by the action of bacteria on nitrogenous matter," or in other words it is a putrefactive alkaloid, a product of decomposition. There are many known ptomaines, but very few of them are really poisonous. The poisonous ptomaines may be formed by pathogenic organisms, by a few yeasts and moulds, and a few anærobic spore-bearing organisms, all putrefactive in their action. There must be putrefaction to get poisonous ptomaines, and no packer would think of packing putrefactive products, so the only possibility arises where a can has leaked or swelled. Of the hundreds of reported cases of poisoning from canned foods, I only know of one where the charge was proved, and that was from a can of salmon that had a pin-hole leak, and the consumer should not have eaten the contents, which were abnormal. Physicians and others should be very careful before diagnosing a sickness as due to ptomaine poisoning caused by eating canned foods: an injury is being done to a large industry, and the public are needlessly scared.

Canned foods are generally regarded as non-perishable products, and are consequently put into a shed or damp cellar which is not fit for anything else. The result is that the labels are discoloured, the cans rust, and pin-hole leaks result. Although freezing does not materially alter the flavour of canned foods, it is not advisable to allow them to be frozen, for when they thaw out the cans sweat and rust very easily. All canned foods should be stored in a dry place, of even temperature, with good air circulation around and underneath the pile.

London Section.

Meeting held at Burlington House on Monday, 3rd February, 1913.

DR. W. R. HODGKINSON IN THE CHAIR.

THE TECHNICAL PRODUCTION OF ETHANE.

BY DR. C. SPRENT.

On account of the growing importance of Sabatier's method of "hydrogenation" in chemical industry, the following description of another successful technical application of this method, namely, the production of pure ethane by the combination of hydrogen and ethylene in the presence of finely divided nickel, will no doubt be of interest.

The investigations here outlined are the results of experiments carried out by the author at the "Elektrochemische Werke G.m.b.H." in Bitterfeld. The ethane, on account of its low boiling point (—93° C.), was required in the place of carbon dioxide for a refrigerating machine, which required a filling of about 600 kilos. of ethane, and was especially constructed for this purpose.

All other known methods for the production of ethane were first tried, but were found to be unsuitable. To make ethane, Sabatier[*] passed a mixture of 2 vol. of ethylene and one vol. of hydrogen through a tube one metre in length, containing freshly reduced and finely divided nickel: the gas on leaving the tube was passed through fuming sulphuric acid in order to absorb the excess ethylene. The resulting gas was then found to be pure ethane.

By means of the theorem of Nernst applied to the equilibrium, $C_2H_4 + H_2 \leftrightarrows C_2H_6$, it may be shown that one vol. of hydrogen can be added to an equal vol. of ethylene in such a way as to leave practically no remainder of either of the gases of the left side of the equation. It is merely necessary to find the right catalyst and conditions for the desired result. Simple though this reaction appears, the production of ethane in quantity was found to be a difficult matter, requiring for its completion as a rational process a thorough investigation and the application of very different methods than would have been supposed necessary.

The chief difficulties encountered can be placed under two heads, firstly the production of pure ethylene, and secondly the quantitative saturation of one vol. of ethylene by one vol. of hydrogen.

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[*] Chem. Zeit., 1907, 1096.

First, as regards the former of these. The method used was fundamentally that of Maihle, by the passing of the vapour of alcohol over aluminium oxide according to the reaction, $C_2H_5{\cdot}OH=C_2H_4+H_2O$. Maihle* showed that the catalytic action of the aluminium oxide was not only dependent on the temperature, but also on the physical structure of the catalyst, an amorphous oxide giving a good yield of ethylene, and the crystalline oxide a poorer one. In these experiments the same phenomena were very often observed; many samples of alumina gave no ethylene whatever, but converted the alcohol into an oily substance. The catalytic value of any sample of alumina can be tested to some extent by shaking the oxide with distilled water. The active samples treated thus are converted partially into a colloid, the particles of which move towards the cathode when subjected to an electric current. The particles of inactive samples immediately fall to the bottom of the vessel. Kahlbaum's aluminium oxide, "gereinigt," gave better results than any oxide prepared by myself.

Great care must be taken to keep the reaction at the temperature at which the yield of ethylene is at a maximum, namely, 360° C. If the temperature be raised the ethylene commences to decompose, forming hydrogen, methane, and carbon, and, moreover, the yield of gas decreases, on account of the amorphous oxide being slowly converted into the crystalline state. The high temperature also affects the catalyst in such a way as to alter the nature of its reaction with the alcohol, and thus aldehyde and hydrogen can be evolved by the decomposition of the alcohol.

On the other hand, the temperature should not be allowed to fall below 360° C.; because not only does the amount of ethylene then decrease, but a considerable amount of ether may in this way pass into the ethylene. The ether is formed by a primary decomposition of the alcohol, which takes place at a temperature of about 230° C. The ether itself, however, is also decomposed, forming ethylene and water at a temperature of 300°. Unless the temperature of the whole apparatus where the gas is generated is kept at 360°, a portion of ether may pass through with the ethylene without forming ethylene. The reaction takes place in reality in two phases,

$$2C_2H_5OH=(C_2H_5)_2O+H_2O:$$
$$(C_2H_5)_2O=2C_2H_4+H_2O.$$

Especially in an apparatus on a large scale it was found that the ethylene always contained some ether, sometimes as much as 10 per cent. This fact is lost sight of in the laboratory if the gas is collected over water, or the usual solutions used for the determination of the gases by absorption.

The formation of the ether can be reduced to a small percentage, if the oven in which the reaction takes place be placed in a lead bath and the alcohol vapour heated to a temperature of 360° before being passed through.

For the production of ethylene in quantity, iron tubes 3 inches in diameter and 1½ metres in length were employed; these were fitted inside with suitable contrivances to hold the catalyte. The tubes were connected with the vessel in which the methylated spirit was evaporated.

Ethylene produced in this way is not, however, yet able to be used for the synthesis with hydrogen to form ethane, as it contains impurities which on coming in contact with the finely divided nickel bring about a decrease of the catalytic activity of the nickel, and, if the process is continued, eventually cause it to become entirely inactive. The elimination of these disturbing impurities formed the chief difficulty in the beginning of these experiments. Firstly it was found indispensable to eliminate the ether and other traces of impurities such as aldehyde, isoprene, etc., by compressing the ethylene up to about 50 atmospheres. In this way the impurities were condensed and could be removed by a suitable contrivance in the apparatus. If these impurities were allowed to pass into the nickel oven not only was the catalytic action impaired, but the gas was made impure by the products of decomposition of these substances. The ethylene thus treated was also found to contain traces of sulphuretted hydrogen arising from the presence of sulphates in the alumina. This impurity was removed by passing the gas through a solution of lead acetate. A further washing of the gas with concentrated sulphuric acid was found essential; certain impurities, the nature of which was not determined, and which acted as poisons to the contact substance, were eliminated by this treatment.

The ethylene purified in this way was entirely free from any impurity, having a weakening effect on the catalyte. The hydrogen used was a product of the alkali works of "Griesheim-Elektron" in Bitterfeld, and was so pure as to require no further treatment.

The two gases, ethylene and hydrogen, were mixed in equal volumes, the adjustment being made with the aid of the gas-mixing and measuring apparatus known as the "*Rotamesser*," and then allowed to pass into the oven containing the finely divided and freshly reduced nickel. This oven was constructed similarly to the oven used for ethylene, only here the tubes were only one meter in length and four in number. The first two were coupled parallel with one another, the gas leaving each of these combining and passing into two more similar tubes coupled one behind the other. The dimensions of the tubes were determined by experiment, so that by the gas-velocity used (2 cbm. per hour) the temperature arising from the formation of the ethane (the reaction is exothermic) was unable to reach the point at which ethane decomposes, on account of the radiation of the heat. Working with the same gas velocity and a greater diameter of the oven, it was necessary to cool the interior by means of waterpipes.

The necessary temperature of 200° C. can be kept up with very little external heating. The difficulty, however, was that under no conditions of temperature, or by means of any arrangement of the contact substance in the oven, could the reacting gases be made to unite quantitatively, the best result obtained being a percentage of 10 per cent. ethane in the gas formed. This became a very acute difficulty, as chemical methods of removing the hydrogen and ethylene proved impracticable.

The next step was to employ an air-condensing apparatus (Linde's system), used for the production of oxygen, and attempt to separate the ethylene and hydrogen from the ethane by means of rectification. This proved only a partial success, as only hydrogen could be eliminated, the ethylene remaining with the ethane. The rectifying column of the machine worked under a pressure from 3—5 atmospheres, and no doubt it would have been possible to get a better result had there been another column where the liquid gases had been under a pressure of only a little more than that of the atmosphere. In fact it was shown that the liquid gas mixture, after standing some time in a Dewar flask, contained only 1 per cent. of ethylene. However, the loss of ethane carried off with the other gases would mean a very considerable one.

The solution of the problem was only arrived at when it was decided to effect the combination of the two gases under pressure. According to the law of Le Chatelier, it was clear that pressure must have a beneficial effect, but in consideration of the sudden rise of temperature occasioned by the combination of so much gas in the small oven, it seemed unavoidable that the temperature should rise above the temperature of decomposition of ethane. Moreover, a polymerisation of the ethylene seemed possible.

Experiments showed that the combination of equal vols. of ethylene and hydrogen under pressure in this way was impracticable, owing to the sudden rise of temperature making a proper control of the apparatus uncertain and precarious. However, by passing the gas mixture containing 80% ethane, 10 per cent. ethylene, and 10 per cent. hydrogen at a pressure from 30—40 atmos. through an iron autoclave filled with nickel pumice stone, a complete success was attained, the resulting gas being pure ethane.

The 80 per cent. ethane gas mixture, produced in the way mentioned above, which was collected in a gasometer, needed only to be drawn off by means of a gas-compressor, which then pressed the gas through a second nickel oven which, as already stated, was held under a pressure of from 30 to 40 atm. From thence the gas passed through the condenser straight into the steel cylinder, where the ethane was liquefied and weighed off.

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* Chem. Zeit., 1909, pp. 18, 29, 212, 253.

A careful adjustment of the "*Rotamesser*" measuring the volumes of the two gases at the commencement of the process is necessary to the success of the reaction, as an excess of one or the other of these gases naturally detracts from the purity of the ethane. The error must be in this case corrected by an addition of the required amount of one of the gases to the gasometer containing the ethane gas mixture.

It is advisable to work with a slight excess of hydrogen in order to avoid disturbances of this kind, as the hydrogen can always be "blown off" by opening the valve of the cylinder containing the liquid ethane. In the case of ethylene this is not possible.

The process here described runs continuously, and, with the little trial plant set up in Bitterfeld, 25 kilos. of liquid ethane were made daily. The plant is to be employed to produce 100 kilos. per diem.

During these experiments several interesting secondary reactions were observed, a description of which will be given at a later date.

THE FEEDING VALUE OF THE HORSE-CHESTNUT.

BY S. J. M. AULD, D.SC. (LOND.),

Professor of Agricultural Chemistry at University College, Reading.

During the year 1911, particularly abundant crops of acorns and of horse-chestnuts caused farmers and stock breeders throughout the country to turn their attention seriously to the possibility of using these substances for feeding purposes. The value and use of acorns as a stock feed has been much discussed, and many owners are well acquainted with their use, but the horse-chestnut has not been so seriously considered, although one or two cases are known to the writer where they have been used as a feeding stuff. Many inquiries on the subject were received at Wye College during the past year, and as very little information was available in the literature, it was decided to investigate the value and suitability of horse chestnuts as a constituent of regular rations for various animals.

The horse-chestnut, *Aesculus Hippocastanum,* grows in large quantities throughout the United Kingdom and the nuts, which have a very bitter taste, are popularly supposed to be poisonous. Little is known, or at any rate recorded, with regard to their chemical composition. They contain a saponaceous substance, the exact nature of which is undetermined, but the presence of which can easily be demonstrated by the froth produced when the ground-up nuts are shaken with water.

Preliminary examination.—A preliminary chemical examination showed the presence in the horse-chestnuts of an appreciable quantity of a non-drying oil, a small amount of tannin, the saponin, and certain uncharacterised glucosides. Whether the latter are identical with the aesculin and aesculetin which have been separated from the bark of the tree, and aphrodisein which is stated to exist in the seeds, is not certain. The bitterness of the nut is, however, probably due to glucoside-like substances, and not to tannin, since it persists after the removal of the latter and is destroyed by digestion with dilute acid. The bitter substance is extracted with alcohol and is not precipitated with the saponin by means of lead acetate.

Analysis of horse-chestnuts.—About half a ton of chestnuts were procured for the experiments and samples were drawn from these for analysis. The relative proportions of husk and kernel were determined on the material as received and also after drying at 50°—60° C., and at 100° C. The proportions are :—

As received—

85·5	per cent.	kernel	containing	41·17	per cent.	water.
14·5	,,	husk	,,	19·41	,,	,,

Air dried—

82·0	,,	kernel	,,	2·22	,,	,,
18·0	,,	husk	,,	7·06	,,	,,

Dried at 100° C.—

83·1	per cent.	kernel
16·9	,,	husk

The kernel consequently loses its moisture more readily than the husk, and, in so doing, it shrinks away from the latter, thus facilitating decortication.

Analyses of the ground air-dried kernel and husk carried out by Mr. E. A. Fisher, of the Wye College Chemical Department, gave the following results :—

	Kernel per cent.	Husk per cent.	Total nut per cent.
Water................	2·22	7·06	3·04
Ash................	2·86	1·66	2·66
containing phosphoric acid (P_2O_5)	29·11	12·19	—
Crude protein	12·08	5·66	10·99
True protein	8·77	4·37	—
Crude fibre	2·13	13·15	—
Oil (ether extract)	6·26	0·89	5·34
Carbohydrates (non-nitrogenous extractive matter)	74·45	71·58	73·97
containing sugar	2·51	—	—
	100·00	100·00	—

It is obvious, therefore, that the horse-chestnuts should form a very nutritious feeding-stuff. The amount of crude fibre is greatest in the husk, but in the complete nut it is not excessively high. The amount of crude protein is considerable and very important, despite the fact that about 3 per cent. consists of amides, amino-acids, etc. The oily material, also, is higher than generally supposed.

Feeding experiments with horse-chestnuts.—The feeding trials were largely carried out by Mr. G. O. Searle of Wye College, to whom the writer wishes to express thanks for his painstaking assistance. The experiments throughout were regarded as of a preliminary nature, and though many animals were given the nuts in small quantities to test their palatability, four only were set aside for a protracted trial, *viz.*, a calf, a sheep, and two pigs.

Preparation of the nuts.—Given whole, or only roughly crushed, most animals refused the nuts or ate them sparingly. It was decided that they should be dried and ground. Air-drying at ordinary temperatures is too slow and incomplete, and recourse was had to drying with artificial heat. Experiment showed that this could be done in a hop-oast by using a good fire, but any oven in which the temperature can be raised to about 70° C. could no doubt be used. After drying and partial crushing, the greater portion of the outer husk may readily be removed; the residue is then ground to a meal of any desired fineness. For these trials the grinding was done in a hand mill in the laboratory.

Grinding after boiling with water.—The ordinary chestnut meal prepared as above retains the bitter taste of the original nuts, and attempts were made to remove or reduce the quantity of the bitter principles present in order to make the feed more palatable. Boiling the meal with water produces a thick porridge-like mass which is impossible to strain, and soaking in cold water alone has practically no effect. Extraction with alcohol is useful, but does not wholly remove the bitterness; indeed, the extracted material when mixed with milk was refused by some young pigs.

Eventually the partly crushed chestnuts were allowed to soak in cold water over-night, then boiled for half an hour or so and the water rejected. The residual material was dried, partially husked and reduced to a meal as before. This material is still bitter, but less so than the ordinary meal, and has a pleasant smell and appearance. An analysis of this mixture showed the following composition :—

	Per cent.
Water	8·2
Ash	2·5
Crude protein	9·3
Oil (ether extract).....................	6·3
Crude fibre	9·5
Carbohydrates	64·2
	100·0

This material was largely substituted for the ordinary meal during the feeding trials, particularly towards the end of the investigation.

Feeding trials.—As an introduction to the feed, 4 lb. of the meal were mixed with 1 lb. of molascuit; of this mixture 1 lb. was given to the calf and ½ lb. each to the sheep and the first pig. At first the animals would not touch it, but later it was well mixed with their other food and by morning was well cleared up except in the case of the pig, which generally left about half its ration. This treatment was continued for a fortnight, the horse-chestnuts being given on alternate days. The calf invariably finished his ration and the sheep was not far behind, but the pig was never satisfactory and always left a big proportion of its food.

At the beginning of March, 1912, no ill effects having been noticed, the animals were put on regular rations as follows:—

Calf—
2 lb. chestnut meal, ¼ lb. molascuit, 8 lb. hay, and 1 lb. linseed cake.

Sheep—
1 lb. chestnut meal mixed with a little molascuit and about ¼ lb. dried grains and 2 lb. mangels and hay.

Pigs—
1 lb. chestnut meal mixed with 2--3 oz. molasses, 1 lb. barley meal, 1¼ lb. sharps. (The whole made into a wash.)

The first pig from the beginning gave trouble and would not take much of the food, despite the use of such devices as increasing the quantity of molasses, adding a quantity of condimental food, etc. The second pig, introduced at this period, started by eating about half its ration but finally left all of it and the pigs were consequently removed from the trial.

The sheep cleared up the chestnut ration moderately well, and was kept on the experiment for three weeks without losing condition or suffering ill effects, but it never liked the food and eventually was withdrawn for other reasons.

The calf took the chestnut meal remarkably well, the bitterness being apparently fairly well masked by the molasses feed. The amount given was slowly increased during April, 1912, by ½ lb. at a time every five or six days. When the quantity reached 3 lb., the 1 lb. of linseed cake was stopped, the animal thus receiving the whole of its concentrated ration in the form of chestnut meal. The best results were obtained when the meal was mixed with ¼—½ lb. of molascuit and a handful of wet grains or wet beet pulp in order to moisten the mixture slightly. By the end of May the calf reached the limit of 5 lb. of chestnut meal per day. Beyond this point it would eat no further, which is hardly surprising, considering the high nutritive value of the horse-chestnut and the bulky ration made up with the hay and molascuit. The 5 lb. of meal given per diem is equivalent to nearly 7½ lb. of fresh nuts.

During the period of feeding with horse-chestnut meal the calf apparently suffered no ill effects whatsoever. There was frequently a slight running at the eyes and nose during feeding, probably caused by the saponin, but this effect was transitory. These symptoms were also noticed in the boy who ground the chestnuts. The calf's physical condition was very much better at the end of the experiment than at the beginning. After keeping for one week on the 5 lb. allowance, thus completing a three-months' trial of the food, the experiment was ended.

The weights of the calf were distinctly interesting, the results being as follows:—

	cwt.	qrs.	lbs.	
Jan. 16	4	1	2	
Mar. 2	4	2	3	29 lb. in 46 days; calf in rather poor condition. Chestnut ration started.
Mar. 21	4	2	27	24 lb. in 19 days; this was with chestnuts and linseed cake.
April 10	4	2	19	Calf lost weight when cake was stopped, there being at first insufficient chestnuts to make up for it.
May 14	5	0	21	When sufficient horse-chestnut meal given, calf made a large increase, 58 lb. in 34 days.

Nutritive value of the horse-chestnut.—Analysis and feeding trials show the chestnut meal to be highly nutritious. Taking the meal from boiled nuts, as described above, the albuminoid ratio is found to be 1 : 8·6. The starch equivalent of the mixture, calculated on an average 10 per cent. moisture content, is 74. This is calculated from a digestibility trial quoted by Kellner. The chestnut-meal is therefore a fairly concentrated food and compares in character with the best feeding meals. For fattening purposes or for store cattle, the high starch equivalent suggests that the nuts would prove very useful, providing the animals would take them. The great drawback is, of course, the bitterness. There is apparently no poisonous action, and to test this point further an extract of chestnuts was re-absorbed into bran and fed to guinea pigs. Quantities of extract equivalent to 7 lb. of chestnuts were consumed by the guinea pigs without any ill effect.

Summary and conclusions.

(1) Horse-chestnuts are not poisonous to any of the farm animals tried, within the limits of what they can be induced to eat.

(2) Analysis and feeding trials show the nuts to be highly nutritious. In a trial extended over three months a calf received up to 5 lb. per day of horse-chestnut meal, improving in condition and making good increase in weight. A sheep received the nuts over a period of three weeks without ill effect and two pigs were fed over a shorter period. The latter were unsatisfactory and would not take the food.

(3) The chestnuts are best prepared in the form of a meal after drying and removing the larger portion of the husk. To decrease the bitterness, the nuts may be crushed, soaked and boiled with water previous to drying and are best fed mixed with a little molasses or molasses feed. The extraction and treatment might possibly be done on a commercial scale.

(4) Chestnut meal is a fairly concentrated food. The albuminoid ratio is 1 : 8·6 and the starch equivalent 74. The material might profitably be used for store cattle or possibly for fattening, if animals can be induced to eat it. Calculated from the starch equivalent, 1 lb. of horse-chestnut meal would be equivalent to:—

1 lb. 1 oz.	feeding barley
1 lb. 4 oz.	oats
1 lb. 8 oz.	bran
2 lb. 5 oz.	good meadow hay

Manchester Section.

Meeting held at the Grand Hotel on Friday, January 24th, 1913.

DR. GILBERT J. FOWLER IN THE CHAIR.

CONTRIBUTIONS TO THE TECHNOLOGY OF THE PAPER INDUSTRY.

BY CLAYTON BEADLE AND HENRY P. STEVENS.

THE INFLUENCE OF SODA CONSUMPTION IN BOILING UPON THE YIELD OF PULP PRODUCED.

In the investigation of any fibre for service in the manufacture of paper the determination of the soda consumption is of primary importance. We generally proceed first of all by boiling with excess of soda, say twice that which is likely to be consumed, when at the termination of the boiling, the soda consumed is estimated and a second boiling is carried out with the amount of soda found to be consumed in the first. If the material is now insufficiently boiled, a third boiling is made with ⅕ more soda than is contained in the previous one. This is likely to leave some soda in excess at the end of the boiling. If now the material in the third boiling is found to possess the requisite qualities in regard to beating, bleaching, etc., the amount of soda used in the third boiling is regarded as the commercial quantity. More frequently, however, a greater number of boilings is required in which the conditions as to pressure, time, concentration of liquor and so forth are varied.

It is important, furthermore, to determine the soda consumption from hour to hour as the boiling progresses, in order to ascertain how long the boiling should be continued. For this purpose we blow off every hour or every half-hour a sufficient amount of liquor, say 100 c.c., and determine the free and total soda, calculating the combined by difference and expressing the combined as a percentage of the total. The free soda can be sufficiently accurately estimated by carefully titrating the liquor with normal sulphuric or hydrochloric acid, transferring drops periodically to neutral litmus paper made with specially sized paper. As the liquor is frequently intensely coloured the effect on the litmus paper is observed after flicking off the drop. The total soda is merely determined by incineration and titration in the presence of methyl orange.

Soda Exhaustion on Boiling Cotton and Hedychium.

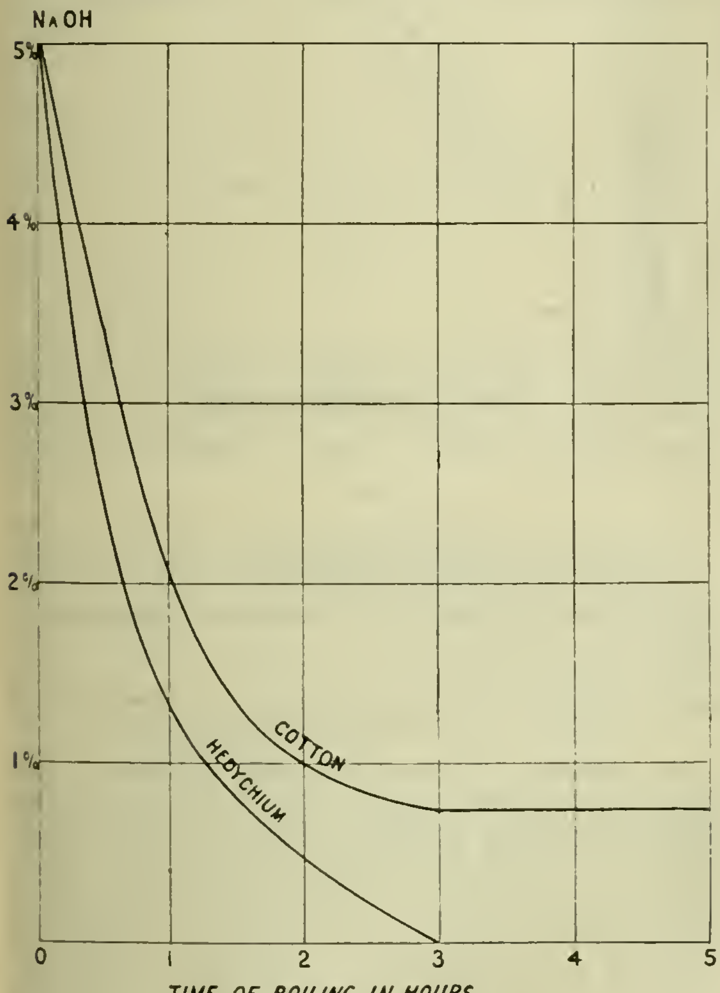

Fig. 1.

In order to check the accuracy of our methods we have evaporated liquors to the consistency of a thick dough and proceeded with the examination of this mass on the lines of ordinary soap analysis which gives for the free and combined soda almost identical figures with those obtained, as above, with the original dilute liquors.

To save time, one can merely determine the free alkali and, knowing the soda and the volume of the liquor originally added, calculate the combined. This, however, is only approximately accurate on account of the fact that the free mother liquor which drains from, or is blown off from. the boiled material is of a different concentration from that which is soaked up by, and remains in close contact with it. This is due to the fact that there is an absorption of the alkali by the material. The same absorption is found to take place on the mercerisation of cotton when the mother liquor draining or pressed from the mercerised mass is found to be of less strength than that which remains in close contact with the cotton. It also takes place, as we have recently demonstrated, when monofils of regenerated cellulose are exposed to caustic soda solutions in the cold in dilutions between 1 and 6 per cent. NaOH and for greater concentrations if the solution is raised in temperature.*

In laboratory investigations the best way of obviating this difficulty is to wash out the whole of the liquor at the end of the boiling, make up to a given volume, determine the free and combined soda and calculate to weight of raw material under treatment. In large scale operations, where this is not possible, we determine the free and combined soda in the mother liquor and, knowing the percentage of soda added in the first instance on the weight of raw fibre treated, we calculate the free and combined as a percentage on the raw fibre. Some fibres such as cotton, linen rags and esparto, are treated so as to purposely contain an excess of soda at the end of the boiling. Others, such as *Hedychium* (which is typical of the manila) class, is required to contain no free soda. Fig. 1 shows two average soda exhaustion curves, in one case for boiling cotton rags, and the other for *Hedychium.*

It is generally known that the greater the amount of soda employed, *i.e.*, the more drastic the treatment, the lower the yield. Sutermeister has, as the result of a large number of determinations, established a relationship between the yield and the soda consumption of spruce and poplar.†

Hedychium.—Comparing the Soda Consumption, during Boiling, with the yield of unbleached Pulp produced.

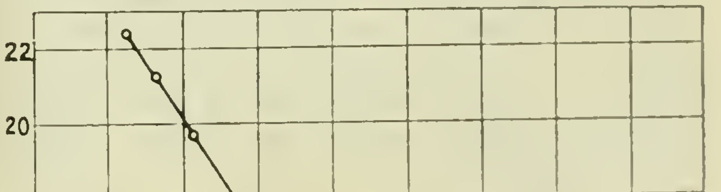

Fig. 2.

In order to ascertain whether similar results are to be obtained when treating other materials, we have taken the results obtained with *Hedychium* and plotted a curve

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* The influence of temperature on hydration of and absorption of soda by regenerated cellulose. Eight. Int. Cong. Appl. Chem. 1912. Vol. 13, page 25.

† Wood : Consumption of caustic soda in cooking (pulping) ——, and its influence on the yield and bleaching properties of the fibre. E. Sutermeister. Eighth Int. Cong. Appl. Chem. 1912. Sect. VIa. Orig. Comm., **13**, 265—269.

(Fig. 2) with the abeissae as yield and the ordinates as soda consumption, against which, on the same figure, we have given Sutermeister's curve for spruce. It will be observed, on comparing the two, that the curves are very similar. We have in the case of spruce a critical soda consumption of 15 per cent. and for *Hedychium* 5 per cent. At 5 per cent. *Hedychium* is sufficiently boiled for the production of commercial papers and above this percentage of consumption there is no benefit. It will be observed in both cases that there is a curve up to the critical soda consumption above which there is a straight line. From the critical point upwards in both cases the loss per unit of soda consumption is a constant quantity. In the case of *Hedychium* the average loss (0—15 per cent. NaOH) per unit of soda consumed is 1·66 and in the case of spruce the average (0—22 per cent. NaOH) is 3·25. Therefore the matter rendered soluble per unit of soda consumption is double in the case of the spruce as compared with that of *Hedychium* with almost identical yields. We have varied the conditions of the boiling *qua* time, temperature, concentration and so forth, and we furthermore confirm the views of Sutermeister that the yield and in a large measure also the qualities of the product obtained are dependent upon the soda consumption alone and are not influenced by the other conditions.

THE INFLUENCE OF TIME OF BEATING UPON THE RATE OF DRAINAGE FROM THE MACHINE WIRE OF THE PAPER MACHINE.

The rate of drainage is conditioned in some way by the wetness of the stuff, and this again by the beating and previous chemical treatment. No two kinds of material behave alike in this respect, consequently the question of drainage requires the exercise of a good deal of ingenuity on the part of the paper-maker. He is, however, materially assisted by many modern contrivances which promote the flow of the water with the assistance of gravitation and suction. The greater the amount of natural drainage however the better for the paper-maker. Generally speaking, *ceteris paribus*, the more "free" the stuff, the more rapid the drainage or the "wetter" the stuff the slower the drainage.

For the purpose of determining the change in the "free" working of a raw material as the result of chemical treatment and quite apart from the subsequent beating, the following method has been devised and usefully employed. Taking the case of cotton, this is taken in the air dry state, pressed into loose wads 15 × 10 mm., weighing 0·1 grm. The wads are let fall from a certain height on to the surface of a column of water and by means of a stop-watch the length of time necessary for the stuff to pass through the surface is noted. A tall glass jar is used for the purpose and the surface of the liquid kept on a level with the eye so that the operation can be carefully observed. The following figures are determined in the manner above cited:—

	Mean of 4 tests.
Cotton wool (ordinary) more than	24 hrs.
Bleached but unboiled short-fibred cotton ...	31·3 secs.
Cotton once boiled in 1 per cent. caustic soda	12·3 ,,
,, once boiled in 2 per cent. caustic soda	5·7 ,,
,, boiled and bleached and boiled again	4·0 ,,
,, after extraction with ether and alcohol	0·5 ,,

Thus, raw cotton floats on the surface like a feather and properly purified cotton will sink through the surface in half a second.

The rate at which pulps are wetted, as indicated by the above method of testing, has some connection with the rate at which the free water drains away from a pulp. As the pulp passes on to the paper machine, it contains about 98 per cent. of water and 2 per cent. of fibre. A modern paper machine travels at the rate of 5—10 ft. per second and the length of the machine wire is about 25 ft. Consequently, in order that the bulk of the free water may have passed off before the material reaches the suction boxes, it is necessary that it should drain away very rapidly. On the other hand, too rapid drainage detracts from the felting qualities of the paper.

In order to ascertain what influence the time of beating had upon the rate of draining, we made determinations with *Hedychium* pulp, making tests at every half-hour up to 3 hours' beating, the results of which are shown on the accompanying diagram.

Hedychium.—Showing the effect of time occupied in Beating upon the rates of drainage on the Paper Machine.

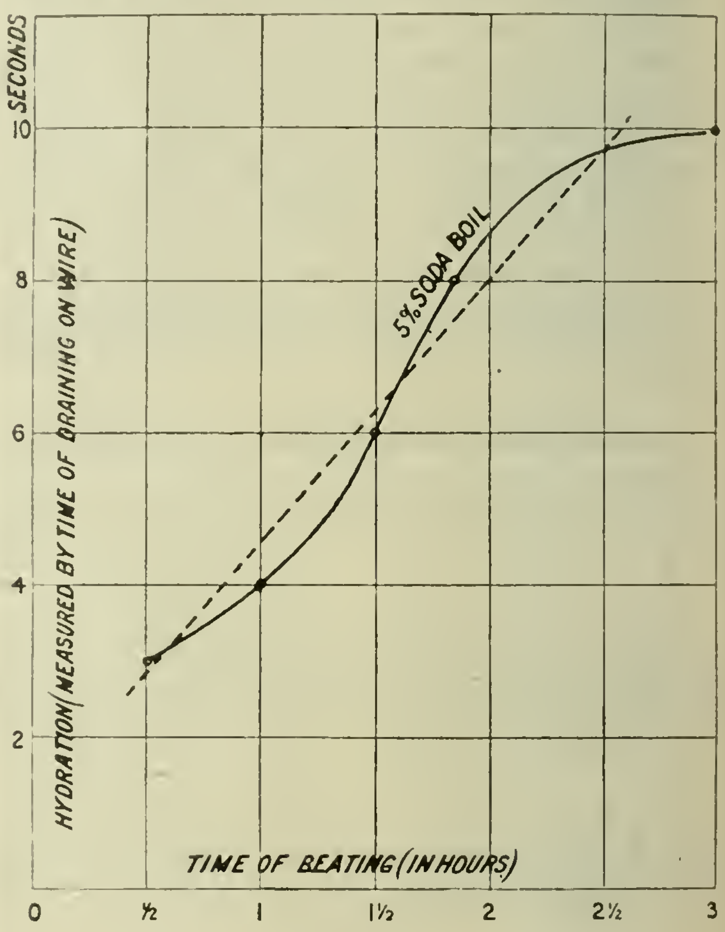


FIG. 3.

These results seem to indicate a wavy line or S curve but on the whole a fairly uniform rate of progression in the wetness and resistance to draining as measured in this way.

THE INFLUENCE OF SODA CONSUMPTION AND TIME OF BEATING ON THE SHRINKAGE OF PAPER.

The shrinkage of paper and what is known as the register of watermarks is largely controlled by the time occupied in beating as well as by the more or less drastic method employed in beating. It is however partly controlled by such means as tension put upon the web in the course of manufacture. Sometimes the register of a watermark, that is, its exact position in the sheet, is corrected by emptying into the stuff chest an additional engineful of stuff beaten either wetter or more free than the rest, according as to whether more or less shrinkage is required. In addition to the actual beating the amount of soda consumed in the boiling of the material prior to the beating is a determining factor. The diagram records the results of our tests with *Hedychium* paper made at different stages of the beating.

For each stage in the beating a large number of observations were made and the average taken (at least 20 measurements in each case) and to eliminate the opposing effects of tension, the sheets were allowed to shrink freely while drying.

As will be seen from the diagram (Fig. 4) (the abeissa of which represents the time of beating in hours and the ordinate the lineal shrinkage on drying as a percentage of the wet length of the paper), the shrinkage is rendered greater by increasing the soda consumption as well as by prolonging the time of beating.

Hedychium.—The influence of time of Beating upon the shrinkage of the Paper.

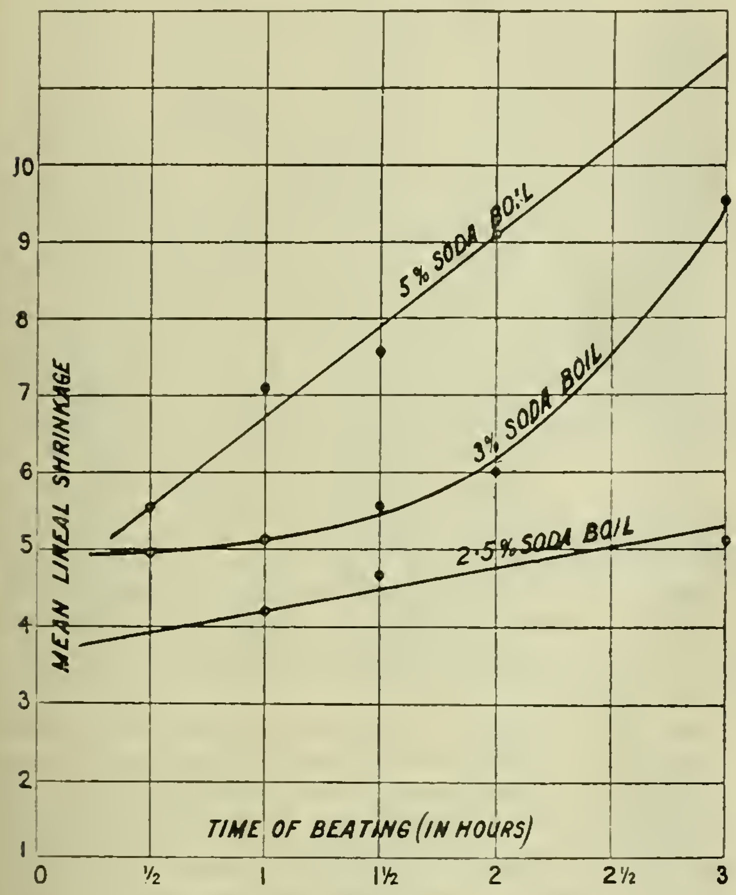


FIG. 4.

Measurements made on paper prepared from other materials led us to conclude that other paper-making materials behave in a similar way to that recorded for *Hedychium* and that any differences that may exist between different materials are a matter of degree rather than of kind.

THE EFFECTS OF SODA CONSUMPTION AND TIME OF BEATING UPON THE BREAKING LENGTH AND BURSTING STRAIN OF PAPER.

The figures herein recorded in the case of breaking length represent the length of a strip of paper which, if suspended freely in still air from a great height, would just break with its own weight. The figures for bursting strain are expressed in pounds per sq. in. as is the general custom in this country.

These two expressions, which are used commercially for indicating the strength of papers, do not vary in the same proportion and their relation to one another varies with different kinds and qualities of paper. For certain commercial purposes the breaking length is taken as the criterion whereas with others more importance is attached to the bursting strain. A close study of these two modes of expressing the strength of paper for the purpose of establishing any relationship between the two has never been made.

As furnished to the beater, the boiled material consists in the case of *Hedychium*, Manila, and such fibres, of threads (*i.e.*, fibro-vascular bundles), the dry breaking length of which is about 60,000 metres and, as the average breaking length of a paper producible from this or any other strong fibre cannot be made to exceed about 10,000 metres, the fibre bundles have in the dry state about six times the maximum strength of a felted paper producible from the ultimate fibres composing the bundles.

On prolonged wetting in water alone, the breaking length of these threads is diminished by about one-half and to a lower figure when acted upon by soda but this breaking length resumes more or less its original value when the material is dried again.

At the early stages of beating the threads are only in part reduced to the condition of ultimate fibres, the paper being of a very hairy nature, this hairiness diminishing as the beating proceeds. The hairiness at the incipient stages of beating is due to the presence of threads, *i.e.*, fibro-vascular bundles which in themselves possess a relatively high strength as already explained. Hence it is that a fictitious strength is given to such paper. As the beating proceeds, the fibre bundles become separated into ultimate fibres and the paper has to rely more for its strength upon the *felting* qualities of these *ultimate* fibres as distinct from the fibre bundles. The felting qualities, which are comparatively low at the early stages, gradually increase with the beating. Hence, in the case of 5 per cent. soda (Fig. 5), with one and a half hour's beating where the hairiness is rapidly disappearing but the felting strength is still low, the breaking length of the paper as indicated by the curve is much lower than at a somewhat earlier stage, *e.g.*, after one hour's beating. These observations apply to properly boiled stuff in which 5 per cent. of soda has been consumed.

Hedychium.—Showing the effect of time occupied in Beating upon the Breaking Length and Bursting Strain of Paper.

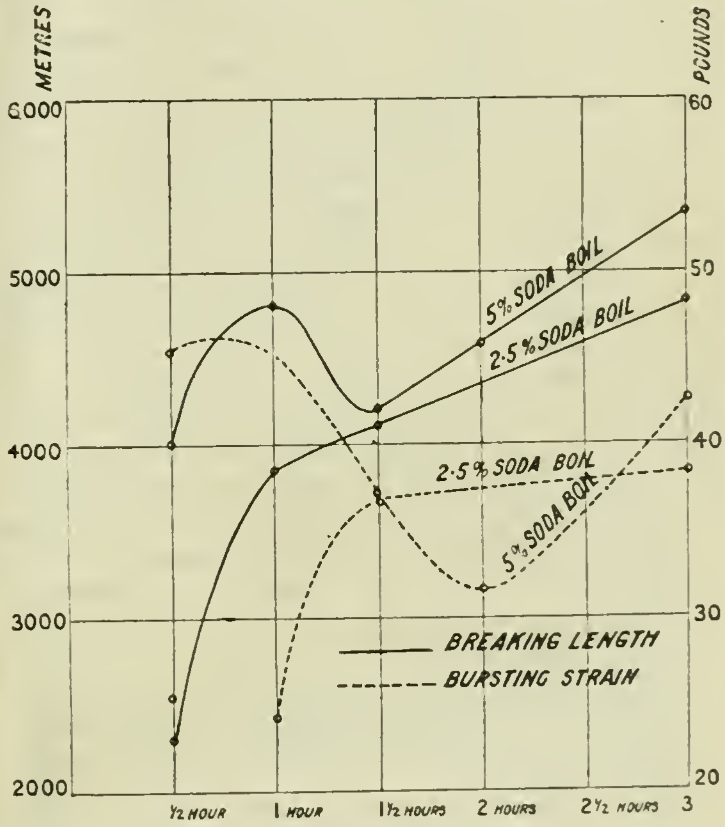


FIG. 5.

In the case of a much lower percentage of soda consumption, as when the boiling is incomplete, the circumstances are somewhat different. Here (with 2½ per cent. soda) the tenacity of the threads (fibre bundles) offers such resistance to the separation of the ultimate fibres as to ensure their hydration as rapidly as they become separated. This results in an increase of strength, the curve showing a continuous rise from the first half-hour onwards, in place of a fall followed by a subsequent rise as when a 5 per cent. soda is used for boiling the material. In all cases, however, for equal times of beating it will be observed that the smaller amount of soda gives the lower breaking length.

As the bursting strain of paper varies with the thickness, it is important to note that the substance of the paper made in each case was 20 lb. Demy equal to 74 grms. per sq. metre, with a thickness of 0·10 mm.

Turning to the bursting strain figures as indicated by the dotted line, it will be noticed in the case of 5 per cent. NaOH that after the first hour there is a diminution of breaking length but that the bursting strain comes to a minimum at a later stage in the beating, that is, at about 2 hrs. instead of 1½ hrs.—that is, it lags behind the breaking length, after which it rapidly rises.

In the case of the 2½ per cent. soda consumption (*i.e.*, incompletely boiled material), the bursting strain rises rapidly up to 1½ hrs. beating, after which, on further heating up to 3 hrs., only a slight rise is noticed. In this case also the bursting strain follows and lags behind the breaking length.

These results indicate that there is some connection between bursting strain and breaking length.

Discussion.

Mr. J. H. **Lester** suggested that perhaps the difference between the character of the bursting strain curve and the strength curve was due to the fact that the latter was independent of elasticity.

Mr. C. **Beadle** said that the actual tensile strength of a paper was something distinct from the bursting strain, and elasticity had much to do with the bursting strain. If a paper combined great strength with great elasticity the bursting strain would be relatively high; that was why the bursting strain test was so valuable. The relationship between the two sets of curves might be largely influenced by the change in the elasticity of the paper.

Mr. J. H. **Lester** said that the paper threw light on the nature of hydration and the influence of soda treatment upon it. In cases where cellulose was dealt with in dilute chemical solutions in ways somewhat analogous to the processes described by the authors, as regards the soda changes, they had practically the same problem to deal with, although, generally, in bleaching processes they were working with more dilute solutions. The action of the hypochlorite of lime resembled that of soda; a solution of it might be much weaker than the liquor which remained behind attached to the cellulose itself. The ease with which water might be abstracted from pulp reminded him of a test used to ascertain actual absorption rather than loss of moisture. It was a case of retention in one case and abstraction in the other. Blotting papers were generally used to ascertain this, but he had used the following method for determining the absorptive value of material. A capillary tube charged to the height to which water would naturally rise therein was used. The end of the tube charged in that manner was applied against the substance to be tested, and there was then a direct capillary force exercised by the material itself on the water in the tube, drawing it down to an arbitrary mark, say halfway down the tube. He found the rate of absorption ascertained in this manner to be in many cases a very convenient method of testing the absorbent qualities of fibrous material.

Mr. **Raymond Ross** said it seemed to him that probably adsorption was merely surface tension. In the case of paper the probabilities were that it was merely a question of surface tension.

Mr. **Gilbert Gunn** said that he did not consider breaking length to be a reliable test of the strength of any material. It was the breaking length in terms of the unit of sectional area which gave reliable results. Some time ago he had tested some paper that had been super-calendered and before super-calendering. When super-calendered the paper was reduced about one-third in thickness and it increased in strength about 30 per cent. Under breaking strength it only increased 7·3 per cent., and under breaking length per unit of sectional area he got about 30·1 per cent. Then he made another test of quite a different kind. There were a series of papers made from different kinds of fibres, and from a study of those fibres one would have expected the papers to be placed in a certain order when they were tested under breaking length. They did not, however, fall in with the estimate that had been formed, but when they were tested in the terms of breaking length per unit of sectional area they came out in the order in which they were expected to be found from a knowledge of the mixings. He was not, therefore, quite sure that the simple breaking length would give accurate results unless the papers were absolutely homogeneous and entirely of the same material. As to the time of boiling, it was a well-known fact that if any material were overboiled the fibre ultimately became very soft and made a very soft paper, which was much more absorbent, stretched more, and also shrunk more. In the case of esparto grass, if they were boiling Spanish or Tripoli, they had to regulate the percentages very carefully, and watch the pressure and the time so as to get quite constant results. Esparto varied a little in quality, and the percentage of alkali had to be altered somewhat. His own opinion was this, and it seemed to be borne out by the diagrams and results obtained by Mr. Beadle, that the cuticle of the fibre was in a kind of gelatinous condition, and to some extent it was not so resistant as the inner portion of the fibre. The outer skin was of a slightly different and more acid composition as compared with the centre of the fibre. If the fibre was overboiled the reaction was so severe that this was dissolved and they got less yield. Instead of getting a hard fibre making a good hard paper they got a very much softer paper. It was absolutely necessary, therefore, to keep the soda down to the right amount, and also not to prolong the boiling over a certain period. Of course, in the case of dirty rags it was essential to keep a revolver going somewhat longer in order to rub the dirt out. The thing they had to watch was that they did not get any excess of soda.

Mr. F. H. **Terleski**, referring to the question of pressure during the boiling of the fibre with soda, asked if the consumption of soda increased with the pressure, and was the difference in yield by any means due to removing resins or soluble bodies in the caustic soda which might possibly be present in the fibre. Had anything been done in the way of extracting resins, resinous bodies, or like bodies by solvents first and then treating the fibre with soda afterwards?

Mr. **Beadle** said in reply that, as the Chairman had remarked, the different factors were easily dissected; they could be expressed more or less independently of one another, though there was a great interdependence between them. Everything the paper maker did in the course of the treatment of the raw material influenced the final results. Thus the method and time of boiling altered the amount of power consumed in the heating, and what the heater man did concerned the machine man too. Reference had been made to the question of the breaking length. Ordinary breaking strain was not nearly so valuable as breaking length, because breaking length was an expression which eliminated the question of cross sectional area altogether. If one determined the breaking strain of a paper it was no use unless it referred to a paper of a given substance. The breaking strain of paper would vary with the thickness of the paper and so forth, whereas if the specific strength of a paper material was the same in all cases then the breaking length would be the same for all thicknesses. Another way of expressing the strength was in grammes per square millimetre cross sectional area. The cross sectional area could easily be determined, but one had to deal with the question of percentage by volume of the air spaces, and paper might contain anyway from 20 per cent. to 60 per cent. of air space. They had published results on about ninety commercial papers representative of all classes (The C.B.S. Units. Spon). These figures showed the proportion by volume of air space and that of the cellulose and other constituents contained in each paper, and they varied enormously. The extent to which the paper "bulked" undoubtedly very materially affected its specific strength.

Mr. **Gunn** remarked that the breaking strain referred to was in terms of sectional area.

Mr. **Beadle** continued that that would be influenced by the bulking of the paper. They might have two papers of equal "substance" in lbs. per ream, and alike in all other respects, but if one was "bulked" more than the other the breaking strain in the cross sectional area would be different. Therefore he agreed that to eliminate those difficulties it was far better to express it as breaking length. Although they opposed it for a long time they had been gradually converted to the method of expressing the strength of the paper in breaking length, and it was coming much more into use in this country.

Mr. **Gunn** asked whether Mr. Beadle could explain why there was such a difference in breaking length of 30·1 per cent. and 7·3 per cent. when they were all calculated from the same papers. The breaking length was of no earthly use unless it gave some reliable result.

Mr. **Beadle** replied that it might be accounted for by the bulking.

Mr. Gunn pointed out that the paper was reduced from 0·08 to 0·06 mm. in thickness in calendering, and consequently the strength of the paper jumped up.

Mr. Beadle said the calendering of a paper which resulted in decreasing its thickness would alter its strength, and it very much affected the figure for breaking strain if it was calculated per unit of cross sectional area, because the cross sectional area had been very much reduced. If it was expressed on a reduced cross sectional area it would show a much higher figure than before. He agreed with the view that the breaking strain expressed per unit of cross sectional area was altogether misleading. It was of less value than expressing it per unit of substance, which came nearer the idea of using the breaking length method of expression. Everything, however, tended to point to the advisability of arriving at some uniform method of expressing the strength, and his opinion was that there was nothing to beat the breaking length.

Mr. Gunn: It is the one generally adopted, but it has not always given reliable results.

Mr. Beadle said if they could only get into the habit of using it and forget their old methods they might possibly find it very much easier for all concerned. Certainly it was pretty universally used on the Continent, and seemed to give satisfaction. As to the question of the effect of pressure on soda consumption, pressure *per se* had no effect at all, as far as he knew. In this case it was simply a matter of reaching a certain temperature, and the greater the temperature the greater the rapidity of the process. Time was a factor also. They could boil at higher pressure and reduce the time or keep the temperature down and prolong the time. With regard to the removal of resins, there was a very small percentage of resin in ordinary pulp-wood. In the case of *Hedychium* they thought they might find some resinous products to account for the peculiar parchment-like properties. The combined alcoholic and etherial extracts, however, amounted only to about one per cent., so that resins could not in any way be held to account for the peculiar quality. Furthermore, if resins had been present to any extent they would probably have been removed during the boiling operation.

Demonstration of the Rainbow Cup.

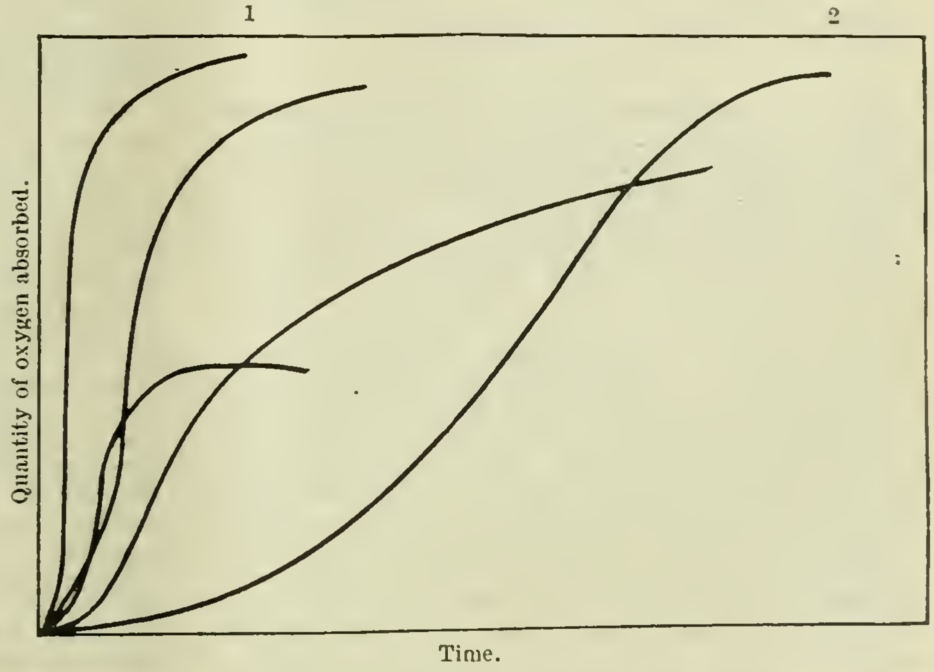
Dr. Hoffert exhibited an instrument known as the Rainbow Cup, which was displayed by Professor Vernon Boys at the Royal Society Soirée some time ago. He said that it was interesting to chemists who were also dyers and colourists, because the colours obtained were of great purity and brilliance, and the combinations which could be secured were so varied and numerous that those who produced colours for designs would find them very instructive.

THE ACTION OF GASEOUS OXYGEN ON INDIARUBBER.

BY S. J. PEACHEY.

See this J., Dec. 16th, 1912, pp. 1103—1105.

As a contribution to the discussion on this paper, Dr. Wo. Ostwald, of Leipzig, wrote as follows:—As far as I can gather from the paper and the discussion no attention has been called to the significance attaching to the form of the oxidation curves. Both curves may be referred to the S-form type, for it is evident that after a certain period the second curve reaches a final value, that is to say must again become horizontal. This S-shaped velocity curve for the oxidation of indiarubber enables one to draw some interesting inferences as to the chemical dynamics of the process, for curves of this type are characteristic of the so-called autocatalytic processes, *i.e.*, for such reactions in which, during the reaction itself, a catalyst is either formed or increased in quantity. The group of reactions which comes into question here includes the phenomenon of autoxidation, and for this particular case the type of curve obtained by Mr. Peachey is especially characteristic. Perhaps the best studied example of the autoxidation of an organic substance is that of linseed oil (A. Genthe. Z. angew. Chem., 1907). I append a group of curves representing this oxidation process, drawn for another purpose (biological) from the figures in Genthe's paper. The complete agreement between the linseed oil and the rubber curves is at once apparent. Attention may be called especially to the curves marked 1 and 2, which correspond most closely to those obtained by Mr. Peachey. The experiments of Mr. Peachey show, therefore, that the oxidation of indiarubber is presumably an autoxidation process, analogous to that of the formation of varnish, in which the catalyst is probably (as in the case of linseed oil) a labile intermediate product, rich in oxygen (possibly an organic peroxide).



Mr. S. J. Peachey said that the suggestion that the oxidation of rubber was an autoxidation process, analogous to that which occurred during the "drying" of linseed oil, was of great interest. As a matter of fact, the possibility of peroxide formation had already presented itself to him, and in most of the experiments referred to in his paper, the oxidation product was tested for substances of this nature. An aqueous extract of the resinous product (which is partly soluble in water) was treated with an acidified solution of potassium iodide, and in every case there resulted a somewhat slow but eventually strongly marked liberation of iodine. The extract also gave a faint but distinct yellow colouration with a solution of titanic sulphate. It would appear, therefore, that either hydrogen peroxide or some organic substance of the nature of a peroxide was always produced during the atmospheric oxidation of indiarubber, a fact which supported Ostwald's view that the reaction was one of autoxidation. Experiments on the nature of the peroxide produced were now in progress.

Mr. Clayton Beadle said that Dr. Stevens and himself had read a paper before the International Congress of Applied Chemistry, 1912, dealing with the different rate of vulcanisation of rubber which had been deprived of its resins as compared with normal rubbers, and in other papers they had communicated the effects of the removal of proteins upon the rate of vulcanisation (Kolloid. Zeitschrift, 1912, 11, 61, see also this J., 1912, 999.) Rubber containing the normal quantities of proteins and resins behaved in quite a different manner to rubber which had been deprived of them. He took it that Mr. Peachey's paper tended to show that rubbers deprived of their natural resins were far more susceptible to oxidation and very much more readily perished than rubber in its normal state.

The CHAIRMAN remarked that Mr. Peachey had said definitely that resin-free rubber was oxidised far more quickly than rubber containing the natural resins.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, January 24th, 1913.

PROF. M. C. WHITAKER IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL TO MR. J. GAYLEY.

Dr. C. F. CHANDLER said: It is my very pleasant privilege as the senior Past-President of the Society of Chemical Industry, residing in this country, to present to Mr. James Gayley the Perkin Gold Medal, for important achievements in industrial chemistry.

This medal has been awarded to Mr. Gayley by the Perkin Medal Committee of the Associated Chemical and Electrochemical Societies of America in recognition of his most valuable work in chemical metallurgy.

James Gayley is the maternal grand-nephew of Sir Henry Bell, who established steam navigation on the Clyde, where he launched "The Comet" in 1812. He was born at Lock Haven, Pa., October 11th, 1855, educated at West Nottingham Academy, Md., and graduated from Lafayette College in 1876 with the degree of Mining Engineer. In 1906 he received from The University of Pennsylvania the honorary degree of Doctor of Science, and in 1912 the same degree from Lehigh University. In 1908 he received the Elliot Cresson Gold Medal for the Promotion of the Mechanic Arts from the Franklin Institute.

Mr. Gayley began his professional life as chemist for the Crane Iron Company, Catasauqua, Pa., 1877–80. He was next superintendent of the Missouri Furnace Company, St. Louis, and later was the manager of blast furnaces, E. and G. Brooke Co., Birdsboro, Pa., 1880–85. In 1885 he became manager of the blast furnaces at the Edgar Thomson Works, and he was subsequently promoted to the position of general manager of the same works; later he became a managing director of the Carnegie Steel Company. In 1901 he was made First Vice-President of the U.S. Steel Corporation, remaining in this position until 1909. He was tho inventor of furnace improvements, bronze cooling plates, a stand for the ladle in pouring Bessemer heats, and the dry air blast.

I cannot recall a more far-reaching invention than that of the dry air blast for the manufacture of iron, for which he has received, between October 23rd, 1894, and September 5th, 1911, no less than fifteen successive patents in this country. I am told that his results in this direction alone mean a reduction of at least one dollar per ton in the cost of producing pig iron, besides making it possible for the ironmaster to produce in all weathers a product of uniform quality. When one remembers that there were produced in the United States, during the past year, twenty-nine millions of tons of pig iron, it will be seen that this invention of the dry air blast means a saving to the American people of $29,000,000 per annum.

I have presented to you very briefly the great achievements of Mr. Gayley in the field of applied chemistry, but quite fully enough to satisfy you that your Committee is fully justified in placing Mr. Gayley by the side of the previous recipients of the Perkin Medal as one of our greatest industrial chemists and chemical engineers. It gives me great pleasure, as the representative of the Society of Chemical Industry, and the affiliated Chemical and Electrochemical Societies, to hand to Mr. Gayley this token of the appreciation and affection of his fellow-chemists.

Mr. JAMES GAYLEY said: I wish to thank Dr. Chandler for his gracious words, and also the Awarding Committee and the Societies which they represent for conferring this great honour upon me. I appreciate it still more because the Committee have stepped aside from what is purely the chemical industry to another great industry, that of iron metallurgy, which, nevertheless, is one in which the application of chemistry is the controlling factor, and this recognition of the broader field of chemistry brings with it a keen sense of appreciation of this distinction conferred upon me.

The iron blast furnace is but the chemist's crucible on a gigantic scale, operated on chemical principles, and the mechanical appliances are instruments of precision, constructed and adjusted to carry out in an efficient manner the chemical reactions involved.

The "rule of thumb" practice, which ended thirty-five to forty years ago, is well-nigh forgotten. The application of chemistry to iron smelting has effected a wonderful transformation in that industry, so that to-day the chemist occupies the foreground in directing its operations.

Moisture in the atmosphere has long been recognised as a variable and influential element in the manufacture of iron. Truran, in his "Manufacture of Iron," written in 1862, refers at length to the influence of moisture on the quality and make of iron, and the increased consumption of fuel in the summer season, but does not touch on the problem of its regulation or removal. Later, in England, it was proposed to extract the moisture by passing the air over lumps of calcium chloride, but Sir Lowthian Bell showed the impracticability of that scheme on account of the rapidly diminishing power of absorption possessed by the calcium chloride. Charles Cochrane, an eminent iron manufacturer of Great Britain, proposed and obtained a patent for the extraction of moisture from the air by bringing it into intimate contact with liquid calcium chloride flowing over chains suspended in a chamber; but later he declared that the benefits to be derived from extracting moisture did not justify the cost. Nevertheless, the moisture in the atmosphere was recognised as a disturbing element. Some of the earlier makers of anthracite iron in the Lehigh Valley stated that they frequently knew in the morning what kind of iron their furnaces were making by observing the weather conditions; yet, prior to the first dry air installation in 1904, this variable element of moisture was accepted in a spirit of resignation, as something to be endured, like storm and sunshine, a condition beyond control.

It was my privilege to be invited in 1885 to take charge of the Edgar Thomson blast furnaces of the Carnegie Steel Company, a plant which represented the most advanced construction in blast furnace equipment, and was supplied with the best fuel and ores. In the operation of these large furnaces the influence of the atmosphere was forcibly impressed, as the steel works were being supplied with hot metal direct from the furnaces—for the Jones metal mixer had not come into use. It was a difficult matter to supply metal approximating uniformity even under the best conditions, and quite impossible under conditions of varying atmospheric humidity.

For several years observations were made twice a day of the moisture in the atmosphere, and a direct relation was established between the quantity of moisture and the grade of metal, with particular reference to the silicon which is the heat-producing element in the acid Bessemer converter. In summer the air blown into the converter was heavily charged with moisture, and in consequence a higher percentage of silicon in the metal was normally required, while at the same time these atmospheric conditions operated on the furnaces to produce a metal lower in silicon; thus the operation of furnaces in conjunction with Bessemer converters on direct metal may well be presumed to have been a difficult and trying proposition.

Under these conditions of manufacturing, the removal of the moisture from the atmosphere, or rather its reduction to a low degree and one of practical uniformity, appeared to hold out the only means of effecting regularity, and at the same time to promise a considerable saving. It was a matter of constant observation that a sudden change in the weather, making a quick drop in the temperature and content of moisture, would cause the furnaces to work excessively hot, but this period of dryness could not be taken advantage of, for before any changes could be made effective in the furnace charge to meet current atmospheric conditions, the moisture might have increased to its normal seasonable amount.

Observations of the humidity in the atmosphere were made daily from 1886 to 1890, when the first experiments for moisture removal were begun. A modern furnace consumes about 40,000 cb. ft. of air per minute, and for each grain of moisture per cubic foot there enters the furnace one gallon of water per hour for each 1000 cb. ft., that is, if the moisture was 1 gr. per cb. ft., 40 gallons of water would enter the furnace per hour. The variation of moisture from month to month in the Pittsburg district is shown in the following table :—

	Average temp.	Weight of water per cubic foot of air.	Water per hour entering a furnace using 40,000 cb. ft. of air per minute.
	° F.	grains.	gallons.
January	37·0	2·18	87·2
February	31·7	1·83	73·2
March	47·0	3·40	136·0
April	51·0	3·00	120·0
May	61·6	4·80	192·0
June	71·6	5·94	237·6
July	76·2	5·60	224·0
August	73·6	5·16	206·4
September	70·4	5·68	227·2
October	56·4	4·00	160·0
November	40·4	2·35	91·0
December	36·6	2·25	90·0

While the moisture in January averaged 2·18 grains, yet the variation for the month was from 0·56 gr. to 2·55 gr., and while June shows an average of 5·94 gr., yet the extreme variation was from 4·8 gr. to 8·50 gr., or in other words the moisture entering the furnace varied from 192 to 340 gallons per hour. During the mid-winter period the moisture may vary as much as 150 per cent. in the same day, but in mid-summer it rarely varies more than 25 per cent.

Having secured extensive data on the varying humidity of the atmosphere over a period of five years, the problem of reducing the moisture and making it uniform next presented itself.

The experience of English engineers was against the absorption process with calcium chloride, and my predecessor at the Edgar Thomson Works, Mr. J. H. Cremer, had constructed an apparatus to desiccate in the same way, but he obtained very unsatisfactory results. As our observations showed a reduction of moisture through a reduction of atmospheric temperature, the reduction of temperature by mechanical refrigeration suggested itself as the obvious method of removing the moisture; and on this basis the first experiment was undertaken in 1890 in a crude way.

We began by passing air through two chambers in succession : in the first chamber the air came in contact with pipes cooled by water, and in the second chamber anhydrous ammonia was expanded through the pipes. As the air came from the blowing engine it was quite warm, but after passing through the chambers it was very cold ; each chamber was only six feet long, and the volume of air treated was small indeed.

Various forms of apparatus were constructed from the period 1890 to 1895, and tests were made as opportunity offered. In 1896 I left the active management of the works to enter upon the general business of the Carnegie Steel Co. in connection with the ore department and the assembling of all raw materials. If the opportunities for experimenting were rare when stationed at the works, they became more so when located in the general office. I therefore secured the services of a young engineer, Mr. Walter, from a refrigerating company, and when they learned the nature of my experiments they kindly loaned me a small ammonia compressor to carry on the work. We used two air drying chambers—each four feet square and eight feet long, filled with pipe coils and equipped with the necessary refrigerating appliances. A blast engine with an air cylinder, three feet in diameter and capable of supplying 3500 cb. ft. of air per minute, was installed, and from this engine and its small air supply the data were worked out for treating 40,000 cb. ft. of air, which was the quantity required to supply a modern blast furnace.

We had ourselves to work out the necessary data for a practical demonstration; makers of refrigerating machinery were unable to help us, the treatment of a hurricane of air being an entirely different problem to refrigerating the air for cold storage rooms. In our experiments we tried rarefaction with refrigeration, but we did not obtain satisfactory results. For some time the chamber into which the cold air was discharged accumulated a large quantity of snow, and the air flowing in produced a veritable snowstorm. This was delightful on a hot July day, but unless we could have overcome this snowstorm it would have been disastrous to the process. We tried to extract it from the air, but without success. The essential thing was not to produce it, and in this we were finally successful. We were trying to refrigerate to a very low and unnecessary degree, and the frost did not become fixed on the cold pipes ; by increasing the temperature of the brine circulating through the pipes the snow became fixed, and promptly disappeared from the cold air blast. We worked generally under conditions of the highest humidity in the Pittsburg district, which we secured by admitting steam to the air inlet when necessary.

About the year 1900 we had plans worked out in detail for a plant to treat 40,000 cb. ft. of air per minute, and I then applied to my company for an appropriation of $100,000 to make this installation; and here my most difficult work began—to persuade my associates that moisture in the air could appreciably, even in a small degree, affect the working of a blast furnace. Money was readily appropriated for the mechanical appliances of the furnaces, or for securing uniformity in the physical and chemical composition of the ores, coke, and limestone, but few realised that the weight of air consumed per ton of iron was 50 per cent. greater than that of the other raw materials combined. It was not until 1903 that I secured an appropriation to construct the first plant.

Early in June, 1904, the dry-air plant, which was erected at the Isabella Furnaces at Pittsburg, was in proper working order and ready to be put on the furnace. It was necessary to apply the dry air gradually so as not to disturb the furnace adjustment, and as there were three blast engines we arranged first to supply dry air from one engine, making the blast one-third dry air. We decided to apply this dry air at 9 a.m., and I had the weight of ore charge increased by 5 per cent., and this increase was timed to reach the combustion zone of the furnace at 11 a.m. When the dry air was turned on at 9 a.m. the furnace soon showed the effect of it, the gas became greyer, a sure sign of the furnace working hotter, and when the 5 per cent. increase in ore had reached the hearth it was not discernible that the furnace had been given an increased duty.

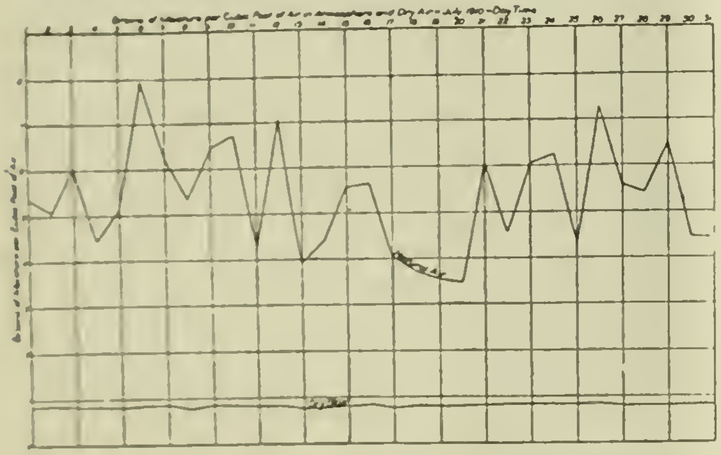
The operations of the furnace were conducted on a conservative basis, and the long time spent in working out and developing the air drying plant was rewarded, for the plant started and continued to perform its work without a hitch. By the sixth day the furnace was being supplied with two-thirds dry air and one-third natural air, and 9 per cent. increase in ore charge had come to work ; the furnace condition was splendid. The 9 per cent. in increased weight of ore charge represented the same percentage increase in output, and a like reduction in the amount of fuel used per ton of iron.

At this point there was a delay of two months, owing to the collapse of the refrigerating chamber, the concrete walls of which were not equal to the strain of the vibrations of the blast engines. The repairs having been completed the furnace was started again as before, and in two weeks' time we had secured a fuel economy of 15 per cent., and then by small increments we gradually worked up to a point of 20 per cent. efficiency. That is, we effected a fuel saving of 20 per cent. and increased the output to the same extent. This practice was continued for about six months, but the manager thought it was safer to make some allowance for irregularities in the raw materials, and the fuel economy was adjusted to 15 per cent. Even with dry air blast there is a disinclination to work up to the high limit of efficiency, for the prior experience of every furnace manager with natural air had shown the necessity of keeping a good margin of safety.

Our first installation consisted of a chamber filled with pipes, the air being cooled by indirect contact with cooling fluids (brine). The temperature of the brine is such that the air entering the chamber at 80° F. is discharged at 23° F. In the two-stage process the air is brought into direct contact with refrigerated water in the first chamber, and is reduced to about 35° F.; then it passes to the second chamber filled with pipe coils through which brine circulates, and the final temperature is obtained. The two stage method is more cheaply operated, and costs a third less to build.

It was not our purpose throughout our experiments to work out the most economical method of drying air for the first installation. What we aimed at was to construct a plant that would efficiently and continuously produce dry air, in order to determine its economical value in the furnace.

The following chart shows the variableness of moisture in natural air, and the regularity of dry air. The record covers the month of July, 1910.



The following exhibit is taken from the records of a dry air plant and shows the quantity of water extracted from the air.

July, 1910.	Gallons of water delivered to furnace in 24 hours.	
	With natural air.	With dry blast.
	gallons.	gallons.
1	5,349	834
2	5,517	849
3	5,438	829
4	4,432	814
5	5,488	844
6	7,797	849
7	5,428	844
8	5,873	799
9	6,633	829
10	5,981	819
11	4,511	785
12	6,203	804
13	4,002	779
14	4,713	785
15	5,828	809
16	5,522	819
17	4,116	809
18	3,588	809
19	3,410	809
20	3,915	819
21	6,119	809
22	4,678	814
23	5,876	814
24	6,327	834
25	5,152	819
26	6,450	829
27	5,764	809
28	5,453	809
29	6,184	819
30	4,525	799
31	4,298	782
Total, July	164,560	25,254

The records obtained at several works from the use of dry air, and which in each case cover a considerable period, are as follows:—Works A obtained a decrease in coke consumption of 10·5 per cent. and an increase in output of 23 per cent. Works B obtained a decrease in coke consumption of 6 per cent. and an increase in output of 15·3 per cent. Works C obtained a decrease in coke consumption of 9·8 per cent. and an increase in output of 11·8 per cent. Works D obtained a decrease in coke consumption of 10·5 per cent. and an increase in output of 16 per cent. The results obtained at different plants are modified by the raw material used, and the personal equation of management enters into it.

The results given above are taken from works in three different countries. The claim I personally make for the process is that with an increase in output of 10 per cent. the saving in fuel per ton of iron will be reduced 10 per cent., and I consider this conservative.

One of the advantages obtained through dry air is the elasticity it permits in the furnace operations to meet business conditions. If trade is dull, the furnace can be operated to secure the maximum of fuel economy with a small increase in output, but when trade is "booming" and pig iron is in demand an increased output is more desirable than a saving in fuel, and the furnace can readily be made to respond.

The manager of the Dowlais Works, at Cardiff, Wales, experimented with one furnace to determine what results could be obtained under each condition of operating. For a period the furnace was operated principally to secure increased output, and obtained an increase of 26 per cent. with a fuel saving of 12·3 per cent. In the next period they operated principally to obtain decreased fuel consumption, and obtained an increase in output of 12 per cent. with a decrease in fuel of 17·4 per cent.

In addition to the advantages from dry air already mentioned, it is found that the furnace works with greater regularity, and in consequence a more uniform metal is produced, and a required grade of metal can be made with precision. In low-silicon irons the sulphur does not increase as it does when natural air is used. The saving in coke effects a corresponding saving in the limestone necessary to flux the ash of the coke, and there is less phosphorus entering the metal. As the furnace charges settle more regularly, there is less fine ore carried over with the gases.

A manager of blast furnaces using dry air recently said that they found it to be an "educator" in their practice, as it had taught them the advantage of securing regularity in many other directions.

I shall not attempt herein to set forth any of the theories advanced to account for the fuel saving, which has been found to be in excess of what is necessary to dissociate the moisture. That feature has been ably discussed both in America and in Europe.

Mr. Henry M. Howe made the following remarks:—

Interesting as are the other aspects of the Gayley process, its greatest interest lies, I think, in the light which it throws on the nature of expert evidence and on the value of expert opinion.

It consists simply of drying the air used for burning the fuel in the iron blast furnace, apparently a rather simple matter. As a heat engine the blast furnace was known to be highly efficient, as human heat engines go. Nevertheless, by the extremely simple step of drying the blast Mr. Gayley made a further important saving of fuel, amounting in some cases to 20 per cent., and according to our present evidence to about 10 per cent. on an average, for usual American conditions.

The heat required for heating and dissociating the moisture of the blast is a minute fraction of the total heat requirement of the blast furnace process: how then dare we say that the removal of this heat requirement may save 10 or even 20 per cent. of the fuel?

Not a few of us had grown so used to calculating the heat needed for a given chemical and physical work like that of the blast furnace, and the heat evolved by the combustion of a given weight of fuel under known conditions, and to calculating thus the thermal balance, that we had lost sight of the supreme importance of temperature. The atmospheric moisture, calorimetrically considered, is indeed slight, but thermometrically considered it is sometimes of overwhelming importance. As to its effect on climate, Tyndall says: "To say that on a day of average humidity in England the atmospheric vapour exerts 100 times the action of the air itself would certainly be an under-statement of the fact." The sum and substance of it is that the blast furnace process has among its various duties to supply a certain quantity of heat at or above a certain high temperature, which for brevity we may call the critical temperature. No quantity of heat offered at any lower temperature will do this work. Drying the blast saves fuel by improving the temperature-distribution of the heat generated.

In the blast furnace, when combustion has raised the temperature above the critical point, there is available first a certain quantity of heat above that temperature, the hyper-critical heat, and second another and larger quantity of heat below that temperature, the hypo-critical heat, the heat remaining when the temperature has sunk to the critical point. The hyper-critical heat is needed for certain work which can be done only at hyper-critical temperatures, the hypo-critical heat is available for work which can be done at hypo-critical temperatures; so that, just as we have hyper- and hypo-critical heat, we have also hyper- and hypo-critical work. For heat economy the hyper-critical heat should be to the hypo-critical as the hyper-critical work is to the hypo-critical work. The proportion between the two evidently depends on the temperature reached by combustion itself. The higher this temperature, the higher proportion does the hyper-critical heat bear to the hypo-critical heat. If the temperature developed by combustion is so low that the ratio of hyper- to hypo-critical heat is too low, *i.e.*, below the ratio of hyper- to hypo-critical work, then in generating enough hyper-critical heat to do the hyper-critical work we are forced to generate an excess of hypo-critical heat over and above the hypo-critical needs of the process, and this excess of hypo-critical heat is used to poor advantage or is wasted. A mere change in the ratio between hyper- and hypo-critical heat, induced by a change in combustion temperature, can lead to a wholly disproportionate change in the economy of the process of the blast furnace.

Thus it was with Neilson's introduction of the hot blast. Formerly blast furnaces were fed with cold air, with the result that, because of the low temperature of combustion, the proportion of hyper-critical to hypo-critical heat was far below the proportion of hyper- to hypo-critical work needing to be done, with the result that the burning of enough fuel to provide enough hypo-critical heat yielded a quantity of hyper-critical heat far in excess of the hyper-critical work to be done, and this excess was used to poor advantage or wasted. Hence raising the temperature of combustion by heating the blast led to a saving of fuel which appeared little short of miraculous.

The degree of economy caused by blast drying should vary from case to case with the initial lack of hyper-criticalness in the combustion temperature; and if there is no such lack initially, as may happen conceivably, then blast drying should cause no economy.

Other means of adjusting the ratio of hyper- to hypo-critical heat suggest themselves, such as raising the temperature of combustion by further preheating the blast, by enriching it in oxygen, by removing part of the atmospheric nitrogen, and by electric induction at the very focus where the hyper-critical work goes on; and lowering the critical temperature by changes in the conduct of the process. We have not reached the end of knowledge in general, or of the improvement of the blast furnace process in particular. But the fact that blast drying, in removing the effects of the fluctuations in the atmospheric moisture, removes a serious cause of irregularity in the working of the furnace and in the quality of its product, gives it an administrative and commercial advantage over other means of raising the combustion temperature which may well be decisive.

The deliberateness and caution, indeed the tardiness, with which the iron trade has proceeded in adopting dry blast is referable to various reasons, such as hesitation to incur the certainly great expense of its installation, the competition of other devices for increasing earnings in other directions, the wish of each to get the benefit of the experience gained by its earlier adopters, uncertainty as to whether the saving found by one will apply to the different conditions of another's furnace, and the like.

Dr. **Edward Hart** gave some personal recollections of Mr. Gayley's early career, and referred to his generosity in providing the means for establishing new chemical laboratories at Lafayette College, as well as his munificent gifts to Lehigh University and the Allegheny Observatory.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Some properties of red vulcanised fibre. Parker. *See* V.

Patents.

Separating materials of different specific gravity; Machinery for——. P. J. Ogle and Mineral Concentrators, Ltd., London. Eng. Pat. 22,452, Oct. 11, 1911.

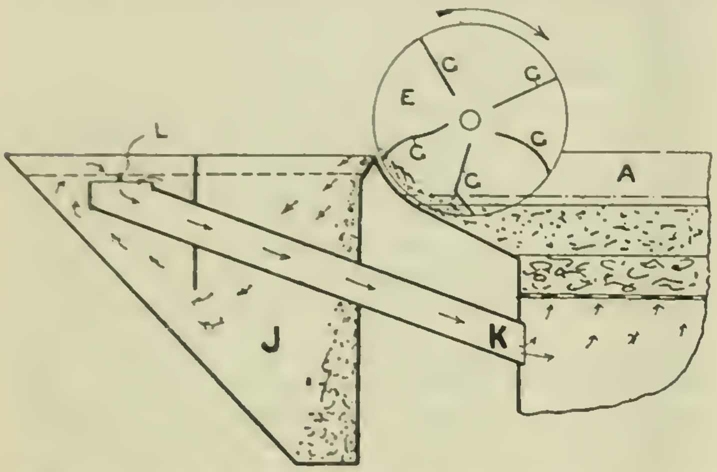
The materials to be separated are fed on to the upper surface of an endless flexible travelling belt, provided with transverse riffles. Water is fed on to the belt near its highest point, and flows downwards in the opposite direction to the travel of the belt. The belt is mounted in such a manner that it is nearly horizontal at the lower end and rises with a gradually increasing gradient. In this way the damming-back action of the riffles gradually diminishes from the lower end of the belt upwards and becomes zero at the highest point, where the concentrate is discharged. A transverse motion is also imparted to the belt to assist the separation.—W. H. C.

Evaporating, distilling, and similar installations. O. Söderlund, T. Boberg, and Techno-Chemical Laboratories, Ltd., London. Eng. Pat. 22,670, Oct. 14, 1911.

The claims relate to improvements in the process described in Eng. Pat. 12,462 of 1911 (this J., 1912, 971). As the solution being evaporated becomes more concentrated, the boiling point rises, and to overcome any difficulties caused by this, it is proposed to carry out the evaporation in successive stages, with increased pressure at every succeeding stage. This end is attained by providing a series of evaporators, so that each stage is carried out in a separate vessel, or the whole evaporation may be completed in one vessel by providing a compressor which can be so regulated that, as the liquid becomes more concentrated, the compression becomes greater.—W. H. C.

Separating materials of differing specific gravities; Washing apparatus for ——. H. J. Greaves, Derby. Eng. Pat. 20,143, June 15, 1912.

A rotary pump or wheel, E, provided with blades, G, is rotated in the direction of the arrow in the upper layer of water in any suitable type of washer, A, and delivers the water together with the lighter material into the settling tank, J. The solids settle to the bottom of J, and are removed by suitable means, and the water returns through the pipe, K, the upper end, L, of which is adjustable, to the washer, A, to be used over again.—W. H. C.

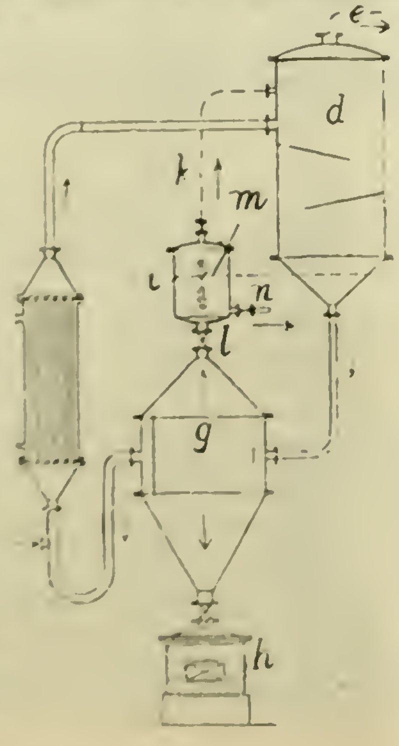


Evaporator. O. Schmeisser. Ger. Pat. 253,625, Dec. 4, 1910.

The patent relates to apparatus in which the evaporation is effected in chambers under progressively decreasing pressure, the liquid overflowing from one such chamber to the next, and is specially applicable to apparatus in which annular evaporating and condensing chambers are disposed concentrically, one inside the other. According to the present patent a pipe, or chamber, through which the liquid flows, in passing from one evaporating chamber to another, is disposed between the first-mentioned evaporating chamber and the condensing chamber, and in the case of annular apparatus it also is of an annular shape. According to one claim the annular walls of the condensing chambers are fixed to the cover of the apparatus, whilst the annular partitions between the evaporating and overflow chambers are fixed to the bottom or floor of the apparatus, in order to facilitate cleaning.—A. S.

Evaporating apparatus for solutions. C. H. Borrmann. Ger. Pat. 253,878, July 23, 1910.

In the apparatus claimed, above the chamber in which the separated salt collects is another chamber designed to to receive specifically lighter substances which also separate during the evaporation. The apparatus may be used, for example, for the recovery of ammonium sulphate from dilute wash-liquors. The ammonium sulphate which separates in the chamber, *g* (see fig.), is transferred as required to the salt-filter, *h*; the lighter impurities (tarry matter) pass upwards into the separator, *i*, which is connected with the vacuum space of the evaporating chamber, *d*, by the pressure-equalising conduit, *k*. The working of the apparatus is so regulated that the liquid level in *i* is always visible through the view-glass, *m*. When a sufficient quantity of tar has accumulated, it may be removed continuously by means of a pump, or it may be run off through *n*, after closing *l* and admitting air to the separator, *i*.—A. S.



Evaporating apparatus for brine and other liquids. F. Schulz. Ger. Pat. 254,486, Sept. 16, 1911.

The patent relates to evaporating pans having heating channels in the bottom. The heating channels are closed against the interior of the evaporator by thin metal plates fixed in place by welding and lying in the plane of the bottom of the evaporator.—A. S.

Distillation; Process and apparatus for ——. E. A. R. Chenard. First Addition, dated July 8, 1912, to Fr. Pat. 443,499, May 7, 1912 (this J., 1912, 971).

In one form of apparatus according to the principal patent, the vapours are passed through a series of fractionating chambers built up of a series of inverted conical trays arranged one above the other with cylindrical containing walls, alternate trays being perforated at the centre and near the periphery respectively, so that the vapours pass in a zig-zag course through the chambers. The liquid collecting at the centre of the trays perforated near the periphery passes into small U-shaped tubes, where it is subjected to the slightly higher temperature of the tray next beneath. In another arrangement the vapours pass in a horizontal direction through the chambers, which are provided with vertical partitions perforated in a similar manner to the above.—H. H.

Drying wet grains, spent hops, and so forth. A. T. Smythe, Craven Arms, Shropshire. Eng. Pat. 429, Jan. 5, 1912.

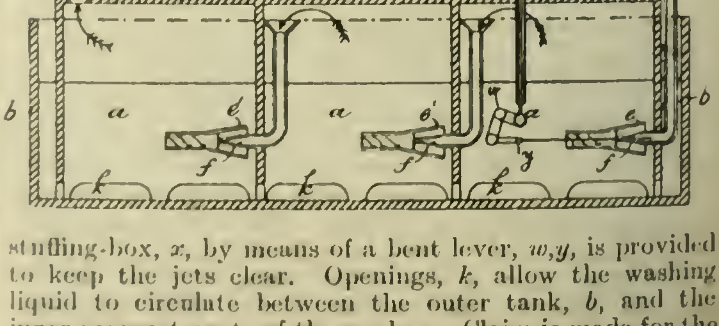
The apparatus consists of an elongated chamber through which the material to be dried is passed. Highly heated air is injected into the material from pipes having nozzles distributed along the path taken by the material, or the air is injected between a series of stepped overlapping shelves, formed in the chamber. The hot air is introduced at a high velocity, so that in addition to drying the material, it also serves to assist the passage of the latter through the apparatus.—W. H. C.

Desiccating apparatus. A. P. Hunt, Chicago, Ill. U.S. Pat. 1,050,463, Jan. 14, 1913.

The material to be desiccated is forced through inlet openings, into the upper end of a vertical chamber, and hot gas is forced into the chamber through a pipe with lateral openings, itself projecting into the chamber and directed downwards and centrally through it. At the bottom of the chamber is a separator which collects and discharges the dried material and directs the air to the exit ports.—W. H. C.

Liquids or solids held in suspension or combined in gases or fumes; Extraction of ——. J. Armstrong, London. Eng. Pat. 821, Jan. 10, 1912.

The gas containing the materials to be removed is compressed and forced through the liquid, *a*, in the several compartments of the washer from the jets, *f*. Cones, e^1, open at both ends and rifled internally, are fixed as shown to break up the gas into an exceedingly fine state of division. A wire operated from without, through a stuffing-box, *x*, by means of a bent lever, *w*,*y*, is provided to keep the jets clear. Openings, *k*, allow the washing liquid to circulate between the outer tank, *b*, and the inner compartments of the washer. Claim is made for the



use in this washer of tar for condensing tar, of acid for ammonia, of oil for benzol and light hydrocarbons, and of water or other cheap liquid for solids.—W. H. C.

Gases; Purifying, cooling, and mixing apparatus of the "disintegrator" type for ——. H. Theisen. Second Addition, dated June 11, 1912, to Fr. Pat. 404,336, June 23, 1909 (this J., 1910, 201).

Comprises detail improvements in a rotary gas-washing apparatus of the "disintegrator" type as follows, viz.: (1) the fan blades are curved to impel the gases more forcibly against the washing surfaces, and are perforated to prevent accumulation of dust, etc.; (2) the washing liquid is collected and carried away by a channel formed round the periphery of the casing; (3) the speed at which the gas passes through the apparatus may be increased by providing the periphery of the rotary drum with outlet tubes sufficiently long to contain a body of gas which is subject to strong centrifugal action; (4) the disintegrator blades are set at an oblique angle to impart an axial movement to the gas in addition to the radial movement; (5) fresh water may be injected into the gas as it passes through the outlet channel of the apparatus; (6) the washing water is introduced in such a manner as to prevent obstruction by solid particles, etc.; (7) the parts can be readily removed for repairs; (8) the efficiency of the machine may be increased by combining a number of disintegrators in series.—H. H.

Centrifugal machine for cleaning gas. H. Heekmann. Ger. Pat. 254,271, May 24, 1911.

In the usual centrifugal machine for cleaning gas, the dust-laden gas is introduced near the axis and is driven outwards, the dust being thrown by the centrifugal force on to the wall of the casing. The finest particles of dust, however, frequently do not reach the wall of the casing and may be carried away by the gas travelling in the same direction. According to the present patent, a second casing is placed adjacent to the purifier casing and separated from it by a partition. In this second casing is a fan or the like by which the gas, freed from dust, from the purifier casing, is forced from the circumference towards the discharge outlet near the axis. By this change of direction of the gas, it is claimed that efficient separation of the dust is effected.—A. S.

Furnaces. W. Sillery, Glasgow. Eng. Pat. 4162, Feb. 9, 1912.

The claim is for a furnace having a travelling fire-grate and provided with overlapping arches, one above the other, which project alternately from the opposite end walls of the furnace. The arch which is the nearer to the fire-grate projects from the front end of the furnace. —W. H. C.

Kilns, muffles, and the like. G. V. Evers, Stourbridge. Eng. Pat. 9277, April 19, 1912.

In kilns or muffles which have double walls connected together by bonding bricks or the like so as to leave an intervening gas space, the claim is for arranging the alternate horizontal rows of bonding bricks or blocks in such a manner that they engage one of the walls only. The other layers of bonding bricks engage both walls. —W. H. C.

Liquefied gases; Process and device for the production of a high vacuum in the jacket of double-walled receptacles for low-boiling ——. J. E. Lilienfeld. Ger. Pat. 253,975, July 19, 1911.

The jacket of the double-walled vessel (Dewar vessel) is placed in communication with a vessel which is maintained at the temperature of liquefied hydrogen. The vessel containing the liquefied hydrogen may be placed inside the other vessel, and the complete device may consist of two double-walled vessels, the jackets of which are in communication.—A. S.

Vacuum; Production of a high —— by cooling. J. E. Lilienfeld. Ger. Pat. 253,976, July 19, 1911.

The vessel to be exhausted is put in communication with the vacuous jacket of a double-walled vessel containing liquefied hydrogen.—A. S.

Washing apparatus for filtering material, in which the latter is circulated. R. Haag. Ger. Pat. 254,618, March 7, 1912.

The receptacle containing the filtering material and the wash-water is provided with a centrifugal pump, which withdraws the filtering material and then introduces it again into the receptacle. The wash-water laden with impurities flows away through a vertical perforated cylinder which rotates within the receptacle. The hollow shaft of this cylinder is provided with slots and encloses a tube also provided with slots. By moving the tube the slots in the shaft can be opened in succession from the top downwards.—A. S.

Mixing liquids; Apparatus for ——. M. Deacon and W. Gore, London. U.S. Pat. 1,050,111, Jan. 14, 1913.

See Eng. Pat. 262 of 1912; this J., 1912, 1069.—T. F. B.

Gases; Apparatus for recording the speed of ——. M. Bouffart, Herstal-lez-Liège, Belgium. U.S. Pat. 1,050,333, Jan. 14, 1913.

See Eng. Pat. 993 of 1911; this J., 1911, 1148.—T. F. B.

Refrigerating apparatus. E. Volland, Sürth on Rhine, Germany. U.S. Pat. 1,050,877, Jan. 21, 1913.

See Eng. Pat. 26,261 of 1911; this J., 1912, 1019.—T. F. B.

Separating materials of different specific gravity; Machinery for ——. P. J. Ogle, Assignor to Mineral Concentrators, Ltd., London. U.S. Pat. 1,050,991, Jan. 21, 1913.

See Eng. Pat. 22,452 of 1912; preceding.—T. F. B.

Filtering apparatus. W. W. Robacher, Rochester, Assignor to Just Process Co., Syracuse, N.Y. U.S. Pats. 1,051,160 and 1,051,161, Jan. 21, 1913.

See Fr. Pat. 418,045 of 1910; this J., 1911, 10.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke ovens; Suction of the crude gases from ——. E. Jenkner. Stahl u. Eisen, 1913, **33**, 145—149.

In order to avoid leakage of gas between the heating flues and the interior of the ovens, the pressures should, as far as possible, be equal at both sides of the oven walls at every point. Modern ovens are constructed so that the pressures in the heating flues can be exactly controlled, but the pressures in the oven chambers may vary. In order to equalise the pressures in different parts of the same chamber, a number of separate outlets may be provided at different points in the oven wall, leading to the hydraulic main. This construction has already been proposed for the purpose of removing the gases quickly and reducing their period of contact with the hot surfaces of the oven walls, in order to reduce the decomposition of the valuable by-products. The arrangement adopted by the author comprises a series of vertical outlets from the roof of each chamber, opening laterally into an air-cooled pipe which rests in a channel in the upper part of the oven wall. The gases, passing rapidly into the cooled pipe, are preserved from loss by decomposition of the by products. With this arrangement the temperatures in the ascension pipes were reduced from 595°, 750°, 640° and 610° C. to 300°, 335°, 341° and 305° C. respectively. The increase in the amount of by-products is shown by the quantity of ammonia, which amounted to 7·3 grms. per cub. m. with a group of ovens fitted with cooled outlet tubes, as compared with 5·6 grms. per cub. m. for a group of ovens with ordinary outlet connections.—A. T. L.

Coke-oven gas; Temperature of decomposition of ——. O. Simmersbach. Stahl u. Eisen, 1913, **33**, 239—245. (Compare this J., 1912, 75.)

The decrease in the heating value of coke-oven gas when preheated in the gas chambers of a Siemens-Martin furnace is from 25 to 33 per cent., instead of about 4 per cent. as has been supposed. Numerous tables are given showing analyses of coke-oven gas before and after heating to various temperatures. For example, laboratory experiments in which the same gas was passed over heated refractory material for 11 to 14 seconds at successively higher temperatures, the deposited carbon being burnt off after each experiment, gave the following results :—

	Before heating.	After heating to :				
		800° C.	900° C.	1000° C.	1100° C.	1220° C.
Carbon dioxide	3·4	2·1	1·3	1·0	0·7	0·2
Oxygen	0·9	0·5	0·3	0·2	0·2	0·1
Carbon monoxide	6·3	11·0	12·0	12·9	13·5	14·4
Hydrocarbons	2·7	2·0	0·2	0·1	0·0	0·0
Methane	33·2	27·6	20·2	17·3	15·6	5·5
Hydrogen ...	42·6	48·6	58·8	63·7	66·1	75·7

The temperature to which the gas is heated in the regenerator of a Siemens-Martin furnace is from 1000°—1060° C. The decrease in heating value per unit volume is accompanied by an increase in volume of the gas, and therefore by an increase in the speed of the gas current, and this in turn leads to the extension of the zone of combustion beyond the furnace chamber. The decomposition of the gas by heat involves the following reactions : (1), $CH_4+3CO_2=4CO+2H_2O$: (2), $CO+H_2O=CO_2+H_2$: and (3), $CH_4+H_2O=CO+3H_2$. A gas containing 68·3 per cent. of methane before heating, contained 58·5 per cent. at 800° C., 54·3 at 900° C., 32·6 at 1000° C., 7·7 at 1100° C. and 5·8 at 1200° C. The decomposition of ethylene begins at 500° C. and is practically complete at 900°—1000° C.—A. T. L.

Hydrogen and saturated hydrocarbons; Analysis of mixtures of ——. *Complex mixtures.* P. Lebeau and A. Damiens. Comptes rend., 1913, **156**, 325—327. (See also this J., 1913, 126.)

It is possible to separate mixtures of hydrocarbons by cooling to a suitable fixed temperature so that the condensed portion shall consist of only two hydrocarbons, the proportions of which can then be determined by combustion. From a mixture of ethane, propane, and isobutane at −127° C. all the ethane remains uncondensed and all the isobutane is condensed. A mixture containing 4·41 c.c. of ethane, 5·35 c.c. of propane, and 2·61 c.c. of isobutane, on separation at this temperature yielded two fractions which by analysis consisted of 4·35 c.c. of ethane, 5·47 c.c. of propane and 2·54 c.c. of iosbutane.—W. H. P.

Methane; Employment of low temperatures in the production of ——. P. Sabatier. Chem.-Zeit., 1913, **37**, 148.

In the formation of water-gas the following reactions occur : $C+H_2O=CO+H_2$ and $C+2H_2O=CO_2+2H_2$. If the mixed gases be heated in the presence of finely divided nickel, methane and hydrogen are produced. Sometimes a side reaction occurs : $2CO=C+CO_2$, the deposition of carbon spoiling the catalyst ; the latter is revivified by passing steam over the nickel, which gas reacts with the carbon according to the equation given above. Any excess of carbon monoxide and carbon dioxide is removed by strongly cooling the gas, which leaves a nearly pure mixture of methane and hydrogen. —A. H. C.

Acetylene; Adsorption of —— *by palladium black.* C. Paal and C. Hohenegger. Ber., 1913, **46**, 128—132.

Palladium black in pure aqueous suspension slowly adsorbs acetylene ; in the course of 596 hours, 0·05359 grm. was adsorbed by 0·5 grm. of palladium black. Pure palladium black suspended in 60 per cent. alcohol has a very pronounced adsorptive power. Dried palladium black likewise adsorbs considerable amounts of acetylene. When the palladium contains oxygen the reaction is at first explosive and the acetylene is partially decomposed into carbon and hydrogen. With pure palladium the reaction is less violent and the adsorption takes place much more slowly, 0·13473 grm. of acetylene per 1 grm. of palladium being ultimately retained. The acetylene in all cases is not adsorbed unchanged but is slowly polymerised and converted into other products.—E. F. A.

Petroleum; Crude —— *from the Gold Coast.* Bull. Imp. Inst., 1912, **10**, 579—583.

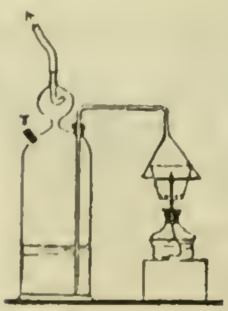
Four samples obtained from Bonyere, in the Axim district of the Gold Coast Colony, were examined. The crude oil would be suitable for use as a liquid fuel. One sample had the sp. gr. 0·944 at 15·5° C. ; flash point (Abel closed test), 152° C. (305° F.) ; calorific value, 10,606 cals. ; freezing point, below −2° C. (28° F.) ; bromine absorption, 15·5 per cent. Another sample was heated at its boiling point for several hours under a reflux condenser, in order to induce "cracking," and then fractionally distilled till a pitch-like mass was left as residue. The results of the fractionation are shown in the following table :—

Fraction.	Boiling point.	Yield, by volume.	Sp. gr.	Flash-point.	Bromine absorption.
		per cent.			
Light petroleum	80°—150° C.	7·1	0·753	Below 0° C.	68·7
Kerosene ...	150°—200° C.	3·6	0·806	46° C.	58·5
	200°—300° C.	45·4	0·875	73° C.	35·2
Lubricating oil	Above 300° C. (under 300 mm. pressure)	23·5	0·952	—	44·4
Residue and loss		20·4	—	—	—

—A. S.

Sulphur in petroleum lamp oil; Volumetric method of determining ——. F. Schulz. Petroleum, 1913, **8**, 585—586.

The lamp method of Heusler and Engler (Chem.-Zeit., 1896, 197) may be simplified by conducting the products of combustion through hydrogen peroxide solution and determining the sulphuric acid gravimetrically or volumetrically. Owing to the rapid current of air required for a smokeless flame, the ordinary absorption vessels cannot be used, and the form of apparatus shown in the figure has therefore been devised. The absorption vessel is charged with 30 c.c. of a 3 per cent. solution of hydrogen peroxide diluted with 30 c.c. of water and exactly neutralised with $N/10$ alkali, with methyl orange as indicator. The petroleum (5 to 6 grms.) is burned in the small lamp (as shown) consuming 1·3 to 1·6 grm. per hour, and the gases conducted into the absorption vessel. The lamp is then weighed again to obtain the amount of oil consumed, and the contents of the absorption vessel titrated with $N/10$ alkali. Traces of nitric acid formed in the combustion have no influence on the results. In parallel determinations the differences between the gravimetric and volumetric methods were less than 0·01 per cent. The bulk of the oxides of nitrogen passes through the absorption vessel unchanged. For a gravimetric determination Richter's "hyperol" [hydrogen



peroxide free from sulphuric acid], is the most suitable absorption agent. The method may also be used for the determination of sulphur in coal, etc., the sample being burned in a current of oxygen.—C. A. M.

Carbonylferrocyanides. Williams. *See* VII.

The technical production of ethane. C. Sprent. *See* London Section, p. 171.

Mineral oil exports from the United States in 1912. Oil, Paint, and Drug Rep., Feb. 3, 1913. [T.R.]

The following figures relate to exports of mineral oils from the principal customs districts of the United States in 1911 and 1912, representing about 92 per cent. of the shipments from all ports :—

	1911.		1912.	
	Gallons.	$	Gallons.	$
Crude	184,984,498	5,791,211	172,822,223	6,373,771
Illuminating	1,108,333,605	60,857,290	1,023,681,414	61,918,491
Naphthas	131,286,657	10,988,213	175,089,771	19,365,132
Lubricating and paraffin	181,259,004	22,977,857	213,559,784	27,860,862
Residium, gas and fuel oil	130,366,250	3,771,749	259,376,853	6,357,126

Patents.

Fuel; Production of artificial ——. London Industrial Contract and Finance Syndicate, Ltd., and E. Eaton. London. Eng. Pat. 6981, March 21, 1912.

70 parts of cinders or domestic house-coal ashes are finely ground and mixed with 10 parts of lime or chalk and 20 parts of tar previously solidified by treatment with sulphuric acid. After thoroughly mixing the mass is placed in a pug-mill and treated with ordinary or superheated steam. From 2½ to 5 per cent. of naphtha or other tar oil is then added and the mixture is briquetted.—W. H. C.

Coke-oven. H. Koppers, Essen-on-the-Ruhr, Germany. U.S. Pat. 1,051,372, Jan. 21, 1913.

In an oven in which a series of heating flues and also of hot-air passages are formed in the brick walls between the coking chambers, the conduit for distributing gas to the various heating flues is made of refractory material and in sections, with suitable packing between them, so that the sections can move relatively to the adjacent brickwork. The inner surface of the conduit is glazed to prevent diffusion.—A. T. L.

Gas washer. P. G. Schmidt, Olympia, Wash. U.S. Pats. 1,051,016 and 1,051,017, Jan. 21, 1913.

(1). The washer comprises a horizontal cylindrical casing, divided into inlet and outlet compartments by a central ring-shaped partition, the inlet and discharge orifices being in the periphery of the casing. A rapidly rotating member is mounted on a horizontal shaft within the casing and this member has a central ring-shaped partition in the plane of the partition in the casing. The inlet compartment of the rotating member comprises a cylindrical screen through which all the gas passes towards the centre in opposition to the centrifugal action of the rotating member, whilst the scrubbing liquid is introduced within the screen in the form of spray. (2). A casing having an inlet and an outlet for the gas at opposite ends contains a rotating member comprising a set of concentric screens on each side of a central partition and radial blades on the outside of each set of screens.—A. T. L.

Motor spirit; Production of ——. *Production of oils or spirits for use in internal-combustion engines.* R. de Fazi, Rome. Eng. Pats. 25,177, Nov. 11, 1911 and 27,679 of 1912, date of Appl. Nov. 11, 1911.

(1) Petroleum or shale oil distillates are mixed with gasolene or other light hydrocarbons in the presence of light aromatic hydrocarbons such as benzene. For example, a crude petroleum of sp. gr. 0·79 to 0·82 and containing 2 to 3 per cent. of sulphur, is first mixed with 1 to 2 per cent. of heavy tar oil and 1 per cent. of sulphuric acid and allowed to stand for 24 hours. The oil is then decanted and treated with 3 to 5 per cent. of quicklime to remove the sulphur, sufficient water being added to slake the lime. After 12 hours the oil is mixed with 6 to 10 per cent. of benzene, 0·1 per cent. of essence of bitter almonds, and 1 per cent. of sulphuric acid. After 4 hours the oil is decanted, mixed with 10 per cent. of gasolene and treated with slaked lime. The oil is then decanted and filtered, and mixed with gasolene in any desired proportion. (2). The claims are for the various steps in the process described above.—A. T. L.

Coke ovens. R. S. Moss, Chicago, U.S.A. Eng. Pat. 10,819, May 7, 1912.

See U.S. Pat. 1,025,419 of 1912 : this J., 1912, 526.—T.F.B.

Petroleum, coal tar, and the like; Apparatus for the continuous distillation and purification of crude ——. E. A. Barbet, Paris. Eng. Pat. 27,005, Dec. 2, 1911. Under Int. Conv., Dec. 3, 1910.

See Fr. Pat. 434,677 of 1910 ; this J., 1912, 324.—T. F. B.

Evaporating apparatus for solutions. Ger. Pat. 253,878. *See* I.

Converting heavy hydrocarbons into "siccative oils," and product resulting therefrom. Fr. Pat. 446,475. *See* XIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Charcoal; Kilns for revivifying animal ——. J. Buchanan, Liverpool. Eng. Pat. 5263, Mar. 2, 1912.

The patent relates to kilns revolving about a vertical axis and having cooling chambers for the burned charcoal arranged beneath the burning chambers. Outwardly sloping discharging passages are arranged in an intermediate member between the bottom of the burning chamber and the tops of the cooling chambers, and this member is mounted on a vertical spindle so as to rotate with the kiln. The discharging passages lead centrally into the upper ends of the cooling chambers. The cooling chambers have outlet pieces at their lower ends provided with external lugs carrying vertical set-screws which bear on a bracket carried by the spindle. By means of these screws the cooling chambers can be adjusted vertically so as to make a tight joint at their upper ends.—A. T. L.

Filaments for electric lamps; Machines for forming ——. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, New York. Eng. Pat. 11,252, May 11, 1912.

The machine is suitable for making filaments from plastic material such as tungsten powder mixed with a binder, or "agglomerated by the colloidal process." The machine comprises a rotating horizontal disc carrying horizontal projecting studs at its edge, these studs intersecting a filament as it leaves a fixed squirting orifice so that the filament forms loops hanging down between the studs. These loops are carried round by the disc until they come opposite a pair of burners which heat the two branches of the loop simultaneously at points near the studs, so as to sever the loop from the continuous filament. At this instant a rod is thrown forward beneath the loop so as to invert it as it drops and guide it on to a support. This support may be a conductor, and can be heated so that the loops hanging on it will take its shape. The studs pass a brush before they again reach the squirting nozzle, so that the short pieces of filament remaining on them are removed.—A. T. L.

Filaments for incandescence electric lamps ; Manufacture of ——. E. Morsaint. Fr. Pats. 446,140, July 18, and 446,310, July 22, 1912.

(1) Carborundum crystals are ground very fine, treated with *aqua regia* to remove metallic impurities, washed, dried, and formed into a paste with a carbonaceous binding material. The paste is formed into filaments which are sprinkled with carbon to prevent adhesion, dried, and heated in a closed chamber for 4 or 5 hours at a temperature of 600° C., after which the temperature is slowly raised to 1500° or 1600° C. The carbon is then eliminated by heating the filaments to a red heat in the presence of dry air, and finally the filaments are heated to a temperature of 2000° C. in an electric furnace. It is stated that carborundum filaments are not injured by excessive voltage. (2) Carborundum filaments prepared as above but while still in the porous condition (*i.e.*, before the final treatment in the electric furnace) are soaked in a liquid such as collodion containing finely divided silicon in suspension. The liquid must be such that no trace of free carbon is left in the filament after it has been exposed to a red heat in a very slightly oxidising atmosphere, so that no combination between free carbon and the silicon can take place. When all the free carbon has been removed in this manner, the filaments are heated for 2 or 3 hours to a temperature of 2000° C. in an electric furnace, whereby a filament composed of a crystalline aggregate of pure carborundum and silicon is obtained.—H. H.

III.—TAR AND TAR PRODUCTS.

Natural asphaltum and petroleum pitch ; Detection of—— in residues from the distillation of coal tar. F. Schwarz. Chem. Rev. Fett- Ind., 1913, **20**, 28—30. (See also this J., 1912, 63.)

A method of detecting natural asphaltum or petroleum pitch in the residues from the distillation of coal tar is based upon the fact that distillates of the latter (consisting in the main of aromatic hydrocarbons) are converted by sulphuric acid almost quantitatively into sulphonic acids which are soluble in water, whereas the distillates from natural asphaltum or petroleum pitch are only affected to a limited extent by this treatment. If however large quantities (*e.g.*, up to 20 per cent.) of these bituminous products are present in coal tar pitch, the distillation causes decomposition, with the formation of unsaturated hydrocarbons capable of being attacked by sulphuric acid. The following method of separating the compounds which combine with sulphuric acid obviates the necessity of distillation :—Ten grms. of the pitch are heated to 160° to 180° C. in an oil bath, then stirred for 5 minutes with 4 c.c. of concentrated sulphuric acid, and the temperature kept at 180° C. until all sulphurous acid and excess of sulphuric acid have been expelled. The mass is then thoroughly ground up with 40 grms. of bone charcoal, and extracted in a Soxhlet apparatus with petroleum spirit of low b. pt., the extract evaporated, the residue taken up with more petroleum spirit ; the solution filtered and evaporated, and the residue weighed. Any sulphur present is removed by treating the residue (without stirring) with acetone, filtering the solution, evaporating the filtrate, and again weighing the residue. The amounts of constituents not attacked by sulphuric acid varied as follows in the case of the samples examined : Coal tar pitches, 0·10 to 0·20 ; natural asphaltums, 1 to 16 (usually 3 to 8) ; and petroleum pitches, 6 to 36 per cent. (usually 15 to 30 per cent.). If the result obtained as above greatly exceeds 0·2 per cent., the presence of natural asphaltum or petroleum pitch is indicated.—C.A.M.

Patents.

Nitro-p-diaminoanthraquinones ; Process for preparing acyl compounds of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 254,185, May 4, 1911.

When acyl-*p*-diaminoanthraquinones are treated with concentrated nitric acid at temperatures not exceeding 25° C., the nitro group enters the position *ortho* to an amino group. If the nitration is carried out in sulphuric acid solution, products soluble in alkalis are obtained.
—T. F. B.

*Dinitro-*1.1′*-dianthrimide ; Process for preparing* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 254,186, Jan. 19, 1911.

A dinitro derivative of 1.1′-dianthrimide is obtained by treating it in sulphuric acid solution with two mols. of nitric acid in presence of boric acid. The compound is not obtained in the absence of boric acid. By reduction it is converted into the corresponding diaminodianthrimide.
—T. F. B.

Nitroanthraquinonylanthranilic esters ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 254,475, Sept. 1, 1911.

When nitroaminoanthraquinones are heated with *o*-halogenbenzoic esters in presence of copper or a copper compound and a substance which unites with acid, the esters of nitroanthraquinonylanthranilic acid are obtained.
—T. F. B.

Dianthraquinonyl thioethers ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,561, Jan. 30, 1912.

Anthraquinone-mercaptans or their salts are heated with or without the addition of substances which unite with hydrogen sulphide. A diluent may also be added, if necessary.—T. F. B.

Anthraquinone from anthracene ; Process for preparing ——. Chem. Fabr. Grünau, Landshoff und Meyer A.-G. Ger. Pat. 254,710, Aug. 9, 1910. Addition to Ger. Pat. 234,289, May 8, 1908 (see this J., 1911, 796).

Anthracene is intimately mixed with pumice or asbestos powder, or similar inert solid, and treated with nitric peroxide at a temperature of 100° to 200° C. It is stated that the product is less contaminated with nitrogen compounds than that obtained according to the process described in the principal patent.—T. F. B.

Chloro-anthraquinonecarboxylic acids ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,121, Jan. 17, 1912.

Chloro-anthraquinonecarboxylic acids can be obtained by a process similar to that described in Fr. Pat. 412,979 (this J., 1910, 1098) if the anthraquinone be replaced by its carboxylic acids. By this means it is possible to obtain the new *p*-dichloroanthraquinonecarboxylic acids.—T. F. B.

Tetrahydro-compounds of the benzene series ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 254,473, Nov. 21, 1911.

The vapours of monohalogen substitution products of completely hydrogenated benzene hydrocarbons, containing the halogen in the nucleus, are passed over compounds which unite with hydrohalogen acids or which possess catalytic properties, the temperature being kept below that at which the tetrahydro-compound decomposes.
—T. F. B.

1.3-Dimethyl-5-hydroxybenzene from tar oils ; Process for obtaining ——. F. Raschig. Ger. Pat. 254,716, March 1, 1912.

The fraction of tar phenols of b. pt. 200°—225° C. is submitted to a further fractionation, and the portion distilling at 215°—220° C. is collected ; on cooling, the 1.3-dimethyl-5-hydroxybenzene separates from this fraction, and can be isolated in a state of purity by recrystallisation.—T. F. B.

Quinizarin ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,031, Jan. 3, 1912.

Phthalic anhydride is condensed with *p*-chlorophenol or its sulphonic acids with the aid of concentrated or fuming sulphuric acid, and with addition of boric acid. The addition of boric acid favours the condensation, since with conditions under which dichlorofluorane is practically the only product without boric acid, considerable quantities of quinizarin are formed when boric acid is present. When highly concentrated acid is used, the quinizarin separates completely as sulphoboric ester, which is almost insoluble in concentrated sulphuric acid.—T. F. B.

N-Methylcarbazole ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,304, Dec. 24, 1911.

Potassium carbazole is condensed with esters of chloroacetic acid, the carbazyl-N-acetic ester is saponified, and the carbazyl-N-acetic acid is converted into N-methylcarbazole by heating to temperatures above its melting point.—T. F. B.

Anthracene series ; Manufacture of compounds of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik. Ludwigshafen on Rhine, Germany. Eng. Pat. 8230, April 4, 1912. Addition to Eng. Pat. 894, Jan. 12, 1911.

See Addition of May 23, 1912, to Fr. Pat. 425,859 of 1911 ; this J., 1912, 1174.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Phenols ; Action of aldehydes on ——. H. Wichelhaus. Ber., 1913, **46**, 110—112.

Coloured substances can be obtained by the condensation of trithio-aldehyde with β-naphthol, α-anthrol, β-anthrol, resorcinol, or dihydroxynaphthalene, in presence of zinc chloride, but the products are not easily purified. Better results are obtained by using an aldehyde combined with sulphite, for example by first preparing a compound of the type, $C_{10}H_6(OH).CH_2.SO_3H$ (see Ger. Pat. 87,335) and then treating this with condensing agents so that sulphur dioxide is evolved. The best results were obtained with the compound derived from 2.7-dihydroxynaphthalene. 50 grms. of [2.7-dihydroxynaphthyl]-methanesulphonic acid were treated with 100 grms. of zinc chloride dissolved in 100 c.c. of water containing some hydrochloric acid, and heated slowly in a vacuum apparatus. The water distilled off rapidly, and at a temperature below 100° C. condensation took place, with liberation of sulphur dioxide and production of a violet colouration. After cooling, the product was washed with water and hydrochloric acid till free from zinc chloride, then dissolved in sodium hydroxide solution and re-precipitated with hydrochloric acid. It is a blue substance soluble in pyridine, which dyes silk and yields nitro-derivatives that dye wool and silk in golden-yellow to bronze shades. It has a composition corresponding to the formula, $C_{22}H_{16}O_6$. Products were prepared in an analogous manner from β-naphthol and Schäffer's β-naphtholsulphonic acid. The former dyed wool pink and formed coloured lakes with aluminium, manganese and zinc salts ; and the latter dyed silk reddish-grey.—A. S.

Spectrographic studies in the triphenylmethane group. R. Meyer and O. Fischer. Ber., 1913, **46**, 70—84.

Spectrographic examination of compounds of the triphenylmethane group has shown that they have characteristic absorption spectra. Fuchsone which is quinonoid. containing no auxochrome groups, gives an absorption spectrum similar to that of the salts of phenolphthalein. Similar absorption spectra are obtained with fuchsone containing different auxochromes, and the results show that there is no fundamental difference between the simple quinones and those containing an auxochrome group. Hartley's theory, according to which the true colour carrier is always the benzene nucleus, is confirmed. —G. H. F.

Spectrographic studies in the anthraquinone group. R. Meyer and O. Fischer. Ber., 1913, **46**, 85—92.

The absorption spectra of mono-, di-, and trihydroxyanthraquinones in alkaline solution, and in concentrated sulphuric acid, were studied. The results obtained indicate that a hydroxyl group in the position 2, 6, or 7, acts as a stronger auxochrome than when in positions 1, 4, or 5. Baly and Stewart (Chem. Soc. Trans., 1906, **89**, 511) found two absorption bands for anthraquinone in concentrated sulphuric acid, whereas the authors find three. —G. H. F.

Patents.

Wool-dye ; Greenish-blue ——. W. Berchelmann, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,045,805, Dec. 3, 1912.

5-Nitro-1.4-diaminoanthraquinone is condensed with two molecules of epichlorhydrin, for example in formic acid solution at 30°—35° C. The product is separated and sulphonated, the sulphonic groups probably attaching themselves to the epichlorhydrin residue. Wool is dyed in brilliant greenish blue shades, fast to light, by the new dyestuff.—J. B.

Carboxydiarylhydrols ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,122, Dec. 1, 1911.

By the condensation of equimolecular proportions of aromatic aldehydes with aromatic hydroxycarboxylic acids, carboxydiarylhydrols are obtained as colourless or slightly coloured substances. By condensation with a further molecule of a suitable aromatic hydroxycarboxylic acid, leuco-triarylmethane compounds are formed.—T. F. B.

Sulphide dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 254,328, Oct. 13, 1911, and 254,304, Oct. 29, 1911.

(1) The indophenols or leuco-indophenols derived from the cyclic ureas or thioureas of 1.8-naphthylenediamine, are converted into sulphide dyestuffs in presence of copper or a copper compound. Fast greenish-blue or green dyestuffs are produced. (2) The indophenols or leuco-indophenols from 1.8-naphthylenediamine and *p*-aminophenol or their derivatives, are converted into sulphide dyestuffs, with or without addition of copper or a copper compound.—T. F. B.

Indophenolic condensation products and their leuco-derivatives ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,859, Oct. 13, 1911.

The indophenols or leuco-indophenols from 1.8-diaminonaphthalene and *p*-aminophenol or their derivatives are treated with carbon bisulphide, or the leuco-indophenols are treated with phosgene, and the products (if indophenols) are reduced to the corresponding leuco-compounds. The products are cyclic ureas or thioureas derived from 1.8-diaminonaphthalene.—T. F. B.

2-Aminodiarylamino-5-hydroxynaphthalene-7-sulphonic acids and 2-aminodiarylamino-8-hydroxynaphthalene-6-sulphonic acids and their derivatives ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,510, April 21, 1911.

THE products mentioned in the title, which are stated to be valuable azo dyestuff components, are obtained by treating 2.5.7- or 2.8.6-aminonaphtholsulphonic acid or 2.8-dihydroxynaphthalene-6-sulphonic acid with amino-compounds of the diphenyl series or their derivatives, and sulphites. —T. F. B.

Aminohydroxynaphthalenesulphonic acids ; Process for preparing halogen-substituted ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,715, Dec. 22, 1911.

THE O-N-diacidyl derivatives of 2.5.7- or 2.8.6-aminonaphtholsulphonic acid are treated with chlorinating or brominating agents, and then the acidyl groups are eliminated. Unlike the non-halogenated compounds, the new derivatives do not exhibit fluorescence in alkaline solution : further, when combined with diazo compounds, combination takes place on the nucleus containing the hydroxyl group, and not on the amino side ; the azo dyestuffs are usually bluer than the non-halogenated dyestuffs.—T. F. B.

Azimino-compounds of the anthraquinone series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,745, Jan. 27, 1912.

o-DIAMINO-ANTHRAQUINONES, or N-monosubstitution products thereof, or their derivatives, are treated with nitrous acid or mixtures which form nitrous acid. The resulting azimino compounds may be used as dyestuffs or for the preparation of such.—T. F. B.

Vat dyestuffs of the anthraquinone series ; Process for preparing ——. A. Schaarschmidt. Ger. Pat. 254,023, March 24, 1911.

THE products obtained by condensing *o*-diaminoanthraquinones with benzanthronecarboxylic acids or their substitution products, are melted at high temperatures with potassium hydroxide, potassium alcoholate, or substances with analogous action. Fast vat dyestuffs are produced by this process.—T. F. B.

Indigo series ; Process for preparing colourless condensation products of the ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 254,365, July 21, 1911.

COLOURLESS, crystalline products, which are isomerides of indigo and indirubin, are obtained by the action of indoxyl on the bisulphite compound of isatin. Analogous compounds are obtained by using homologues or derivatives of isatin and indoxyl.—T. F. B.

Vat [indigo] dyestuffs ; Process for preparing yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 254,567, March 24, 1911, and 254,734, May 25, 1911.

(1) THE product obtained by treating indigo with benzoyl chloride is dissolved in sulphuric acid, preferably with heating, and the chlorine-free solution thus formed is poured into water. A dyestuff is obtained which gives yellow shades from the vat. (2) When the product of the action of benzoyl chloride on indigo is heated to a high temperature, alone or with an indifferent solvent or diluent, a substance is obtained which dyes wool and cotton fast yellow shades from the (violet) vat.—T. F. B.

Aryl β-anthraquinonylthioureas ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 254,744, Nov. 29, 1911. Addition to Ger. Pat. 229,111, Feb. 19, 1909.

ARYL-β-ANTHRAQUINONYLTHIOUREAS are obtained in a pure condition by the action of aryl mustard oils on β-aminoanthraquinone in presence of a condensing agent. The products dissolve in alcoholic alkali to blue solutions. —T. F. B.

Anthraquinone series ; Process for preparing condensation products of the ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,340, Nov. 24, 1910.

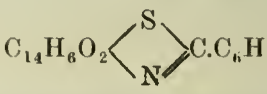
THE diazo-compounds of β- or α-aminoanthraquinones or their substitution products are condensed with β- or α-amino- or diaminoanthraquinones or the corresponding anthranols, or their substitution products. The resulting products are either dyestuffs or substances readily converted into dyestuffs ; thus, the action of β-aminoanthraquinone on diazotised β-aminoanthraquinone results in the formation of a golden-yellow vat dyestuff.—T. F. B

Vat dyestuffs ; Process for preparing ——. Kalle und Co. Ger. Pat. 254,468, Nov. 8, 1910. Addition to Ger. Pat. 182,260, Nov. 14, 1905.

EASILY reacting α-derivatives of 4-chloro-5-bromo-isatin (*e.g.*, the chloride or anilide) are condensed with oxythionaphthene or its carboxylic acids or with phenylthioglycol-*o*-carboxylic acid. The resulting products dye fibres from the vat in excellent blue shades, unaltered by soaping. —T. F. B.

Vat dyestuffs of the anthraquinone series containing sulphur ; Process for preparing ——. F. Ullmann. Ger. Pat. 254,743, Dec. 17, 1911.

1-HALOGEN-2-AMINOANTHRAQUINONES or their derivatives are condensed with aromatic thiol-acids of the general formula, R.CO.SH, where R represents an aryl or anthraquinonyl radical. Thus, from 1-chloro-2-aminoanthraquinone and potassium thiolbenzoate a product of the formula,



$$C_{14}H_6O_2\left\langle{S \atop N}\right\rangle C.C_6H_5,$$

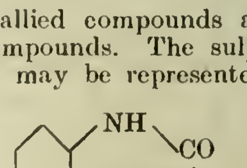
is obtained. The thiol-acid salts may be prepared, for example, by the action of alkali sulphides on the aromatic carboxylic acid chlorides.—T. F. B.

Leuco compounds of the indigo series ; Process for preparing ——. W. Holtschmidt. Ger. Pat. 254,983, March 16, 1912.

INDIGO, its homologues substitution products, or analogues, especially indigo dyestuffs soluble in water, or indigoid compounds which are easily suspended in water, are reduced by means of suitable metals in the form of foil or wire, or other form which presents a large surface, in aqueous solution or suspension, with or without addition of ammonia or other alkali of suitable strength, or an acid or salt, and preferably at the ordinary temperature. —T. F. B.

Azo dyestuffs ; Process for preparing ——. M. Claass. Ger. Pat. 255,078, Jan. 13, 1912.

SULPHAZONES or allied compounds are combined with aromatic diazo compounds. The sulphazones, the constitution of which may be represented by the formula,



may be obtained by reduction of the *o*-nitrophenylsulphoxyacetic acids, $NO_2.C_6H_4.SO_2.CH_2.COOH$.—T.F.B.

Vat dyes of the anthraquinone series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7291, March 25, 1912.

SEE Fr. Pat. 446,751 of 1912 : this J., 1913, 131.—T. F. B

Azo dyestuffs ; Manufacture of basic ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8872, April 15, 1912.

SEE Fr. Pats. 444,065 and 444,113 of 1912 ; this J., 1912, 1073.—T. F. B.

Carboxydiarylhydrols ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12.162, May 22, 1912.

See Ger. Pat. 254,122 of 1911 ; preceding.—T. F. B.

Tetrachlorindigo ; Violet —— and process of making same. A. Stock, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,050,179, Jan. 14, 1913.

See Fr. Pat. 440,462 of 1912 ; this J., 1912, 809.—T. F. B.

Anthraquinone vat dye. W. Herzberg and W. Bruck, Schöneberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,050,829, Jan. 21, 1913.

See Fr. Pat. 427,479 of 1911 : this J., 1911, 1111.—T.F.B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Plantain fibre from India ; Wild ——. Bull. Imp. Inst., 1912, **10**, 536—537.

A sample of wild plantain fibre from Tenasserim, Burma, was lustrous, of a pale brown colour with a slight greyish tinge, of good strength, and varying in length from 4 ft. to 5 ft. 6 in. It was valued at about £20 per ton in London, with "fair current" Manila hemp at £22—£22 10s. per ton, and was stated to be particularly valuable on account of its softness.—A. S.

Red vulcanised fibre ; Some properties of ——. F. H. Parker. Phil. Mag., 1913, **25**, 210—214.

The amount of water absorbed by red vulcanised fibre (one of the most suitable materials for the pistons of compressing engines in air-liquefying plant) and the consequent increase of volume were measured. The absorption of water, rapid at first, decreases in rate and tends towards a limit. One specimen absorbed 0·76 c.c. of water per 1 c.c. of its original volume in 34 days, its final volume being 1·61 times the original volume. In a second specimen, 1 c.c. increased in 19 days to 1·51 c.c., absorbing 0·62 c.c. of water. When, instead of water at the ordinary temperature, water at 60° C. was used, the absorption was much more rapid, but the final volume and the volume of water absorbed were less than at the lower temperature. On being exposed to air, the soaked specimens lost water rapidly—90 per cent. of the whole in 9 days, in one instance. The increase of volume is not isotropic ; the rectangular prisms used were cut from flat sheets, and the increase in the dimension across the thickness of the sheet was enormously greater than those in the dimensions in the plane of the sheet. Microscopic examination showed this to be due to the structure of the mass, the number of fibres or cells per cm. through the thickness being much greater than the number along the surface, owing to the pressure exerted during the manufacture of the sheet. In similar experiments basswood absorbed 0·31 c.c. of water per c.c., and white deal 0·74 c.c., but without sensible change of volume.—J. T. D.

Celluloid ; Viscosity and its importance for the chemistry of —— in theory and practice. H. Schwarz. Z. Chem. Ind. Kolloide, 1913, **12**, 32—42.

For factory control purposes the author recommends the following two simple methods. With very viscous liquids the time is noted in which a glass sphere of 7—8 grms. falls through a column of the liquid 20 cm. high. With thinner liquids the relative times taken by a definite volume of the liquid and of water to flow from a pipette are compared, the lower mark on the pipette being just below the bulb and some distance from the outlet. Figures are given illustrating the "ageing" (change of viscosity) of solutions of nitrocellulose in an alcoholic solution of camphor on keeping ; this effect makes it impossible to obtain always solutions of constant viscosity even if the same proportions of the same nitrocellulose and the same solvent be used ; the "ageing" is less noticeable in the more dilute solutions, and a 0·5 per cent. solution of nitrocellulose in a 50 per cent. solution of camphor in alcohol maintains its viscosity tolerably well on keeping. Solutions of nitrocellulose in an alcoholic solution of camphor are more viscous than solutions in ether-alcohol (4 : 3), and the latter are more viscous than solutions in acetone. In solutions of nitrocellulose in alcoholic solutions of camphor, the viscosity is lower in solutions of higher camphor concentration, and this is in accord with practical experience that a high content of camphor improves the quality of celluloid. Experiments in which a solution of nitrocellulose in an alcoholic solution of camphor was heated to 60° C. and then allowed to cool, and the viscosity determined at intervals of 10° C. during both heating and cooling, indicated that the variation of viscosity with change of temperature is reversible. McDonald's assertion (this J., 1911, 785) that the viscosity of acetone solutions of nitrocellulose is notably affected by exposure to light could not be confirmed. Addition of a small quantity of urea (1 per cent.) to a stable solution of nitrocellulose in an alcoholic solution of camphor increased the viscosity by 10—15 per cent., but larger additions of the same substance appeared to have no action whatever in this direction. The relation between the viscosity of the nitrocellulose solution and the brittleness of the celluloid is discussed, and it is pointed out that practical experience shows that when well-dried collodion-cotton in dissolved in a 75 per cent. solution of camphor in alcohol in the proportion of 1 : 12·5, the solution works better on the rolls the lower its viscosity. The effect of variations in the bleaching of the cotton and in the processes of nitration and washing on the viscosity of solutions of the nitrocellulose is also discussed.—A. S.

Paper ; The degree of porosity of ——. W. Colditz. Wochenbl. Papierfabr., 1913, **44**, 376—378.

Printing papers require a harder or softer sizing according to the nature of the printing to be done and the consistence of the ink. It is not sufficiently recognised that the resistance or absorbency of paper towards oily printing inks has no direct connection with the hardness of sizing as commonly measured in relation to aqueous writing inks. The resistance to oily inks depends on the closeness of texture and relative absence of porosity of the paper. In default of a direct method for measuring the rate of penetration of oil varnishes through printing papers, the author has adopted a method which depends on the fact that the porosity is expressed by the ratio of the apparent specific gravity of the paper to its real specific gravity. The apparent specific gravity is calculated by ascertaining the weight of a measured volume of the paper, whilst the real specific gravity of the solid constituents of the paper is calculated by ascertaining the amount of oil displaced by a given weight of the paper. The author employs olive oil for this purpose, and it is essential that the paper be steeped in the oil for at least half a day to ensure the complete displacement of the air before the weighing is made. The procedure is the usual one for the determination of the specific gravity of solid bodies, a sinker large enough to contain the sample of paper being employed and its displacement both of oil and water being previously determined.—J. F. B.

Blotting papers ; Influence of dyestuffs on the absorbency of ——. Von Possanner and S. Berger. Wochenbl. Papierfab., 1913, **44**, 278—281.

It is well known that coloured blotting papers are inferior in absorptive power to white papers of the same manufacture, and the authors have made experiments with a view to determining the comparative effects of typical dyestuffs of the various groups. Dyeings were carried out on pure pulps of cotton, soda wood pulp, and sulphite pulp, and the absorptive powers of the papers produced under similar conditions were tested comparatively with papers made from the undyed pulps. In all cases a diminished absorptive power under the action of the dyestuffs was recorded, and in most cases the diminution was very considerable. The percentage diminution was greatest for the first 1 per cent. or so of dyestuff added, and the unfavourable effect became smaller as the percentage of dyestuff was increased, until generally a point was reached at which further addition of dyestuff produced no appreciable effect. Substantive dyestuffs, which are recommended for unsized pulps on account of their great affinity for vegetable fibres, produced the most unfavourable effect on the absorbency of the cotton fibres; their influence on the wood cellulose papers was less marked, possibly because these fibres are already charged with impurities from the digestion process. The behaviour of the basic and acid dyestuffs was less regular; generally they affected cotton pulp less severely than the substantive dyestuffs. For cotton papers, Auramine O, Victoria Blue B, Victoria Yellow conc., Fast Blue 5 B, and a mixture of Brilliant Green with Acid Green showed the least influence on the absorptive power. With sulphite pulp the basic dyestuffs all showed very unfavourable results, whilst mixtures of basic and acid dyestuffs were even worse with these papers. With soda wood pulp, except in the case of Victoria Blue, which was very detrimental, there was little difference between the substantive, basic, and acid dyestuffs, but mixtures of the two latter groups gave generally rather lower absorptive powers.—J. F. B.

Contributions to the technology of the paper industry. C. Beadle and H. P. Stevens. *See* Manchester Section, p. 174.

Patents.

Silk; Preserving tin-weighted ——. E. Meili, Hawthorne, N.J., Assignor to Weidmann Silk Dyeing Co., Paterson, N.J. U.S. Pat. 1,050,158, Jan. 14, 1913.

The silk is treated with a solution of a hydrazine salt such as the acetate.—B. N.

Artificial fibres; Process for the manufacture of ——. P. Girard, Lyons, France. Eng. Pat. 5386, Mar. 4, 1912. Under Int. Conv., Mar. 6, 1911.

Artificial threads, of a fineness which may attain 0·5 denier, are produced from solutions of cellulose and wound up, in groups more or less numerous, on bobbins or spools. The mass of threads on the bobbins is then cut through along one or more generating lines of the cylinder, so as to yield fleeces of parallel filaments ready, without combing or other treatment of similar nature, for the production of spun threads on a roving frame.—J. F. B.

Cellulose acetate; Manufacture of ——. F. Paschke, Brighton. Eng. Pat. 15,868, July 8, 1912.

Cellulose acetate is manufactured by the action upon cellulose of a mixture of acetic anhydride and glacial acetic acid in conjunction with a suitable anhydrous copper salt, *e.g.*, the sulphate, nitrate, chloride or a mixture of the acetate and nitrate. The product is subjected to a partial de-acetylation by the action of chlorine. Example: 200 kilos. of cellulose are treated at a temperature of 70° C. with 1300 kilos. of a mixture of 30 per cent. of acetic anhydride and 70 per cent. of glacial acetic acid, in which 5 kilos. of anhydrous copper sulphate are dissolved. After the reaction, 600 kilos. of 80 per cent. acetic acid are added and the product is poured into jars in which it is treated with chlorine in the proportion of about 2 parts of chlorine per 100 of cellulose at a temperature which must not exceed 60° C. De-acetylation is thereby produced and should be stopped when the product contains 50–55 per cent. of combined acetic acid. This state is reached when the product is soluble in ethyl acetate, and may be recognised by a fall in the specific rotatory power from $[\alpha]_D = -21^\circ$ to $[\alpha]_D = -7^\circ$. At that stage water is added to precipitate the ester as a flocculent mass. —J. F. B.

Drying machine [for paper, etc.]. H. S. Hopkins. Fr. Pat. 445,847, July 6, 1912.

A machine for drying paper, cloth, or similar material in long lengths, comprises a long chamber divided into a number of compartments through which the paper, etc., is carried on an endless band conveyor. The heated air is supplied from above through a series of bell-shaped openings in such a manner as to hold the paper, etc., in contact with the conveyor, being forced into the last compartment of the series by a pump and then conducted through the other compartments in turn through pipes fitted with small auxiliary fans. The speed at which the fans are driven can be varied for the purpose of varying the pressure exerted by the air upon the paper, etc., and in cases where a large amount of moisture has to be removed, a certain amount of fresh dry heated air may be supplied to the separate compartments. To prevent curling at the edges of the paper, two strips of fibrous material may be fitted at the edges of the conveyor band to which the paper clings.—H. H.

Sulphite wood liquor; Manufacturing alcohol from ——. P. G. Ekström, Harnäs, Assignor to Aktiebolaget Ethyl, Falun, Sweden. U.S. Pat. 1,050,723, Jan. 14, 1913.

As a preparatory step to the manufacture of alcohol by the fermentation of the saccharine matters of sulphite wood pulp liquors, "a catalyser for oxidation and a base" are added to the liquor which is aerated while in a hot state; the solid matters are then separated, the liquor is cooled and again aerated cold before fermentation. —J. F. B.

Flax; Treatment of waste —— for obtaining a product adapted to be spun like carded wool yarn. A. Kube, Walditz, Germany. U.S. Pat. 1,051,124, Jan. 21, 1913.

See Fr. Pat. 443,205 of 1912; this J., 1912, 1026.—T. F. B.

Viscose (cellulose xanthogenate); Manufacture of —— and its use for coating or printing suitable fabrics and surfaces. L. Lilienfeld, Vienna. Eng. Pat. 1378, Jan. 17, 1912. Under Int. Conv., Jan. 20, 1911.

See Fr. Pat. 439,040 of 1912; this J., 1912, 584.—T. F. B.

Cellulose esters of fatty acids; Process for the manufacture of ——. B. R. Seifert and F. Todtenhaupt, Assignors to Chem. Fabr. von Heyden A.-G., Radebeul, Germany. U.S. Pat. 1,051,165, Jan. 21, 1913.

See Fr. Pat. 423,197 of 1910; this J., 1911, 615.—T. F. B.

Pulp; Recovering —— from waste papers. J. M. Burby, Long Island City, U.S.A. Eng. Pat. 9503, April 22, 1912.

See U.S. Pat. 1,029,848 and Fr. Pat. 444,703 of 1912; this J., 1912, 680, 1075.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Patents.

Kiers, washing machines and the like for boiling, washing, sterilising, bleaching in laundries and for other purposes. W. W. L. Lishman. Eng. Pat. 473, Jan. 6, 1912.

Kiers, etc., stationary or otherwise, are fitted with circulating apparatus which is also in communication with a mixing vat, thus insuring an uninterrupted cycle of operations. The circulating pipe is arranged to allow ready access to the interior. A removable inner lining may be used, in which the goods are packed.—J. B.

[Dyeing] fabrics; Apparatus for treating ——. S. Sokal, London. From O. Scheiber, Triest, Austria. Eng. Pat. 808, Jan. 10, 1912.

In apparatus used for washing, dyeing, etc., the wooden rollers usually employed are replaced by rollers made of concrete, constructed on a hollow core, reinforced and preferably rendered acid-proof. A suitable material is made by adding graphite, water-glass and glycerin to the concrete mixture. The rollers must be mounted on dash-pot bearings to minimise shocks.—J. B.

Skein-silk-dyeing apparatus. E. L. Maupai, New York. U.S. Pat. 1,051,342, Jan. 21, 1913.

The skeins are suspended in the dye-vessel on spools mounted on radial arms which are fitted to a rotating frame in such a way that the spools are caused to revolve as the frame rotates.—J. B.

Dyeing ; Process for vat ——. C. Rachou and E. Chaumat, Camares, France. Eng. Pat. 2735, Feb. 2, 1912. Under Int. Conv., Feb. 8, 1911. Addition to Eng. Pat. 1247 of 1911, dated Jan. 18, 1910.

See Addition of Feb. 8, 1911, to Fr. Pat. 413,031 of 1909 ; this J., 1912, 533.—T. F. B.

Dyeing hairs, furs, and the like ; Process for ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 13,764, June 12, 1912.

See Addition of May 7, 1912, to Fr. Pat. 413,877 of 1910 ; this J., 1912, 1121.—T. F. B.

Filter for purifying and simultaneously removing iron and manganese from water for industrial purposes, especially for dye-houses. Ger. Pat. 253,835. *See* XIXb.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Carbon dioxide ; Action of —— *on alkalis and alkaline earths. A time-reaction.* D. Vorländer and W. Strube. Ber., 1913, **46**, 172—181.

The fact that the introduction of carbon dioxide into incompletely saturated lime-water is followed not immediately but only after some time by turbidity and precipitation has been attributed to the intermediate formation of soluble basic carbonates, or to the production in the first instance of colloidal calcium carbonate, which remains in solution as hydrosol, and later coagulates and precipitates. The truth is, that the reaction between carbon dioxide and the base takes time ; for if dilute solutions of lime-water, tinted with phenolphthalein, and of carbon dioxide, in equivalent quantities, be poured together into a flask which is then closed and allowed to stand, the disappearance of the colour is not immediate (as would be the case if calcium carbonate were at once formed, colloid or crystalline), but only occurs after a lapse of time. This lapse of time is greater as the solutions are more dilute : with 5 c.c. each of 0·0472*N* lime-water and 0·0675*N* carbon dioxide (the carbon dioxide must be in slight excess, for calcium carbonate solution through hydrolysis reacts faintly alkaline towards phenolphthalein), the colour disappeared in 10 minutes, whilst with the same quantities, each diluted with 55 c.c. of water, it remained for 48 hours. Excess of carbon dioxide quickens the reaction : with 8 c.c. instead of 5, the time was 6¾ minutes, with 10 c.c., 29 seconds, with 15 c.c., 5 seconds. Similar results were obtained with baryta water, but the reaction is much more rapid—1 second in place of 10 minutes, and about 10 minutes in place of 48 hours. In the case of sodium hydroxide or sodium carbonate, which of course need excess of carbon dioxide for their conversion into bicarbonate before phenolphthalein is decolourised, the effect of dilution is hardly noticeable : 3·2 c.c. of 0·1037*N* sodium hydroxide and 10 c.c. of 0·698*N* carbon dioxide required 23 to 29 seconds, and 3 c.c. of 0·100*N* sodium carbonate and 5 c.c. of 0·669*N* carbon dioxide 16 to 20 seconds for the disappearance. In all cases temperature has a very marked influence on the speed of the reaction, the speed at 15° C. being from 6 to 40 times as high as that at 0° C. From experiments with other acids the authors consider it likely that the speed of these reactions with carbon dioxide is dependent upon the speed of formation of carbonic acid, H_2CO_3, from carbon dioxide and water. —J. T. D.

Prussian blue reaction ; The ——. D. Vorländer. Ber., 1913, **46**, 181—192.

The slow precipitation of Prussian blue when dilute solutions of potassium ferrocyanide and ferric chloride are mixed is not due to the formation and slow coagulation of a hydrosol, for when given quantities of the two salts are diluted to an equal extent with water, weak acid, and salt solution, and then mixed, the blue colour and subsequent precipitation appear later in the mixture containing acid, and much later still in that containing salt, than in that containing water. The reaction is a time-reaction, and in dilute solutions proceeds very slowly. The author finds that the reaction of ferrous salt on ferrocyanide is instantaneous, and that the subsequent oxidation of the product by the dissolved oxygen in the solution yields Prussian blue more rapidly in dilute solutions than does the direct reaction of ferric salt on ferrocyanide. Ferrous salts thus form the best mode of testing for ferrocyanides : not only is the reaction more rapid than with ferric salts, but it is less influenced by acids or salts, and excess of ferrous salt can be used without its colour interfering with the detection of a blue colouration. In the converse test, it is neither necessary nor desirable to convert all ferrous salt into ferric salt. In Lassaigne's test or in testing for cyanides by conversion into ferrocyanide, it is desirable to use as little excess of alkali as possible, and to filter from the precipitated iron hydroxide. A much smaller excess of acid need then be used, and the addition of ferrous salt gives an immediate reaction. No adsorption of the ferrocyanide by the precipitate of iron hydroxide occurs. —J. T. D.

Silver salts ; Action of halogens on ——. H. S. Taylor. Chem. Soc. Trans. 1913, **103**, 31—36.

Iodine reacts with silver salts, in a manner analogous to that observed in reactions with chlorine and bromine, to yield insoluble silver iodide, hypoiodous acid, and another acid. The reaction occurring may be represented by the equation : $AgX+I_2+H_2O=AgI+HIO+HX$. (See also R. L. Taylor, this J., 1897, 353.) Owing to the instability of hypoiodous acid a second reaction occurs, accelerated by rise of temperature, increase in concentration, or presence of soluble silver salts, in which reaction the hypoiodous acid is converted into iodide and iodate. This secondary reaction may be generally represented by the equation : $3HIO+3AgX=2AgI+AgIO_3+3HX$. The simple equation of Birnbaum (Annalen, 1869, **152**, 111) and of Normand and Cumming (Chem. Soc. Trans., 1912, **101**, 1852), $3I_2+3H_2O+6AgX=5AgI+AgIO_3+6HX$, represents the sum of the two preceding equations.

Carbonylferrocyanides. H. E. Williams. Chem. Soc. Proc., 1913, **29**, 10.

The carbonylferrocyanides exist in the mother liquor resulting from the working up of "cyanogen mud." They can be recovered by precipitating with ferric salts, boiling the precipitate with lime, precipitating the ferrocyanide present as calcium ammonium ferrocyanide, by converting a portion of the liquor into the ammonium salt, mixing with the bulk, and boiling. The filtrate is boiled with lime to remove the excess of ammonia and the salt allowed to crystallise. The salts of the alkali- and alkaline earth-metals, including lithium and magnesium, are very soluble, and several are deliquescent. The salts of the heavy metals are for the most part insoluble in water : lead, chromic, stannic, and aluminium salts produce no precipitate. The following salts among others were described : Ammonium salt, $(NH_4)_3Fe(CN)_5CO,3H_2O$: the calcium salt, $Ca_3[Fe(CN)_5CO]_2,8H_2O$, is deliquescent, and forms double salts, $CaKFe(CN)_5CO,5H_2O$ and $CaNH_4Fe(CN)_5.CO$; the cupric salt, $Cu_3[Fe(CN)_5CO]_2,14H_2O$, is pale green, and loses $7H_2O$ at 100° ; the lithium salt, $Li_3Fe(CN)_5CO,4H_2O$, is deliquescent, and loses $2H_2O$ at 100° ; the magnesium salt, $Mg_3[Fe(CN)_5CO]_2,16H_2O$, loses $10H_2O$ at 100° ; the manganese salt, $Mn_3[Fe(CN)_5CO]_2,18H_2O$, is white, loses $15H_2O$ at 100°, and when oxidised with nitric acid forms a dark brown manganomanganic salt; the zinc salt, $Zn_3[Fe(CN)_5CO]_2,7H_2O$, is white, and loses $4H_2O$ at 100° C.

Thorium. Solubility of the active deposit of ——, in various solvents. C. F. Hogley. Phil. Mag., 1913, **25**, 330—332.

THE active deposit from thorium hydroxide contained in a metal dish was collected on a piece of platinum foil suspended over the dish and connected with the negative pole of a battery. This foil was then submitted to the action of the various solvents examined. Aqueous solutions of salts, hydroxides, and acids, dissolved both thorium B and thorium C, but the former always in relatively larger amount. The solubility in boiling water is small and slow; that in boiling solution of potassium iodide is more than twice as rapid. Dilute acids, even cold, dissolve the deposit still more rapidly. Organic solvents have about the same rate of solution as water, but dissolve chiefly thorium C. Thorium B is quite insoluble is chloroform and methylene iodide.—J. T. D.

Nitric oxide formation in the high-pressure arc; Changes involved in ——. A. Koenig. Ber., 1913, **46**, 132—134.

THE author criticises the experiments of Fischer and Hene (this J., 1913, 82) on the ground that they probably did not succeed in passing their discharge through a single gas before mixing it with the other. In their apparatus it is likely that the pulsations of the discharge, producing rapid expansions and contractions would result in the sucking of some of the external gas into the capillary. It is also to be noted that while Strutt's active nitrogen will not react with oxygen, Fischer and Hene did obtain nitric oxide when they sparked nitrogen and passed it into oxygen. Since active nitrogen does not react with oxygen, and active oxygen (ozone) does not react with nitrogen, the author prefers to assume that the activation of both gases is necessary before combination.—W. H. P.

Permanganate solution; Reduction of —— by carbon monoxide gas. G. Just and Y. Kauko. Z. physik. Chem., 1913, **82**, 71—77.

THE authors have previously experimented upon the reduction of permanganate solution by hydrogen and found by kinetic methods that a molecule of the gas reacted with a molecule of the salt (Z. physik. Chem., 1911, **76**, 601). The experiments were continued with carbon monoxide, using the same apparatus suitably altered for the difference in the nature of the two gases. It was found that the primary reaction was one molecule of carbon monoxide with one molecule of permanganate. A determination of the temperature-coefficient showed that the velocity of the reaction was about doubled for a rise in temperature of 10°. The simultaneous action of carbon monoxide and hydrogen on permanganate solution produced no opposing influence in the two reactions.—J. H. J.

PATENTS.

Radioactive liquid or gaseous substances, or liquid and gaseous substances containing emanation. Method of repeatedly delivering suitable portions of ——. E. Fenderl and R. Vierthaler, Vienna. Eng. Pat. 20,081, Sept. 3, 1912. Under Int. Conv., Sept. 4, 1911.

LIQUID or gaseous radioactive substances and the like are stored in a vessel with a gas which is radioactive or contains emanation at a pressure above that of the atmosphere. By means of a suitable valve any desired portion of the contents can be withdrawn.
—F. SHDN.

"Metallate silicate"; Production of ——. R. Boehringer, Plainfield, N.J., and A. E. Gessler, Clifton, Staten Island, N.Y. U.S. Pat. 1,050,204, Jan. 14, 1913.

THE "metallate silicate," such as aluminate-silicate, is produced by mixing chemically equivalent quantities of sodium aluminate and sodium silicate, in solutions sufficiently dilute to form a flaky precipitate.—B. N.

Silicate minerals containing alkalis; Process for decomposing —— by means of lime. Chem. Fabr. Rhenania and A. Messerschmitt. Ger. Pat. 254,544, May 24, 1911.

CLAIM is made for the use of the lime mud obtained in the manufacture of caustic soda and similar processes. The lime mud is mixed with the powdered silicate mineral and the resulting plastic mass is ignited.—A. S.

Ammonium nitrate; Manufacture of ——. Traine und Hellmers and H. Weyer. Ger. Pat. 254,935, April 11, 1911.

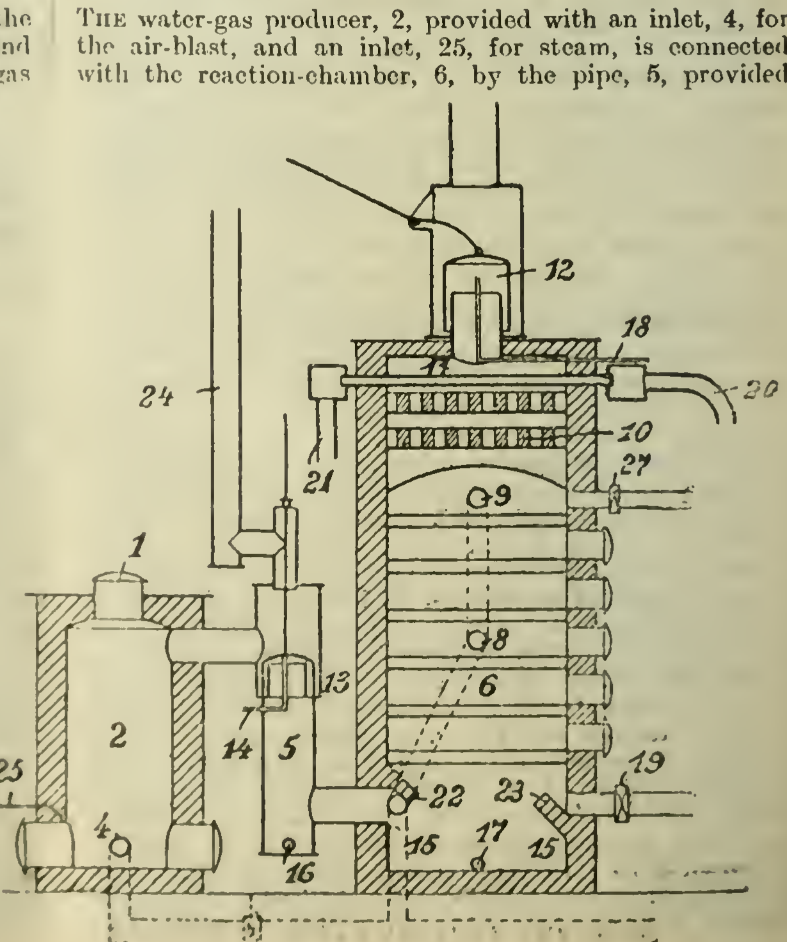
A MIXTURE of calcium nitrate with excess of ammonium sulphate, with or without addition of water, is heated under ordinary or increased pressure until the water is completely expelled and the mass is fused. The product, after cooling, is broken up and treated with a suitable organic solvent, *e.g.*, alcohol, to extract the ammonium nitrate. It is stated that ammonium nitrate of about 99·9 per cent. purity can be obtained directly in this way.—A. S.

Sulphurous acid; Process for the preparation of liquid —— by direct liquefaction of cooled and dried sulphurous gases. H. H. Niedenführ. Ger. Pat. 254,044, Aug. 14, 1910.

THE cooled and purified gases (*e.g.*, from the roasting of ores) are compressed and then again cooled in order to remove the heat developed by the compression and separate any sulphuric acid present, care being taken to prevent, as far as possible, any liquefaction of sulphurous acid. The gases then pass into a separator in which a relatively lower pressure is maintained, whereby most of the sulphurous acid is liquefied, whilst carbon dioxide, nitrogen, etc., remain in the gaseous condition.—A. S.

Hydrogen; Apparatus for the production of pure —— by the decomposition of steam by glowing iron or from water-gas and potash-lime. H. Strache. Ger. Pat. 253,705, Oct. 26, 1910.

THE water-gas producer, 2, provided with an inlet, 4, for the air-blast, and an inlet, 25, for steam, is connected with the reaction-chamber, 6, by the pipe, 5, provided



with a gas-discharge pipe, 24. Just above the place where the pipe, 5, enters the reaction chamber is a firebrick baffle, 22, and there is a similar baffle, 23, on the opposite side of the chamber. A branch from the air-supply pipe opens just below the baffle, 22, and similar branches open at 8 and 9. The reaction chamber, 6, is divided into compartments by gratings on which the reaction material (*e.g.*, iron) is placed. In the upper part of the chamber, above the regenerator, 10, are purifying retorts, 11, the gas entering at 20 and leaving at 21. When the apparatus is used for the production of hydrogen from steam and iron, the valves, 13, 12, 19, and 27, and the openings, 8 and 9, are closed, and steam is introduced through the pipe, 14, below the valve, 13, so as to displace any gases from the pipe, 5, and the ash-pit, 15. Steam is then introduced through the tube, 18, below the valve, 12, displacing gas from the reaction chamber from the top downwards. The blast-pipes, 16 and 17, and the tube, 14, are then shut off, and the valve, 19, opened. The hydrogen produced passes away through 19, to a holder, whence it passes through the pipe, 20, into the purifying retorts, 11, charged with potash lime.—A. S.

Hydrogen; Preparation of —— from metals and water. F. Bergius. Ger. Pat. 254,593, Oct. 24, 1911.

The metal is subjected to the action of liquid water heated above its boiling point in a closed vessel. It is stated that in this way hydrogen can be obtained directly under a pressure of more than 100 atmospheres.—A. S.

Nitric acid; Process of manufacturing concentrated ——. M. Moest and R. M. von Berneck, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,050,160, Jan. 14, 1913.

See Fr. Pat. 432,990 of 1911; this J., 1912, 127.—T. F. B.

Potassium hydrate; Process of making high-percentage crystallised ——. H. Haberland, Assignor to Salzbergwerk Neu-Stassfurt und Theilnehmer, Zscherndorf, Germany. U.S. Pat. 1,050,453, Jan. 14, 1913.

See Eng. Pat. 6405 of 1907; this J., 1907, 871.—T. F. B.

Ammonia; Process for the manufacture of —— by means of aluminium nitride. O. Serpek, Paris. Eng. Pat. 10,036, April 27, 1912.

See U.S. Pat. 1,040,439 of 1912; this J., 1912, 1078.—T.F.B.

Tartaric acid; Processes for extracting and recovering —— in the form of potassium bitartrate from tartaric materials. Cantoni, Chautems, et Cie., and E. Degrange, Geneva. Eng. Pat. 2552, Jan. 31, 1912. Under Int. Conv., Feb. 25, 1911.

See Fr. Pat. 426,714 of 1911; this J., 1911, 956.—T. F. B.

Borax and boric acid; Manufacture of ——. E. L. Fleming, Chester, and T. L. Miller, Liverpool. Eng. Pat. 4736, Feb. 26, 1912.

See Fr. Pat. 442,820 of 1912; this J., 1912, 1032.—T. F. B.

Cyanide of hydrogen; Process of manufacturing ——. I. Moscicki and C. Jablczynski, Freiburg, Assignors to Aluminium-Industrie A.-G., Zürich, Switzerland. U.S. Pat. 1,050,978, Jan. 21, 1913.

See Fr. Pat. 417,794 of 1910; this J., 1911, 26.—T. F. B.

Ammonium nitrate from ammonium sulphate and sodium nitrate; Process of manufacture of ——. F. A. Freeth, Great Crosby, and H. E. Cocksedge, London. U.S. Pat. 1,051,097, Jan. 21, 1913.

See Eng. Pat. 16,454 of 1910; this J., 1911, 1013.—T. F. B.

Gases [nitrogen or hydrogen]; Economic method of obtaining ——. C. E. Acker, Ossining, Assignor to The Nitrogen Co., New York. U.S. Pat. 1,050,902, Jan. 21, 1913.

See Eng. Pat. 17,666 of 1911; this J., 1912, 129.—T. F. B.

Impts. in and apparatus for the electrolytic manufacture of light metals, alloys of light metals with heavier metals, caustic alkalis, etc. Eng. Pats. 1001, 1003, 1004 and 1005. *See* XI.

VIII.—GLASS; CERAMICS.

Kaolinite molecule; The chemical constitution of the ——. II. J. W. Mellor and A. D. Holdcroft. Trans. Eng. Ceram. Soc., 1911—1912, 11, 169—173. (See also this J., 1911, 804.)

The heating curve and dehydration curve of well-defined crystals of kaolinite from the coalfield of Glamorganshire were determined. The thermal phenomena exhibited in the heating curve were similar to those of a china clay, a slight terrace in the curve being due to decrepitation and projection of the material from the crucible. The dehydration test confirmed the result previously obtained that there is no definite temperature of dehydration. The total loss on ignition was 15·94 per cent., but the content of organic matter was large, and some other mineral, possibly halloysite or montmorillonite, was probably present to the extent of 10—15 per cent.—H. H. S.

Chromium red glaze; Notes on the ——. II. C. E. Ramsden. Trans. Eng. Ceram. Soc., 1911—1912, 11, 196—203. (See also this J., 1912, 386.)

The glazes used were wholly fritted in order to avoid decomposition of the stain in the further fire. The author is in agreement with all other investigators except Purdy, that the source of the chromium does not affect the tint. The formula, $CaO,SnO_2,0{\cdot}024Cr_2O_3$, is given for the stain before calcination. If much more chromium is introduced, darker colours are obtained through the formation of insoluble chromates which are not removed in washing. Lime is essential to the production of a good crimson glaze. Magnesia and baryta turn it green and steel-grey respectively. The tint of the calcined powder is not an indication of the colour of the resulting glaze. Lead oxide in the glaze is essential to crimson. Silica preserves the red tint under the glaze, while alkalis make it lilac. Borates have but slight influence.—H. H. S.

Patents.

Ceramic masses; Preparation of ——. O. Gerber. Ger. Pat. 254,513, Nov. 30, 1911.

Broken earthenware and broken porcelain, both finely ground, are mixed together without a binding agent, and then worked up in the usual manner. It is stated that a mixture of 40 per cent. or more of finely ground earthenware, free from iron, with 50—60 per cent. of finely ground porcelain, gives on burning, a white sintered, porcelain-like product. The finely ground mixture may be shaped into the desired form either by dry-pressing or by the wet method.—A. S.

Quartz glass; Method of making transparent ——. A. Voelker, Beuel, Germany. U.S. Pat. 1,051,035, Jan. 21, 1913.

See Fr. Pat. 421,718 of 1910; this J., 1911, 424.—T. F. B.

IX.—BUILDING MATERIALS.

Silica in [Portland] cement raw material: The rôle of ——. H. Luftschitz. Tonind.-Zeit., 1913, 37, 169—170.

The author suggests that Portland cement would be more resistant to chemical action if the silica content of its raw materials were higher and the lime content somewhat lower than in ordinary practice. He bases his opinion on experiments carried out with mixtures of highly silicious blast-furnace slags and limestone, and concludes that a mixture approximating to the composition: silica, 30; ferric oxide and alumina, 15; and lime, 55 per cent. respectively, forms the ideal raw material for making cement, which will possess the maximum resistance to acid liquors and sea water.—O. R.

Cements: Action of the salts in alkali water and sea water upon ——. P. H. Bates, A. J. Phillips, and R. J. Wig. J. Franklin Inst., 1913, **175**, 65—67.

Small hollow cylinders of cement and cement mortar were exposed to the percolation of the saline solutions, which were renewed from time to time and the portions removed analysed. Also cement briquettes were exposed to the action of the sea. The investigation extended over two years. The chief results found were that porous cement mortar and concrete can be disintegrated by the mechanical force exerted by the crystallisation of a salt in its pores if a sufficient quantity accumulates. Porous stone and brick behave similarly. In the laboratory hydraulic cements decomposed readily under the action of sulphates and chlorides, but in the field this is retarded by surface carbonating or by a formation of saline deposit. Cement concrete partially or completely immersed in sea water is unaffected. Cements of high iron and aluminium content remained good in fresh and sea water, whereas other cements rapidly deteriorated. The changes which take place in sea water in contact with cement are that magnesium is precipitated in proportion to the solubility of the lime in the cement, and that the sulphates are taken up, but only traces of sodium chloride. Metal reinforcement is not corroded if imbedded two inches from the surface.—J. H. J.

Patents.

Wood; Drying and seasoning ——. B. Loomis, Hartford, Conn., Assignor to Loomis Utilisation Co. U.S. Pat. 1,050,151, Jan. 14, 1913.

Gas is burnt in air, and the hot gaseous products are circulated in contact with the wood to heat it gradually. The wood is then gradually cooled by means of a cool gaseous mixture, and the heating and cooling operations are repeated until the wood is thoroughly dried and seasoned, without cracking, after which it is subjected to the action of a hot dry gas to form an exterior crust or hard shell for preventing the subsequent absorption of moisture. —B. N.

Press for the manufacture of artificial stone and agglomerates of all kinds. P. M. H. Buret. Fr. Pat. 446,639, July 29, 1912.

The piston of a high-pressure press for making artificial stone, etc., is operated by a screw and nut device having a broken thread by means of which a quick down-stroke for charging the press can be effected. To allow of the withdrawal of the compressed block from the press, a weighted lever is provided which lifts the piston to the top.—H. H.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

[Iron] Cupola furnace; Melting in the ——. R. Moldenke. Trans. Amer. Inst. Min. Eng., 1913, 37—46.

In melting iron in the cupola, in actual practice the best results are obtained by the use of 300,000 cub. ft. of air per hour for a cupola of 54 in. diameter. If the metal be introduced less than 8 min. after the commencement of blowing, the bed is too thin and should be increased by charging a little more fuel between the metal charges, whilst if it be not introduced until after more than 10 min., the bed is too thick and should be correspondingly reduced. It is concluded that the following conditions should be observed:—(1) The proper amount of air required by the capacity of the cupola should be used; (2) the bed coke should be dry and well lighted before charging; (3) the bed should be of the proper height to give "first iron" in from 8 to 10 min.; (4) the metal charges should be of equal weight and no larger than will be just covered by the coke required to melt them; (5) the coke charges should be so adjusted to the metal charges that the melting zone remains stationary and at the right point; (6) the blast volume (not pressure) should be constant throughout the heat; (7) the charges should be evenly distributed; (8) only one row of tuyères should be used; (9) the melting rate should be watched and the intermediate coke charges adjusted accordingly; (10) large pieces of metal should be avoided; (11) heavy coke with small percentages of cell space can stand large charges while light coke with a large percentage of cell space must have very small charges to yield the best results.—A. H. C.

Bismuth ores; Occurrence, distribution, and utilisation of ——. Bull. Imp. Inst., 1912, **10**, 628—641.

After a brief description of the different bismuth minerals and an account of the distribution of bismuth ores, sections are devoted to the dressing of the ores, the extraction of the metal and its properties and uses, and the commercial value and production of bismuth ores. In the following table is given the percentage composition of crude and refined bismuth as produced in some of the most important centres:—

	Crude bismuth.			Refined bismuth.	
	Australia.	Bolivia.	Peru.	Saxony.	
Bismuth ..	96·2	99·05	93·57	99·74	99·98
Antimony .	0·8	0·56	4·57	—	—
Arsenic ...	trace	—	—	0·01	trace
Copper ...	0·5	0·26	2·06	0·02	0·03
Lead	2·1	—	—	0·11	0·06
Iron	0·4	—	—	trace	trace
Sulphur ...	—	—	—	0·04	—
Silver	—	0·08	—	0·07	—

The production of bismuth ores in recent years, so far as statistics are available, is shown in the following table:—

	1908.		1909.		1910.		1911.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Metric tons.	£	Metric tons.	£	Metric tons.	£	Metric tons.	£
Germany* ..	8,535	33,000	10,388	33,700	10,313	31,450	not available	
Italy†	—	—	12	48	—	—		
Norway	12	330	—	—	5	1,377		
Spain	96	1,020	78	1,621	53·5	—		
New South Wales	9	2,017	9	1,624	6·0	2,004	8	1,800
Queensland‡	23	10,595	10·5	2,771	21	9,708	10	5,525
South Australia	2	300	—	—	—	—	—	—
Tasmania	3·8	462	2·9	980	11	4,249	14·5	5,758
United States§	2·3	–	No returns		41	—		
Bolivia	160	24,552	311	153,873	237	116,086	not available	
Peru	9	1,908	30	9,772	24	7,556		

* Bismuth, nickel, and cobalt ores. † Bismuth, silver, cobalt, and gold ores.
‡ Also produces mixed bismuth and wolfram concentrates (120 tons valued at £11,564 in 1911).
§ Metallic bismuth from refining of lead and copper ores.

—A. S.

Zirconium; Studies on the element ——. *II.* E. Wedekind. Annalen, 1913, **395**, 149—194. (See also this J., 1910, 358 and 1255.)

The preparation of metallic zirconium by means of magnesium or by the aluminothermic method was not satisfactory, but good results were obtained by a method worked out by the author and H. Kuzel. Pure zirconium oxide was intimately mixed with an excess of metallic calcium (as finely divided as possible). The mixture was placed in an iron tube which was exhausted to about 0·5 to 0·1 mm. The bottom of the tube was heated with a blow-pipe till the reduction began, after which the tube was cooled by blowing air on to it and finally dipping in water. When quite cool, the contents were rapidly pulverised and treated first with water which had been boiled and then cooled, next with acetic acid and finally with very dilute hydrochloric acid. Air should be excluded during the whole of the treatment. The residue was finely powdered and again digested with boiled dilute hydrochloric acid. The powder was filtered off, and washed with air-free water till the calcium reaction (spectroscopic) was no longer given. The water was removed by acetone and the powder dried in an exsiccator at ordinary temperature and then in a high vacuum at 250°—300° C. The portion for analysis was further dried in a completely exhausted porcelain tube at 800°—1000° C. This operation was carried out in a small kryptol furnace. A regulus was obtained which on filing and polishing gave a fine metallic surface which did not change in air. The yield of the powder was about 97·5 per cent. The metal contained 97·7 per cent. of free zirconium (including about 0·4 per cent. of iron). The sp. gr. of the powder at 18° was 5·98 and of the fused (sintered) metal at 17·5° C. 6·204. The metal was completely melted (not sintered) by making an arc between zirconium electrodes *in vacuo*, in the Weiss-Neumann furnace (see this J., 1910, 218) The sp. gr. of the completely melted product was 6·44 at 16° C. The calcium method is very convenient and has been applied to other refractory metals such as titanium, thorium, tantalum, etc. The melting point of the zirconium prepared by the author was found to be 1530° by G. K. Burgess and 2350° C. by v. Bolton. Burgess melted the metal on platinum, but his method has given good results with iron, chromium, etc., and it is probable that v. Bolton's result is too high owing to formation of zirconium oxide (m. pt. about 2500° C.). A sample of commercial zirconium hydride, considered to have the formula, ZrH_4, was found to contain some oxide, and the formula, ZrH_2, was found for the hydride. The oxide obtained on oxidation does not appear to be ZrO_2, but it does not correspond in composition to the suggested Zr_2O_3 (compare Weiss and Neumann, *loc. cit.*). A new compound, the nitride, Zr_3N_2, was obtained by heating the metal in nitrogen at 1050° C. On passing hydrogen over the nitride for ¼ hr. at 1050° C., 8·7 per cent. of the theoretical yield of ammonia was obtained. The so-called amorphous zirconium was obtained by Berzelius' method (avoiding re-oxidation), by heating potassium zirconium fluoride with potassium in an iron tube. On heating the powder obtained, it often becomes pyrophoric. It only contains about 35 per cent. of free zirconium. Its characteristic feature is its great surface: it is like a colloidal gel and retains water with great tenacity. With acids it easily passes into a hydrosol. The hydrogel precipitated from this hydrosol is very similar to the amorphous zirconium.—H. E. P.

Metals; Disintegration of —— *at high temperatures. Condensation nuclei from hot wires.* J. H. T. Roberts. Phil. Mag., 1913, **25**, 270—296.

The author used as a test for the evolution of particles from heated metals the formation of fog (the particles acting as condensation nuclei) on the sudden expansion of air saturated with water, which he finds far more delicate than any gravimetric test. In this way he has found that platinum begins to disintegrate at 500° C.; the disintegration is not so marked as to be sensible to the balance below 1000°—1100° C. The second set of nuclei evolved (the first set are temporary, and cease altogether after the wire has been experimented on for some time; the second set continue to be evolved) are not produced in nitrogen, hydrogen, nor vacuum, but only in oxygen or a gas containing it; the rate of their formation is roughly proportional to the oxygen-pressure. The author attributes them to the formation at a high temperature of the oxide, PtO_2, which is probably endothermic, and dissociates at a lower temperature. The phenomena described by Crookes (this J., 1912, 540) are all explicable on this hypothesis; and direct volatilisation of the platinum is rendered improbable by the fact that no disintegration was observed in a vacuum. Palladium, however, does volatilise.—J. T. D.

Perkin medal presentation proceedings [*drying blast air*]. *See* New York Section, p. 180.

Mineral production of the United States. Board of Trade J., Feb. 6, 1912. [T.R.]

The "Engineering and Mining Journal" gives the following figures for the mineral and metal production of the United States in 1911 and 1912:—

		1911.	1912.
Mineral and chemical substances —			
Arsenic	lb.	6,162,000	5,852,000
Coal, anthracite	tons of 2000 lb.	90,526,556	84,308,437
Coal, bituminous	,,	402,121,307	427,655,966
Coke	,,	34,472,534	41,803,199
Copper sulphate	lb.	33,454,000	39,480,741
Iron ore	tons of 2240 lb.	41,878,190	59,485,477
Petroleum	brls. of 42 U.S. galls.*	218,372,850	218,970,815
Tungsten ore ...	tons of 2000 lb.	1,139	1,290
Metals—			
Copper (*a*)	lb.	1,083,856,371	1,242,836,024
Ferromanganese	tons of 2240 lb.	184,717	202,186
Gold (*b*)	dols.	96,890,000	91,685,168
Iron	tons of 2240 lb.	23,464,627	29,445,068
Lead (*c*)	tons of 2000 lb.	400,958	418,224
Nickel (*e*)	lb.	29,545,967	33,311,233
Quicksilver ..	flasks of 75 lb. net.	21,500	25,147
Silver (*b*)	ounces Troy	60,399,400	62,369,901
Zinc (*d*)	tons of 2000 lb.	295,836	347,922

* United States gallon = 0·833 Imperial gallon.

(*a*) Production from ore originating in the United States. (*b*) The statistics for 1911 are the final and those for 1912 are the preliminary statistics reported by the director of the Mint. (*c*) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (*d*) Total production at smelters, except those treating dross and junk exclusively: includes spelter derived from imported ore. (*e*) Imports for first 10 months only as regards 1912; this nickel is refined in the United States for the production of metal, oxide, and salts.

PATENTS.

[*Steel, etc.*]. *Method for the microscopic examination of test-pieces and for obtaining micro-photographs of same while under strain.* B. W. Winder, Sheffield. Eng. Pat. 3891, Feb. 16, 1912.

Claim is made for a method of obtaining microphotographs of the prepared (etched) surface of a test-piece of steel or other metal during the application of tensile strain up to fracture, in which the microscope and photographic camera employed are supported independently of the testing machine. The camera may be of the ordinary or the cinematograph type, and in either case provision may be made for projecting the image upon a screen for class demonstration.—W. E. F. P.

[*Iron*]. *Metallic products: Method of producing* —— *from iron ore.* H. L. Hartenstein, Constantine, Mich., Assignor to Electro-Chemical and Development Co., Pierre, S.D. U.S. Pats. 1,050,735 and 1,050,736, Jan. 14, 1913.

(1) Partial reduction of the ore is first brought about in a heating chamber, as the ore passes from the coolest to the hottest portion, by means of carbon monoxide, which is introduced from an outside source, together with air. Reduction is then completed in an electric furnace closed to the air, the carbon monoxide generated being utilised to

aid in the partial reduction of a following charge of ore. (2) The finely comminuted ore is first heated and partially reduced by agitating it in the presence of burning carbon monoxide. The hot ore is then mixed with comminuted carbonaceous matter, and reduced to metal in an electric furnace closed to the air. The carbon monoxide formed in the final reduction is mixed with sufficient air to support combustion and burnt in the presence of a fresh charge of ore.—T. St.

[*Steel*] *Smelting ; Electric* ——. G. H. Benjamin, New York. U.S. Pat. 1,051,065, Jan. 21, 1913.

The charge of iron, containing carbon and phosphorus, is introduced into a furnace, and subjected to the action of the high temperature effects of a transmitted electric current, simultaneously with the action of basic fluxes containing lime "in excess of that required to combine with the carbon." The action is continued until the carbon and phosphorus have combined with the lime, the slag is removed, and the resulting metal then subjected to an electric current, producing a relatively lower temperature than in the first heating. During the latter process, the materials, such as a metal and carbon, required in order to form a definite grade of steel, are introduced.—B. N.

Iron-nickel-copper alloy. G. H. Clamer, Philadelphia, Pa. U.S. Pat. 1,050,342, Jan. 14, 1913.

The alloy is made by mixing with steel 7 per cent. of a previously prepared alloy of the approximate composition : Ni, 68, Fe, 2, and Cu, 30 per cent. The final alloy is a steel containing : Ni, up to 6 ; Cu, 0·5 to 2 ; and C, up to 0·5 per cent.—T. St.

Metals ; Furnace for melting ——. M. Davis, Watertown, N.Y., U.S.A. Eng. Pat. 550, Jan. 8, 1912. Under Int. Conv., Sept. 1, 1911.

The furnace is so mounted that it may be raised, lowered, rotated, tilted or rocked as required ; the pouring spout is adjustable, and means are provided whereby the charge may be poured either from one fixed position or from different points in succession. The whole apparatus is supported upon a wheeled truck for portability.—W.E.F.P.

Furnaces ; Electric metallurgical ——. V. Stobie, Sheffield. Eng. Pat. 2081, Jan. 26, 1912.

The polyphase arc furnace, such as a three-phase one, is fed with current from a four wire star-connected supply, three electrodes being arranged above the bath, and a fourth electrode, connected with the neutral point of the supply system, is similarly arranged to take unbalanced currents. —B. N.

Hydro-electric smelting. *Process of* ——. A. Tommasini, New York. Assignor to M. E. Thornton, Hickory, N.C. U.S. Pat. 1,050,255, Jan. 14, 1913.

The hearth of the furnace is in the form of a long inclined tube, the ore at atmospheric temperature being fed into the upper end, and the metal withdrawn from the lower. Hydrogen, heated by an electric arc to a temperature higher than the melting point of the metal in the ore, is passed into the lower end of the hearth. The moisture, carried away from the hearth by the excess of hydrogen, is condensed, and the hydrogen returned to the electric arc for further use in the process.—B. N.

Crucible furnaces. A. C. Ionides, jun., London. Eng. Pat. 2839, Feb. 3, 1912.

A furnace from which the products of combustion of a practically "self burning mixture" of combustible gas and air—*e.g.*, a mixture of coal gas and air in the proportions requisite for complete combustion—are removed by downward displacement ; only a very small difference of pressure exists between the inlet and the outlet openings of the furnace, the fuel being supplied—under low pressure and in admixture with a minimum quantity of air—through a burner in which the passages are sufficiently constricted to prevent back-firing. It is stated that in a furnace of this construction, the hot products of combustion pass through the crucible chamber at a speed most conducive to the rapid and efficient transmission of heat to the crucible.—W. E. F. P.

Shaft-furnace for the chlorinating or sulphatising roasting of burnt pyrites. Bayerische A.-G. für Chemische und Landwirtschaftlich-chemische Fabrikate. Ger. Pat. 254,480, Feb. 1, 1911.

The furnace is closed below by two funnel-shaped members, placed one above the other, with a space between. Below the lower funnel is a screw-conveyor for removing the roasted ore. The air enters the furnace through the space between the two funnels. The roasted ore may be discharged by the conveyor into a closed chamber beneath, which is connected with and stands under the same pressure as the furnace, or it may be delivered into a lixiviating vessel, in which the lixiviating solution is kept at a level sufficient to counterbalance the pressure of the air blast supplied to the furnace.—A. S.

[*Copper and iron*] *Metals ; Treatment of* ——. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 3752, Feb. 14, 1912.

The metal, embedded in a mixture of aluminium powder, sal ammoniac (ammonium chloride), and zinc or graphite is heated in a non-oxidising atmosphere for about 2 hours at a temperature of about 450° C., after which it is removed from the mixture and heated for a further 15 or 20 minutes at a temperature between 700° and 800° C. It is claimed that copper and iron thus treated are rendered highly resistant to oxidation and corrosion, even when subjected to prolonged heating.—W. E. F. P.

Metals ; Electro-deposition of —— *and like electrolytic processes, and apparatus or appliances to be used in connection therewith.* A. Round and F. Fisher, Birmingham. Eng. Pat. 15,492, July 3, 1912.

The anode-container, which is suspended, consists of a perforated or open cane or wicker-work receptacle, or a cage formed from a grill of bars or rods constructed of wood or other insulating or non-corrodible material. It comprises one or more detachable or hinged sides or perforated panels, in combination with current-conducting strips, or contact plates, which are rigidly attached to the inside of the container, or to the body of the apparatus by means of bolts passing through the anode material. The strips may extend through the top of the apparatus, and are formed into suspension hooks or hangers to engage a conductor bar.—B. N.

Aluminium ; Process of refining ——. E. O. Leggett, Niagara Falls, N.Y., U.S.A. Eng. Pat. 17,594, July 29, 1912.

The metal (1 lb.)—preferably in the form of thin sheets—is to be mixed with sulphuric acid (½ fl. oz.) and potassium chlorate (1 oz.) and fused ; after stirring the mixture and then allowing it to settle, the purified metal is to be withdrawn from beneath the dross.—W. E. F. P.

Copper ; Art of separating —— *from other metals.* T. A. Edison, West Orange, N.J. U.S. Pats. 1,050,629 and 1,050,630, Jan. 14, 1913.

Metallic copper may be separated from other metals with which it is associated by treating the associated metals with a solution of (1) ammonium sulphate, or (2) copper sulphate containing a reducible haloid of a metal of variable valency. Gas containing oxygen is supplied to the mixture, which is heated and stirred.—T. St.

Copper ; Process for removing —— *from other metals.* R. R. Moreno, Allentown, Pa. U.S. Pat. 1,050,678, Jan. 14, 1913.

Copper deposit is removable from the bore of a gun by the action of an ammoniacal solution in presence of air, the copper being converted into "ammoniacal oxide of copper." (See also Eng. Pat. 3225 of 1905; this J., 1905, 1309.)—T. St.

Copper and other metals, the oxides of which are soluble in aqueous ammonia, free or combined; Process for dissolving —— in order to separate them from metals with other properties. P. Schmidt und Desgraz Ges. m. b. H. Ger. Pat. 255,084, Feb. 23, 1912.

The metal or alloy is used as anode in an electrolytic bath consisting of an ammoniacal solution of ammonium or alkali salts of non-reducing inorganic acids, the alkaline reaction of the bath being maintained by addition of ammonia or ammonium carbonate, or a mixture of the two. (See also Eng. Pat. 717 of 1906; this J., 1907, 55.) —A. S.

Metals which are to be alloyed with magnesium; Purification of ——. Aluminium- und Magnesiumfabrik. Ger. Pat. 253,520, Feb. 6, 1910.

The metal is melted with about its own weight of pure magnesium, the melt is allowed to stand for some time, and the upper layer of pure magnesium alloy is separated from the impure lower layer, and used for preparing alloys of the desired magnesium content.—A. S.

Contact substances containing metallic titanium; Preparation of ——. F. Lehmann. Ger. Pat. 255,071, March 29, 1912.

The titanium is deposited in admixture with other metals on an inert support by a chemical, electrolytic, or mechanical process. It is only when prepared in this way, and hence in a state of finest sub-division, that titanium is active as a contact substance.—A. S.

Metallic oxides; Separation and recovery of —— from smelter fumes. H. Schliessmann. Ger. Pat. 255,122, Feb. 6, 1912.

The fumes are led in a zig-zag path in contact with cooled surfaces in a series of cooling chambers arranged on the "ring system."—A. S.

Manganese steel; Manufacture of ——. W. S. Potter, New York. Eng. Pat. 1479, Jan. 18, 1912. Under Int. Conv., Jan. 27, 1911.

See U.S. Pat. 1,018,000 of 1912; this J., 1912, 286.—T.F.B.

Armour plate. S. S. Wales, Munhall, Pa., U.S.A. Eng. Pat. 5091, Feb. 29, 1912.

See Fr. Pats. 441,382 and 441,383 of 1912; this J., 1912, 820.—T. F. B.

Copper and nickel; Extraction of ——, particularly from low grade ores and products. W. Borchers, Aachen, Germany, and H. Pedersen, Trondhjem, Norway. Eng. Pat. 9146, April 18, 1912. Under Int. Conv., Dec. 29, 1911. Addition to Eng. Pat. 227 of 1912, dated March 22, 1911.

See Ger. Pat. 248,802 of 1911; this J., 1912, 933.—T.F.B.

Impts. in and apparatus for the electrolytic manufacture of light metals, alloys of light metals with heavier metals, caustic alkalis, etc. Eng. Pats. 1001, 1003, 1004 and 1005. *See* XI.

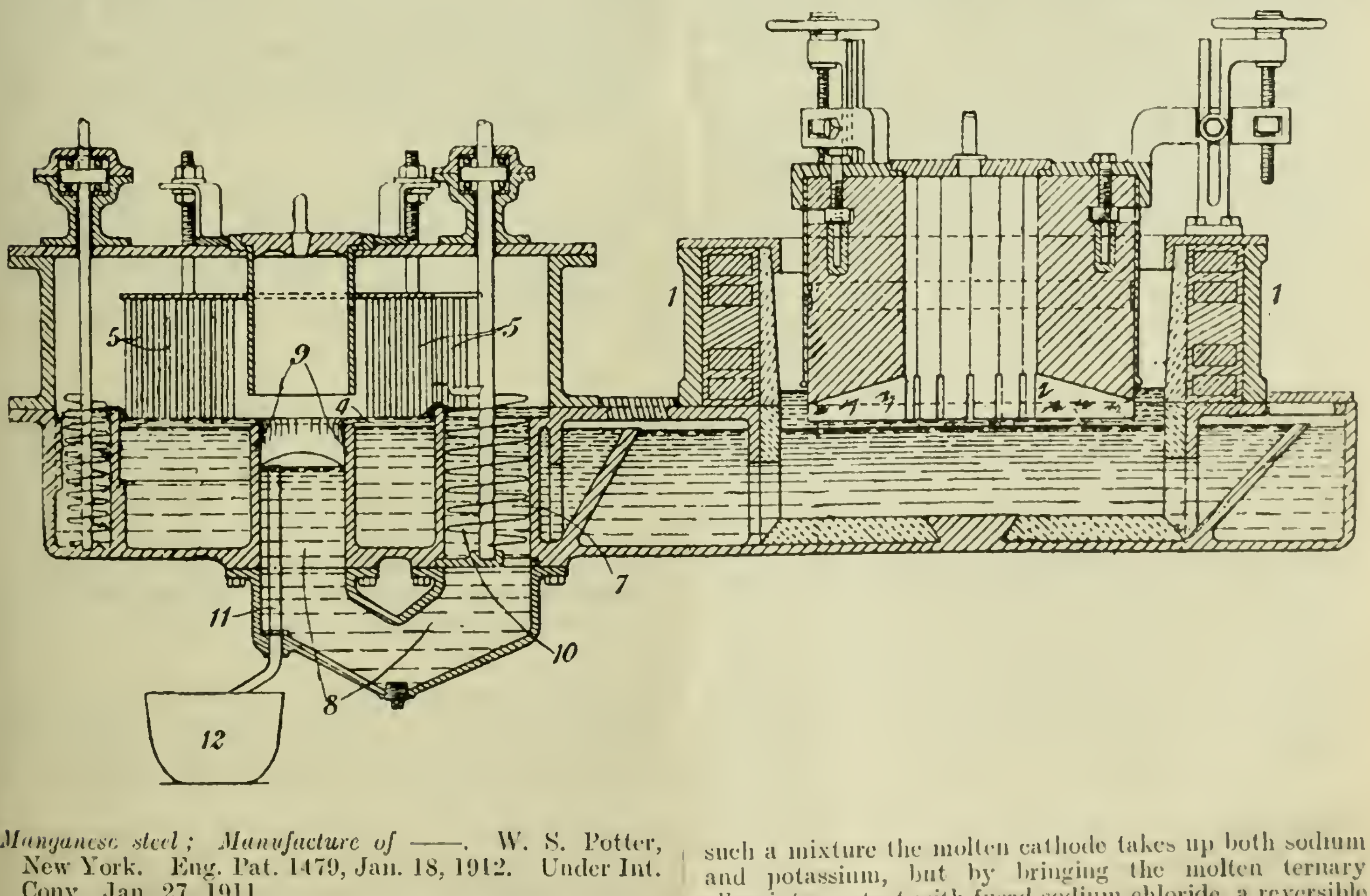
XI.—ELECTRO-CHEMISTRY.

Changes involved in nitric oxide formation in the high-pressure arc. Koenig. *See* VII.

Patents.

(1) *Electrolytic manufacture of alloys of light metals with heavier metals, and the continuous treatment of such alloys for obtaining final products,* (2) *electrolytic manufacture of light metals and reaction products thereof,* (3) *electrolytic manufacture of caustic alkalis in pure anhydrous condition, and* (4) *the manufacture of alkali, or allied, metals; Impts. in and apparatus for the ——.* E. A. Ashcroft, London. Eng. Pats. 1001, 1003, 1004 and 1005, Jan. 12, 1912.

(1) Alloys of light metals, such as sodium, with heavier metals, such as lead, are obtained by employing the latter metal as cathode in the electrolysis of a mixture of fused salts such as sodium and potassium chlorides. With such a mixture the molten cathode takes up both sodium and potassium, but by bringing the molten ternary alloy into contact with fused sodium chloride, a reversible reaction may be brought about, the potassium passing



from the alloy into the melt and sodium passing into the alloy. By keeping the primary or secondary electrolyte in continuous and rapid movement, an alloy of lead and sodium may be obtained practically free from potassium. By means of a conducting coil, the main electric current may be passed once or twice round the interior of the metal casing of the first cell in which the electrolysis of the chlorides takes place, thus producing a magnetic field which sets up a whirl in the electrolyte and aids the removal of potassium from the ternary alloy. The base of the apparatus is made from a single casting, which includes the lower parts of the two cells, an intermediate reservoir, and weirs and passages for the alloy. The first cell, 1 (see fig.), which is kept at a higher temperature than the other parts of the apparatus, is lined with refractory material, in order to prevent loss of heat from the molten alloy to other parts of the casting. The body of the alloy is maintained at a constant level in the two cells by the employment of weirs connecting the cells with an intermediate reservoir, 7, the latter taking up the variations in bulk of the alloy, which is circulated by means of a suitable pump. The anode employed in the first cell consists of a series of radially placed segments, forming a carbon cylinder which is provided with contacts and protective devices. The swirl of the fused salt drives the liberated chlorine towards the centre, most of the gas being led off in a pure condition through the anode. The rest of the chlorine liberated at the exterior of the anode, in the open part of the cell, is carried away in a current of air. (2) For the recovery of the alkali metals, or reaction products therefrom, the part of the cathode, 5, exposed to the electrolyte must be restricted in area within certain limits. With a current of 2500 ampères at 1½ to 2 volts, the following are the best dimensions: circular lead alloy anode, 680 mm. diameter, 200 round nickel cathode rods, each 10 mm. diameter dipping 2 mm. into the electrolyte, the lower ends of the rods being 10 to 15 mm. from the anode surface. The secondary electrolyte thus flows in a thin layer, 4, over the anode surface, being circulated by the pump, 10, and passing over the weir, 9, into a collecting chamber, 8. The liberated alkali metal, in globules, is carried over the weir and accumulates on the surface of the electrolyte in the chamber, 8, being then led away by the pipe, 11, to the vessel, 12. To minimise the solution of the alkali metal in the electrolyte, the chamber, 8, is artificially cooled. In an alternative form, suitable for low melting electrolytes, such as an amide or caustic alkali, the electrolyte chamber, 7, and pump, 10, are arranged outside the cell. In a further form, the cathode is arranged horizontally, in a considerable depth of electrolyte, and a conical shield, supported by two tubes above the cathode, conveys the liberated alkali metal to an enclosed hood. A current of gas is passed through the tubes, thus depressing the electrolyte to the lower ends of the tubes, and insulating the rods which convey the current from the cathode through the tubes. An active gas, such as ammonia, steam, etc., may be passed through the tubes into the melt, the gas reacting with the nascent metal and producing a derivative such as an amide, caustic alkali, etc. (3) The alloy of lead and alkali metal is formed in the first cell, and, by the action of ammonia, an alkali metal amide is formed in the second cell. This is then passed through two decomposing vessels, into which steam is passed for the production of fused anhydrous caustic alkali and dry ammonia. Steam is passed into the first vessel, and the moist ammonia liberated is passed into a second finishing vessel to complete the decomposition of the amide. The dry ammonia liberated from the second vessel is again used in the process for the production of amide. (4) The alkali metal is extracted from the lead alloy by first forming the amide, which is then electrolysed in a cell similar to the Castner cell employed for the electrolytic production of caustic soda. The metal is thus liberated at the cathode and ammonia gas at the anode. In an alternative process, the light metal is dissolved from a lead alloy at about 400° C. in an alkali metal amide, and the saturated amide is cooled to about 200° C., a large quantity of the dissolved alkali metal being thrown out of solution on the surface of the melt. A combination of this process with that of electrolysis may also be employed. The electrolysis may also be carried out at a temperature at which the radical liberated at the anode reacts with the dissolved light metal, an amide or allied compound previously saturated with the light metal being employed as the electrolyte. The melt is afterwards again re-saturated from a lead alloy.—B. N.

Electrolysing liquids; Apparatus for ——. E. Balke, Charlottenburg. Assignor to Siemens und Halske A.-G., Berlin, Germany. U.S. Pat. 1,051,060, Jan. 21, 1913.

The electrolytic vessel is divided into compartments by means of partitions, each of the latter being provided with an opening through which the liquid to be electrolysed may flow from one compartment to another. A number of slotted electrodes are mounted on the partitions by means of the slots, and terminals are provided on the outer electrodes at each end of the vessel and on one or more of the intermediate electrodes.—B. N.

Electro-osmotic extraction of water from animal, vegetable, or mineral substances. Ges. für Electro Osmose, m. b. H. Frankfort-on-Maine, Germany. Eng. Pat. 23,545, Oct. 15, 1912. Under Int. Conv., July 17, 1912.

The material is subjected to the action of an electric current, in a space of constant volume, containing the electrodes, under pressure, but without any movement of the drying mass. For example, the electrodes may be of hard lead, arranged behind the cloths of a filter-press, and the substance pumped in under a slight pressure. Under some conditions suction may be employed instead of pressure. The polarity of the electrodes may be changed periodically, to prevent certain substances which separate at the cathode choking the water outlet.—B. N.

Endothermic reaction of gases; [Electrical] Apparatus for the ——. W. S. Lee, Charlotte, N.C. U.S. Pat. 1,051,131, Jan. 21, 1913.

Two rotatable discs are located in the same plane, adjacent to each other, but spaced apart, and parallel shafts are supported on the discs, with means for moving the shafts towards and from each other, so that the position of the discs may be varied whilst the shafts remain parallel. The surfaces of the discs may be connected with a source of electrical current, and the gas to be acted upon is directed between the adjacent moving portions of the surfaces, a chimney, with an air inlet and outlet, surrounding these parts.—B. N.

Furnace; Revolving electric —— intended chiefly for the manufacture of aluminium nitride. Soc. Générale des Nitrures, Paris. Eng. Pat. 16,406, July 13, 1912. Under Int. Conv., Aug. 4, 1911. Addition to Eng. Pat. 29,299, Aug. 11, 1910.

See Addition of Aug. 4, 1911, to Fr. Pat. 430,553 of 1910; this J., 1912, 1136.—T. F. B.

Furnaces; Electric ——. J. M. Bocuze, Lyons, France. Eng. Pat. 21,290, Sept. 18, 1912. Under Int. Conv., Oct. 14, 1911.

See Fr. Pat. 435,493 of 1911; this J., 1912, 395.—T. F. B.

Melting furnace; Electric-resistance ——. A. Voelker, Beuel, Germany. U.S. Pat. 1,051,036, Jan. 21, 1913

See Fr. Pat. 421,631 of 1910; this J., 1911, 424.—T. F. B.

Electrodes for use in producing endothermic gas reactions. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 24,051, Oct. 21, 1912. Under Int. Conv., Oct. 24, 1911.

See U.S. Pat. 1,029,885 of 1912; this J., 1912, 691.—T. F. B.

Products formed in gases at high temperatures; Process of and [electric] furnace for securing ——. C. F. R. von Koch, Stockholm. U.S. Pat. 1,051,120, Jan. 21, 1913.

See Fr. Pat. 435,733 of 1911; this J., 1912, 385.—T. F. B.

Electrolytical purposes; Article [of refractory material] for ——. B. Schwerin, Assignor to Ges. f. Elektro-Osmose m. b. H., Frankfort-on-Maine, Germany. U.S. Pat. 1,050,303, Jan. 14, 1913.

SEE Fr. Pat. 426,072 of 1911; this J., 1911, 942.—T. F. B.

Electric storage battery plate. A. Ricks, Gross Lichterfelde-Ost, Germany. U.S. Pat. 1,051,261, Jan. 21, 1913.

SEE Eng. Pat. 4843 of 1912; this J., 1912, 933.—T. F. B.

XII.—FATS; OILS; WAXES.

Hardened oils; Characteristics of —— and detection of arachidic acid therein. H. Kreis and E. Roth. Z. Untersuch. Nahr. Genussm., 1913, **25**, 81—85.

RESULTS obtained by Bömer (this J., 1912, 996) are confirmed, and it is also stated that sesamin can be extracted from hardened sesamé oil. Bellier's reagent for seed oils (nitric acid of sp. gr. 1·4, and resorcinol in benzene) may be used with hardened sesamé, arachis, and cottonseed oils, but gives somewhat different shades of colours than in the case of the untreated oils. Both acid and oil give an orange-yellow colouration in the case of hardened marine animal oils. On shaking hardened sesamé oil with hydrochloric acid (sp. gr. 1·19), as in Bishop's test, no green colouration is obtained. Bellier's method of detecting arachidic acid (this J., 1899, 393) is not applicable to hardened oils, which may yield heavy precipitates in the test. The following method is therefore recommended:—Twenty grms. of the fat are saponified with 40 c.c. of 40 per cent. alcoholic potassium hydroxide solution, 60 c.c. of alcohol added to the soap solution, and the liquid acidified with about 15 c.c. of 50 per cent. acetic acid and treated at boiling temperature with a solution of 1·5 grms. of lead acetate in 100 c.c. of alcohol, without waiting for the separation of the fatty acids. After standing overnight in the case of ordinary fats or 3 hours in the case of hardened fats, the separated lead salts are decomposed with boiling 5 per cent. hydrochloric acid. The separated fatty acids (about 2 grms.) are dissolved in 50 c.c. of warm 90 per cent. alcohol, and the solution cooled for 30 minutes in water at 15° C. The resulting crystals are recrystallised, first from 25 c.c. and then from 12·5 c.c. of 90 per cent. alcohol, and their m. pt. determined. In the presence of at least 5 per cent. of arachis oil their m. pt. will exceed 70° C. When only a small quantity of crystals is obtained it is advisable to collect them in an Allihn's tube containing asbestos, to dissolve the residue in ether, and to recrystallise the residue left on evaporation of the solvent.—C. A. M.

Oil from the seeds of Camellia theifera (tea); Examination of ——. A. Kesava Menon. Year Book of Indian Guild of Sci. and Technol., 1912, 144—145.

THE seeds (from one to four in a capsule) of *Camellia theifera* (*Thea sinensis*, Linn.), a variety of the tea plant found in Upper Assam, Manipur, and Sylhet, are round or semi-circular and contain a bitter kernel. The seed weighs 0·5—2 grms. and consists of 60 per cent. of kernel and 40 per cent. of shell. A sample of kernels from plants growing in Tinsukia and Assam, yielded on extraction with petroleum ether, 16·1 per cent. of a clear straw-coloured oil, which deposited "stearine" on standing. The oil and the fatty acids therefrom had the following characters: *Oil:* sp. gr. at 15°/15° C., 0·9028; acid value, 3·75; saponif. value, 189·9; Reichert-Meissl value, 0·56; titration number of insoluble volatile acids "$\frac{1}{10}$KOH = 0·56"; iodine value, 92·7; unsaponifiable matter, 2·65 per cent. *Total insoluble fatty acids* (93·04 per cent.): m. pt., 38·9° C.; iodine value, 94·13; neutralisation value, 199·9; mean molecular weight, 280·5. *Solid fatty acids* (25 per cent., on total acids): m. pt. 57·8° C.; iodine value, 13·84; neutralisation value, 209·8; mean molecular weight, 267·3. *Liquid fatty acids* (74·75 per cent.): iodine value, 117·8; neutralisation value, 191·1; mean molecular weight, 293·5. It is suggested that the cultivation of tea seed for oil-yielding purposes might be profitable.—A. S.

"*Katian*" *seeds and fat from British North Borneo.* Bull. Imp. Inst., 1912, **10**, 549—551.

THE seeds of the "katian" ("katio" or "kachian") plant (*Bassia Mottleyana*, C. B. Clarke) weigh, on the average, 0·34 grm. each and consist of 68 per cent. of kernel and 32 per cent. of shell. The kernels yield 51·3 per cent. of a pale greenish yellow, soft fat, which closely resembles that of *Bassia latifolia* (see this J., 1912, 98), but is somewhat softer. The fat consists of about 75 per cent. of olein and 25 per cent. of stearin (and probably palmitin). The sample examined had a high acid value (77·9), having been extracted from old and somewhat mouldy seeds, but otherwise yielded results on examination closely agreeing with those given by Brooks (this J., 1909, 612) for a sample of native-prepared "katian" fat.—A. S.

Fats; Notes on the work of Kremann and Schoulz on the synthesis of ——. D. Holde. Ber., 1912, **45**, 3701—3702.

THE results obtained by Kremann and Schoulz (this J., 1912, 1010) in regard to the melting points of mixtures of tripalmitin, tristearin, and triolein, confirm the view previously expressed by the author (this J., 1901, 1003; 1902, 126; 1903, 101) that the solid fatty acids of fats liquid at the ordinary temperature must be present not in the form of triglycerides, but in the form of mixed glycerides of solid and liquid fatty acids or of solid solutions (or isomorphous mixtures) of glycerides of solid and liquid fatty acids.—A. S.

Ammonium soaps; Aqueous solutions of ——. F. Goldschmidt and L. Weissmann. Z. Chem. Ind. Kolloide, 1913, **12**, 18—31.

THE present paper deals with experiments on ammonium soaps prepared from the fatty acids of palm-kernel oil. The behaviour of the ammonium soaps differs in many respects from that of the corresponding potassium soaps (see this J., 1912, 593). The results indicate that although the solutions of ammonium soaps contain, in the condition of colloidal solution, the solid solution of soap and fatty acids known as "acid soap," the gelatinising power of the soap solutions must be attributed to the presence of another colloid of the emulsoid type, the "acid soap" being of the suspensoid type (compare McBain and Taylor, this J., 1911, 434). The specific electrical conductivity of ammonium soap solutions increases with the concentration but is not directly proportional thereto; the molecular conductivity also increases with increasing concentration, apparently to a constant maximum value, and is about one-half that of the corresponding potassium soap. The viscosity rises with increasing concentration, at first slowly and then rapidly to very large values; in the more concentrated solutions it is greatly affected by change of temperature. Ammonium chloride even at small concentrations greatly increases the viscosity and lowers appreciably the conductivity; at higher concentrations it causes the separation of "acid soap." By addition of ammonia the viscosity is first slightly increased and then, on further addition, diminished to below the original value, subsequently rising again with still larger quantities of ammonia. The conductivity rises to a maximum and then decreases continuously on addition of ammonia, the fall amounting to about 3 per cent. per mol. of ammonia. The effect of ammonium chloride in increasing the viscosity of the soap solutions is greatly intensified by the presence of ammonia in addition.—A. S.

Edible vegetable oils; Denaturation of —— for entry into Australia. Board of Trade J., Feb. 13, 1913. [T.R.]

AUSTRALIAN Commonwealth By-laws (Nos. 256-7), dated 20th December last, amend By-laws Nos. 194 and 220 respecting the denaturation of edible vegetable oils, n.e.i., for purposes of entry under Tariff heading No. 234

(G) (viz. : at 6d. per gall.) into the Commonwealth. Under By law No. 256 it is provided that blown rape seed oil having a specific gravity of 0·96 or higher at 60° F. shall be considered sufficiently denatured by the blowing process. By-law No. 257 amends By-law No. 220 (see this J., 1912, 782) with the effect that it is now provided that blown rape seed oil, used for denaturing edible colza (rape seed) oil when intended for church use as a burning oil, should have a specific gravity of not less than 0·96 at 60° F.

Patents.

Soap ; Process for making ——. S. S. Krayer, St. Louis, Mo. U.S. Pat. 1,049,495, Jan. 7, 1913.

For the production of a neutral soap, suitable for dissolving mineral oils, paints and varnishes, a glyceride is boiled with excess of alkali, so as to produce an alkaline soap, the mixture is cooled and a mineral oil solvent such as benzol, ether or a chloride of carbon is added ; and, finally, sufficient sulphonated oil, *e.g.*, sulphonated castor oil, is added just to neutralise the excess of alkali. A filler such as silica may be added to the mass.—E. W. L.

Soaps ; Preparation of disinfectant —— with the aid of oil of turpentine or similar crude oils containing pinene. K. Rülke. Ger. Pat. 254,129, Feb. 19, 1911.

The product obtained by the action of acids on oil of turpentine or the like is treated with soaps or with the raw materials for the manufacture of soaps, an excess of alkali being preferably used. The oil of turpentine or the like may be partially or completely freed from terpenes before treatment with acid. It is stated that the borneol produced from the crude product obtained by the action of acids on oil of turpentine, by the excess of alkali used in the manufacture of the soap, does not crystallise out but remains dissolved in the soap.—A. S.

Emulsions formed by aqueous liquids with fatty substances of any kind ; Process for rapidly separating ——. A. Rost, Dresden. U.S. Pat. 1,050,696, Jan. 14, 1913.

See Fr. Pat. 440,474 of 1912 ; this J., 1912, 827.—T. F. B.

Apparatus for the treatment of [extraction of oil from] animal and fish refuse. Eng. Pat. 2545. *See* XIXB.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Paints, especially lithopone paints ; Analysis of mixed ——. P. Nicolardot. Ann. Falsif., 1913, **6**, 39—41.

About 5 grms. of the paint is weighed out exactly into a small tube, which is then placed in a flask fitted with a thistle funnel and a delivery tube, and 50 c.c. of toluene and 150 c.c. of hot distilled water are added. After the oil has separated, 5 c.c. of hydrochloric acid are added very gradually and the liquid heated to boiling. The evolved gases are led through a train consisting of (1), a wash-bottle containing fuming nitric acid, (2) a glass tower filled with glass marbles and containing fuming nitric acid, (3) a wash bottle containing sodium hydroxide solution, and (4) a wash-bottle containing potassium permanganate solution. After the acid is all added, air is drawn slowly through the apparatus, and the heating is continued for 2 hours. The toluene solution is separated, filtered, and dried over potassium carbonate. The toluene is then driven off and the oil heated at 105° C. till the weight is constant. The acid solution is filtered, and the two portions of insoluble matter ignited together. To the boiling solution barium chloride is then added, the precipitated barium sulphate being taken as a measure of the zinc sulphate in the original paint. Lead, iron, etc., are determined in the usual way. The nitric acid and sodium hydroxide are mixed, evaporated to dryness, the residue treated with hydrochloric acid, and the sulphuric acid precipitated as barium sulphate. The permanganate solution should show no trace of sulphuric acid. Any sulphur adhering to the walls of the first wash-bottle is removed by bromine. Nitric acid is preferable to bromine as the oxidising agent, as bromo-compounds of toluene are formed which obstruct the passage of gas in the tubes. From the sulphuric acid thus determined the amount of zinc sulphide in the original paint is calculated.—T. St.

Mildew in paints ; Formation and inhibition of ——. H. A. Gardner. J. Franklin Inst., 1913, **175**, 59—64.

A red lead paint was examined in which the pigment portion had no affinity for the oil in which it was ground but had become gelatinous. There was a slight film on the surface with white mould spots. The film was cultivated on agar and produced a green mycelium with a white portion below the surface. The white portion was found to consist of a mass of spores and the green portion to be mycelium and spores. The mould was identified as *Penicillium crustaceum*. The chemical composition of the oil lying over the pigment and the original linseed oil showed no difference except what could be attributed to the presence of the red lead. The author has found that 5 per cent. of solvent naphtha added to paint prevents formation of mildew owing to its content of xylene and toluene.—J. H. J.

Turpentine oils from India. Bull. Imp. Inst., 1912, **10**, 539—546.

Most of the Indian oil of turpentine is obtained from *Pinus longifolia*, but other species of pine are also grown. Two samples of oil from *P. longifolia*, one crude and one rectified, were examined. They were similar in general character to samples examined previously (see this J., 1911, 756 ; also 1911, 1279) and were of a different character to the best grades of American and French oils. Indian *P. longifolia* oil would probably realise a price equal to or somewhat better than that of Russian turpentine oil. A sample of *P. Khaysa* oil had the sp. gr. 0·870 at 15°/15° C., $[\alpha]_D=-5^\circ\,30'$, distillate from 162°—163° C., 25 ; 163°—165° C., 57 ; 165°—169° C., 11 per cent. The rotatory powers of the distillates indicate that the oil is a mixture of terpenes, and it would be equal in value only to the lower grades of American oil of turpentine. A sample of *P. excelsa* oil had the sp. gr. 0·862 at 15°/15° C. ; $[\alpha]_D=+42^\circ\,30'$; distillate from 157°—158° C., 74 ; 158°—160° C., 16 ; 160°—170° C., 7 per cent. The oil consisted mainly of *d*-pinene and was comparable with the best grades of American oil of turpentine.—A. S.

Patents.

Lithopone ; Manufacture of —— resistant to light and air. W. Brase. Ger. Pat. 254,291, Sept. 29, 1909.

Alkali nitrate is added to ordinary lithopone.—A S.

Moulded compositions. [Phenol-formaldehyde condensation products.] British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 6405, Mar. 14, 1912.

It has been found advantageous to employ for certain purposes (insulation), mixtures of a stable, permanently fusible condensation product of phenol (or cresol, etc.) and formaldehyde, and a polymerisable condensation product of these two substances, in preference to either of these condensation products alone. The polymerisable condensation product may be made by mixing phenol or the like with formaldehyde (or its homologues) in approximately molecular proportions, and adding a few per cent. of a base such as sodium carbonate or ammonia. The product is fairly stable and soluble in most organic solvents. A stable and permanently fusible condensation product may be made by carrying out the reaction in presence of acid, using water as a moderating agent A suitable mixture consists of phenol (90 per cent solution), 1120 c.c., formaldehyde (40 per cent. solution), 800 c.c., hydrochloric acid, 120 cc , and water, 8000 cc. In producing a moulded article containing asbestos (or other filler) the following process is employed : 25 to 30 parts of a solid polymerisable product and 15 to 10 parts of stable fusible product are finely ground together and then mixed with 60 parts of asbestos. The mixture is moulded under hydraulic pressure in steel dies and hardened by the application of heat for from 10 minutes to 2 hours according to the size of the article. The hardened mixture has a softening point of at least 150° C.—E. W. L.

Heavy hydrocarbons; Process for converting —— into "siccative oils" and product resulting therefrom. C. J. Greenstreet. Fr. Pat. 446,475, July 24, 1912.

Heavy hydrocarbons are converted into oils capable of evaporation without leaving an oily residue, and hence suitable for use as paint oils, by treating them at a temperature of from 205° to 535° C. with steam in sufficient quantity to produce a volume of water upon condensation equal to at least 25 per cent. of that of the oil. The mixture of oil and steam is forcibly injected as a spray into one end of a spiral coil situated in a furnace preferably maintained at a temperature of from 425° to 535° C., and then passes into a series of condensers. The condensed oil is fractionated and again subjected to steam treatment if necessary.—H. H.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubbers; Artificial ——. II. C. Harries. Annalen, 1913, **395**, 211—264. (See also this J., 1911, 1073; 1912, 510, 733.)

Details are given of a series of experiments undertaken to compare natural and synthetic rubbers of various kinds. The bromides and nitrosites are not satisfactory compounds for this purpose, and the best method appears to be that of measuring the velocity of decomposition of the diozonides and dioxozonides with water. This is done by mixing 0·05 grm.-mol. of the ozonide with 100 grms. of water in a 250 c.c. round-bottomed flask provided with a reflux condenser, and heating in a glycerin bath to 120°—125° C. After a given time the flask is cooled, the undecomposed ozonide shaken together, and the clear liquid decanted. The vessel is dried for some hours *in vacuo* and weighed, the decanted liquid is then again added, and the flask heated once more for a given time. As the author has recently shown, rubber can form a diozonide ($+2O_3$) and a dioxozonide ($+2O_4$). The latter is obtained by the action (sometimes prolonged) of the strongest unwashed ozone. The former gives more aldehyde, the latter more acid, on hydrolysis, which explains some of the differences obtained when ozonising various natural rubbers and guttapercha and also the occasional occurrence of lævulinic aldehyde diperoxide. The decomposition velocity curves of diozonide and dioxozonide were very similar. The curves for the ozonides of purified natural rubber, guttapercha, and rubber obtained by autopolymerisation of isoprene at 95° C. were the same, while the curve for rubber obtained by polymerisation of isoprene with glacial acetic acid was nearly the same. Piperylene rubber (see later) gave a rather greater difference. The curve for sodium-isoprene rubber was entirely different. In this case it is much more difficult to obtain a dioxozonide. The products of decomposition were similar for these various rubbers, except that they could not be identified in the case of the sodium-isoprene rubber, and that certain African rubbers gave different proportions of aldehyde and acid (thus confirming the results of Gottlob; see this J., 1908, 30) even when the ozonisation was carefully controlled. This points to an abnormality in these rubbers, perhaps to steric differences.—*Piperylene rubber.* The author obtained piperylene, $CH_3{\cdot}CH:CH{\cdot}CH:CH_2$, by treating acrolein with magnesium ethyl bromide, decomposing with water, extracting with ether, separating the resulting carbinol, $C_2H_5{\cdot}CHOH{\cdot}CH:CH_2$, from the ether by fractionation, and heating it with a dehydrating agent (preferably phthalic anhydride). The piperylene obtained in this way boils at 40°—45° C. Another method is to treat ethyl formate with magnesium ethyl bromide and then distil the diethylcarbinol so obtained with phosphorus pentoxide, giving Δ^2-amylene. This is brominated in chloroform, yielding 2·3-amylene bromide, which is allowed to drop on soda-lime (saturated with carbon dioxide) heated in a metal vessel to about 600° C., as in the preparation of isoprene. Piperylene is obtained in the distillate. On long heating (14 days at 105°—110° C.) this gives rubber. The nitrosite and bromide of the rubber were prepared. As mentioned above, the decomposition curve of the ozonide is somewhat different from that of the ozonide of natural rubber. The decomposition products are also different, methyl succinic dialdehyde (not known hitherto) being probably obtained. Piperylene rubber appears to be an isomeride of natural rubber in which the double bonds are in the 2.6- instead of the 1.5-position. On the polymerisation of piperylene a terpene was also obtained, which gave an ozonide. Piperylene also gave a sodium-rubber, the nitrosite of which was different from that of normal piperylene rubber.—*Normal butadiene rubber.* The derivatives of this rubber are described. The rubber was separated from a terpene, C_8H_{12}, by repeated rolling on heated rollers, and the decomposition curve of its ozonide was then compared carefully with that of the 1.5-cyclo-octadiene from pseudopelletierine, which has a very characteristic decomposition curve. (See this J., 1908, 469). The two curves were found to agree, and thus it is established that the normal rubber molecule contains a ring of eight carbon atoms.—H. E. P.

β,γ-Dimethylbutadiene: Comparison of the products of heat- and autopolymerisation of ——. C. Harries. Annalen, 1913, **395**, 264—272.

There are three products obtained by polymerisation of β,γ-dimethylbutadiene, viz., (1) the normal rubber (long heating), (2) that obtained by Kondakow (long keeping) as a practically insoluble mass, and (3) the resinous easily-soluble mass obtained by allowing (2) to stand in the air. Sodium-rubbers have not been obtained. The ozonides were compared. All give acetonylacetone on decomposition, but (2) and (3) in much smaller amount than (1). All three give dioxozonides also. The decomposition curves were studied. The difference in amount of the decomposition products and the difference in the curves, shows that these three bodies are not identical. Indeed (3) is not a true rubber. This suggests that the body obtained by Pickles (this J., 1910, 707) from isoprene by standing in the cold is different from the normal rubber obtained on heating; the bromides and nitrosites do not prove identity, since those of compounds (1) and (2) above are very similar despite the difference in the ozonides.—H. E. P.

Para rubber from Dominica. Bull. Imp. Inst., 1912, **10**, 555—556.

The sample (small biscuits) was of very good quality, the loss on washing being 0·8 per cent. and the composition of the dry washed rubber: caoutchouc, 93·9; resin, 2·9; protein, 2·8; and ash, 0·4 per cent. The rubber was valued at about 4s. 10d. per lb. in London, with fair average quality plantation Para biscuits at 4s. $10\frac{3}{4}$d. to 4s. $11\frac{1}{2}$d. per lb.—A. S.

Ceara and Rambong rubbers; Insoluble constituents of ——. C. Beadle and H. P. Stevens. Z. Chem. Ind. Kolloide, 1913, 12, 46—48.

Experiments were made with Ceara (*Manihot*) and Rambong (*Ficus elastica*) rubbers similar to those made previously with smoked and unsmoked Para rubber (this J., 1912, 999, 1099). It was found that with Ceara rubber (high nitrogen content) and Rambong rubber (low nitrogen content) also, the removal of the insoluble constituent has a prejudicial effect on vulcanisation, and that concentration of the insoluble constituent in a portion of the rubber leads to an increase in the content of "combined sulphur" on vulcanisation. Differences were observed in the three kinds of rubber with regard to the distribution of the nitrogen. The percentages of nitrogen (referred to the original nitrogen content) left in the rubber freed from

insoluble matter were: Para 15, Ceara 20, and Rambong 73, although the separation of the insoluble matter appeared to be equally complete in the three cases. The effect of the separation of the insoluble matter on the vulcanisation was about the same in the case of Para and Rambong rubbers, but was much less pronounced in the case of Ceara rubber.
—A. S.

Ceara rubber. Bull. Imp. Inst., 1912, **10**, 551—554.

The results of the examination of samples of Ceara (*Manihot Glaziovii*) rubber from the Sudan, Northern Rhodesia, and Portuguese East Africa, are given.—A. S.

Landolphia Kirkii rubber from Natal. Bull. Imp. Inst., 1912, **10**, 554—555.

Two samples were examined, one of ball rubber as prepared by natives, and the other of rubber "worms" as prepared by the Guiguet machine. The latter was of good quality and would be readily saleable. It was valued at 3s. 9d. to 3s. 10d. per lb. in London, with fine hard Para at 4s. 4½d. per lb.—A. S.

African rubbers; [Mechanical] tests of ——. P. Breuil. Caoutchouc et Guttapercha, 1913, **10**, 6884—6891.

Comparative tests were made with *Funtumia* rubber, herb rubber, and a sample of weak Para. With each rubber two mixings were made, and each mixing was vulcanised at 143° C. for various lengths of time. One mixing contained: rubber, 87, litharge 5, magnesia 4, and sulphur 4 parts, and samples were vulcanised for 1, 1¼ and 1½ hr. respectively; the second mixing contained 6 parts of sulphur, but the same proportions of the other ingredients, and samples of this were vulcanised for 1, 1¼, 1½ and 1¾ hr. The author displays, in a series of tables, the figures obtained for the following values with each sample: *Suppleness or pliability*, as measured by the elongation per cent. produced by a load of 25 grms. per sq. mm. of cross-section of a test strip 40 mm. wide and 5 mm. thick. *Cyclic fatigue*, which is defined by the formula, $\frac{a_2 - a_1}{a_1}$, in preference to that proposed by Beadle and Stevens, viz. $\frac{\log a_2 - \log a_1}{\log 5}$, a_1 and a_2 being respectively the elongation at the first and fifth cycles. (The dimensions of the test piece and the load were the same for the fatigue test as for the suppleness test.) *Breaking strain* and *elongation at break*, determined with long-waisted, briquette-shaped samples, which were cut from sheet by means of a band knife. The ends of these test-pieces were 30 mm. wide, the width of the long waist was 10 mm., the total length was 80 mm., and the length of the waist 35 mm. With test pieces of this shape and cut in the manner indicated, the break occurred in each of 29 instances at the narrow section and not in the jaws of the testing machine. In addition to the above values the tables include values for permanent elongation after the fifth cycle, and after break, and for the "*general value*" (= ½ breaking strain × elongation at break), or the work done in producing fracture expressed in kilogrm.-cm. per c.c. of the stretched material. The general results of the tests are to bring out the greater suppleness of vulcanised *Funtumia* and herb-rubber samples, more particularly with the lower percentage of sulphur, as compared with the weak Para; the greater cyclic fatigue of the two African rubbers; their very much lower tensile strength, and their lower "general value." With the higher percentage of sulphur the African rubbers tend to approximate more closely in their properties to the weak Para.—E. W. L.

Rubber content of rubber goods; Determination of the ——. P. Goldberg. Chem.-Zeit., 1913, **37**, 85—86.

The author summarises the various methods proposed for the direct and indirect estimation of rubber in vulcanised samples, including that adopted by the Verband Deutscher Elektrotechniker for the examination of cable insulation, and claims a high position as regards accuracy—more particularly in connection with normal cable-insulations for the following process:—1 grm. of the acetone-extracted rubber, dried at 50°—60° C., is placed in a porcelain boat, and introduced into a 50 cm. glass tube open at both ends. Dried nitrogen from a container is passed through the tube and when all the air is displaced, the boat is heated with a small flame. The rubber melts and its decomposition products distil. The latter are drawn away by means of a water-pump. The residue in the boat is weighed after cooling, and represents the mineral matter. A number of analyses are quoted in which the percentage of rubber found in this way does not differ by more than 0·3 per cent. from that actually introduced into the mixing. When easily dissociable carbonates, antimony sulphide, or vermilion are present, precautions are necessary. In the first case the carbon dioxide evolved is absorbed in alkali and estimated; if golden sulphide of antimony be present it is converted by the process into trisulphide, and can be estimated by treating the residue with an alkali sulphide, and determining the antimony either electrolytically or volumetrically. Vermilion is quantitatively volatilised and must therefore be determined in the original sample, preferably by the method of Frank and Birkner (this J., 1910, 224).—E. W. L.

Rubber goods; Koettstorfer's [saponification] value as a measure of the resins and substitute [factices] present in ——. M. Vallery. Monit. Scient., 1913, **3**, 82—83.

It is claimed that the determination of the saponification value is sufficient for most practical purposes as an indication of the amount of resins and fatty substitutes present in a vulcanised rubber mixing. A quantity of the rubber sample (subdivided by rasping) sufficient to reduce the titre of the *N*/1 alcoholic caustic soda employed by at least 20 per cent., is heated with a known volume of *N*/1 alcoholic soda for 3 hours in a flask fitted with reflux condenser. After cooling, the liquid is made faintly acid with a known volume of standard hydrochloric acid and titrated back with *N*/10 sodium hydroxide in presence of phenolphthalein. Experiments made on the effect of various degrees of subdivision of the rubber upon the values obtained, indicated that reliable results cannot be obtained unless the rubber sample is comminuted by rasping.—E. W. L.

Discussion on the action of oxygen on indiarubber. See Manchester Section, p. 179.

Patents.

Caoutchouc-like substance; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,591, June 10, 1912.

The product obtained as described by Kondakow (J. prakt. Chem., **64**, 109—110) from β-γ-dimethylerythrene is heated for 8 hours in a closed iron vessel to from 150°—200° C. when a compact elastic mass is obtained.—E. W. L.

Rubber products; Reclaiming ——. A. Wheeler, Assignor to E. D. and B. Lowenthal, Chicago, Ill. U.S. Pat. 1,049,955, Jan. 7, 1913.

Rubber waste containing cellulose is pulverised and treated with a cellulose solvent, such as cuprammonium solution, but the treatment is arrested before the cellulose loses its tenacity and coherence. The cellulose is not separated from the rubber and the mass may be vulcanised to form a hard rubber product.—E. W. L.

India-rubber substitute. J. W. Butler, Eltham. Eng. Pat. 23,210, Oct. 20, 1911.

A mixture of hard tar (8 oz.) and bitumen (9 oz.) is heated to 200° F. (93° C.) and mixed with soya oil (8 oz.) which has also been heated to 200° F. (93° C.). Vaseline (3 oz.) or paraffin wax, etc., is then added and the mixture heated to 400° F. (205° C.). Thereafter the following ingredients may be added:—talc (10 oz.), powdered asbestos (7 oz.), magnesium oxide (2 oz.), kauri gum (2 oz.) and flowers of sulphur (6 oz.).—E. W. L.

Rubber: Machine for reducing vulcanised —— to powder. T. Gare, New Brighton. U.S. Pat. 1,050,122, Jan. 14, 1913.

See Eng. Pat. 8976 of 1907; this J., 1908, 633.—T. F. B.

Manufacture of dichloro-derivatives of hydrocarbons having the chlorine atoms attached to different carbon atoms. Eng. Pat. 277. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Cassia auriculata or tarwar bark: its analysis and use. P. V. Mehd. Year Book of Indian Guild of Sci. and Technol., 1912, 137—138.

Infusions were prepared from the powdered bark at 30°—40° C., 40°—50° C., 50°—60° C., and 85°—90° C., respectively, and it was found that whilst the non-tannins (9·8—11·8 per cent.) were extracted almost completely even at the lower temperatures, the maximum amount of tannin (21·9—22·1 per cent.) was extracted at 85°—90° C. No glucose could be detected in the infusion. The precipitate produced with basic lead acetate was of a peculiar chocolate colour which appears to be characteristic of cassia (tarwar) bark. A piece of English hide was tanned for three weeks in liquors, prepared from myrobalans and cassia bark, which had stood for over two weeks; the acidity of the liquor was maintained by addition of formic acid, and the strength was kept up by addition of further quantities of the infusion of cassia bark and myrobalans. The hide was then drummed with a strong freshly-prepared infusion of myrobalans to which myrobalans dust was added. After drumming for half an hour every day during one week, the leather was taken out and finished in the usual way, using cod oil and drying at 60°—70° F. (15·5—21° C.). The leather was of a very light colour, possessed a mellow feel, and gave the following results on analysis: moisture, 12·5; oil, 2·0; water-soluble matter, 16·9; hide-substance, 40·4; combined tannin, 28·2; glucose, 0·0 per cent. It is concluded that though cassia bark may not be suitable for fancy leather goods and leather for book-binding, it may be used with advantage for heavy as well as for dressing leathers, giving when blended with myrobalans, a mellow tannage, and a very good, light-coloured leather, which compares favourably with that produced by any of the other blends at present in common use.—A. S.

Valonea; The production of ——. Bull. Imp. Inst., 1912, 10, 645—653.

A concise description of the cultivation, harvesting, preparation and use of valonea. Some statistics of the trade in valonea are given in the following tables:—

Exports from:	1909.	1910.	1911 (estimated).
	tons.	tons.	tons.
Smyrna	56,616	73,370	80,000
Greece	8,000	8,000	3,000

Imports to:	1909.		1910.		1911.	
	tons.	£	tons.	£	tons.	£
United Kingdom	21,921	217,370	17,921	169,948	12,405	121,227
Hamburg*	10,442	112,520	20,309	209,292	10,156	109,619

* Including imports of "Knoppern," which, however, are now so largely replaced by valonea, sometimes called "Orientalische Knoppera," that the figures represent chiefly valonea.

—A. S.

Leather and gall-nuts from Hong-Kong. Bull. Imp. Inst., 1912, 10, 576—579.

The samples of buffalo leather and ox leather did not compare well with ordinary East Indian hides, being weaker, and having their texture damaged, apparently by the use of tanning liquors of excessive strength. The sample of Chinese gall-nuts (stated to have been produced on *Rhus semialata*, Murr.) contained 11·7 per cent. of moisture, 2·0 of ash, 61·5 of tannin, and 7·1 per cent. of soluble non-tannins. The colour of a solution prepared from them, containing 0·5 per cent. of tannin, when examined in a 1 cm. cell, was 0·4 red; 0·7 yellow. The galls were valued at a somewhat higher price than ordinary Chinese galls.—A. S.

Patent.

Tanning. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 8512, April 10, 1912.

See Fr. Pat. 443,730 of 1912; this J., 1912, 1045.—T. F. B.

XVI.—SOILS; FERTILISERS.

Nitrate and nitrite assimilation. V. O. Baudisch and E. Mayer. Ber., 1913, 46, 115—125.

Potassium nitrate or nitrite in formaldehyde or aqueous methyl alcoholic solutions when exposed to solar radiations or those from a mercury lamp yield formhydroxamic acid, HC(OH):N.OH. Aliphatic hydroxamic acids are capable of reacting in a great variety of ways. The alkali salts readily decompose to ammonia and alkali carbonate. A mixture of potassium nitrate and formaldehyde when exposed to sunlight liberates nitrous oxide and hydrogen together with some carbon dioxide and monoxide. In a potassium nitrite-formaldehyde solution nitric oxide is also formed. In all cases where nitroxyl, HN:O, should be formed, a mixture of nitric oxide and hydrogen was obtained. Angeli's salt, NaON:NO.ONa, for example, decomposes on warming in aqueous solution into nitrous and nitric oxides and ammonia. The illuminated potassium nitrite-formaldehyde mixture was proved experimentally to contain methylamine and an alkaloid closely related to nicotine and giving an intense pyrrole reaction. Whereas carbonic acid is reduced to formaldehyde mainly by the energy of the red and yellow rays of the spectrum, it is essentially the blue, violet and ultraviolet rays which reduce nitrate to nitroxyl, HN:O.

—E. F. A.

Basic slag; Determination of the phosphoric acid of —— soluble in citric acid. W. Simmermacher. Chem.-Zeit., 1913, 37, 145—146.

The author states that if ferric chloride and then a mixture of ammonium citrate and magnesia mixture be added to the citric acid solution, too high a value is obtained, owing to the co-precipitation of ferric hydroxide; if, however, ammonium citrate be added slowly and the precipitated iron hydroxide redissolved, a precipitate free from iron and silica is obtained, so long as the solution is acid; that is, all the iron should be in the form of citrate before the solution becomes alkaline. Fresh solutions of the magnesia-citrate mixture precipitated fine crystals free from iron, whilst an old solution gave large crystals and too high a result owing to the formation of the double salt, $2C_3H_4OH(COOH)_3,4NH_3,MgO$, on long standing of the mixed solutions. To obtain accurate results, the ammonium citrate solution should be added first and then fresh magnesia mixture. It is stated that only ferric iron has the power of preventing the co-precipitation of silica.—A. H. C

Catalytic manures [manganese] and beetroot cultivation, Bertrand. *See* XVII.

Effect of manganese on pineapple plants. Ripening of the pineapple fruit. Wilcox and Kelley. *See* XIXa.

PATENTS.

Fertiliser containing nitrogen and phosphoric acid ; Manufacture of a ——. D. Landenberger. Ger. Pat. 255,385, Feb. 21, 1911.

NITROLIM (crude calcium cyanamide) and raw phosphate are treated together with the requisite quantity of sulphuric acid in order to obtain a mixed fertiliser containing superphosphate and free from lime.—A. S.

Fertilising agent ; Process and apparatus for manufacturing a —— with the aid of the nitrogen of the air. O. Frank and O. Fincke, Berlin. Eng. Pat. 1774, Jan. 22, 1912.

SEE Fr. Pat. 439,244 of 1912 ; this J., 1912, 738.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Beetroot cultivation ; Catalytic manures [manganese] and ——. G. Bertrand. Bull. Assoc. Chim. Sucr., 1910—1911, 743. Z. Ver. deut. Zuckerind., 1913, **63**, 35—48. (See also this J., 1911, 228, 502.)

RESULTS obtained by the author, by Garola and by Stoklasa are given showing the favourable influence of soluble manganese salts on the growth of beetroots, both as regards increased weight and increased sugar content. The amount of manganese in normal beets is only 0·01 to 0·02 mgrm. per 100 grms. of root.—L. J. DE W.

Beetroot juice ; The natural alkalinity of ——. Influence of the mode of extraction and of defecation and carbonatation on its permanence or attenuation. L. Brancourt. Bull. Assoc. Chim. Sucr., 1913, **30**, 396—401.

THE natural alkalinity of the juice produced during 1912 showed a tendency to become less or to vanish during concentration, notwithstanding the fact that the general increase in purity would indicate a more normal and regular development of the roots than usual. The author draws attention to a similar trouble which came under his notice during a recent season. The reason of the disturbance was traced to a change made by the attendant of the diffusion battery in drawing off the juice at 82° C. instead of at 78°—80° C. A return to the latter limits of temperature immediately put matters right. It was also found that any juice that had already passed the diffusers could be rectified by arresting the first carbonatation at an alkalinity equal to 120—160 grms. of lime per hectolitre of juice instead of the usual 90—100 grms. for juice drawn off at 78° and 80° C. respectively.
—L. J. DE W.

Beetroot juices ; Removal of magnesia and iron from ——. H. Hamstra. De Suikerindustrie, 1912, **12**, 374—378.

THE magnesia and the iron present in limed juice are derived partly from the lime used and partly from the beetroot itself. Magnesia is present as hydroxide, but in the first stage of saturation is converted partly into the insoluble basic carbonate, and partly into the soluble acid carbonate. During the second saturation, when the temperature is ultimately raised to boiling point, the acid carbonate is decomposed into the normal compound, which is practically insoluble in dilute sugar juices. If in the second saturation the temperature be not finally raised to boiling point, a greater or smaller amount of normal magnesium carbonate will be deposited in the effect, but the rate of this decomposition will not be proportional to the increase of concentration of the syrup. Ferric compounds are soluble in limed juice containing calcium saccharate, although quite insoluble in carbonated juices free from calcium saccharate, so that after saturation, when all the saccharate is decomposed, the ferric iron is completely eliminated. Ferrous compounds, in the first stage of saturation, form with carbon dioxide a soluble compound, which later, in the presence of freshly formed calcium carbonate, is quantitatively precipitated. It is therefore advisable in conducting the second saturation to add a small amount of lime to ensure the formation of calcium carbonate, and the elimination of ferrous compounds in this manner. During the past two campaigns in a Dutch factory it was found that provided carbonatation be carefully carried out the elimination of calcium, magnesium, and iron compounds can be satisfactorily accomplished. By determining the amount of these constituents introduced in the raw juice and the lime used for defecation, and that passing into the scums and molasses, the following figures expressing the percentages removed for the two seasons were as follows : calcium oxide, 99·95, 99·98 ; magnesium oxide, 98·99, 99·10 ; and iron oxides, 97·76, 98·27. It is emphasised that the removal of the lime as completely as possible is important, for upon this depends the elimination of the iron. That this is so is shown by a series of figures for the lime and iron remaining in the molasses, the amount of iron being always directly proportional to the percentage of lime present.—J. P. O.

Caramel. Briant. *See* XVIII.

PATENTS.

Bone black ; Process for revivifying —— by heating in absence of air. A. H. Imbert. Ger. Pat. 254,148, Nov. 28, 1911.

THE revivification is effected in an electric furnace, the bone black itself acting as a heating resistance. By means of a median partition which does not extend to the bottom, a U-shaped chamber is formed inside the furnace. The electrodes are at the upper ends of the limbs of the U. The bone black is fed in through channels between the electrodes and the median partition, and the revivified material is discharged through an opening, provided with a door, at the bottom.—A. S.

Mucilaginous products ; Manufacture of ——. C. V. Greenwood, Blundellsands, Lancs. Eng. Pats. 564, Jan. 8, and 17,862, Aug. 1, 1912.

MUCILAGINOUS substances may be obtained from seeds other than those mentioned in Eng. Pats. 10,822 of 1905, 569 of 1908, and 19,768 of 1909 (this J., 1906, 944 ; 1909, 153 ; and 1910, 1172), the process of extraction being modified. Amongst the seeds now employed are those of *Acacia* (three varieties), *Parkinsonia aculeata, Poinciana regia, Balsamocarpon brevifolium, Gleditshia japonica, Cassia* (three varieties), *Linum usitatissimum, Plantago psyllium*, fenugreek, quince, etc. The brown colouring matter contained in the husks is destroyed by treatment with a suitable reagent, such as alcohol, ammonium sulphate, sodium silicofluoride, hydrogen peroxide, hypochlorites, sulphurous acid, acetic acid, or alkalis ; when possible, the husks are removed after being bleached. An enzyme solution may be extracted from certain of the seeds and then mixed with the endosperm or with the matter extracted therefrom either before, during, or after the extraction of the gummy matter. Malt extract may be employed in place of the enzyme solution mentioned.
—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Brewing waters ; Influence of —— containing different proportions of calcium sulphate on brewing processes. K. Maurer and F. Steinecker. Z. ges. Brauw., 1913, **36**, 44—47, 61—64.

THIS investigation comprised laboratory experiments in which various malts were mashed with distilled water and with pure solutions of calcium sulphate of different degrees of saturation ; the worts obtained were afterwards fermented. The increase in the sp. gr. of the worts, arising from the presence of calcium sulphate in the waters employed for mashing, was for any given malt, proportional to the content of calcium sulphate in the water, and corresponded fairly well with that which would be expected, supposing the calcium sulphate exercised no influence on the mashing process and simply contributed its own quota to the wort-gravity (cp. Bleisch, this J , 1912, 453). This supposition, however, was found to be incorrect, for the increase in the ash-content of the worts was always far too small to account for the higher wort-gravities, and the latter must therefore have been to some extent due to organic matter. The whole of the sulphuric acid of the calcium sulphate remained in the worts, even after fermentation, but the greater part of the calcium disappeared owing in part to precipitation as phosphate, but probably also to other causes, for as the quantity of calcium sulphate in the brewing waters was increased, the phosphorus-content of the worts diminished to only a relatively small extent. Part of the increased gravity of the worts prepared with gypseous water was due to nitrogenous matters. The worts prepared with partially saturated solutions of calcium sulphate contained 14—25 per cent. more nitrogen than those prepared with distilled water, but when saturated calcium sulphate solutions were employed the difference was not so great. The worts which contained the largest amounts of assimilable nitrogen and fermentable extract, were those prepared with partially saturated gypseous waters. From one experiment of the authors, it appears that calcium sulphate tends to increase slightly the quantity of pentosans extracted from the malt during mashing, but this point will be further investigated. The influence of calcium sulphate on the colour of the worts was very noticeable; the palest worts were produced by half-saturated solutions of the salt. According to Windisch calcium sulphate tends to produce protein-turbidity. The authors observed no such tendency; on the contrary, a glutin-haze which appeared when certain worts prepared with distilled water were chilled, was less perceptible when gypseous waters were used for mashing. Calcium sulphate appears to exert its most favourable influence on brewing processes, when it is present in the brewing water to the extent of only partial saturation (about 0·6 grm. per litre or 42 grains per gallon). It then tends to produce pale beers rich in proteins, and promotes the formation of fermentable extract and the assimilation of nitrogenous matters by the yeast.—J. H. L.

Brewing water; The so-called de-carbonating apparatus for the removal of carbonates from ——. C. Bleisch. Z. ges. Brauw., 1913, **36**, 41—44.

The author has carried out a comparative study of the removal of carbonates, (1) by boiling the water in a covered vessel provided with an outlet, under a pressure of 2—2½ atm. for periods up to 2 hours, and (2) by the new continuous de-carbonating process in which the water is heated for a short time under a very high pressure (see Roehlitzer, this J., 1911, 1402; Elsässer, this J., 1912, 1090). The pressure usually employed in the second process is 5 atm., and the water then reaches a temperature of 159° C. The brewing water used in this investigation possessed considerable carbonate hardness, containing 11·52 grms. of calcium carbonate, 3·74 grms. of magnesium carbonate, and 0·66 grm. of sulphuric anhydride per hectolitre. The second process, with a pressure of 5 atm., gave substantially the same results as the first one with a boiling period of one hour. In both cases nearly all the calcium carbonate was removed, but very little magnesium carbonate, so that the hardness of the water after treatment was mainly due to the latter salt. The only effect of continuing the first (boiling) process for two hours instead of one was that the removal of the calcium carbonate was rather more complete. In order to effect a considerable removal of the magnesia from the water, it was found necessary to modify the second (pressure) process by prolonging the time during which the water is heated; by one hour's treatment under 5 atm. pressure, about half of the total magnesium carbonate was removed. The author concludes that the new de-carbonating process, as usually carried out, gives no better results than the boiling of the water under ordinary pressure for one or two hours. The prolonged application of the pressure-process necessary to effect a considerable removal of magnesium carbonate might not increase the cost of the process very much, but it would greatly reduce the quantity of water with which the apparatus could deal in a given time.—J. H. L.

Brewing liquor; Saline treatment of ——. W. Duncan. J. Inst. Brewing, 1912, **18**, 549—560.

The author has made comparative experiments on the yield of extract obtained by mashing malt according to the method prescribed by the Malt Analysis Committee (this J., 1906, 236) with (a) distilled water, (b) distilled water treated with calcium or magnesium salts. He finds that the presence of calcium salts (carbonate corresponding to an alkalinity of 28·4 grains per gallon, or 20—100 grains of chloride, or 50 grains of sulphate per gallon) lowers the yield of extract corrected for the amount of salt in the water, quite appreciably. This is mainly accounted for by precipitation of mineral matter, chiefly phosphates, any modification of diastatic activity being of minor importance. As previously observed by Matthews and Lott, magnesium salts cause no appreciable loss of extract. Neutral calcium salts do not precipitate mono-potassium phosphate, but the presence of calcium and magnesium carbonates in the mashing liquor increases the content of di-alkali phosphates in the wort and decreases the content of acid phosphates. As to whether the decrease of acid phosphates is desirable depends on several factors; experience with mashing liquors containing carbonates has shown that the worts obtained are liable to exhibit sluggish and uneven fermentation, and the presence of di-alkali phosphates imparts a reddish tint to the wort during hop-boiling, and tends to produce an exceptionally rank hop character. In the case of an all-malt brewing, it is shown that if the malt contains 0·35 per cent. of phosphoric anhydride in a form (di-alkali phosphate) which is precipitable by neutral calcium salts during mashing and wort boiling, the brewing liquor, used at a rate of 6·5 barrels per quarter, must contain 65 grains of calcium salts (sulphate) per gallon in order that all the precipitable phosphate may be removed. Under ordinary conditions where part of the malt is replaced by other material, 45 grains of neutral calcium salts per gallon of liquor is sufficient. In these calculations no account is taken of any increment in the content of precipitable phosphates which would be caused by carbonates if these were present in the brewing liquor. (Compare Baker and Hulton, this J., 1910, 644.)—L. E.

Alcoholic fermentation III. Conditions of formation of acetaldehyde in fermentation by permanent yeast (Dauerhefe). S. Kostytschew. Z. physiol. Chem., 1913, **83**, 93—104. (See also this J., 1912, 553, 741.)

Further experiments are described, which support the hypothesis that acetaldehyde is an intermediate product of alcoholic fermentation. The quantity of aldehyde obtainable from the autofermentation of permanent yeast in presence of zinc chloride and toluene is much less than that obtained by the fermentation of a sugar in presence of zinc chloride and toluene (cp. Neuberg and Kerb, this J., 1912, 893). The author is unable to confirm the statement of Neuberg and Kerb (*loc. cit.*) that ethyl alcohol favours the production of aldehyde. An attempt was made to demonstrate the intermediate formation of acetaldehyde in alcoholic fermentation by adding an easily reducible substance (methylene blue) capable of taking up the available hydrogen from the reductases and so preventing the reduction of the aldehyde to alcohol, which, according to the author's view, is the final step in fermentation. This attempt was successful.—J. H. L.

Beer and wort; Study of the organisms causing ropiness in ——. J. L. Baker, F. E. Day and H. F. E. Hulton. J. Inst. Brew., 1912, **18**, 651—665.

About 150 organisms were isolated from ropy materials collected from three different breweries. A number of them produced ropiness in beer or wort, and 15 were fully examined. Eleven organisms produced ropiness in beer, and resembled each other so closely that they are regarded as one species for which the name *Bacterium aceti viscosum* is suggested. Hitherto the organisms stated to have been isolated from ropy beer in England are *Bacillus viscosum* (van Dam, this J., 1896, 129), and *Pediococcus cerevisiæ* (Brown and Morris, this J., 1895, 672), but neither of these was found in the materials examined by the authors. It is concluded that *Bact. aceti viscosum* is largely responsible for ropiness in English beers. A beer infected with this organism prior to fermentation, is more likely to become ropy than if infection occurs after fermentation. As a member of the acetic acid group, the bacterium is aerobic, and may, in presence of sufficient oxygen, increase the acidity of beer. The development of ropiness is not retarded by an increase in the quantity of hops used, nor is it affected in any way by a moderate increase in the amount of sugar or soluble nitrogen present in the beer after fermentation; a large addition of soluble nitrogen (asparagin) was found, however, to favour ropiness. Ropiness in beer develops most readily at a temperature of 60°—75° F. (16°—24° C.); temperatures of 55° and 80° F. (13° and 27° C.) are not so favourable. Four organisms produced ropiness in wort, but not in beer. Their morphological characteristics are different to those of *B. aceti viscosum*, as is also their growth in media.—J. H. L.

Caramel. L. Briant. J. Inst. Brew., 1912, **18**, 673—686.

At the present time caramel is usually prepared by heating glucose with ammonia or its salts (cp. Salamon and Goldie, this J., 1900, 301), and large quantities, of very satisfactory quality, have been produced by McCowan's method (this J., 1899, 931). Caramels prepared with ammonia usually possess a tinctorial value of 25°—32° (0·1 per cent. solution in a 1-inch cell, read on a 52-series of colour glasses in a Lovibond tintometer), but recently some have been prepared which approach 60°. They contain nitrogen (0·3—5 per cent.) which is not present as ammonia, except in traces, and is not assimilable by contain nitrogen (0·3—5 per cent.) which is not present as ammonia, except in traces, and is not assimilable by yeast. The colouring matter of caramels prepared with ammonia is probably nitrogenous in character, for from solutions of very dark caramels phosphotungstic acid precipitates most of the colouring matter and most of the nitrogen. Large additions of caramel to wort sometimes affect fermentation unfavourably; the yeast heads become poor, the skimming heads short, and the beer racks full of yeast, throws a heavy deposit in cask and is liable to be yeast-bitten. This trouble may be to some extent overcome by dressing with flour and salt, or by vigorous aeration, but occasionally neither of these means is effective in securing proper skimming heads. The deleterious action of certain caramels on yeast may be due to the presence of formaldehyde (see Trillat, this J., 1906, 161) or other toxic substances; the author extracted from one sample of caramel 0·035 per cent. of a phenolic substance. According to Schweitzer (this J., 1900, 838) the colouring matter of caramel prepared with alkalis is precipitable by acetic acid and lead acetate, and the detection of this substance (alcaramel) in beer is evidence that caramel prepared with alkalis has been added. This reaction is not shown by caramels prepared with ammonia, or is shown only faintly. In the valuation of commercial caramel, colour, flavour and permanent brilliance when added to beer, are the most important points. The colour may range from 18° to 60° (see above), but the products of best flavour are usually those of medium colour, *e.g.*, below 35°. Samples should not be alkaline in reaction, and should show no considerable change in tint when treated with tartaric acid (0·5 per cent. concentration). The extract yielded by caramel seldom exceeds 32 saccharometer lb. per cwt. The addition of aniline colours for intensifying the tint of caramel appears to be very rare.—J. H. L.

Patents.

Yeast; Process and plant for the conversion of brewers' and other yeasts into bakers' ——. J. A. Stevenson, Acton, Middlesex. Eng. Pat. 989, Jan. 12, 1912.

The yeast is washed in a vat fitted with a stirrer, with water to which is added about 1 oz. of phosphoric acid, ammonium tartrate or sodium sulphate per 10 gallons. It is then run into a descending trough which may be fitted with revolving brushes; if desired, a jet of water may also be introduced. The brushed yeast passes to a second vat fitted with a stirrer, and after the lapse of 2—4 hours, it is transferred to a press where it is subjected to a pressure of 40—50 lb. per sq. in. The pressed yeast is placed in a blending tank fitted with a stirrer, and mixed with water or preferably with wort which may be prepared from say equal parts of rye, malt, and maize; the yeast is blended with 25—40 per cent. of a strong distillers' yeast, and a small quantity of acetone, toluene, or thymol may be added to prevent bacterial growth. The blended yeast is run into another vat provided with a stirrer and thence to a divided receptacle where it is mixed with about one-fourth of its volume of an accelerating mixture, means being provided for introducing the yeast and mixture into the receptacle in the required proportions. The accelerating mixture consists of: water, 10 gallons; sugar, 0·5—1 lb.; phosphoric acid, 0·5 oz. (or potassium phosphate, 0·5—1 oz.); ammonium tartrate, 0·5—0·75 oz.; cream of tartar, 0·25—0·5 oz.; extract of malt, rye, or malt and maize, 3—5 oz. The mixture of yeast and the accelerating agent is pumped from the receptacle to a press and at a certain pressure determined by weights on a delivering valve; should this pressure be exceeded, the valve rises and allows a portion of the mixture to return to the receptacle. The yeast, when pressed and dried, is ready for use.—L. E.

Enzymic agent and process of producing it; Catalytically acting ——. A. D. Barr, Jersey City, N.J. U.S. Pat. 1,051,061, Jan. 21, 1913.

An enzymic protein substance (pepsin) is saturated with alkali (ammonia), evaporated, and then saturated with acid (acetic acid) and evaporated. The product has the composition of an acid and alkaline cleavage product of the enzymic protein, and an enzymic power different from that of this protein.—L. E.

Brewing process. L. Braun, Jaroschau, Austria. Eng. Pat. 7939, April 2, 1912. Under Int. Conv., April 8, 1911.

See Ger. Pat. 252,996 of 1911; this J., 1913, 103.—T.F.B.

Sour liquids for use as vinegar substitutes and for preservative pickling, and other purposes. R. Wahl, Chicago, U.S.A. Eng. Pat. 19,462, Aug. 24, 1912. Under Int. Conv., Sept. 5, 1911.

See U.S. Pat. 1,028,508 of 1912; this J., 1912, 655.—T.F.B.

Alcohol from air passed through fermenting-vats or the like; Process of regaining ——. A. Zeckendorf, Cincinnati, Ohio. U S. Pat. 1,051,051, Jan. 21, 1913.

See Fr. Pat. 434,949 of 1911; this J., 1912, 354.—T. F. B.

Fermentable substances; Treatment of ——. J. A. Stevenson, Acton. U.S. Pat. 1,051,171, Jan. 21, 1913.

See Eng. Pat. 27,782 of 1910; this J., 1912, 353.—T.F.B.

Drying wet grains, spent hops and so forth. Eng. Pat. 429. *See* I.

Manufacturing alcohol from sulphite wood liquor. U.S. Pat. 1.050,723. *See* V.

XIXa.—FOODS.

Pineapple plants; Effect of manganese on ——. *Ripening of the pineapple fruit.* E. V. Wilcox and W. P. Kelley. Hawaii Agric. Expt. Stat., Bull. 28, Sept., 1912.

The root system of pineapples is very variable and particularly sensitive to adverse soil conditions. In a soil containing manganese the roots become less extensive and are characterised by the development of swollen tips followed by their death and decay. The diseased plants contain more calcium oxalate and their ash contains more lime and less phosphate and magnesia than when grown on normal soils. Pineapple fruits contain only faint traces of starch during early growth and none when the fruits reach maturity. During the growth of the fruit, relatively small amounts of carbohydrates are stored in it, but within the short period of normal ripening there is a rapid accumulation of carbohydrates derived from the starch previously stored in the stalk which serves as a repository for starch and contains large amounts of it. Pineapples gathered green do not develop a normal amount of sugar in subsequent ripening. Their average composition is: acidity 0·58, fibre 0·22, solids in the juice 6·45, reducing sugars 1·22, sucrose 3·9, total sugars 4·12, total hydrolysable carbohydrates as invert sugar 4·35 per cent. Fruit allowed to ripen normally on the plant has the composition: acidity 0·74, reducing sugars 4·23, sucrose 7·88, total sugars 12·11 per cent.—E. F. A.

The scientific advancement of the canning industry. R. T. Mohan. *See* Canadian Section, p. 167.

The feeding value of the horse-chestnut. S. J. M. Auld. *See* London Section, p. 173.

Patents.

Food products and other materials; Process of and apparatus for dehydrating ——. R. Haddan, London. From General Dehydrator Co., New York. Eng. Pat. 28,990, Dec. 22, 1911.

Food materials, and more particularly fruits and vegetables, are dried by placing them in shallow layers in a chamber or series of chambers and there subjecting them to the action of a current of air which has been cooled previously to remove moisture and then heated to a temperature not exceeding 140° F. (60° C.). The inlet and outlet pipes for the air may be tapered, and fans are provided for increasing the pressure inside the chambers and for exhausting the moist air therefrom. Means are provided in the chambers for directing the current of air downwards through the material to be dried, and the latter may be supported on travelling conveyors, in which case rotary brushes are provided for removing material adhering to the delivery end of the conveyor.—W. P. S.

Coffee or other beans containing caffein and other alkaloids; Manufacture of rectified ——. N. Rosewater, Cleveland, Ohio, U.S.A. Eng. Pat. 1328, Jan. 17, 1912.

See U.S. Pats. 1,016,293 and 1,016,294 of 1912; this J., 1912, 250.—T. F. B.

Milk; Sterilisation of ——. A. Helbronner, M. von Recklinghausen, and V. Henri, Paris. Eng. Pat. 14,833, June 25, 1912. Under Int. Conv., June 28, 1911.

See Fr. Pat. 442,807 of 1911; this J., 1912, 1004.—T. F. B.

Drying wet grains, spent hops and so forth. Eng. Pat. 429. *See* I.

Process and plant for the conversion of brewers' and other yeasts into bakers' yeast. Eng. Pat. 989. *See* XVIII.

Separatory funnel [for the determination of fat in butter]. U.S. Pat. 1,049,411. *See* XXIII.

XIXb.—WATER PURIFICATION; SANITATION.

Iron; Determination of —— in water. O. Mayer. Monit. Scient., 1913, 3, 81—82.

Two colourimetric methods for the estimation of iron as thiocyanate are described. (1) $\frac{1}{10}$ to $\frac{1}{11}$ of a litre of the water is evaporated to dryness, in a porcelain capsule, with hydrochloric acid containing bromine; the residue is treated with 5 c.c. of hydrochloric acid (1 : 4) and a 10 per cent. solution of a thiocyanate, made up to from 20 to 100 c.c. —according to the content of iron—with distilled water, and the colour compared with that of a similar solution prepared by adding a standard solution of iron—(0·2251 grm. of ferric potassium sulphate or 0·2157 grm. of ferric ammonium sulphate in a litre of distilled water containing 10 c.c. of hydrochloric or sulphuric acid) to 10 c.c. of the acid indicator diluted with distilled water. (2) 100 c.c. of the water are treated with at least 10—20 drops of a solution of 1 c.c. of bromine in 500 c.c. of concentrated hydrochloric acid and 20—40 drops of a solution of 250 grms. of ammonium or potassium thiocyanate in 500 c.c. of distilled water, and shaken with 10 c.c. of a mixture of equal volumes of ether and amyl alcohol. The amyl alcohol rapidly rises to the surface, carrying any iron with it in the form of thiocyanate, which is soluble in amyl alcohol. A content of 0·001 mgrm. of iron per litre can be detected by this method In order to estimate the iron a comparison is made with the colour produced by adding a standard solution of iron to a mixture of 95 c.c. of distilled water, 10 c.c. of acid indicator, and 10 c.c. of ether-amyl alcohol mixture.—E. W. L.

Magnesium chloride in water; Determination of ——. E. Bosshard and W. Burawzow. Z. angew. Chem., 1913, 26, 70—72.

The authors examined the method proposed by Pfeiffer (Z. angew. Chem., 1909, 22, 435), according to which a large quantity of magnesium chloride is stated to be decomposed on continued heating and finally all chlorine removed as hydrochloric acid. The water was evaporated in a platinum basin on the water bath and afterwards on the sand bath with a thermometer inserted in the sand. The temperatures reached varied between 410° and 448° C. Hydrochloric acid was removed from calcium chloride in appreciable quantities, and part of the chlorine was removed from sodium chloride after 2—3 hours. The loss of chlorine in the latter case was much greater when magnesium sulphate was mixed with the salt. Calcium sulphate also assists in driving off chlorine from sodium chloride. Calcium sulphate prevents the complete decomposition of magnesium chloride by heat on account of the formation of calcium chloride. When calcium sulphate is present with the chlorides of sodium and magnesium, more hydrochloric acid is removed than that corresponding to the magnesium chloride alone. Although it is thus shown that Pfeiffer's method is useless for the determination of magnesium chloride in presence of other salts, the method of estimating the hydrochloric acid evolved from the dried residue on heating should afford a measure of the "corrosive power" of a given water. The more volatile hydrochloric acid found in a water by this method, the greater will be its action upon iron, in a boiler for instance. For the determination of magnesium chloride, the authors propose the following method: The water is evaporated to dryness on the water bath and the residue extracted with a mixture of equal volumes of alcohol (99—100 per cent.) and ether and the solution filtered. The residue insoluble in the alcohol-ether contains all the sodium chloride, which is estimated by titration with silver nitrate. The alcohol-ether solution is strongly diluted with water and made up to known volume, and in the solution, which contains the chlorides of calcium and magnesium, the chlorine and calcium are determined. In the case of natural waters containing calcium sulphate and bicarbonates of calcium and magnesium, the method is also quite accurate.—D.J.L.

Colloids in effluents; Determination of ——. P. Rohland. Z. Chem. Ind. Kolloide, 1913, 12, 45—46.

From 50 to 100 c.c. of the effluent, freed from suspended particles, are treated with 1 c.c. of a 1 per cent. solution of Aniline Blue, evaporated on the water-bath to the consistence of a syrup, the residue (an insoluble adsorption-compound of the dyestuff and the colloids present in the effluent) taken up in hot water, transferred to a tared filter, washed with hot water, dried, and weighed. The quantity of unadsorbed Aniline Blue in the filtrate is determined colourimetrically. If c be the weight of the residue, a the quantity of Aniline Blue added, and b the quantity remaining unadsorbed, then the quantity of colloids present in the effluent is $c-(a-b)$.—A. S.

Bordeaux mixture efficiency. L. A. Hawkins. U.S. Dept. Agric., Bureau of Plant Industry.

A monograph giving an account of the composition and preparation of and experiments with Bordeaux mixture. A mixture in which the suspended copper compound settles out only slowly may be prepared by adding concentrated calcium hydroxide to dilute copper sulphate or *vice versa*, provided always that the mixture is agitated sufficiently. The addition of rosin-fish oil soap to the mixture is shown to increase the adhesiveness, the quantity of copper retained on the leaves sprayed with the different mixtures being determined in each case. In experiments with grape berries two pounds of rosin-fish oil soap to 50 gallons of spray mixture was the most valuable of any added adhesive, ground glue being second. Ferrous sulphate did not increase the adhesiveness. The use of an adhesive is necessary to make the fungicide adhere to the bloom-covered grapes; berries sprayed with Bordeaux mixture alone retained no copper.—E. F. A.

Mercury content of the air and dust in places where metallic mercury is used. A. Blomquist. Ber. deuts. Pharm. Ges., 1913, **23**, 29—46.

The air of the room to be examined was charged with chlorine from potassium chlorate and hydrochloric acid, and 4000 litres of the air were drawn by a water pump through three absorption cylinders, one containing hydrochloric acid and stannous chloride, another the same reagent together with glass beads, and the third caustic potash. The cylinders were then washed out into a flask and rinsed with a little hydrochloric acid containing free chlorine. The acid liquid was neutralised with caustic potash, acidified again with 7 c.c. of 25 per cent. hydrochloric acid, and heated to 75° C. in a water bath with 8 grms. of zinc dust for 10 hrs. The mercuric chloride is reduced to metallic mercury which amalgamates with the excess of zinc. The whole is then passed through an asbestos filter and washed, and the filter returned to the flask and dissolved in 60 c.c. of 25 per cent. hydrochloric acid. Then 5 grms. of potassium chlorate are added, the flask connected with a reflux tube and heated on the water bath for 2 hrs. After cooling, the solution is filtered through a small filter into a 200 c.c. flask and washed with water to make 150 c.c. Then 10—15 c.c. of a solution of stannous chloride in hydrochloric acid are added and warmed, when the mercuric chloride is reduced to the metallic state. If there is sufficient mercury present to produce a colour or precipitate visible to the naked eye, the contents of the flask are filtered through a gold asbestos filter, when the mercury forms an amalgam with the gold. The filter is washed with water, alcohol, and ether, dried over sulphuric acid, and weighed. It is then heated to redness and weighed again, when the loss in weight gives the mercury present. When the amount of mercury is less than 2 mgrms. and there is no reaction visible to the eye in the reduced solution, it is better to insert one or more brass wires to withdraw the mercury from solution, and by heating these in a capillary tube to obtain a visible globule, from which an approximate estimate of the amount can be made. Results of the analysis of the air of workrooms in the University of Upsala and other places are given, a few tenths of a mgrm. of mercury being the amount usually found. The process is applicable also to a few grms. of dust and to about a litre of urine.—J. H. J.

Patents.

Tanks for freeing liquids from suspended solids. J. Fieldhouse, Walthamstow. Eng. Pats. 2213, Jan. 27, 1912, and 14,824, June 25, 1912.

In tanks such as those described in Eng. Pat. 2520 of 1905 (this J., 1906, 256) the division walls of the outer compartments are extended upwards to the level of the wall of the central chamber and of the outer wall of the tank; collecting channels, with fixed or adjustable weirs and scum boards, are provided on the top of, or at the sides of, the wall of the central chamber. Means are also provided for dividing the scum or other floating matter, for regulating the flow of liquid in the channels, for isolating the contents of each outer compartment, etc. A truncated pyramid is arranged in the central chamber of the tank to provide for the even distribution of the inflowing liquid.—W. P. S.

Animal and fish refuse; Apparatus for the treatment of [extraction of oil from] ——. C. and R. Downs, and Thompson, Ltd., Hull. Eng. Pat. 2545, Jan. 31, 1912.

The refuse is cooked by means of steam in a closed vessel provided with a stirrer; the oil is then removed from the upper part of the vessel and the solid material is drawn off from the bottom and pumped into a filter-press, where the remaining oil and water are separated.—W. P. S.

Sterilising liquids; Apparatus for ——. E. Ey, Charlottenburg, Assignor to Siemens und Halske, A.-G., Berlin, Germany. U.S. Pat. 1,046,061, Dec. 3, 1912.

The apparatus includes a sterilising vessel, mounted to rock, containing a mercury lamp and connected with a pipe and cock for the supply of liquid to be treated. The vessel is connected by a clutch with one end of an axially displaceable and rotatable shaft, the other end of the shaft being fitted with a handle. When the apparatus is to be set in action, the shaft is first axially displaced, the vessel being tilted thereby, and an arm, attached to the shaft and in contact with a guide-bar to prevent the shaft rotating, acts on a quick-break switch which closes the circuit for the lamp. On further displacing the shaft, the clutch connecting it with the vessel is disconnected by a stop, and the vessel, actuated by a spring, returns to its original position; the mercury lamp is ignited when the vessel rocks back. The arm attached to the shaft has now left the guide-bar and the shaft can rotate, the arm bearing against another guide which prevents a spring from returning the shaft to its original position. A second arm attached to the shaft is connected with the supply cock, and as the shaft rotates this cock is gradually opened. The movement of the shaft in the opposite sense to that above described shuts the supply cock and breaks the lamp circuit, and the clutch between the shaft and vessel is again engaged.—L. E.

Liquids; Process of sterilisation of ——. C. W. Volney, Keyport, N.J.; S. L. G. Volney, executrix of C. W. Volney. U.S. Pat. 1,050,707, Jan. 14, 1913.

The liquid, such as milk, is treated with a gas having germicidal properties, and this gas is then expelled by passing a current of sterilised air through the liquid. —W. P. S.

Water; Apparatus for treating or softening ——. J. Wilson, London. Eng. Pat. 13,912, June 15, 1912.

The apparatus consists of a vertical tank divided into two compartments by a horizontal partition; the water is admitted into the upper chamber, a portion of it being directed into a reagent container situated therein. It then passes through a pipe extending nearly to the bottom of the lower chamber. This pipe may be conical, the upper narrow end extending a short distance above the partition. The treated water is drawn off from the lower chamber at a point just below the partition.—W. P. S.

Water; Filter for purifying and simultaneously removing iron and manganese from —— *for industrial purposes, especially for dye-houses.* J. Roden. Ger. Pat. 253,835, Aug. 2, 1910.

The water is passed through a receptacle containing a filter, the liquid level being maintained at a definite height by means of a float. The filter is composed of layers of gravel, increasing in thickness from above downwards, between which are interposed thicker layers, also increasing in thickness from above downwards, composed of pumice which has been saturated with ferric chloride solution, dried at 150° C., immersed for a long time in sodium silicate solution (water glass), then treated with ammonia solution, again dried at 150° C., and finally impregnated with a solution of potassium permanganate.—A. S.

Sludge; Process and apparatus for decomposing ——. Wasser und Abwasser-Reinigung Ges. m. b. H., Neustadt on Haardt, Germany. Eng. Pat. 3535, Feb. 12, 1912. Under Int. Conv., Feb. 15, 1911.

See Fr. Pat. 439,758 of 1912; this J., 1912, 744.—T. F. B.

Refuse-destructor furnace. J. H. Thwaites, London. U.S. Pat. 1,050,253, Jan. 14, 1913.

See Eng. Pat. 2264 of 1911 ; this J., 1911, 1183.—T. F. B.

Sterilisation of liquids ; Apparatus for the ——. T. Nogier, Lyons, France. U.S. Pat. 1,051,350, Jan. 21, 1913.

See Fr. Pat. 420,281 of 1909 ; this J., 1911, 382.—T. F. B.

Sea water ; Distilling apparatus for ——. R. Köster, Vienna, and G. Kolleretzky, Modling, Austria. Eng. Pat. 11,553, May 15, 1912.

See Fr. Pat. 443,914 of 1912; this J., 1912, 1145.—T. F. B

Preparation of disinfectant soaps with the aid of oil of turpentine or similar crude oils containing pinene. Ger. Pat. 254,129. *See* XII.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Cinchona ; Determination of the alkaloids in ——. L. Ployart and C. Vallée. J. Pharm. Chim., 1913, **7**, 118—121.

For the determination of the total alkaloids in cinchona, 7 grms. of the powdered drug, dried at 100° C. and passed through a No. 45 sieve, are placed in a 200 c.c. flask with 140 grms. of chloroform and 10 c.c. of dilute ammonia. The whole is shaken vigorously at frequent intervals during 3 hours, when 3 grms. of tragacanth and 20 c.c. of distilled water are added. The whole is well shaken and allowed to stand for an hour. 100 grms. of the chloroform are rapidly filtered through a dry filter under cover, the chloroform distilled off, and the residue dissolved in 5 c.c. of 95 per cent. alcohol by the aid of gentle heat. The alcoholic solution is transferred to a separating funnel containing 15 c.c. of dilute hydrochloric acid (1 : 250), the containing vessel being washed once with 5 c.c. of alcohol, then twice with 25 c.c. of ether. After shaking, the acid liquid is run on to a wet filter, and the ethereal portion washed with 10 c.c. of distilled water. The ethereal portion is shaken once more with 15 c.c. of the dilute hydrochloric acid, and washed twice with 10 c.c. of water. The combined acid liquids are warmed to drive off the ether, cooled, and made up to 100 c.c. with the water used for washing. 20 c.c. of the solution are precipitated with silicotungstic acid according to the method of Yvon (J. Pharm. Chim., 1902, **16**, 153).—F. Shdn.

Aconitum Lycoctonum ; The alkaloids of ——. H. Schulze and E. Bierling. Arch. Pharm., 1913, **251**, 8—49.

After surveying the work of previous investigators the authors give the results of their own observations. The root was extracted with alcohol and the extract freed from sucrose. Fatty and oily matters were removed, and the extract was made alkaline with sodium carbonate and extracted with ether which took out lycaconitine, the yield of crude base being about 2·5 per cent. The alkaline liquid was then extracted with chloroform, and the bases thereby obtained were dissolved in dilute hydrochloric acid and treated with potassium thiocyanate. The precipitate was removed, and the clear liquid made alkaline and extracted with chloroform, which on evaporation gave myoctonine, the yield being about 0·9 per cent. Lycaconitine has the composition $C_{36}H_{46}N_2O_{10}$, and has $[\alpha]_D = +42{\cdot}47°$ in alcohol. Solutions of the base or its salts have no fluorescent properties. Myoctonine has the same elementary composition, but double the molecular weight ; it has $[\alpha]_D = +44{\cdot}79°$ in alcohol. Both alkaloids are decomposed into lycoctonine and lycoctoninic acid when warmed with an alcoholic solution of sodium hydroxide. The alkaloid which gave an insoluble thiocyanate decomposed in the same way under the action of alcoholic sodium hydroxide solution. Lycoctonine, $C_{25}H_{39}NO_7$, melts at 131°—133° C., and has $[\alpha]_D = +49{\cdot}64°$ in absolute alcohol. It is a moderately strong base and forms crystalline salts. The methiodide crystallises from a mixture of alcohol and ether and melts with decomposition at 178° C. Lycoctoninic acid, $C_9H_9ON(COOH)_2$, crystallises from dilute alcohol in small yellowish leaflets or needles and melts at 179°—180° C. When heated with water under pressure, or when allowed to stand in dilute hydrochloric acid, lycaconitine is resolved into succinic acid and a base, *anthranoyllycoctonine*, possessing fluorescent properties. Myoctonine decomposes in the same way when treated with dilute hydrochloric acid. Anthranoyllycoctonine has the composition $C_{32}H_{44}N_2O_8$, and crystallises from alcohol in light brown lustrous leaflets, m. pt. 154°—155° C. When heated with alcoholic sodium hydroxide solution, lycoctonine and anthranilic acid are formed. Succinic and anthranilic acids are produced by boiling lycoctoninic acid with dilute hydrochloric acid.
—F. Shdn.

Caulophyllum thalictroides ; The constituents of the rhizome and roots of ——. F. B. Power and A. H. Salway. Chem. Soc. Proc., 1913, **29**, 2—3.

The material employed for this investigation consisted of the rhizome and roots of the American plant *Caulophyllum thalictroides* (Linné), Michaux (Nat. Ord. *Berberidaceae*). A preliminary test showed the presence of an alkaloid, and a small amount of an enzyme was obtained, which slowly hydrolysed amygdalin. An alcoholic extract of the ground material, when distilled in a current of steam, yielded a small amount of an essential oil. From the alcoholic extract the following definite compounds were isolated : (i.) Methylcytisine, $C_{12}H_{16}ON_2$ (m. p. 137° C.; $[\alpha]_D = -221{\cdot}6°$), the *picrate* of which melts at 228° C. ; (ii.) a crystalline glucoside. *caulosaponin*, $C_{54}H_{88}O_{17},4H_2O$ (m. p. 250°—255° C.), which on hydrolysis is resolved into *caulosapogenin*, $C_{42}H_{66}O_6$ (m. p. 315° C.), and dextrose ; (iii.) a new crystalline glucoside, *caulophyllosaponin*, $C_{66}H_{104}O_{17}$ (m. p. 250°—260° C. ; $[\alpha]_D = +32{\cdot}3°$), which on hydrolysis is resolved into *caulophyllosapogenin*, $C_{56}H_{88}O_9$ (m. p. 315°C.), and arabinose ; (iv.) a phytosterol, $C_{27}H_{46}O$ (m. p. 153° C.) ; (v.) citrullol, $C_{28}H_{45}O_2(OH)_3$; (vi.) a mixture of fatty acids, consisting of palmitic, stearic, cerotic, oleic, and linolic acids The alcoholic extract also contained a quantity of sugar, which yielded *d*-phenylglucosazone (m. pt. 210° C.), and a comparatively small amount of resinous material.

Lemon grass oils from India. Bull. Imp. Inst., 1912, **10**, 546—548.

Four samples were examined, with the results shown in the following table :—

	" Tyrna oil."	" Cochin oil."	" Mariani oil."	" Ceylon oil."
Sp. gr. at 15°/15° C.	0·9030	0·9035	0·8973	0·9109
Opt. rotation at 20° C. (100 mm.)	—0°30′	—0°40′	—0°20′	—
Citral (by sodium bisulphite method), per cent.	72·2	81·5	78·0	73·7
Solubility	Not completely soluble even in 10 vols. or more of 70 per cent. alcohol.			

The " Cochin oil " would fetch the best market price for lemon grass oil, especially if it were possible so to prepare it that it was completely soluble in 70 per cent. alcohol. It is suggested that the production of this oil in Assam might be extended with advantage.—A. S.

Cymenes and the three menthanes : Preparation of the three ——. P. Sabatier and M. Murat. Comptes rend., 1913, **156**, 184—187.

By means of active nickel at 180° C., *o*-, *m*-, and *p*-cymenes (methyl*iso*propyl benzenes) can be hydrogenised in the nucleus and converted into the corresponding menthanes (methyl*iso*propylcyclohexanes). To prepare the cymenes the three isomeric dimethylcresylcarbinols are dehydrated by heating at 350° C. and converted into the cresylpropenes, $CH_3C_6H_4{\cdot}C(CH_3):CH_2$. These when hydrogenised at 220° C. in presence of almost inactive nickel are transformed into the cymenes. The compounds obtained in the three series are fully described: *o-cymene* has a musk-like odour, b.p. 175° C.; *m*-menthane obtained from sylvestrene is a liquid of pleasant odour, b.p. 167°—168° C.; $[\alpha]_D = +1{\cdot}6°$. The physical constants of the others agree with those previously recorded.—E. F. A.

Acetaldehyde: Action of mean and extreme ultra-violet rays on ——: acidification, polymerisation, resinification. D. Berthelot and H. Gaudechon. Comptes rend., 1913, **156**, 233—236.

Acetaldehyde, either as liquid or vapour, was exposed to ultra-violet rays in the absence of air. In glass vessels which only allow the initial ultra-violet rays to pass, no transformation of aldehyde to acid took place. In vessels of quartz, however, considerable quantities of acetic acid were formed from the aldehyde. No formic acid was obtained. The oxygen necessary for the oxidation is derived by the reduction of a second molecule of the aldehyde: a proportion of resinous substances is formed. When exposed to the extreme ultra-violet rays, the aldehyde undergoes rapid polymerisation, paraldehyde and metaldehyde being obtained. In aqueous solutions of aldehyde the change is somewhat different—no polymerides or resins are formed, but there is a large increase in the amount of acid formed, which consists of equal parts of formic and acetic acids. Caramelised substances are also produced which impart a yellow colour to the solution.—E. F. A.

Bismuth; Organic salts of —— with alkalis. R. C. Cowley. Chem. and Drug., 1913, **82**, 212.

Like the closely related metals, arsenic and antimony, bismuth, as bismuthyl tartrate, forms alkali-compounds, analogous to tartar emetic, bismuthyl-tartrate being a monobasic acid. The bismuthyl-alkali citrates, tartrates, and racemates are soluble in water; the malates, oxalates, succinates, and camphorates are insoluble. The solution of bismuthyl-sodium tartrate is easily prepared and is very stable. It is suggested that it may prove a useful substitute for the "*Liquor Bismuthi*" used in medicine. It is prepared as follows:—70 grms. of bismuth subnitrate are dissolved in 57 c.c. of nitric acid (sp. gr. 1·420) diluted with a similar volume of water. 64·5 grms. of sodium potassium tartrate, dissolved in a little water, are then added, and also a solution of 57 grms. of sodium bicarbonate. The mixture is heated to expel carbon dioxide, and the precipitate is washed until free from nitrates. It is then dissolved in 230 c.c. of *N*/1 sodium hydroxide solution. A perfectly clear, stable solution is thus obtained, of the same bismuth concentration as "*Liquor Bismuthi.*" It is suggested that these organic bismuthyl alkali salts may find useful application in medicine. Bismuthyl-lithium citrate is already so used.—J. O. B.

Ether; Duty-free admission of —— into Holland for use in preparing iodoform gauze and iodoform cotton wool. Board of Trade J., Feb. 13, 1913. [T.R.]

A Dutch Royal Decree, dated the 15th January, provides for the duty-free admission into the Netherlands, under certain conditions, of sulphuric ether required in factories or workshops as an auxiliary for the preparation of iodoform gauze and iodoform cotton wool.

Patents.

Dichloro-derivatives of hydrocarbons having the chlorine atoms attached to different carbon atoms; Manufacture of ——. W. H. Perkin, C. Weizmann, and H. Davies, Manchester. Eng. Pat. 277, Jan. 3, 1912.

Vapours of monochloro-derivatives of hydrocarbons are chlorinated in such a manner that the chlorine enters into combination as soon as it comes in contact with the vapours, and so as to permit the removal of the dichloro-compound: in this way the formation of trichloro and higher products can be almost entirely prevented. For example, isoamyl chloride is chlorinated in the apparatus and by the method described in this Journal, July 15, 1912, p. 621, until the mixture produced boils at about 130° C.; it is then fractionated and may be separated into four parts, *viz.* (1) a portion boiling below 140° C., and consisting mainly of isoamyl chloride, (2) a fraction boiling at about 140°—170° C., (3) a fraction boiling up to 105° C. *in vacuo*, and (4) a residue. Fractions (2) and (3) may be refractionated, and yield three main fractions, the first boiling at about 142° C. and corresponding to the formula, $(CH_3)_2CH.CHCl.CH_2Cl$; the second of b.pt. 150° C. and formula, $(CH_3)_2CCl.CH_2.CH_2Cl$; and the third, formula, $CH_2Cl.CH(CH_3).CH_2.CH_2Cl$, and b.pt. 170°—172° C.—T. F. B.

1-*Dimethylaminobutene*-3 *and* 1-*dimethylamino*-2-*methylbutene*-3; *Process for preparing ——.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,529, Jan. 13, 1912.

When 3-hydroxybutyldimethylamine or 2-methyl-3-hydroxybutyldimethylamine is heated with sulphuric acid, water is eliminated and the corresponding dimethylaminobutene is produced. When the products are methylated and then heated with alkalis, they are readily converted into erythrene and isoprene, respectively. —T. F. B.

Paraffin series; Production of mono-halogen derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 4766, Feb. 26, 1912.

The vapour of a paraffin hydrocarbon containing more than one carbon atom is mixed in the dark with chlorine and the mixture subjected to the action of ultra-violet rays.—F. Shdn.

Dichloro-ethylene; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 254,069, April 28, 1911.

It is stated that theoretical yields of dichloro-ethylene may be obtained by heating mixtures of acetylene and chlorine in capillary tubes or in tubes filled with granular material, at temperatures of 150° C. or higher. The process may also be carried out by causing excess of acetylene to react with chlorine at a temperature of at least 40° C.—T. F. B.

Dialkylamino formic acid esters; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,587, May 15, 1912.

When a chloroformic acid ester, such as the phenyl ester, is mixed with a benzene solution of trimethylamine, an ammonium compound containing halogen is formed. On boiling, methyl chloride is evolved, and a dialkylaminoformic acid ester is produced. The phenyl ester melts at 44°—45° C. and boils at 134°—135° C. at 16 mm.—F. Shdn.

Amino-antipyrine; Manufacture of homologues of methyl sulphites of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 15,755, July 5, 1912. Under Int. Conv., Oct. 25, 1911. Addition to Eng. Pat. 15,658 of 1912, dated July 20, 1911 (this J., 1912, 1147).

In place of the alkali or ammonium formaldehyde bisulphite described in the original patent, a homologue of such bisulphite may be used, for instance an alkali or ammonium acetaldehyde or propylaldehyde bisulphite.—F. Shdn.

Amino-antipyrine; Manufacture of methyl sulphites and homologous sulphites of —— and of derivatives of amino-antipyrine substituted in the phenyl nucleus. Farbwerke vorm. Meister, Lucius, und Brüning, and M. Bockmühl, Höchst on Maine, Germany. Eng. Pat. 15,758, July 5, 1912. Addition to Eng. Pat. 15,658, July 14, 1912. (this J., 1912, 1147).

The solution obtained by the interaction at a raised temperature of a solution of formaldehyde-bisulphite or a homologue and amino-antipyrine or a derivative of the same is allowed to stand at any temperature up to 50° C. The solid cake of crystals thus obtained is dissolved in hot methyl alcohol, filtered, evaporated and the product which separates crystallised from alcohol.—F. Shdn.

p-Alkyloxyphenylamino-alkyl sulphites ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,305, July 27, 1911.

When acetaldehyde or one of its higher homologues and an alkali bisulphite or ammonium bisulphite act on *p*-alkyloxyaminobenzenes, in concentrated aqueous solution, and with or without addition of alcohol, *p*-alkyloxyphenylaminoalkyl sulphites are formed. The products possess marked antipyretic and sedative properties. —T. F. B.

Hexamethylenetetramine salts of α-phenylquinoline-γ-carboxylic acids and derivatives thereof ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 23,365, Oct. 12, 1912. Under Int. Conv., Nov. 8, 1911.

Equivalent quantities of hexamethylenetetramine and α-phenylquinoline-γ-carboxylic acid or a derivative (containing one or more substituents in the quinoline nucleus or in the phenyl group) can be made to combine in a suitable solvent such as alcohol. The salt formed by the combination of the above-mentioned acid and base melts with decomposition at 185° C.—F. Shdn.

Morphine esters of alkyl- and aryloxy-fatty acids; Process for preparing the ——. Chem. Fabr. von Heyden. Ger. Pat. 254,094, March 24, 1911

Morphine is esterified according to the usual methods with the alkyloxy or aryloxy derivatives of fatty acids, their halogenides, or anhydrides.—T. F. B.

Amino-alcohols ; Process for preparing aromatic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,438, July 11, 1911.

The reduction of aromatic aminoketones to the corresponding amino-alcohols is readily effected by hydrogen in presence of colloidal metals of the platinum group.—T.F.B.

Halogen-formic acid esters ; Process for preparing ——. E. Merck. Ger. Pat. 254,471, Feb. 1, 1912. Addition to Ger. Pat. 251,805, Jan. 21, 1912.

Esters of halogen-formic acids with tertiary alcohols may be obtained by the process described in the principal patent (this J., 1912, 1201), providing the temperature of the reaction be kept below 0° C. In working up the products, the use of water or other substances which remove hydrohalogen acids, is avoided. The chloroformates of dimethylethylcarbinol and methyldiethylcarbinol are liquids which can be distilled *in vacuo* without decomposition.—T. F. B.

Urethanes of tertiary alcohols ; Process for preparing ——. E. Merck. Ger. Pat. 254,472, Feb. 29, 1912.

Urethanes of tertiary alcohols of the type, $RO.CO.NR_1R_2$ (where RO is the residue of a tertiary alcohol, and R_1 and R_2 hydrogen, alkyl, or aryl radicals) are obtained by the action of ammonia or a primary or secondary amine on the halogen-formates of tertiary alcohols (see Ger. Pat. 254,471 ; preceding). The urethanes may be used for medicinal purposes.—T. F. B.

Xanthines and their substitution products ; Process for preparing formaldehyde compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,488, Oct. 27, 1911.

Formaldehyde compounds of xanthines and their substitution products, from which the formaldehyde may be readily eliminated, are obtained by treating the xanthine derivative or the salts of the corresponding purine base, with formaldehyde or its equivalent, with or without a condensing agent. The formaldehyde compounds are more readily soluble in water than the xanthines from which they are derived.—T. F. B.

Dibromohydrocinnamic acid ; Process for preparing an ester of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,666, Oct. 8, 1911. Addition to Ger. Pat. 252,158, Feb. 5, 1911.

The fenchyl ester of dibromohydrocinnamic acid is obtained by replacing in the principal patent (Eng. Pat. 19,366 of 1911 : this J., 1912, 661) the borneol or isoborneol by fenchyl alcohol, or by the introduction of bromine into fenchyl cinnamate. The new ester is stated to possess valuable therapeutic properties.—T. F. B.

Nicotine ; Process for extracting ——. Elsässische Tabakmanufaktur vorm. J. Schaller und Bergmann. Ger. Pat. 254,667, June 16, 1911.

Green leaves, stems, etc., of tobacco plants are mixed, without previous drying, with an alkali, lime, or other substance which prevents fermentation, such as phenol, salicylic acid, or formaldehyde. The mass is now submitted to distillation with steam (preceded, if desired, by a diffusion process), and the vapours containing nicotine are led into an absorption vessel, in which they come in contact with acid, the temperature of which is at least as high as that of the entering vapours.—T. F. B.

Hydroquinine ; Process for preparing homologues of ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 254,712, Aug. 6, 1911.

Homologues of hydroquinine may be obtained by the alkylation of hydrocupreïne in the ordinary way.—T.F.B.

Homopiperonalamine ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 254,860 and 254,861, Dec. 7, 1911, and Jan. 17, 1912. Additions to Ger. Pat. 245,523 (see this J., 1912, 661 ; also Ger. Pat. 248,046, this J., 1912, 797).

(1) Homopiperonaloxime may be reduced to homopiperonalamine by aid of the electric current in acid solution or suspension. (2) In a similar manner, the electrolytic reduction of methylenedioxy-ω-nitrostyrol in acid media results in the direct formation of homopiperonalamine.—T. F. B.

Aromatic hydroxy-acids ; Process for preparing nucleus-substituted mercury derivatives of ——. Chem. Fabr. von Heyden. Ger. Pat. 255,030. Jan. 25, 1911.

Aromatic hydroxycarboxylic. hydroxysulphonic, or hydroxyarsinic acids which contain mercury united to the aromatic nucleus by a single linkage. are treated with alkaline or neutral reducing agents. The products are soluble in water, neutral, and only exhibit the toxic properties of mercury to a small degree.—T. F. B.

Dichloro-ethylene ; Process for obtaining ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 446,263, July 19. 1912.

See Ger. Pat. 254,069 of 1911 ; preceding.—T. F. B.

Method of repeatedly delivering suitable portions of radioactive liquid or gaseous substances. Eng. Pat. 20,081. *See* VII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gelatin and acid substances ; Adsorption compounds of ——. Lüppo-Cramer. Phot. Ind., **17**, Nr. 29. Z. angew. Chem., 1913, **26**, 17.

The yellow colouration produced by acidified potassium ferricyanide solution in gelatin, is more readily washed out by means of neutral salt solutions than by pure water.

The adsorption compounds of gelatin with acid organic dyestuffs, metaphosphoric acid, and thiosulphuric acid behave similarly. When using acid fixing baths, in which thiosulphuric acid is probably present, it is, therefore, desirable to wash the fixed films with a 5 to 10 per cent. solution of sodium chloride or sulphate.—T. F. B.

Quinol and sulphite ; The action of oxygen on ——. J. Pinnow. Z. wiss. Phot., 1912, 289. Z. angew. Chem., 1913, **26**, 17.

AN analytical study of the products in various stages of the action of oxygen on quinol in presence of sulphite, showed that first two mols. of sodium sulphite react with one mol. of quinol, forming one mol. of quinolmonosulphonic acid and one mol. of sodium sulphate : the monosulphonic acid then combines with a further mol. of sulphite, with the aid of oxygen, forming the disulphonic acid, which finally combines with more sulphite, forming compounds which split off sulphuric acid.—T. F. B.

Alkaline solutions containing quinol and sulphite on exposure to the air ; The character and cause of the blue fluorescence which develops in ——. T. C. Porter. Chem. Soc. Proc., 1913, **29**, 4.

MOIST *p*-benzoquinone and quinhydrone each react directly with neutral as well as with acid alkali-metal sulphites to form compounds which differ according to which of the reagents is in excess. With excess of sulphite remarkably stable compounds such as $(NH_4HSO_3)_2C_6H_4O_2$ are produced. These, in turn, form with alkali- and alkaline-earth-metal hydroxides substances which give brilliantly fluorescent aqueous solutions. It was shown that the fluorescence of "stale" quinol and sulphite photographic developers is identical with that just mentioned, and due to the same cause.

PATENTS.

Photography in colours ; Colour screens for ——. O. S. and H. E. Dawson, Wanstead. Eng. Pat. 5859, March 8, 1912.

THE minute patches of colour constituting the screen are so made that the outline of each colour patch is different from that of any other colour in the screen, and that the entire screen is made up of the colour patches, and contains no black or white elements.—T. F. B.

Polychrome point-screens for colour photography ; Process for producing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 254,180, Sept. 24, 1910.

SOLUTIONS of a suitable colloid, coloured with the three primary colours, are atomised by means of a stream of gas, and the drops thus obtained are suspended in a suitable liquid in which they will not set ; the emulsions are then mixed to produce a neutral grey, and the mixture is applied to a support in the usual manner.—T. F. B.

Flash-light powders. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pats. 254,407 and 255,018, Nov. 4, 1910, and Oct. 6, 1911.

(1) MAGNESIUM oxide or carbonate is added to a mixture of magnesium or magnesium-aluminium powder and cadmium nitrate. (2) Aluminium powder is added to mixtures of magnesium powder and cadmium nitrate. These additions prevent the violent combustion which is liable to occur if moisture is present in the mixtures.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

PATENTS.

Explosives ; New ——. W. Fairweather, Glasgow. From Dynamit-Act. Ges., vorm. A. Nobel und Co., Hamburg, Germany. Eng. Pat. 1177, Jan. 15, 1912.

CLAIM is made for the addition of aluminium silicide to known explosives. Examples given are (1), 85 per cent of ammonium nitrate and 15 per cent. of aluminium silicide ; (2), 75 per cent. of ammonium nitrate, 10 of trinitrotoluol, and 15 per cent. of aluminium silicide. It is stated that such mixtures furnish explosives which besides their great safety in handling, possess a blasting force which considerably exceeds that of all ammonium nitrate explosives which have hitherto been produced, and is equal to or even greater than that of explosives with a high percentage of nitroglycerin.—T. ST.

Military powder from nitrocellulose ; Manufacture of ——. Ver. Köln-Rottweiler Pulverfabriken. Ger. Pat. 254,434, Jan. 24, 1911.

THE nitrocellulose is mixed with the gelatinising agent (*e.g.*, ether) in an air-tight closed chamber and the pressing of the finished powder into the desired form is effected in the same chamber likewise with exclusion of air. In the apparatus described, several cylinders are disposed around a central column, and each cylinder passes in turn under a filling device, over a mixing device, and under a compressing piston. After the nitrocellulose has been charged into the cylinder, a piston is introduced which compresses it and leaves a central hollow space into which the gelatinising agent is then allowed to flow. The mixing device enters the lower end of the cylinder and whilst rotating passes first upwards and then downwards throughout the height of the cylinder. When in its highest and lowest positions the mixing device is rotated for a short time without any progressive motion. From the mixing device the cylinder passes under a piston which forces out the finished explosive through a die or the like.—A. S.

Explosive charges from fusible explosives ; Process for casting ——. Dynamit A.-G. vorm. A. Nobel und Co. Ger. Pat. 255,026, June 1, 1911.

THE fused explosive when cooled to near its melting point is cast around a cold core of the previously cast or compressed explosive, which may be bare or enclosed in a casing of cardboard or the like.—A. S.

Matches ; Compositions for ——. W. H. Dixon, London. Eng. Pat. 27,491, Dec. 7, 1911.

As a substitute, wholly or partially, for glue, etc., it is proposed to use feculose (acetate of starch), or other starch derivative having similar characteristics, as the binding material in match compositions. The acetate of starch is capable of being brought to the required degree of plasticity by heating with water, and after cooling, may be remelted. It does not injuriously affect, nor is it affected by the other ingredients employed. It is cheaper than the binding materials usually employed and burns to a fine ash.—T. ST.

XXIII.—ANALYTICAL PROCESSES.

Lithium ; Determination of ——. W. W. Skinner and W. D. Collins. U.S. Dept. Agric., Bureau of Chem., Bull. No. 153, Sept. 14, 1912.

As a result of an investigation of various methods which have been proposed for the determination of lithium in mineral waters, that recommended by Gooch (see this J., 1887, 713), modified slightly in some of the details of manipulation, was found to be satisfactory when weighable amounts of the metal are present. The method is carried out as follows : The water is acidified with hydrochloric acid, barium chloride is added, and the whole is evaporated to dryness ; the residue is dissolved in a small quantity of water and hydrochloric acid, the barium sulphate is removed by filtration, and the filtrate is evaporated. After ignition to remove ammonium salts, the residue is dissolved in water, the magnesium salts are precipitated by the addition of milk of lime (a double precipitation is necessary if the water contains a large quantity of alkalis), and the excess of calcium hydroxide, together with barium salts, is removed by treatment with ammonium carbonate

in ammoniacal solution. The filtrate from the calcium precipitate is evaporated, the residue is ignited, and any remaining traces of calcium salts are removed as oxalate. The solution is then evaporated in a weighed platinum basin, the residue is treated with a small quantity of hydrochloric acid, again evaporated to dryness, ignited, and weighed. The mixed chlorides thus obtained are dissolved in a few c.c. of water and the solution is transferred to a flask (any insoluble matter is filtered off, ignited, and its weight deducted from that of the mixed chlorides); the solution is now boiled until the salts begin to crystallise out, and about 40 c.c. of amyl alcohol are added. The contents of the flask are next distilled until a thermometer in the neck of the flask indicates 130°—132° C. (the boiling point of amyl alcohol), a drop or two of dilute hydrochloric acid being then added and the distillation continued until the boiling point of amyl alcohol is again reached. The mixture is cooled slightly and filtered, note being made of the volume of the filtrate, and, after the insoluble portion has been washed with a little anhydrous amyl alcohol, the filtrate is evaporated to dryness. The residue, consisting of lithium chloride with small amounts of potassium and sodium chlorides, is treated with sulphuric acid, ignited, and weighed. The sulphates are then dissolved in water, and treated with ammonium phosphate and ammonia; if any precipitate forms within about 15 hours, it is collected and weighed as magnesium pyrophosphate, an equivalent weight of magnesium sulphate being subtracted from the weight of the mixed sulphates. To correct for the solubility of potassium and sodium chlorides in amyl alcohol, there must be subtracted from the weight of the sulphates, 0·00109 grm. for every 10 c.c. of the amyl alcohol filtrate (exclusive of the amount used for washing). In many cases the corrections amount to the total weight obtained within the limit of the weighing error of the work, and the amount of lithium present may then be determined by means of the spectroscope. For this purpose the residue of sulphates is dissolved in water and spectroscopic observations are made, until, with increasing dilution of the solution, the lithium line is no longer visible. Knowing the extent of the dilution, the amount of lithium is ascertained by comparative observations with solutions containing known quantities of lithium under the same conditions as to dilution, etc. The limit of visibility of the red line of the lithium spectrum is reached with 0·00002 mgrm. of lithium per c.c. of solution. A preliminary and approximate spectroscopic determination of lithium in the mixed chlorides obtained in water analysis saves much time by indicating whether it is worth while to extract the lithium for weighing. A similar test may be used to determine whether much strontium is present in the calcium precipitate obtained in the usual way.
—W. P. S.

Nitric nitrogen; Determination of —— by Schloesing's method. M. Canet. Bull. Soc. Chim. Belg., 1913, **27**, 10—12.

When a rubber stopper is employed to close the evolution flask used in this method, the nitric oxide collected in the measuring burette almost always contains a quantity of air, the latter diffusing through the stopper as this becomes heated. This may be prevented by abandoning the use of rubber stoppers and making a sealed joint between the neck of the flask and the delivery tube.
—W. P. S.

Kjeldahl-Gunning method; A source of error in the ——. E. Carpiaux. Bull. Soc. Chim. Belg., 1913, **27**, 13—14.

Self has previously shown (this J., 1912, 361) that loss of nitrogen takes place in the Kjeldahl-Gunning method when the quantity of potassium bisulphate is large compared with the amount of sulphuric acid present, and that all the nitrogen may be lost if the heating is continued after the composition of the mixture of bisulphate and sulphuric acid approaches that of bisulphate itself. When the substance is digested with 25 c.c. of sulphuric acid and 12 grms. of potassium bisulphate, at least 15 grms. of free sulphuric acid ought to remain at the end of the operation. The author confirms these conclusions and recommends that only moderate quantities of bisulphate be used and that the digestion should not be prolonged unduly after the substance has been decomposed completely. Further, the digestion flasks should not be too small in capacity.—W. P. S.

Arsenic and tungsten; Separation of ——. S. Hilpert and T. Dieckmann. Ber., 1913, **46**, 152—155.

The separation in quantitative analysis of arsenic and tungstic acids is extremely difficult on account of the formation of stable complexes of uncertain composition. The authors have attempted the separation by distillation with cuprous chloride and dilute hydrochloric acid. Even after two distillations, when no more arsenic could be volatilised, it was found that appreciable quantities were retained when tungstic acid was present. If, after the second distillation almost to dryness, the residue is treated with solid caustic potash, heated, again acidified, and again distilled, it is found that all the arsenic has volatilised. It is presumed that the destruction of the surface of the residual tungstic acid by the added alkali is responsible for the liberation of the arsenic which may be retained by adsorption or solid solution.—W. H. P.

Analysis of mixtures of hydrogen and saturated hydrocarbons. Complex mixtures. Lebeau and Damiens. *See* IIa.

Volumetric method of determining sulphur in petroleum lamp oil. Schulz. *See* IIa.

Detection of natural asphaltum and petroleum pitch in residues from the distillation of coal tar. Schwarz. *See* III.

The Prussian blue reaction. Vorländer. *See* VII.

Characteristics of hardened oils and detection of arachidic acid therein. Kreis and Roth. *See* XII.

Analysis of mixed paints, especially lithopone paints. Nicolardot. *See* XIII.

Determination of the rubber content of rubber goods. Goldberg. *See* XIV.

Koettstorfer's [saponification] value as a measure of the resins and substitute [factices] present in rubber goods. Vallery. *See* XIV.

Determination of the phosphoric acid of basic slag soluble in citric acid. Simmermacher. *See* XVI.

Determination of iron in water. Mayer. *See* XIXb.

Determination of magnesium chloride in water. Bosshard and Burawzow. *See* XIXb.

Determination of colloids in effluents. Rohland. *See* XIXb.

Mercury content of the air and dust in places where metallic mercury is used. Blomquist. *See* XIXb.

Determination of the alkaloids in cinchona. Ployart and Vallée. *See* XX.

Patents.

Oxydase apparatus. H. H. Bunzel. Washington, D.C. U.S. Pat. 1,046,259, Dec. 3, 1912. (Dedicated to the public.)

An apparatus for measuring the oxydase-content of plant juices (see this J., 1912, 705).—L. E.

Titration apparatus. H. H. Bunzel, Washington, D.C. U.S. Pat. 1,046,260, Dec. 3, 1912. (Dedicated to the public.)

The apparatus serves for the determination of the carbon dioxide absorbed by the alkali in the oxydase apparatus previously described (see preceding abstract and this J., 1912, 705). It includes a flask fitted with a perforated rubber stopper through which passes the stem of a tap funnel. A glass vessel, which is attached to the lower end of this stem and is situated some distance above the bottom of the flask, serves to hold the alkali taken from the oxydase apparatus. The lower portion of a burette fits by a ground joint into a tubulure in the side of the flask, the lower extremity of the burette being situated just above the glass vessel. The bottom of the flask is covered with a 30 per cent. solution of alkali hydroxide so that the titration may be carried out in an atmosphere as nearly free from carbon dioxide as possible. The top of the burette is fitted with a bulb containing cotton wool to protect the solution in the burette from dust.—L. E.

Separatory funnel [for the determination of fat in butter]. R. H. Shaw, Washington, D.C. U.S. Pat. 1,049,411. Jan. 7, 1913. (Dedicated to the public.)

The hole in the tap at the lower end of the funnel communicates with a short capillary stem, the latter being adapted to hold back the heavier "articles" to be separated.—W. P. S.

Method for the microscopic examination of test-pieces and for obtaining micro-photographs of same while under strain. Eng. Pat. 3891. *See* X.

XXIV.—MISCELLANEOUS ABSTRACTS.

Molybdenum; Distribution of —— in the Liège coal-fields. A. Jorissen. Bull. Soc. Chim. Belg., 1913, **27**, 21—25.

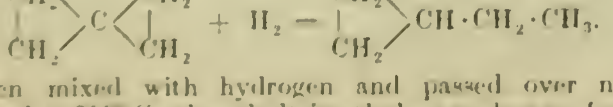
Molybdenum may be detected in the soot and ashes obtained by burning coal from the Liége pits; in many cases, molybdenum compounds may be obtained in solution by simply extracting the soot or ash with water. The large, red coloured heaps of debris found in the neighbourhood of the pits and resulting from the slow combustion of the coal, contain appreciable quantities of molybdenum, and the element appears to be distributed throughout the coalfields. Coal from the Charleroi mines also contains molybdenum.—W. P. S.

Sodamide: Some reactions of —— in the presence of liquid ammonia. E. Chablay. Comptes rend., 1913, **156**, 327—330.

Sodamide suspended in liquid ammonia decomposes methyl iodide with the formation of methylamine and sodium iodide. With ethyl iodide, however, the products include in addition to the amine, ethylene and ammonia. The other alkyl halides behave similarly, the yield of the corresponding olefine increasing as the series is ascended. The author obtained a 5 per cent. yield of ethylene and an 84 per cent. yield of isobutylene.—W. H. P.

Dehydrogenation catalysis; Selective ——. N. D. Zelinsky and B. A. Schtscherbak. J. Russ. Phys.-Chem. Soc., 1912, **44**, 1880—1884. (See also this J., 1913, 76.)

By palladium-black in the cold or by palladium at a higher temperature, spirocyclane (vinyltrimethylene) is reduced in presence of hydrogen quantitatively to ethyltrimethylene:—



$$(CH_2)_2C(CH_2)_2 + H_2 = (CH_2)_2CH\cdot CH_2\cdot CH_3.$$

When mixed with hydrogen and passed over nickel heated at 200° C., the ethyltrimethylene undergoes further reduction, the second ring of the original spirocyclane being opened and isopentane $(CH_3)_2CH.CH_2.CH_3$, formed. —T. H. P

Patent.

Tobacco preparations and processes of making the same. A. Moonelis and H. Baer, New York. Eng. Pat. 1254, Jan. 16, 1912.

See U.S. Pat. 1,016,844 of 1912; this J., 1912, 261.—T.F.B.

Trade Report.

British India. Revised Tariff Valuations for 1913. Board of Trade J., Jan. 30, Feb. 6, and Feb. 13, 1913.

Books Received.

Atomprozente und Gewichtsprozente sowie die Methoden zu ihrer gegenseitigen Umwandlung. Ein metallographische Beitrag zur graphischen Technik der physikalischen Chemie. Von Fritz Hoffmann. Ingenieur der Berndorfer Metallwarenfabrik. A. Krupp. Wilhelm Knapp's Verlag. Halle a. d. S. 1912. Price M. 1.80.

Volume in pamphlet form (11¼ in. × 7¾ in.), and containing 20 pages of subject matter, with 18 illustrations (curve tables) and two large folded sheets with curve tables.

Die Neuere Entwickelung der Kolloidchemie, Vortrag, gehalten auf der 84 Versammlung Deutscher Naturforscher und Aerzte zu Münster i. W. 1912. Von Dr. Wolfgang Ostwald. Theodor Steinkopff's Verlag. Dresden und Leipzig. 1912. Price M. 1.

Pamphlet (9⅛ in. × 6⅛ in.), containing 23 pages of subject matter.

Handbuch der Mineralchemie. Bearbeitet von G. d'Achiardi, R. Amberg, F. R. von Arlt, M. Bauer, E. Baur, F. Becke, E. Berdel, F. Berwerth, G. Bruni, E. Dittler, M. Dittrich, E. Donath, C. Doelter, L. Duparc, A. von Fersmann, G. Flink, R. von Görgey, B. Gossner, W. Heinisch, M. Henglein, K. Herold, M. Herschkowitsch, A. Himmelbauer, H. C. Holtz, O. Hönigschmid, P. Jannasch, E. Kaiser, J. Königsberger, St. Kreutz, A. Lacroix, H. Leitmeier, R. E. Liesegang, G. Linck, J. Loczka, W. Meigen, St. Meyer, R. Nacken, R. Nasini, K. Peters, R. Pribram, G. T. Prior, K. Redlich, R. Rieke, A. Ritzel, J. Samojloff, R. Scharitzer, Hj. Sjögren, F. Slavik, E. Sommerfeldt, H. Stremme, St. J. Thugutt, St. Tolloczko, G. v. Tschermak, P. v. Tschirwinsky, R. Vogel, J. H. L. Vogt, R. Wegscheider, F. Zambonini, E. Zschimmer. Herausgegeben mit Unterstützung der K. Akademie der Wissenschaften in Wien. Von Hofrat Prof. Dr. C. Doelter. Vier Bände. Bd. II. 1. (Bog. 1—10). Theodor Steinkopff's Verlag. Dresden und Leipzig. 1912. Price M. 6.50.

This is part I. of Volume II. of this serial work, and is devoted to the silicon compounds. It is a volume measuring 10¼ in. × 7¼ in., and contains 160 pages of subject matter, with 23 illustrations, besides tables and diagrams. The matter is arranged as follows:—I. The connection of the physical, more especially the optical, properties, with the composition of the silicates. II. Paragenesis of the natural silicate minerals. III. Constitution of the silicates. Under the natural silicates are described the methods of analysis of quartz, chalcedony and opal. IV. Silicon dioxide. Quartz. Also technical details relating to quartz-glass.

Notes on Chemical Research. An Account of certain conditions which apply to original investigation. By W. P. Dreaper. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 2s. 6d. net.

Small volume, measuring 7¼ in. × 5 in., and containing 68 pages of subject matter. It has a frontispiece (Michael Faraday), and is a reprint from "The Chemical World." The text is classified as follows:—I. Historical review and nature of research. II. Preliminary survey and selection of subject matter. III. General procedure and selection of methods of investigation. IV. Chemical and general scientific investigation. V. Application of chemical research to industry. VI. Research in relation to analysis. VII. General conclusions.

Journal of the Society of Chemical Industry.

No. 5, Vol. XXXII. MARCH 15, 1913. No. 5, Vol. XXXII.

Liverpool Section.

Meeting held at the University on Wednesday, January 15th, 1913.

PROF. F. G. DONNAN IN THE CHAIR.

HYDRATION IN PAPER MAKING PROCESSES.

BY CLAYTON BEADLE AND HENRY P. STEVENS.

It is generally recognised that beaten stuff undergoes changes as the result of keeping which influence the character of the paper, and that these changes, as far as they take place under ordinary industrial circumstances, are mostly of a beneficial nature. Generally very little time intervenes between the completion of the beating operation and the conversion of the beaten pulp into paper, usually a few hours. During this short period it is not possible to observe any change, but when the beaten stuff remains in the beating engine and stuff-chests over the week-end, a marked change is frequently noticed, not only in the beaten stuff but in raw materials in all stages of preparation, provided that they are in contact with the water. If rags after boiling are allowed to drain, they become in time heated and rotted, developing a waxlike substance and showing an ethereal extract of 3 per cent. The rags become softer and more easily beaten and the character of the paper is considerably modified. If the boiling is done with lime, the heaping up heats and "tenders" the material. This process is employed in the manufacture of blotting paper. With rag half-stuffs, cotton and linens of all descriptions, if the stuff is allowed to remain for some time immersed in water, it becomes, when beaten, more wet or hydrated and within certain time limits produces a better felted and stronger and closer paper. Save-all stuff containing starch, size, and other materials liable to putrefaction, rag half-stuff from presspate, moist bleached straw pulp, moist mechanical wood pulp, and even strong fibres such as Manilas in their green state, deteriorate owing to mould growths and similar agencies.

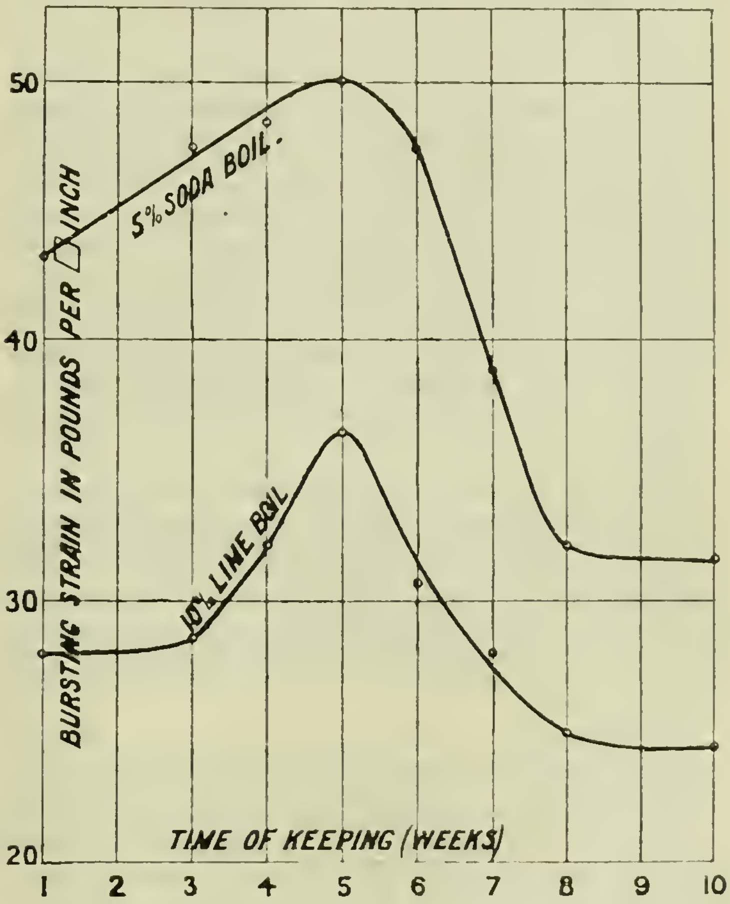
The harmful effect of wet storage is particularly noticeable in materials associated with impurities, as in the case of unboiled rags which if moist will sometimes, even in the space of a few weeks, heat up, decompose, and be converted into soluble products to the extent of 50 per cent.

We recently had occasion to examine a case of a consignment of cotton material containing about 6 per cent. of oil and 5 per cent. of protein which came in contact with water. In the space of a few weeks the whole of the material had become decomposed, friable, and in places was jet black. In this case there was complete absence of mould growth, and the rapid decomposition of the cellulose must therefore be attributed either to chemical or bacterial action.

As will therefore be understood, the presence of moisture during storage or "ageing" is either beneficial or harmful, according to circumstances. It is often beneficial in the case of wood pulp—thus, moist mechanical pulp is a far more useful article than dry mechanical pulp, and the fact that English papermakers do not grind their own mechanical, or cook their own chemical, wood pulp, places them at a great disadvantage in comparison with many of their foreign competitors.

In order to ascertain the influence of "ageing" of beaten stuff upon the bursting strain of paper produced, we chose a fibre which is typical of the Manila class—the *Hedychium coronarium*. This was boiled with 5 per cent. of soda for 5 hours at 40 lb. pressure and beaten in a Hollander. Another lot was similarly prepared, but by boiling with 10 per cent. of lime in lieu of soda. Paper was made from each immediately after the beating and then at differing intervals. In each case the paper was made under similar circumstances as to consistency of stuff, substance of paper, and so forth, the only variable being the time elapsed after beating. The substance was 20 lb. demy (equal to 74 grams per sq. meter) and the thickness was 0·10 mm. The bursting strain is given in the diagram. In the case of the soda boil a steady increase in bursting strain is shown up to 5 weeks and then a rapid decrease to 8 weeks, and from 8 weeks to 10 weeks very little change. In the case of the lime boil, as might be expected, the bursting strain is in all cases less than with the soda boil. It shows also a maximum at the fifth week and a rapid diminution up to the eighth week, after which there is very little change. We noticed in both cases that, after the fourth week, putrefaction set in. This increased rapidly and more than counterbalanced the beneficial effect brought about by the gradual hydration due to prolonged contact with water, hence a maximum bursting strain is reached. It is our intention in a similar way to investigate the effects of wet storage upon the breaking strain and elasticity of paper.

Hedychium.—Illustrating the effects of wet storage of the pulp upon the bursting strain of the paper.



Discussion.

Professor Donnan asked whether the beaten stuff was kept with alkali or not. The great increase in the bursting point of the paper was thought by the author to be due to hydration. Might not the observed effects be dependent on changes in the physical state of the colloid? It would be interesting, for example, to ascertain the effect of various kations and anions on the rate of change of the properties mentioned.

Dr. J. Harger asked whether it would be possible for the weakening effect to be due to the destruction of the fibre by bacteria.

Mr. H. E. Potts asked whether soda had a more penetrating effect on the fibre than lime, and might not the difference be due to the difference in the surface tension induced by the lime or soda used.

Mr. Clayton Beadle replied that the alkali was washed out of the beaten stuff. After beating, the fibre was able to retain a far larger quantity of water than when unbeaten. Whether that was a chemical or physical phenomenon it was difficult to say. Eighteen years ago he had made some experiments on the rates at which desiccated cotton wool and other forms of cellulose took up water on exposure to the air. He believed that he was the first to observe that this absorption gave rise to an increase in temperature and that the two, namely the temperature rise and moisture absorption, bore some relation to one another (Beadle and Dahl, Chem. News, 73, April 17, 1896). Subsequently, without any knowledge of these observations, Professor Orme Masson measured the actual heat evolved per gram of water absorbed (Proc. Roy. Soc., 1904, 74, 230—254). Up to the time of the publication of Masson's researches he (Mr. Beadle) had been inclined to regard the rise of temperature as evidence of chemical changes, but Masson's conclusions were that the amount of heat was approximately that calculated for the quantity of vapour absorbed, and that the water condensed on the cotton did not combine chemically with it. That, however, still left the explanation of "wetting" by prolonged beating or "ageing" an open question. Some regarded it as real hydration, but others thought that it was purely mechanical.

The beaten *Hedychium* became more wet and slimy to the feel, absorbed water and became more gelatinous as the result of ageing, and simultaneously the bursting strain of the paper produced therefrom increased. As the material increased in wetness or hydration it became more susceptible to putrefactive changes, resulting in the destruction of just that portion of the material which had given increased strength, hence the undoing of the initial effects of ageing.

With regard to the use of soda or lime, the relative amounts required to be used in practice was not a matter of molecular ratios. In practice it was found that 10 per cent. of lime would bring about a somewhat similar result to 5 per cent. of caustic soda. In the case of soda, soluble salts were obtained, whilst with lime the salts were insoluble. Furthermore, the amount of lime in solution at any one time was small as compared with soda, and boiling with lime was a longer operation in consequence. The hydration effect was greater in the case of soda, as would be observed on comparing the two curves.

THE CHEMICAL EXAMINATION OF LIQUID FUELS.

BY W. HAMILTON PATTERSON, M.SC.

In comparison with the enormous advances made in the mechanical application of oil as a source of power, the chemical side of the question has been somewhat neglected, and there is much room for scientific research and investigation in the preparation and utilisation of fuels. There is also much overlapping and ambiguity in the nomenclature of the various technical products which are put on the market as liquid fuels. There should be some distinction between "oil fuels" and "fuel oils." In this paper the term "fuel oil" will be reserved for oils burnt in external combustion, *e.g.*, under a boiler for the purpose of raising steam; "oil fuels," on the other hand, will mean oils utilised for the production of power in internal combustion engines. The term liquid fuel may be applied in either case.

Although many fuel oils may often be equally well utilised as oil fuels, there is a difference in the requirements. In oil fuels volatility is of greater importance, and the obtaining of oils which will neither corrode nor give trouble in the cylinders of internal combustion engines on explosion or burning. In fuel oils more vital factors are cheapness, a fairly high flash point, and high calorific value. The various liquid fuels and their allied products derived either from petroleum or coal tars are not definite compounds; it is therefore impossible to assign to these varying mixtures scientific names. It is, however, greatly to be deplored that, in technical usage, the same name is not applied in different parts of the world to denote what is essentially one and the same product. What confusion occurs, for example, in the meaning of the words, paraffin, benzine, solar oil, naphtha, etc. To add still further to the chaos which already exists we find specially coined trade names. Of oil fuels the only variety widely used for certain kinds of motor engines is petrol, but alcohol might be used instead with equal efficiency, provided it could be obtained cheaply enough, and also benzol, or even better, a mixture of the two.

Table I.

No.	Description.	Sp. gr. at 15·0° C.	Carbon.	Hydrogen.	Sulphur.	Oxygen and nitrogen.	Net calorific value in calories.	Net calorific value in B.Th.U.
1	Fuel oil used on trial of a torpedo destroyer ..	0·921	85·28	11·93	0·55	2·24	9,986	17,975
2.	Petroleum product sold at a little over £2 per ton	(0·888) at 18° C.	86·20	12·57	0·31	0·92	10,097	18,175
3.	Ordinary crude petroleum	0·923	—	—	0·45	—	9,956 (Hydrogen assumed 12·0%).	17,921
4.	"Light fuel oil"	(0·900) at 18° C.	88·58	10·81	0·43	0·18	10,114	18,205
5.	"Admiralty fuel oil"	0·928	86·40	11·55	0·34	1·71	9,961	17,930
6.	"Residuum"........................	(0·943) at 18° C.	86·44	11·23	0·30	2·03	10,065	18,117
7.	"Black oil"	0·928	86·44	11·83	0·51	1·22	9,977	17,959
8.	A refined oil	(0·904) at 18° C.	85·05	12·15	0·37	2·43	9,998	17,996
9.	A Roumanian crude oil	0·825	—	—	0·20	—	9,924 (H assumed 13·0%)	17,863
10.	do.	0·830	83·77	12·98	0·29	2·96	10,012	18,022
11.	Solar oil (Texas)	(0·862) at 18° C.	85·35	12·92	0·17	1·56	10,191	18,344
12.	Scottish shale oil	0·855 (at 18·0°C.)	86·16	12·37	0·26	1·21	10,138	18,248
13.	do.	0·862	85·35	12·44	0·29	1·74	10,176	18,317
14	do.	0·867	—	—	0·33	—	9,961 (H assumed 12.5%)	17,930
15	A coal tar oil (?)	0·958	86·16	9.05	0·80	3·99	9,422	16,960
16	A gas oil	1·067	87.62	5·98	0·67	5·73	8,974	16,153
17	do.	1·004	83·72	7·20	0·82	8·17	8,876	15,977

When, however, liquid fuels have to compete with coal for the production of power, only crude products, by-products, or residues can be considered. The available sources of such liquid fuels may be divided as follows :—

(1) Crude petroleum or residues and products from petroleum.

(2) Tar oils from coal distillation, coking or producer plants, especially from bituminous coal producers.

(3) Liquids or oils from vegetable or animal sources including alcohol and nut oils (at the present time of little importance).

(4) Oils from lignite, peat, wood, or shale.

The last class is not very important as far as this country is concerned, except as regards the Scottish oil production from shale, which amounts to about 70 million gallons per annum. This figure includes, however, a large percentage of constituents too valuable to be utilised as ordinary liquid fuel. The following results have been obtained in the examination of various liquid fuels, most of which are available in this country and obtainable at the cheapest price ; the highest price (*i.e.*, at the time of the experiments) in any case in this country being a little over £3 per ton, most of them, however, being considerably cheaper. They have been examined more particularly with reference to their use as oil fuels. The calorific values were determined by the Mahler bomb calorimeter, a method which gives absolutely reliable results when worked under proper conditions. The sulphur was determined by titration of the bomb liquid, allowance being made for the nitric acid produced in each case. Carbon and hydrogen were determined by the ordinary combustion method of elementary organic analysis.

Open tests were made of flashing and burning points, while viscosity was determined in a special viscometer. The main figures are tabulated in Table I.

Of these oils, Nos. 3, 11 and 14 have been found to work well on Diesel engines, and there is good reason to suppose that Nos. 1, 2, 5, 7, 8, 12, 13 and 14 would work equally well.

Nos. 16 and 17 have been found to give trouble with Diesel engines. As fuel oils probably all the oils tabulated would give an efficiency proportional to their net calorific value. It will further be seen that the sulphur content is in no case excessive. The much lower calorific values of oils Nos. 16 and 17 may account in some measure for the trouble they give in Diesel engines, but there are other factors which are brought out in the tables below. In combustion of fuels in the bomb calorimeter, the products of combustion are cooled to the ordinary temperature of the calorimeter ; the hydrogen of the fuel is oxidised to water which gives up its latent heat on condensation. There is also a small amount of sulphuric and nitric acids produced which must be allowed for. The heat value actually obtained in the bomb calorimeter is the gross value, while that corrected for hydrogen and acid formation is the net value, and corresponds to the maximum energy of the fuel which is available for the production of work in ordinary practice. It is astonishing how in ordinary commercial practice the two values are confused. To apply the right correction for the water condensed, it is necessary to know the hydrogen in the oil (also the free water if there is any present). To ascertain the correction due to the former cause, the only absolutely reliable means is to determine the hydrogen by making an elementary analysis of the oil. This is, however, a tedious process and in most cases, as will be shown below, the hydrogen content may be assumed with an accuracy sufficient for the purpose of applying this correction in technical work.

TABLE II.

No.	Open flash point, °C.	Burning point, °C.	Hydrogen.	Gross calorific value (in calories).	Hydrogen correction.	Acid correction.	Net calorific value.
1.	133°	164°	11·93	10,644	644	14 (total)	9,986
2.	125°	147°	12·57	10,798	679	15 + 7	10,097
3.	125°	155°	(12% assumed)	10,622	(648 assumed)	8 + 10	9,956
4.	187°	220°	10·81	10,720	584	13 + 9	10,114
5.	138°	163°	11·55	10,606	624	13 + 8	9,961
6.	166°	197°	11·23	10,690	606	12 + 7	10,065
7.	144°	172°	11·83	10,640	639	12 + 12	9,977
8.	122°	135°	12·15	10,672	656	10 + 8	9,998
9.	Ordinary temp.	Ordinary temp.	(13·0% assumed)	10,642	(702 assumed)	12 + 4	9,924
10.	Ordinary temp.	Ordinary temp.	12·98	10,731	702	11 + 6	10,012
11.	92°	97°	12·92	10,905	697	13 + 4	10,191
12.	129°	158°	12·37	10,825	668	13 + 6	10,138
13.	130°	150°	12·44	10,868	672	13 + 7	10,176
14.	130°	148°	(12·5% assumed)	10,646	(675 assumed)	3 + 7	9,961
15.	77°	106°	9·05	9,944	489	9 + 24	9,422
16.	90°	109°	5·98	9,322	324	8 + 16	8,974
17.	77°	86°	7·29	9,295	394	7 + 18	8,876

TABLE III.

No.	Net calorific value.	Calculated value.	Difference.	Percentage fractionated.							
				80° C.	120°	160°	200°	240°	280°	320°	360°
1.	9,986	10,300	+ 344	—	—	—	0	3	15	34	51
2.	10,138	10,529	+ 391	—	—	0	8	10	20	—	—
4.	10,114	10,315	+ 201	—	—	—	—	—	0	12	56
5.	9,961	10,295	+ 334	—	—	—	—	—	14	40	76
6.	10,065	10,193	+ 128	—	—	—	—	—	6	20	68
7.	9,977	10,401	+ 424	—	—	—	—	4	11	31	—
8.	9,998	10,335	+ 337	—	—	—	—	11	58	—	—
10.	10,012	10,450	+ 438	6	17	31	41	49	57	—	—
11.	10,191	10,608	+ 417	—	—	0	11	32	64	—	—
12.	10,138	10,529	+ 391	—	—	—	–	0	16	70	—
13.	10,176	10,479	+ 303	—	—	—	0	7	28	—	—
15.	9,422	9,479	+ 57	—	0	4	8	29	—	—	—
16.	8,974	8,639	—335	—	—	—	5	40	55	—	—
17.	8,876	8,620	—256	—	—	{ 180° { 13	48	{ 220° { 86	—	—	—

In Table II., the figures are given for the open flash points, burning points, hydrogen contents, gross calorific value given by the bomb calorimeter determination, the water correction for the hydrogen, the acid correction in the order nitric acid+sulphuric acid, and the corrected or net calorific value.

In low boiling fractions of petroleum products, the hydrogen content may reach 16 per cent. or more.

It is of interest to calculate the calorific values from the results of analysis and to compare them with those actually obtained by the calorimeter. For this purpose, the German modification of the Dulong formula is used, *i.e.*, $81C+290(H-\frac{O+N}{8})+25S-6W$, a formula which gives results in the case of ordinary coal, within 1 per cent. of the actual. It is not meant to be implied that this formula is strictly applicable to oils, but if it is applied, the differences are instructive. Applying this to the oils above, figures are given in Table III.

Figures for fractionation are also appended.

Curves plotted to show the change of viscosity with temperature show very sudden rises in viscosity at the low temperature end of the curve. For instance, viscosity figures for No. 2 are:—

15° C.	18° C.	25° C.	50° C.	75° C.	
68·67	31·71	15·57	5·55	2·70	(Water = 1.)

At the low temperature end of the curve, 0·1° C. makes a very marked difference in the time of flow. This is of importance when oils are to be used on internal combustion engines. The Diesel engine can take an oil which will not visibly flow at ordinary temperature, if the oil has been subjected to a preliminary heating. On the other hand, it is possible to have an oil too mobile, which gives trouble by leaking through the valves. If an engine is taking feed at a temperature where the viscosity curve for the particular oil used is steep, trouble will probably be caused by the slight temperature variations making such a marked difference in the rate of flow of the oil.

A curve plotted to show the percentage fractionated at various temperatures shows a steep initial rise in No. 2 and a wave surface with two crests in the cases of Nos. 9 and 10, but the rest do not differ widely from straight lines of varying inclinations to the ordinates.

The tables above bring out in sharp contrast the distinction between products which have petroleum for their origin and those which have coal. This is especially noticeable in the case of the differences between actual and calculated calorific values which are negative in the latter case.

The two products are entirely different in all their properties, typical mainly of the differences between saturated and cyclic hydrocarbons.

No. 1 fractionated gave the following results:—

	Carbon. per cent.	Hydrogen per cent.
1st Fraction 13 per cent., b.pt. 235°—275° C.	84·04	12·16
4th Fraction 32 per cent., b.pt. above 385° C. (or residue)	87·74	10·45

In the latter case there was some free carbon.

Taking petroleum products by themselves, there is a general relationship between low specific gravity, low flash point, high hydrogen content, low boiling point, and conversely between high specific gravity, high flash point, low hydrogen content and high boiling point; but, as is to be expected in such a complex and varying substance, a mixture of many distinct chemical compounds, no absolute relationship can be traced.

Discussion.

Mr. J. **Twomey** asked if the author could recommend a satisfactory empirical formula for the estimation of the hydrogen in coal.

Mr. **Clayton Beadle** asked if the author could explain the fact that the differences between the calculated and experimental values were positive in all cases of the oils, except the last two on the table.

Professor Donnan asked what was the trouble in the Diesel engine referred to. Was it due to formation of carbon? What oils, other than petrol, could be used in engines of the motor-car type; also how far could the coal-tar oils referred to compare with petrol?

Mr. H. E. **Potts** asked how the sulphur was estimated in the various oils. Personally he found that the addition of alkali chloride to four times the amount of the nitrate present was advisable to give accurate results.

Professor **Baly** asked whether any work had been done with the use of "cracked oils" in engines of the Diesel type. Would it not be possible to carry such oils in cylinders and use them in internal combustion engines? He imagined that those oils were very cheap, and they burnt very easily.

Dr. J. **Harger** asked if the author had had any experience with coal tar oils distilled from coal at low temperatures, such as 400° C. It seems as if the supply of fuel for motor-car engines, etc., in the future must lie in this direction.

Mr. **Patterson**, in reply, said he only knew of one formula for estimating hydrogen in oils, and that connected specific gravity with hydrogen content. The figures he had given showed what very false results that would lead to. The trouble referred to in internal combustion engines was generally due to deposition of carbon. Sulphur was estimated by double titration of the bomb liquid by barium hydroxide and sodium carbonate; this method only occupied about ten minutes. He did not think that the "cracking process" was carried out to any great extent. Either the lowering of boiling point was not greatly altered thereby, or else, if it were so, the quantity of oil so transformed was relatively small. He had no experience with oils made by distillation of coals at low temperatures.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows; Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris 3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

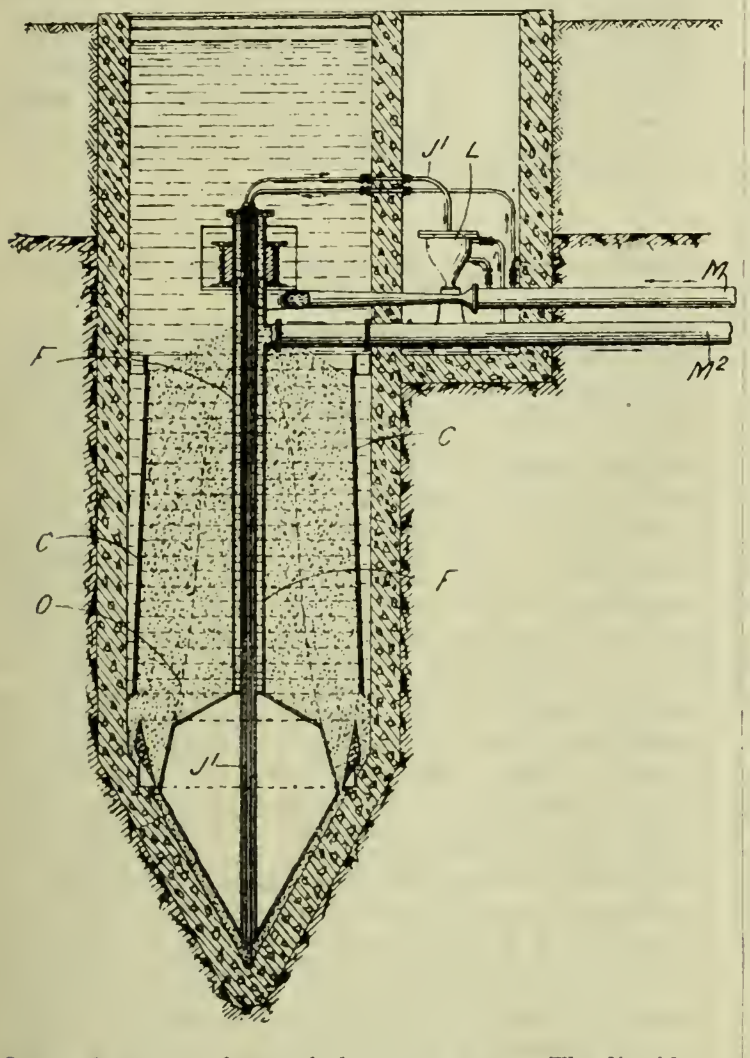
Patents.

Drying apparatus. C. Wille, Tempelhof, Germany. U.S. Pat. 1,051,359, Jan. 21, 1913.

The apparatus consists of a double-walled drying drum mounted to rotate horizontally within a trough, the whole being enclosed in a chamber provided with heaters. Conveyor-devices are mounted on the exterior of the drum—which, if not of polygonal cross-section, is provided internally with chains extending along its whole length for the purpose of bringing the charge into intimate contact with the heated air—and suitable provision is made for the circulation of heated air through and around the drum.—W. E. F. P.

Filtering apparatus. M. Deacon and W. Gore, London. Eng. Pat. 29,301, Dec. 29, 1911.

A filter of the type described in Eng. Pat. 14,487 of 1910, in which the sand or other filtering medium is continuously removed from the bottom of the filter bed, washed, and transferred to the top, is so constructed that the liquid to be filtered is admitted at the sides of the filtering mass as well as at the top or bottom. The figure shows one form of the apparatus. The liquid to be filtered enters through the pipe, M, carrying with it freshly washed sand from the washer, L. The body of sand is contained between perforated surfaces, C, F, and is slowly withdrawn from the bottom through the pipe, J¹, by ejector action and transferred to the washer, L. The filtered liquid is carried away by the pipe, M². The portion of sand inside the dotted line, O, remains practically stationary, while the outer portion moves slowly downwards, and as the liquid has free access from the top and sides, a large filtering surface of constantly renewed sand is continuously exposed.—H. H.



Filtering gaseous fluids; Apparatus for ——. R. Happel, Schwelm, Westphalia. Eng. Pat. 21,200, Sept. 17, 1912. Under Int. Conv., Oct. 28, 1911.

The flexible fabric of which the filtering pockets are formed, is kept distended by means of a flexible cord, attached to the bottom of all the pockets and to the tension beam. —W. H. C.

Precipitates; Apparatus for drying and recovering valuable ——. M. S. Hopkins, Roland Park, and C. R. Barnett, Baltimore, Md., Assignors to Separate Recovery Co., Alexandria, Va. U.S. Pat. 1,049,715, Jan. 7, 1913.

A combined filtering and drying apparatus comprises a filter press having hollow filter-plates, through which a heating medium is passed, and frames arranged alternately between the plates, with filter-cloths between the plates and frames. A vacuum pump serves to draw off the vapour from the press, and a condenser is placed between the press and the pump.—H. H.

Drying apparatus [for road-making materials, etc.]. J. E. Hobbs, Coulsdon, Surrey. Eng. Pat. 29,313, Dec. 29, 1911.

A drying apparatus, more particularly for drying stone, etc., for use on tar-macadam roads, consists of one or more rotary drums with internal blades for agitating the material and a fan for drawing heated air through the drums. The material is transferred from drum to drum by means of pipes which can be turned into an inclined position to collect and transfer the material when desired, and a damper is fitted near the fan to shut off the draught when the first drum is being charged, so that no cold air may be drawn in.—H. H.

Refrigerating or cooling apparatus. E. Josse, Berlin, and W. Gensecke, Charlottenburg, Germany. Eng. Pat. 13,966, June 15, 1912. Under Int. Conv., June 16, 1911.

The apparatus comprises a vapouriser surmounted by a steam injector, which withdraws the vapours formed and transmits a mixture of vapour and air into a surface condenser, cooled by the circulation of cold water. Communicating pipes serve to return air and water from the condenser to the vapouriser, whilst an air suction pipe in the condenser, communicating with an air-pump, and an air inlet pipe in the vapouriser, connected with the atmosphere, allow the required proportion of air to be furnished to the apparatus in the course of its operation. —O. R.

Sandy or muddy liquids; Apparatus for separating fine-grained admixtures from ——. R. Freygang, Hamburg, Germany. Eng. Pat. 25,548, Nov. 7, 1912. Under Int. Conv., Nov. 7, 1911.

A vertical charging tube is in hydrostatic communication with a second tube containing a screw conveyor, which is preferably inclined to the charging tube at a slightly acute angle, and a horizontal, rotating drum-sieve, mounted in a watertight casing, is situated at the junction of the two tubes. A mixture, such as crude kaolin and water, is charged directly on to the rotating sieve, and the fine slime flows through the open end of the drum, whilst coarser materials, such as sand and grit, are retained by the sieve (5000—8000 meshes per sq. cm) and then thrown off owing to the rotation of the drum; an additional lateral movement is imparted to the sand, etc., by means of a helicoidal rib, which is fixed to the outside of the sieve, and the impurities pass by way of a connecting piece into the screw conveyor and are removed. The connecting piece preferably takes the form of two tubes, whereby the liquid accompanying the centrifugally separated impurities is made to flow down one tube into the screw conveyor, and is re-conducted upwards by way of the other tube into the drum casing. —O. R.

Multiple-effect evaporating apparatus. A. L. Webre, Assignor to J. H. Murphy, New Orleans, La. U.S. Pats. 1,049,424, 1,049,425, and 1,049,426, Jan. 7, 1913.

(1) In a multiple effect evaporator, the boiling liquid passes from each unit to the next through an overflow pipe fitted with a controlling chamber, which is connected with the steam space of the evaporator by a pipe provided with a regulating cock and discharges into the succeeding evaporator at a higher level through an inverted siphon tube. A density indicator is placed within the controlling chamber to indicate the rate of evaporation. (2) In an evaporator of the type in which the liquid to be evaporated is heated within a large number of vertical tubes round which steam circulates, vertical partitions are arranged between the pipes so as to form two symmetrical passages of progressively decreasing area through which the steam has to pass. The condensed steam is drawn off from a point near the steam inlet. (3) In a steam-heated evaporator, the steam or mixed air or vapour and steam is drawn off through a pipe fitted with a valve and thermal regulator for controlling it. A cooling fluid is injected into the pipe at a point intermediate between the regulator and the steam chamber.—H. H.

Dry solids from liquid substances; Obtaining ——. G. H. Paltridge, Washington, D.C. U.S. Pat. 1,051,441, Jan. 28, 1913.

The liquid is sprayed in an atomised condition into the upper part of a chamber through which a downward draught of air is produced. The air enters at two points, one near the top and the other near the bottom of the chamber. The vapour of the liquid, the solid particles and the air, all leave the chamber together near the bottom, and the solid particles are separated in an external separator.—W. H. C.

Muffle-kiln. P. Eyer, Halberstadt, Germany. U.S. Pat. 1,051,366, Jan. 21, 1913.

Claim is made for a structure consisting of a horizontal table in which a combustion flue is disposed and upon which a frame grate is mounted so that it can be rotated. Above the grate, and extending across a portion of it, a kiln is situated, "forming an interior chamber portion for receiving that part of the grate disposed therein" and adapted to be heated by the products passing through the combustion flue.—W. E. F. P.

Distilling or concentrating liquids. F. von Werenbach, S. Michele am Etsch, Austria. Eng. Pat. 2315, Jan. 29, 1912. Under Int. Conv., Jan. 27, 1911.

See Fr. Pat. 439,780 of 1912; this J., 1912, 708.—T. F. B.

Evaporating apparatus for brine and other liquids. F. Schulz. Fr. Pat. 447,089, Aug. 9, 1912. Under Int. Conv., Sept. 15, 1911.

See Ger. Pat. 254,486 of 1911; this J., 1913, 184.—T.F.B.

Air; Method of and system for dehydrating and warming ——. R. Haddan, London. From General Dehydrator Co., New York. Eng. Pat. 5706, March 6, 1912.

See Fr. Pat. 440,521 of 1912; this J., 1912, 803.—T. F. B.

Filtering apparatus. J. M. Neil, New York. U.S. Pat. 1,051,620, Jan. 28, 1913.

See Eng. Pat. 14,388 of 1912; this J., 1912, 1169.—T.F.B.

Filter-press combined with hydraulic press. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 447,551, Aug. 8, 1912. Under Int. Conv., Oct. 4, 1911.

See Ger. Pat. 252,577 of 1911; this J., 1913, 75.—T.F.B.

Separating solids from liquids; Receptacle for ——. A. J. Arbuckle, Johannesburg. U.S. Pat. 1,051,662, Jan. 28, 1913.

See Fr. Pat. 416,193 of 1910; this J., 1910, 1391.—T.F.B.

Tunnel-furnace. A. Ramén, Helsingborg, Sweden. U.S. Pat. 1,051,634, Jan. 28, 1913.

See Fr. Pat. 420,234 of 1910; this J., 1911, 346.—T. F. B.

Manufacture of salt and production of power. Eng. Pat. 28,171. *See* VII.

Special metal for use in the manufacture of apparatus for chemical and other industries. Addition to Fr. Pat. 439,094. *See* X.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Calorific value; Determination of —— *by experiment and by calculation.* F. von Juptner. Feuerungstechn., 1913, 1, 120—124, 140—144.

The author has tabulated the elementary analysis and the yields of gas and coke for 94 different fuels of known calorific value, with a view to testing the various empirical formulæ for calculating the calorific power. The best results are obtained by a modification, suggested by the author, of a method due to Berthier which is independent of the elementary analysis. The amount of oxygen consumed by 1 grm. of the fuel is determined by heating with lead oxide and estimating the amount of reduced lead. The quantity of reduced lead multiplied by $\frac{8080}{34}$ gives Berthier's calculated calorific value which is nearly always lower than the figure obtained by a direct calorimetric determination. The agreement is much better when Berthier's value is increased by 10 G, G being the percentage by weight of gas evolved. Using this method 65 of the results agreed with the experimental value to within less than 3 per cent.—W. H. P.

Acetylene solvents. J. H. James. J. Ind. Eng. Chem., 1913, 5, 115—120.

The author gives the results of experiments made with a view to discover a suitable cheaper substitute for acetone as a solvent for acetylene. Laboratory experiments with different liquids gave the following average results for the number of c.c. of acetylene (corrected to 0° C. and 760 mm. pressure) absorbed by 1 c.c. of solvent at —10° C.:—acetaldehyde, 60·2; methylal, 54·3; acetal, 28·8; methyl formate, 48·4; ethyl formate, 42·2; isoamyl formate, 17·5; methyl acetate, 52·3; ethyl acetate, 44·5; isoamyl acetate, 29·3. Some experiments were also made with acetaldehyde of 99—99·5 per cent. purity in an ordinary 6×20 inch acetylene storage tank. It was found that 82 oz. of acetaldehyde absorbed 48 oz. of acetylene at 70° F. (21° C.) with the pressure gauge at 265 lb., as compared with 37 oz. of acetylene absorbed by 85 oz. of acetone at the same temperature, with the pressure gauge at 250 lb. Tests of the candle-power of the gas evolved from the saturated solvent showed that whereas with acetone and another commercial acetylene solvent (a complex mixture of organic liquids) there was little more than 1 hour between the first warning (diminution of candle-power) and the extinction of the light, there was an interval of 4—6 hours in the case of acetaldehyde. The loss of solvent is greater with acetaldehyde than with acetone (about 8 oz. as compared with 4—6 oz. for each discharge of the storage tank), but the aldehyde vapour is a good diluent for acetylene, having a relatively slight effect on the candle-power and calorific value. This is of some importance in connection with the use of acetylene for welding and cutting metals, as in case of emergency the volatile acetaldehyde used as acetylene solvent could be drawn upon when the supply of acetylene failed: the calculated temperature of the hottest part of the oxy-acetylene flame is near 4000° C. and that of the oxy-acetaldehyde flame, above 3400° C. Acetaldehyde can be made directly from denatured alcohol, and hence is likely to become cheaper as improved methods of agriculture make it possible to produce denatured alcohol more cheaply. It is stated that in the production of dissolved acetylene sufficient attention is not paid at the present time to the purity of the gas and of the solvent: impurities in either the gas or the solvent considerably reduce the solubility.—A. S.

Gasoline and denatured alcohol; Comparative fuel values of —— *in internal-combustion engines.* R. M. Strong and L. Stone. U.S. Bureau of Mines, Bull. 43, pp. 243. (Compare this J., 1910, 337.)

An extended series of tests was made with gasoline and denatured alcohol as fuels in five different engines under different working conditions. Two of the engines were single-cylinder horizontal Otto gasoline engines rated at 15 B.H.P. at 260 r.p.m., the pistons being 6¾ in. diam. and 15½ in. stroke. Two other engines were single-cylinder vertical 4-cycle Nash engines, rated at 10 B.H.P. at 280 r.p.m., the pistons being 7⅞ in. diam. and 10 in. stroke. One of these was a gasoline engine, the other an alcohol engine, the clearance being reduced by an extension on the cylinder head. The fifth engine was an Otto alcohol engine having the same dimensions as the Otto gasoline engines, except that the clearance was smaller, and could be varied by placing liners between the big end of the connecting rod and the brasses. With a compression pressure of 70 lb. per sq. in., mixtures were used in which the ratio of air to that theoretically required varied from 1·4 to 0·5 with gasoline as fuel, and from 1·3 to 0·7 with alcohol as fuel. Within these limits the engines ran quite normally, and the practical range of combustibility exceeds these limits. The lowest fuel consumption per B.H.P.-hour was obtained, in the case of each fuel when the air used was 1·25 times that theoretically required. The time of ignition giving the lowest fuel consumption was always before the dead centre, and depends upon the compression, the speed, and the quality of the mixture. It was earlier with the quickest burning mixtures. When other conditions were kept constant, the efficiency and the fuel-consumption were independent of the temperature of the jacket-water. Variations in this temperature may however affect the efficiency by causing other alterations in the conditions of working. The lowest fuel-consumptions were 0·6 lb. per B.H.P.-hour with gasoline and 1 lb. with alcohol when the compression pressure was 70 lb. per sq. in. The gain in efficiency which may be effected because of the greater compression to which it is possible to subject denatured alcohol is shown by the fall in fuel consumption from 1 lb. to 0·7 lb. on raising the compression pressure from 70 lb. to 180 lb. per sq. in. With compression pressures of 190 lb. per sq. in. and upwards, pre-ignition occurred. When the engine adjustments which gave the best fuel economy had been ascertained in this series of tests, further tests were made in which the load was varied without altering these adjustments. This was considered to represent the best conditions in ordinary practice. The fuel-consumption was least at maximum load and increased as the load was reduced. Heating the air supply to 250° F. (121° C.) reduced the power of the engine by 15 per cent. The fuel-consumption was reduced by heating the air at low loads only. In all cases, increased compression gave increased efficiency, but with the same compression alcohol gave a higher efficiency than gasoline. *Mixtures of gasoline and alcohol with one another or with water.*—With gasoline and alcohol supplied from two separate carburettors, in proportions varying from all gasoline to all alcohol, the total fuel consumption varied from the best obtainable with gasoline alone to the best obtainable with alcohol alone. With gasoline and water supplied in the same way, amounts of water up to 50 per cent. were used without appreciable gain in efficiency, the clearance remaining unaltered, but less cooling water was required. The efficiency when using alcohol as fuel was reduced by diluting the alcohol with water, the reduction being from 28·4 per cent. without water to 19 per cent. with 55 per cent. of water. The maximum power of the engine was also reduced. Alcohol may be diluted with 10 to 15 per cent. of water without appreciably affecting the efficiency. The use of small quantities of water with gasoline is advantageous in preventing pre-ignition.—A. T. L.

Asphaltum; Quantitative determination of natural —— in presence of artificial asphaltum. J. Marcusson. Z. angew. Chem., 1913, **26**, 91—93.

The principal artificial asphaltum is coal tar pitch, which is frequently incorporated with natural asphaltum for industrial purposes. Means of differentiation and approximate estimation have been proposed based on the higher proportions of sulphur and mineral matters generally present in natural asphaltum, but these proportions are not constant, and, moreover, are readily susceptible to manipulation. The author has devised a method of analysis based on the fact that the constituents of coal tar pitch soluble in organic solvents are members of the aromatic series, which when treated with sulphuric acid readily form sulphonic acids soluble in water. The bituminous portions of natural asphaltum on the other hand are converted into black insoluble derivatives richer in sulphur than the original, but the aqueous extract of the product is only slightly coloured, whereas if coal tar pitch be present, a black solution is obtained on pouring the product of the reaction into water. By this treatment the bitumen of pure Trinidad asphaltum yields 107·7 per cent. of insoluble precipitate, whilst Syrian and Mexican asphaltums behave in a similar manner. For the extraction of the bitumen, 10 grms. of the sample are treated with 75 c.c. of ethereal hydrochloric acid (prepared by shaking the concentrated acid with ether whilst cooling), added in 3—4 portions. After stirring for 10 minutes, 75 c.c. of water are added, the ether is evaporated, the acid solution is filtered off, and the residue is washed. This is then dried, if necessary, and extracted completely with boiling chloroform. On evaporating the chloroform, the bitumen is obtained and weighed after drying at 105° C. 3 grms. of the bitumen are placed in a thick test-tube, treated with 6 c.c. of concentrated sulphuric acid and heated with frequent agitation in a boiling water-bath for 45 minutes. The product of the reaction is cooled and washed into about 200 c.c. of water in a flask. The precipitate settles out in about an hour. This is filtered off as far as possible by decantation, washed free from acid with cold water, lumps being broken up, and is finally dried at 105° C. and weighed. The result is calculated on the original material. The method gives only the percentage of natural bitumen in the sample and not the proportions of natural and artificial asphaltums; in simple mixtures, however, the proportion of natural asphaltum may generally be calculated by adding on the percentage of mineral matter to the bitumen found. Tests of the method, made with known mixtures of Trinidad asphaltum and coal tar pitch, showed that the results obtained with pure asphaltum were never reached with the mixtures, owing to some influence of the pitch on the reaction with the natural bitumen. Instead of a yield of about 108 per cent. of sulphonated bitumen, the products did not even amount to 100 per cent., and a correction had to be applied for losses. If the percentage of sulphonated natural bitumen, calculated on the original mixture, be increased by 4, numbers agreeing sufficiently well with the true values are obtained. Mineral oil pitches behave in this reaction as natural asphaltum, so that it is necessary to apply other known tests before arriving at a final conclusion.—J. F. B.

Petroleum production in the United States. Board of Trade J., Feb. 27, 1913. [T.R.]

The preliminary estimates place the production of petroleum in the United States in 1912 at 220,200,000 barrels (of 42 U.S. gallons*), valued at 150,000,000 dols., or 68 cents per barrel, as compared with 220,449,301 barrels valued at 134,044,752 dols., or 61 cents per barrel, in 1911. The year 1912 is the first year since 1859 in which the amount produced has not shown an increase. The Californian output of low-grade oil reached 87,000,000 barrels, an increase of about 6,000,000 barrels over last year's figures. This increase was counterbalanced by the decreased production in the high-grade fields with the exception of West Virginia, where the production expanded by about 2,000,000 barrels. Oklahoma and Illinois still maintain their position amongst the high-grade fields, as they are jointly responsible for about two thirds of the total output. Last year, however, showed a decline in Oklahoma, as the average for the year was only 50 barrels per well, compared with 73·4 barrels in 1911. No new States were added to the list of producers in 1912, but Wyoming and Michigan, hitherto only small producers, gave promise of becoming of greater importance. With the exception of California, where over-production and other causes made prices very low, the price of crude oil steadily advanced throughout 1912. This rise was due to fundamental conditions and not to manipulation. Last year, production remained steady whilst consumption grew at such a rapid rate as to result in a genuine shortage, and prices would have risen even higher had there not been a very large surplus in store from previous years. During 1912 the price of very high grade Pennsylvanian oil rose from 1·35 dols. to 2 dols. per barrel at the well. A feature of the oil industry in 1912 was the marked increase in the number of independent oil refineries. Most of the new plants are in Illinois and Oklahoma. On account of the increase in consumption the amount of high-grade oil in stock at the end of the year was about 69,000,000 barrels, as compared with 81,789,400 barrels at the beginning of the year. Oklahoma and Illinois, the two producing States which have been mainly responsible for the large production and surplus stocks, showed a notable decline in 1912 that is liable to be still greater this year, so that only the discovery of new fields can prevent the total output of oil for 1913 showing a considerable decline.

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* 6 U.S. gallons = 5 Imperial gallons.

Use of coke oven gas, without preheating, in the manufacture of steel. Simmersbach. *See* X.

The chemical examination of liquid fuels. W. H. Patterson. *See* Liverpool Section, p. 218.

Patents.

Fuel, Manufacture of artificial ——, and apparatus therefor. Graigola Merthyr Co., Ltd., F. C. Yeo and T. A. Goskar, Swansea. Eng. Pat. 29,220, Dec. 28, 1911.

In order to retain as far as possible the volatile materials in artificial fuel prepared by heating and mixing the fuel components in closed retorts or chambers according to Eng. Pat. 23,555 of 1909 (this J., 1910, 1365; see also Eng. Pats. 6853 of 1896, 7905 of 1900, and 7871 of 1903; this J., 1897, 228; 1901, 350), the solid plug of fuel emerging from the retort is passed into a large cooling chamber sealed at both ends and cooled by a water jacket, where the fuel is broken up, cooled, and a proportion of the volatile constituents condensed. The fuel is re-agglomerated at the bottom of the chamber by an Archimedean screw which discharges it as a solid plug into the open air, the volatile ingredients being occluded in the compressed fuel.—H. H.

Peat; Treatment of —— to facilitate the extraction of moisture. P. Richemonde. Fr. Pat. 447,552, Aug. 13, 1912.

The process consists in heating the raw peat to 60°—100° C. and allowing it to cool. The moisture can then be removed by pressure. The process differs from the Ekenberg process (see Fr. Pats. 331,720 and 332,600 of 1903; this J., 1903, 1122, 1238) in the lower temperature used and the absence of pressure during heating.—A. T. L.

Peat; Process for drying —— for use in gas-producers or for making briquettes. P. Richemond. Fr. Pat. 447,262, Aug. 16, 1912.

The disintegrated peat is pressed into a thin cake between two endless filtering bands which pass between perforated metal supporting plates or over a metal pulley and are suitably tensioned. The moisture is thus reduced to 60—80 per cent. The peat is then further dried by exposure to hot air or to the heat of the sun. A suitable hot-air dryer comprises a chamber through which large quantities of hot air are blown in the upward direction, whilst the peat cake, in small pieces, travels from the top downwards in a zig-zag path on a series of endless bands. —A. T. L.

Gas producers. A. H. Lymn and N. E. Rambusch, London. Eng. Pat. 1232, Jan. 16, 1912.

An upward and downward movement is imparted to the fuel contained in a rotary gas producer, in which either the body or the base revolves, preferably by mounting the revolving part on wheels, which run round an uneven circular rail. If preferred, the rail itself may be revolved, but at a different speed from that of the rotary base or body. By this means the fuel is agitated over the whole area of the producer, the mass of fuel and ash being thus kept continually loose with resulting intense and rapid gasification.—O. R.

Gas producer. W. B. Chapman, Assignor to Chapman Engineering Co., New York. U.S. Pat. 1,049,994, Jan. 7, 1913.

An under-feed gas producer is provided with a rotating body and with a fuel-inlet pipe arranged eccentric to the axis of rotation, so that there is relative movement between the body of fuel in the producer and the fuel inlet.—H. H.

Coal-gas; Retort for the manufacture of ——. P. C. H. Hunt, Melbourne, and F. J. Tipper, Albert Park, Victoria, Australia. Eng. Pat. 12,675, May 29, 1912. Under Int. Conv., Sept. 16, 1911.

The charging end of a fireclay retort is made of the same shape, for a small portion of its length, as its cast iron mouthpiece, but the roof of the retort, throughout the remainder of its length, is raised about three inches and so shaped as to form a gas conduit between the upper level of the coal and the raised portion of the roof. The exterior surface of the raised roof of the retort is flattened, so that one retort may conveniently be superimposed upon another.—O. R.

Hydrocarbons [paraffins, benzene, terpenes]; Purification of —— by means of charcoal and oxygen. Richter und Richter. First Addition, dated Aug. 10, 1912, to Fr. Pat. 421,277, Oct. 10, 1910 (this J., 1911, 409). Under Int. Conv., Dec. 5, 1911.

In order to neutralise any acids which may be present in the hydrocarbons, or which may be formed during oxidation, the hydrocarbons are subjected to a preliminary treatment with alkali, *e.g.*, caustic soda solution. The alkali is removed before treating the hydrocarbon with charcoal.—A. T. L.

Hydrocarbons; Process for transforming high boiling —— into hydrocarbons of lower boiling point. L. G. Leffer. First Addition, dated Aug. 19, 1912, to Fr. Pat. 439,476, Jan. 29, 1912 (this J., 1912, 711).

The process described in the principal patent is modified by causing the vapours from the still to pass through a heated chamber before they are led to the condenser. This chamber is heated to the temperature at which the desired decomposition of the heavy hydrocarbons takes place, and this temperature may be higher than that of the still.—A. T. L.

Briquetting and pressing fuels; Process of ——. A. Rónay, Assignor to Allgem. Briketierungs-Ges. m.b. H., Berlin. U.S. Pat. 1,052,093, Feb. 4, 1913.

See Eng. Pat. 16,500 of 1909; this J., 1910, 678.—T. F. B.

Coal; Apparatus for washing ——. J. Dodds. First Addition, dated Aug. 24, 1912, to Fr. Pat. 427,014, March 8, 1911. Under Int. Conv., Nov. 3, 1911.

See Eng. Pat. 24,406 of 1911; this J., 1912, 863.—T. F. B.

Gas retorts; Means for discharging vertical ——. R. Dempster and Sons, Ltd., and J. H. Toogood. Fr. Pat. 447,603, Aug. 24, 1912.

See Eng. Pat. 17,616 of 1912; this J., 1912, 1021.—T. F. B.

Tar and ammonia from volatile products of the carbonisation of coal; Process for recovering ——. C. Otto und Co. G.m.b.H., Dahlhausen on Ruhr, Germany. Eng. Pat. 15,584, July 3, 1912. Under Int. Conv., July 10, 1911.

See Fr. Pat. 445,402 of 1912; this J., 1913, 13.—T. F. B.

Acetylene and other gases; Process and product for purifying ——. P. J. Granjon, Marseilles, France. Eng. Pat. 19,838, Aug. 30, 1912. Under Int. Conv., Sept. 12, 1911.

See Fr. Pat. 434,137 of 1911; this J., 1912, 220.—T. F. B.

Gas-purifying material; Process of treating waste ——. H. Gonthière and P. Ducancel, Rheims, France. U.S. Pat. 1,051,882, Feb. 4, 1913.

See Fr. Pat. 427,892 of 1910; this J., 1911, 1151.—T.F.B.

Hydrocarbons of higher into those of lower boiling point; Process for converting ——. L. G. Leffer, Weveling-hofen, Germany. Eng. Pat. 2328, Jan. 29, 1912.

See Fr. Pat. 439,476 of 1912; this J., 1912, 711.—T. F. B.

Hydrocarbons; Process for solidifying ——. J. T. Armstrong and J. Mordan. Fr. Pat. 447,085, Aug. 9 1912. Under Int. Conv., Aug. 12, 1911.

See Eng. Pat. 18,300 of 1911; this J., 1912, 1173.—T.F.B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Wood-charcoal; Manufacture of ——. O. Wright. Fr. Pat. 447,307, July 31, 1912. Under Int. Conv., Aug. 2, 1911.

The wood is stacked in a rectangular iron chamber, which has a cover-plate provided with valved air inlets and product outlets. The chamber is provided with doors at the bottom for lighting the wood. These doors are kept closed during carbonisation, and the openings in the cover-plate are regulated so that the air for combustion is drawn downwards through the wood by the draught of the escaping gases. There may be vertical partitions in the chamber acting as baffles to guide the incoming air.—A. T. L.

Filaments for electric incandescence lamps. E. Morsaint. First Addition, dated Aug. 6, 1912, to Fr. Pat. 446,310, July 22, 1912 (this J., 1913, 188).

The silicon employed in the original process for the purpose of eliminating the free carbon from the filaments of silicon carbide is wholly or partly replaced by boron, by which means, it is stated, filaments of varying resistance and luminosity are produced.—W. E. F. P.

Filaments for electric incandescence lamps; Process for the manufacture of ——. E. Morsaint. Fr. Pat. 447,426, Aug. 21, and First Addition, Aug. 23, 1912.

In a process for the manufacture of filaments consisting of agglomerated crytals of silicon carbide and silicon, or of the former substance only, a paste composed of amorphous or crystalline silicon carbide and silicon and a combustible binding agent of which the content of "fixed" carbon is known (*e.g.* a mixture of sugar and gum) is extruded through a die in the ordinary manner; after being slowly dried, "stoved" and heated in an electric furnace at a temperature sufficient to cause the residual carbon of the binding agent to combine with a portion or the whole of the free silicon present (according to the proportions employed), the filaments are very slowly cooled to effect intermolecular crystallisation of the constituents.—W. E. F. P.

Incandescence bodies; Manufacturing ——. W. Bruno, Berlin. U.S. Pat. 1,051,677, Jan. 28, 1913.

See Fr. Pat. 403,433 of 1909; this J., 1910, 13.—T. F. B.

Electric glow-lamps; Method of regenerating ——. E. A. Krüger, Seehausen, Assignor to S. Bloch, Charlottenburg, Germany. U.S. Pat. 1,052,065, Feb. 4, 1913.

See Eng. Pat. 16,230 of 1911; this J., 1912, 117.—T. F. B.

Filaments for electric incandescence lamps; Manufacture of ——. The "Z" Electric Lamp Manufacturing Co., Ltd. Fr. Pat. 447,323, Aug. 9, 1912. Under Int. Conv., Aug. 14, 1911.

See Eng. Pat. 18,392 of 1911; this J., 1912, 865.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Determination of natural asphaltum in presence of artificial asphaltum. Marcusson. *See* IIa.

Patent.

Purification of hydrocarbons [paraffins, benzene, terpenes] by means of charcoal and oxygen. Addition to Fr. Pat. 421,277. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

Sulphanilic acid and its hydrates; Solubility of —— J. C. Philip. Chem. Soc. Proc., 1913, **29**, 28.

The solubility of sulphanilic acid has been determined at temperatures between 0° and 55° C., and the resulting curve exhibits two breaks, corresponding with changes in the character of the solid which is in equilibrium with the saturated solution. The solids which are successively stable in contact with the saturated solution are the dihydrate, monohydrate, and anhydrous acid respectively, and the temperatures at which the transitions occur are 21° and 40° C. The dihydrate of sulphanilic acid is an efflorescent substance which loses all its water rapidly and regularly under conditions in which the monohydrate is unchanged, or is dehydrated with extreme slowness. This observation indicates that the water molecules in the dihydrate and in the monohydrate are attached in different ways.

Phenazine. F. Kehrmann and E. Havas. Ber., 1913, **46**, 341—352.

Considerable quantities of phenazine may be readily prepared by the following process: 10 grms. of *o*-amino- and 16—17 grms. of *o*-nitro-diphenylamine are intimately mixed with 15 grms. of anhydrous sodium acetate and cautiously heated in a distilling flask. At about 250° C. a vigorous reaction sets in, with violet evolution of steam, the temperature rising to 300° C. The mixture is kept boiling for a time, and when the reddish brown vapours of the nitro-compound have disappeared and drops of yellow phenazine condense on the walls of the flask, the temperature is raised, and the phenazine distilled over, the first portion, containing some unaltered nitro-compound, being collected separately. The chief quantity of the distillate is triturated with a little alcohol and drained with the aid of the pump. A somewhat better yield is obtained if the phenazine is distilled over with superheated steam. A yield of 60—70 per cent. of the theoretical yield of phenazine is obtained, on the assumption that 2 mols. of the nitro-compound and 1 mol. of the amino-compound condense to form 3 mols. of phenazine, with elimination of 4 mols. of water. A number of derivatives were prepared from phenazine obtained in this way, viz., methylphenazonium salts, salts of 3-aminomethylphenazonium (the analogue of aposafranine), 1.3-dinitrophenazine, dinitrodihydrophenazine, 2-nitrophenazine and 2-aminophenazine.—A. S.

Dyestuffs and pigments; Rapid testing of the fastness to light of ——. K. Gebhard. Z. angew. Chem., 1913, **26**, 79—81.

The author criticises strongly the proposal of Bancroft (this J., 1912, 866) to make use of oxidation by means of persulphates or hydrogen peroxide as a means for the rapid determination of fastness to light. He points out that the fading of dyestuffs by photochemical oxidation (see this J., 1910, 84, 691) is a very different phenomenon from oxidation by means of oxidising agents, for while in the latter case atomic oxygen is the active agent, in the former, on the other hand, the oxidation is effected by molecular oxygen, which may either: (a) in the absence of moisture form a peroxide, or (b) in the presence of moisture, interact with the water ions and lead to the formation of a relatively labile peroxide-hydrate. It is this labile peroxide-hydrate which causes fading by intermolecular oxidation. The case is parallel with the numerous reactions which take different courses in the presence or absence of light, chlorination and bromination for example, the effect of the presence or absence of moisture being also parallel in the two series. That the same oxidising agent can act in two ways is shown by treating New Blue R with hydrogen peroxide. The solution is decolourised on standing in the dark, whereas in the presence of light the intensely coloured peroxide is formed. These differences are explained by the author according to the theory of ionised valencies, by which means he also explains the fact that Methylene Blue is faster against oxidising agents in the dark than Methylene Green (the nitro-derivative of Methylene Blue), whereas in the presence of light the reverse is the case.—J. B.

Fastness to light of pigment colours from coal tar dyestuffs. Krais. *See* XIII.

PATENTS.

Chromium compounds of [hydr]oxyanthraquinone sulphonic acids ; Manufacture of —— and of colouring matters, inks, colour lakes, and the like, therefrom. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7892, April 1, 1912.

By heating hydroxyanthraquinonesulphonic acids or their salts with chromium salts, intensely coloured compounds are obtained, which are very readily soluble in water, and cannot be precipitated from their aqueous solutions by addition of indifferent salts ; they can, however, be obtained in the solid state by evaporation *in vacuo* or by adding certain organic substances, such as ethyl alcohol, to their aqueous solutions. The same compounds may be obtained by treating with chromium fluoride the soluble salts prepared according to Eng. Pat. 1117 of 1878 by neutralising free alizarinsulphonic acid or purpurinsulphonic acid with chromium oxide. The new compounds may be used for the preparation of inks, colour lakes, etc. The lakes may be obtained by precipitation on a substratum or by forming the chromium compound in presence of a substratum, and then, if necessary, precipitating by means of an alkaline substance. Further, fast prints may be obtained on the fibre by applying the above chromium compounds and then fixing by means of steam or an alkaline reagent. The compounds are of widely differing shades, for example, that from 1-hydroxyanthraquinone-6-sulphonic acid is orange-red, from 1.4-dihydroxyanthraquinone-6-sulphonic acid violet-blue, and from 4-nitro-1.5.8-trihydroxyanthraquinonedisulphonic acid blue-green.—T. F. B.

Azo colour. K. Desamari, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,051,565, Jan. 28, 1913.

Diazotised 5-nitro-2-anisidine is combined with acetoacetic acid-*o*-chloroanilide. The product is insoluble in water and is said to furnish valuable colour lakes.—T. F. B.

Indophenols ; Process for producing derivatives of —— and sulphide dyestuffs. Farbwerk Mühlheim vorm. A. Leonhardt und Co. First Addition, dated Aug. 31, 1912, to Fr. Pat. 445,060, June 15, 1912. Under Int. Conv., April 20, 1912.

A new series of indophenolic compounds is obtained by condensing with aromatic amines the products obtained by oxidising the condensation products of carbazole-indophenols described in the principal patent (see this J., 1912, 1174). Again, a further series of new compounds is obtained by the action of phenols or naphthols or their substitution products on the indophenols derived from carbazole. In either case the new compounds can be converted into sulphide dyestuffs, which are of blue shades, and mostly very fast.—T. F. B.

Vat dyestuffs ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 447,592, Aug. 23, 1912. Under Int. Conv., Sept. 7, 1911.

The arylido-halogen-quinones are converted into vat dyestuffs by treatment with sulphur and sodium sulphide, or with metallic sulphides or sulphydrates alone. Such substances as dianilino-dichloroquinone, dihalogendianilino-dichloroquinone, or the products obtained by the action of chloranil on naphthylamines, etc., may be used. The dyestuffs give various shades of brown from the hydrosulphite vat.—T. F. B.

Vat dyestuffs of the anthracene series and process for making them. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 447,774, Nov. 6, 1911.

The halogen derivatives of anthraquinone-2.3-thioxanthones, $C_{14}H_6O_2{<}\substack{S\\CO}{>}R$ (where R is a benzene, naphthalene, or anthraquinone radical) are condensed with mono- or diaminoanthraquinones or their substitution products. The thioxanthones mentioned may be prepared either by condensing 2-halogenanthraquinone-3-carboxylic acids with halogenated arylmercaptans, or by halogenating the unsubstituted thioxanthones. The dyestuff from anthraquinone-2-bromo-3-carboxylic acid. *p*-chlorothiophenol, and *a*-aminoanthraquinone dyes cotton fast reddish-brown shades from the hydrosulphite vat.—T. F. B

Disazo dyes. K. Desamari, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,051,136 and 1,051,137, Feb. 4, 1913.

See Eng. Pat. 21,201 of 1910 ; this J., 1911, 1108.—T. F. B.

Trisazo dyes. A. Blank, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,051,859 and 1,052,031, Feb. 4, 1913.

See Fr. Pat. 430,527 of 1911 ; this J., 1911, 1306.—T. F. B.

Azo dye. K. Desamari, O. Günther, and H. Schweitzer, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,052,135, Feb. 4, 1913.

See Eng. Pat. 21,202 of 1910 ; this J., 1911, 1108.—T. F. B.

Vat dye. W. Bauer, Vohwinkel, A. Herre, and R. Mayer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,051,856, Feb. 4, 1913.

See Ger. Pat. 247,321 of 1911 ; this J., 1912, 678.—T. F. B.

[Anthracene] dyestuffs dyeing violet to blue shades on wool ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 447,196, Aug. 13, 1912. Under Int. Conv., Aug. 30, 1911.

See Eng. Pat. 26,944 of 1911 ; this J., 1912, 1025.—T. F. B.

[Azo] dyestuffs and their production. H. Levinstein and J. Baddiley, Blackley, Assignors to Levinstein, Ltd., Manchester. U.S. Pat. 1,052,262, Feb. 4, 1912.

See Fr. Pat. 425,388 of 1911 ; this J., 1911, 886.—T. F. B.

Ketodihydrobenzo-p-thiazine ; Compounds derived from —— and process of making them. Act. Ges. f. Anilinfabr. Fr. Pat. 447,179, Oct. 19, 1911.

See Ger. Pat. 243,196 of 1910 ; this J., 1912, 325.—T. F. B.

[Azo] dyestuffs for cotton ; Process for preparing violet ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 447,199, Aug. 13, 1912.

See Eng. Pat. 18,648 of 1912 ; this J., 1912, 1073.—T. F. B.

Aminoazobenzene, its homologues and analogues ; Process for making acetyl compounds of ——. Kalle und Co. A.-G. Fr. Pat. 447,644, Aug. 26, 1912.

See Ger. Pat. 253,884 of 1912 ; this J., 1913, 79.—T. F. B.

Pigment. U.S. Pat. 1,052,145. *See* XIII.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cotton, wool, and silk in mixed fabrics ; Quantitative determination of ——. V. Villavecchia and A. Cappelli. Rev. Gen. Mat. Col., 1913, **17**, 33—37.

The methods employed by the authors in the Italian excise laboratory are described and compared with certain other methods which have been proposed. The authors adopt the plan of making direct determinations of all the fibres and of the moisture, calculating the finish, the loading, the colouring matter and the losses together by difference. This value is then distributed proportionally among all the fibres present, whilst the moisture is distributed in the proportion of the normal moisture coefficients of the various fibres. These coefficients, expressed as percentages of the dry fibres, are : cotton, 8·11 ; wool, 12·36 ; silk, 9·29 ; weighted silk, black, 13·64 ; weighted silk, white and coloured, 9·89. *Determination of cotton.*—5 grms. of the fabric are boiled for 15 minutes with 100 c.c. of 1 per cent. sodium carbonate. The fabric is washed, treated with 100 c.c. of a 10 per cent. solution of potassium hydroxide, and heated until all the animal fibre is dissolved. The residue is washed, boiled for 15 minutes with 100 c.c. of water, washed finally with alcohol and ether, and weighed after drying at 100°—105° C. *Determination of wool.*—5 grms. of the fabric are boiled for 15 minutes with 100 c.c. of 1 per cent. sodium carbonate ; it is washed and digested for 2 hours in cold sulphuric acid of sp. gr. 1·671 (74·7 per cent.). The residue is thoroughly washed, boiled for 15 minutes in 100 c.c. of water, washed with alcohol and ether and dried. *Determination of silk.*—5 grms. of the fabric are boiled with sodium carbonate, as above, and washed ; the material is again boiled for 15 minutes with distilled water, washed with alcohol and ether, and dried at 100°—105° C. The purified fabric is then weighed (P) and plunged for one minute into 100 c.c. of a boiling solution of zinc chloride (sp. gr. 1·711) ; the residue is washed with slightly acidulated water, then with pure water, alcohol, and ether, and finally dried and weighed (P′). The percentage of silk is calculated by the formula $\frac{(P—P') \times 100}{5}$. Instead of zinc chloride, Löwe's reagent may be employed for dissolving the silk, an immersion of 2—3 hours being allowed ; preferably two determinations, one in each way, should be made. The results are calculated in the following manner : Let U=percentage of moisture ; A=sum of the dressing and colouring matters ; f_1,f_2,f_3=the percentages of dry fibres found ; $K_1,K_2.K_3$= the coefficients of moisture of the dry fibres, and X_1,X_2,X_3 =the percentages of the respective fibres together with their dressing, colouring, and moisture, then $X_1 = \frac{f_1(100—U)}{100—U—A} + \frac{Uf_1k_1}{f_1k_1+f_2k_2+f_3k_3}$ and X_2 and X_3 are imilarly found by substituting the respective values of and k in the numerators of the above equation. This method of making direct determinations of all the fibres nd distributing the dressing, colouring, and moisture etween them possesses the advantage of affording results irectly comparable with those obtained by unravelling he fabric.—J. F. B.

elenium in sulphite pulp digestion liquor ; The presence of ——. P. Klason and H. Mellquist. Papierfabrikant, 1913, **11**, 145—148.

a previous paper (this J., 1910, 343) the injurious tion of minute quantities of selenium in the digestion acid " was described. The presence of selenium may detected by the red precipitate formed on acidification th hydrochloric acid, for which purpose it is desirable eviously to concentrate a sufficient quantity of the acid " and remove most of the calcium salts. In actice, the " acid " may contain organic matters which erfere with the recognition of the red colouration ; such cases the test is best made by burning the precipitate as described below. The quantitative determination of the selenium is carried out in the following manner :—One litre of bisulphite liquor containing selenium is evaporated until the free sulphurous acid is expelled. Evaporation is continued, with addition of hydrochloric acid sufficient to prevent the separation of calcium sulphite, until the volume is reduced to 200—300 c.c. The liquid is transferred to a beaker, made distinctly acid with hydrochloric acid and boiled until the last trace of sulphur dioxide is removed. After adding some stannous chloride and again boiling, the beaker is set aside with a cover for 24—48 hours. The liquid must not be too acid nor too highly concentrated, otherwise calcium sulphate may cause trouble. The deposit of selenium is collected on a tight asbestos plug in a sublimation tube, and after the tube has been thoroughly dried, the selenium is burnt to selenious acid which is determined volumetrically with iodine in the manner described previously (this J., 1910, 375). The results are slightly below the true values, but the authors failed to find a more suitable method for the purpose in view. In the case of technical digestion liquors, samples of 3 or 5 litres are evaporated and reduced in separate quantities of 1 litre each, the deposits being united on the filter. The presence of selenium is disguised by the organic matter until the deposit in the sublimation tube is burnt, when a red powder of selenious acid with characteristic odour is obtained. Typical digestion " acids " showed 0·013—0·019 mgrm. of selenium per litre. The sharpest method for testing whether the quantity of selenium present is sufficient to induce serious changes in the composition of the liquor consists in heating some of the liquors in a sealed tube from which the air has been displaced by carbon dioxide. The tube is heated in a bath of boiling xylene at 137° C. for 15 hours, and the alteration in composition, owing to the formation of calcium sulphate, is ascertained. The liquor showing 0·019 mgrm. of selenium per litre on analysis was found to undergo considerable deterioration on heating. In the sulphite pulp mills, no selenium deposit was found on the stones of the acid apparatus nor in the sludge in the acid chamber. All the selenium volatilised from the ore must therefore either go into the liquor or escape partially into the air. Washing the gases with sprays of water in a tower, before absorbing them, failed to remove the selenium entirely, and even with the most effective washing apparatus, some of the selenium in the ore will enter the digestion " acid," causing troubles the extent of which will depend on the quantity so passing.—J. F. B.

Viscose and formylcellulose ; Artificial products from ——. G. Bonwitt. Z. angew. Chem., 1913, **26**, 89—91.

The manufacture of moulded masses, films, bottle caps, etc. from viscose, as carried out in Germany, is described. The massive solids are prepared in the following manner :—The cellulose xanthogenate resulting from the action of carbon bisulphide on alkali-cellulose is left to mature at rest for one or two days, the granular mass is worked up for about an hour in a kneading machine and allowed to remain another 24 hours at rest. The homogeneous paste is forced through a cording press to eliminate air bubbles and is then charged direct into pipes or receivers in which it is dried for 24—36 hours at a temperature of 30° C. During this treatment, the cellulose xanthogenate is decomposed and cellulose is produced. The heating is performed in closed vessels to prevent frothing by the evolution of carbon bisulphide and deformation of the mass. The solids so produced next undergo lixiviation by a special process and then consist of pure cellulose of rubber-like consistence. The products are dried in vacuum chambers with special precautions to prevent deformation, which very readily occurs with uneven drying. All kinds of inert and colouring matters suitable for particular purposes may be incorporated with the viscose paste. The moulded masses may be polished by dipping them in a 10 per cent. solution of viscose and fixing the film by heating at 100° C., and they may be waterproofed by similar treatment with a solution of nitrocellulose or cellulose acetate. Films, dialysers and solid articles are also produced from formylcellulose. The only factory at which this process is worked is at Sydowsaue, and the raw material is hydrated cellulose in the form of artificial silk waste. This is readily dissolved by 90—95 per cent. formic acid yielding pure cellulose triformate. The product of the reaction is dissolved in hot lactic acid and, after distilling off the formic acid, a clear ropy syrup is obtained which solidifies on exposure to the air to a plastic solid. According to another process which is also worked, the solution of cellulose formate is precipitated by amyl acetate, amyl formate or alcohol or a mixture of a hydrocarbon and alcohol. A tough plastic mass is thereby deposited which may be worked up in the usual way with camphor or camphor substitutes. —J. F. B.

Paper ; New sources of supply for the manufacture of ——. C. Beadle and H. P. Stevens. J. Roy. Soc. Arts, 1913, **61**, 347—363.

AFTER alluding to the fact that the supply of pulp wood, particularly in the United States, is showing material signs of exhaustion, the authors pass in review the records of recent investigations of proposed new sources of supply of papermaking fibres. They refer principally to the investigations carried out by the U.S. Forest Service at Wausaw on the utilisation of coniferous woods of inferior quality (this J., 1913, 132) ; Raitt's investigations on bamboo (this J., 1912, 870, 1025) ; cotton seed hull fibre ; bagasse, particularly the McMullen process of shredding as carried out in Cuba ; Brand's investigations on American crop plants (this J., 1912, 120), and finally more fully, to their own experiments with *Hedychium coronarium* (this J., 1912, 870). The extraordinary development of this plant in Brazil is described and the authors have also carried out experiments with plants grown at Kew. The papers prepared from Hedychium fibre are among the strongest hitherto recorded, equal or superior to the best manila papers, and are particularly suitable for the manufacture of paper yarns for textile purposes. The following table has been compiled by the authors to give a comparative survey of the possible importance of the principal new papermaking materials now undergoing development.

Plant.	Acres under cultivation.	Tons per acre per annum of dry raw material.	Tons of raw fibre per annum on total area.	Percentage yield of pulp on dry raw material.	Tons of pulp per acre per annum.	Tons of pulp per annum on total area.
Cropped once a year—						
1. Corn stalks	30,000,000	1·0	30,000,000	12—18	0·12	3,600,000
2. Broom corn	178,000	3·0	450,000	32—40	1·00	150,000
3. Rice straw	720,000	2·0	1,500,000	35	0·70	500,000
4. Flax straw	2,000,000	1·0	2,000,000	30	0·30	600,000
5. Cotton-hull fibres	—	—	150,000	75	—	112,000
6. Cotton stalks	10,000,000	0·45	4,500,000	35—40	0·15	1,500,000
7. Hemp straw	—	5·0	—	20	1·00	—
8. Hedychium	—	6—10	—	60	4·00	—
Cropped every 5 years—						
9. Bamboo (Pearson, Sindall)	—	$\frac{15}{5}$	—	45	1·35 to 1·57	—
10. Bamboo (Pearson, Raitt)	—	$\frac{8}{5}$ to $\frac{18}{5}$	—	45		—
Cropped every 40 years—						
11. Pulp wood	—	$\frac{16 \text{ cords}}{40}$	—	4	0·20	—

—J. F. B.

Grass (Imperata cylindrica, P.B.) from Tripoli ; Utilisation of ——. F. Vignolo-Lutati. L'Ind. Chim., 1913, 13, 17—20.

THE grass, *Imperata cylindrica*, P.B., var. *europaea*, Anderss. (*Lagurus* L., *Saccarum* Lam., *I. arundinacea* Cyr.), which grows abundantly in Tripoli, bears considerable similarity to esparto (*Lygeum spartum*, L.) and alfa (*Stipa tenacissima*, L.). Laboratory experiments indicate that it would prove equally useful as the plants mentioned as a raw material for paper manufacture. The air-dried leaves yield more than 40 per cent. of their weight of cellulose, similar in character to that obtained from alfa or esparto. —A. S.

Parchment papers containing magnesium chloride ; Influence of heat and storage on ——. C. Bartsch. Mitt. K. Materialprüf., 1913, 30, 400—404.

IN 1907 the author conducted experiments on the effect of heat on parchment papers containing magnesium chloride, testing their strength comparatively with that of the same papers similarly treated after washing out the salt. Those experiments showed that heating for 15 days at 30° C. had no injurious effect upon the tensile strength and elongation, but reduced the resistance to creasing to some slight extent. Heating for 3 days at 60° C. produced profound changes in the papers containing magnesium chloride, whilst heating for 30 days at the same temperature practically destroyed them. The author placed the papers away for 4 years and now publishes the results of tensile and creasing tests which show the influence of storage. The papers containing magnesium chloride showed, after 4 years' storage, a slight increase in tensile strength and a slight decrease in elongation. The differences were small and are attributable to slight changes in hygroscopic moisture. Similar results were recorded with the papers freed from magnesium chloride. The tests for resistance to creasing showed, however, very large losses as the result of storage. In the case of the papers containing magnesium chloride, the losses of resistance ranged from 65 to 88 per cent., whilst in the case of the papers free from salts the losses ranged from 50 to 59 per cent. The author concludes that exposure to a temperature of 30° C. for 15 days is not a sufficiently severe test to indicate the probable deterioration of such papers during storage, and that a test by heating at 40°—45° C. for 10 days might give a more accurate measure of the probable change.—J. F. B.

Hydration in paper making processes. C. Beadle and H. P. Stevens. *See* Liverpool Section, p. 217.

PATENTS.

Husking kernels or seeds and obtaining products therefrom. [Preparing the kernels of " St. John's bread " for use in the textile industry.] A. Heinemann, Worms, Germany. U.S. Pat. 1,051,582, Jan. 28, 1913.

THE kernels of "St. John's bread" (carob) are prepared for use in the textile industry by treating them with 75 per cent. sulphuric acid in order to dissolve the husks, the mixture being stirred at ordinary temperatures for several hours. The liquor, containing the dissolved husks, is withdrawn, diluted with water, and the precipitated product is separated from the diluted liquor ; the precipitated product and the husked kernels are finally washed and dried.—B. N.

" St. John's bread " or carob tree ; The husking of kernels or seeds of the —— *and the obtainment of products [for use in the textile industry] therefrom.* J. Y. Johnson, London. From Chem. Fabr. Dr. Adolf Heinemann, Worms on Rhine, Germany. Eng. Pat. 2756, Feb. 2, 1912.

SEE U.S. Pat. 1,051 582 of 1913 ; preceding.—T. F. B.

Flax; Treatment of waste ——. A. Kube, Walditz, Germany. Eng. Pat. 10,422, May 2, 1912.

See Fr. Pat. 443,205 of 1912; this J., 1912, 1026.—T. F. B.

Wool washing and degreasing machine. J. Baudot, Tourcoing, France. U.S. Pat. 1,051,944, Feb. 4, 1913.

See Fr. Pat. 413,442 of 1910; this J., 1910, 1102.—T. F. B.

Preparation of ammonium sulphate [*and glycerin, from distillery vinasse, etc.*] Additions to Fr. Pat. 442,923. *See* VII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Bleaching of cotton with hypochlorite solutions; Formation of chloramines in the ——. R. E. Crowther. J. Soc. Dyers and Col., 1913, **29**, 38—40.

Resist-marks which occurred in cotton piece-goods dyed with a substantive dyestuff were found to be due to oxycellulose, the cause of the production of which has not yet been explained. The spots were found to be associated with small nuclei which had the appearance of cotton husk or stalk, and which gave lignocellulose reactions. The high nitrogen content of these nuclei, and the fact that the cloth when bleached without chlorine did not show the resist-marks, indicate the formation of chloramines as the cause of the trouble. Experiments with unscoured grey yarn did not support this view, however, and if the nitrogenous constituents of cotton form chloramines at all, these chloramines are quite different from those formed when unscoured linen is treated with hypochlorites, for they are completely removed by prolonged washing with water. It was also noticed that unscoured grey yarn which had been treated with hypochlorite and then thoroughly washed, showed a strong tendency to become discoloured on steaming. This was entirely prevented by thoroughly scouring before treating with hypochlorite. The importance of thorough scouring before chemicking is emphasised by this experiment, in contrast to the view of Erban (Färber-Zeit., 1912, 370), although the author's nitrogen determinations showed that this yellowing on steaming was not a function of the nitrogen content of the cotton. Further experiments are being made on the action of hypochlorites on the colouring matter of Egyptian cotton. In the discussion Knecht said that wool which had been treated with chlorine and then well washed, retained for a long period the property of decomposing potassium iodide. Ermen stated that the omission of washing between chemicking and souring caused linen collars to turn yellow on ironing.—J. B.

Blacks; Distinguishing direct and developed —— *from sulphide or Aniline Blacks on dyed cotton.* G. E. Holden. J. Soc. Dyers and Col., 1913, **29**, 36.

The pattern to be tested is singed in a Bunsen flame, or ignited, and, after extinguishing, the colour of the burned portion observed. The substantive, developed, and coupled blacks give a light brown colouration, while the sulphide dyestuffs and Aniline Blacks give a faint black-brown.—J. B.

Alizarin Viridine; Note on the fixation of ——. J. R. Hannay. J. Soc. Dyers and Col., 1913, **29**, 36—38.

Alizarin Viridine when printed with the quantity of chrome mordant usually found sufficient for dyestuffs of this class gave results which did not satisfy the highest requirements as to fastness to soaping. By increasing the quantity of mordant to a minimum of 1·5 volumes of chromium acetate (6—7 per cent. Cr_2O_3) for each volume of dyestuff paste, shades were obtained which withstood severe soaping. The newer brands of the dyestuff behave in the same way.—J. B.

Neutral salt reactions. Procter. *See* VII.

Patents.

Dyeing-machine. H. A. Noar, Philadelphia, Pa. U.S. Pat. 1,052,168, Feb. 4, 1913.

A hank dyeing machine in which the liquor is caused to circulate horizontally by means of a pump, uniform distribution of the liquor being secured by connecting the entrance and exit pipes with two end chambers, separated from the main body of the vat by perforated plates. The hanks are kept in a vertical position by means of a pair of spaced sticks, which are caused to rotate by suitable mechanism.—J. B.

Dyeing machine; Raw stock ——. Z. E. Noah, Greensboro', N.C. U.S. Pat. 1,052,371, Feb. 4, 1913.

The machine consists of a series of compartments each of which is fitted with (a) a double, endless belt of wire mesh by means of which the loose cotton is circulated in the dye-vat, (b) a pair of squeezing rollers for removing excess dye-liquor, and (c) a second set of endless belts, fixed at an inclined position to the vat, by means of which the dyed cotton is circulated in the air for the purpose of oxidising the colour. This series of operations is repeated in each successive compartment.—J. B.

Resist effects under vat dyestuffs; Production of ——. The Calico Printers Association, Manchester, and B. Davenport, Hyde. Eng. Pat. 8738, April 13, 1912.

A new resist paste for vat dyestuffs consists mainly (at least 50 per cent. by volume) of resinous and/or fatty substances, incorporated with which are salts of heavy metals. The object of these latter is to secure thorough penetration of the fibre, the water-soluble salts of lead and copper having been found to be the most suitable. The incorporation is brought about by melting together resin and/or its equivalent and stearic acid or its equivalent, together with a suitable solvent, for example turpentine, and pouring this mixture into a solution of the metallic salt, suitably thickened. The resist is applied preferably by a roller printing machine. The invention consists in a combination of the use of the new resist paste, together with the use of a roller vat in the subsequent dyeing operation.—J. B.

Mercerising stockings or similar knitted and woven goods; Means for ——. B. Müller, Chemnitz, Germany. Eng. Pat. 2141, Jan. 26, 1912.

See Fr. Pat. 433,115 of 1911; this J., 1912, 124.—T. F. B.

Vat-dyeing machine. A. Ashworth, Bury. U.S. Pat. 1,052,399, Feb. 4, 1913.

See Eng. Pat. 24,434 of 1910; this J., 1911, 1310.—T. F. B.

Dyeing vegetable fibres with halogenated indigo dyestuffs; Process for ——. L. Cassella und Co. Fr. Pat. 447,629, Nov. 2, 1911.

See U.S. Pat. 1,029,066 of 1912; this J., 1912, 638.—T. F. B.

Brown resists on the vegetable fibres of articles dyed by the Prud'homme process; Process for producing fast ——. C. Pilz, Liesing, Austria. Eng. Pat. 26,576, Nov. 28, 1911. Under Int. Conv., Dec. 19, 1910.

See Ger. Pat. 242,611 of 1911; this J., 1912, 280.—T. F. B.

Drying sized yarns and warps; Apparatus for ——. A. N. Marr, Thorner, near Leeds. U.S. Pat. 1,052,074, Feb. 4, 1913.

See Eng. Pat. 1303 of 1911; this J., 1912, 68.—T. F. B.

Method of treating chlorides of carbon. Eng. Pat. 7259. *See* XX.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Ammonia ; Catalytic oxidation of ——. II. D. Meneghini. Gaz. chim. ital., 1913, **43**, I., 81—90.

The author has carried out further experiments on the catalytic oxidation of ammonia (see this J., 1912, 383). A mixture of air and ammonia vapour containing a slight excess of ammonia above that required according to the equation: $4NH_3+5O_2=4NO+6H_2O$, was passed over the catalyst at the rate of about 20 litres per hour at temperatures between 300° and 650° C., and the percentage of available oxygen combined was determined. A summary of the results is given in the following table, the catalysts used being: (*a*) burnt pyrites containing 0·53 per cent. of copper, (*b*) ferric oxide, (*c*) chromic oxide, (*d*) manganese dioxide, (*e*) oxides of rare earths (mainly neo- and praseodymium and lanthanum) from monazite, after separation of the thorium, and (*f*) cerium dioxide.

Percentage of available oxygen combined.

Temp., °C.	*a*	*b*	*c*	*d*	*e*	*f*
300	22·5	5	16	7	10	5
350	52·5	12·5	35	17	21·5	7·5
400	75	23	—	29	40	16·5
450	90	35	—	41·5	60	28·5
500	97·5	43	—	52	78	47·5
550	99	51	97·5	60	87	66·5
600	—	56·5	—	65·5	94	76·5
650	—	60	—	70	97·5	84

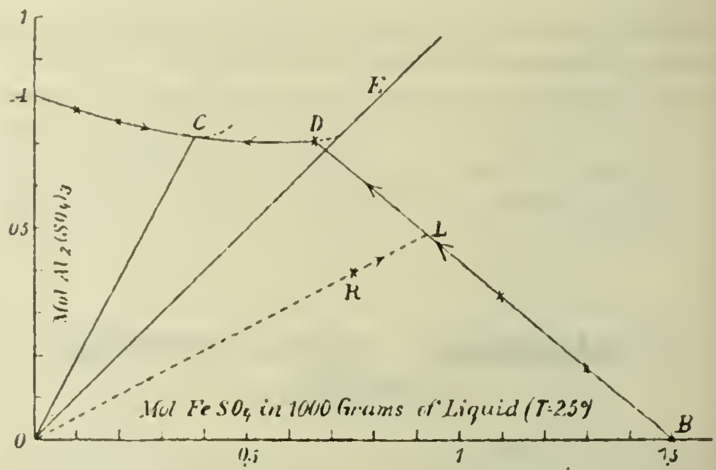
A few experiments, in which the reaction products were absorbed in concentrated sulphuric acid and the total nitrogen, ammonia, and nitrous acid determined, showed that even at relatively low temperatures there is a not inappreciable loss of nitrogen; this loss is diminished by increasing the velocity of the current of gas, and is greater with catalysts which become active only at the higher temperatures. (See also this J., 1912, 280.)—A. S.

Borates. The system, boric acid, ammonia, and water, at 30° C. U. Sborgi. Atti R. Accad. dei Lincei, Roma, 1912, **21**, II., 855—859; 1913, **22**, I., 90—95.

The author has applied the phase rule to the study of the compounds formed by the interaction of boric acid and ammonia in aqueous solution. Weighed quantities of boric acid were mixed with measured quantities of ammonia solution and water, both free from carbonic acid, and the mixtures were maintained at 30° C. in a thermostat, with agitation, until equilibrium was attained. The solid and liquid phases were then analysed separately, and the results were plotted in a triangular diagram. It was found that in aqueous solution at 30° C. the only two compounds of ammonia and boric acid formed are: $(NH_4)_2O,5B_2O_3,8H_2O$ and $2(NH_4)_2O,4B_2O_3,5H_2O$.—A. S.

Aluminium salts ; Crystallisation of pure —— from solutions containing iron, and the artificial preparation of halotrichite [$FeSO_4,Al_2(SO_4)_3,24H_2O$]. F. Wirth. Z. angew. Chem., 1913, **26**, 81—83.

Aluminium sulphate free from iron is largely used in the dyeing industry and for the preparation of sizes for paper. At the present time aluminium sulphate solutions are freed from iron by a troublesome precipitation process. The author's experiments show that pure aluminium sulphate cannot be obtained by crystallisation from solutions containing ferric sulphate, as the two sulphates form solid solutions or absorption compounds. This is not the case, however, with aluminium sulphate and ferrous sulphate, and a study of the ternary system composed of these two sulphates and water at 25° C. has shown that under definite conditions of concentration and temperature, pure aluminium sulphate can be obtained directly by crystallisation from solutions containing ferrous sulphate. The equilibrium diagram of the system is shown in the figure, AC representing the solubility of aluminium sulphate in presence of ferrous sulphate, BD the solubility of ferrous sulphate in presence of aluminium sulphate, and CD the solubility of ferrous aluminium sulphate (halotrichite), $FeSO_4,Al_2(SO_4)_3,24H_2O$. By the evaporation at 25° C. of solutions of aluminium sulphate and ferrous sulphate, the composition of which is represented by a point within the triangle, OAC, crystals of pure aluminium sulphate are obtained. Any ferric iron in the solution should first be reduced by hydrogen, sulphur dioxide, hydrogen sulphide, or the like, and crystallisation is preferably effected in a reducing atmosphere. The equilibrium diagram given also affords an explanation of the fact that no separation of halotrichite occurs when saturated solutions of aluminium and ferrous sulphates are mixed. A mixture of equal quantities of the two solutions has the composition represented by the point, R, *i.e.*, it is unsaturated.—A. S.



Ferric salts and thiosulphates ; The reaction between ——. J. T. Hewitt and G. R. Mann. Chem. Soc. Proc., 1913, **29**, 30.

The authors have studied the reduction of solutions of ammonia ferric alum by sodium thiosulphate and of other ferric solutions made up with the alum and potassium thiocyanate, phenol, or acetoacetic ester. The rate at which ammonium ferrisulphate reacts is slower than that shown by ferric chloride: the iron probably forms part of a negative complex. The reactions measured proved to be all of the fourth order.

Gold salts ; Delicate colour reactions of ——. J. E. Saul. Analyst, 1913, **38**, 54.

When one volume of a 0·1 per cent. solution of certain aromatic reducing agents, such as quinol, pyrogallol, etc., is added to 10 vols. of a solution containing 0·002 per cent. of auric chloride, a violet colloidal solution of gold is produced in the course of two minutes. The colours vary according to the reagent used and the strength of the solution, those yielded by metol (the methyl ether of *p*-aminophenol) and quinol being particularly fine. *p*-Phenylenediamine gives a dark yellowish-green solution, which after a time undergoes further colour changes, and this reaction, being specially delicate, is suggested as a test for traces of gold salts, for which purpose one volume of a 0·1 per cent. solution of *p*-phenylenediamine is added to 10 vols. of a solution containing 0·0005 per cent. of gold chloride; a distinct greenish-yellow colouration is observed even with a solution containing only 0·0001 per cent. of the gold salt.—F. Sodn.

Silver chloride and silver bromide ; Determination of the degree of dissociation of molten ——. G. Schulze. Z. Elektrochem., 1913, **19**, 122—126.

When soda glass is immersed in molten silver chloride or bromide, silver ions diffuse into the glass in exchange for sodium ions (see this J., 1912, 490). The amount of silver which enters the glass, under otherwise similar conditions, is directly proportional to the concentration of silver ions in the melt, so long as this is small, but the proportionality factor cannot be obtained with the pure halide. If a little sodium chloride or bromide is added to the silver halide, the diffusion of silver into the glass diminishes considerably even with only such small additions as 1 per cent. of sodium salt. By determining the extent of this diminution and applying the law of mass action, it has been possible to calculate the proportionality factor, and hence the degree of dissociation of the pure silver salts. At 461° C. it is between $1{\cdot}17\times10^{-3}$ and $1{\cdot}35\times10^{-3}$ for silver chloride, and at 450° C. it is $2{\cdot}35\times10^{-4}$ for silver bromide.—W. H. P.

Neutral salt reactions. H. R. Procter. J. Soc. Dyers and Col., 1913, **29**, 40—41.

If the observation of Arndt, confirmed by Fort (this J., 1912, 1030), that many neutral salts react alkaline to indicators at a high temperature is to be explained on the grounds of hydrolysis, then it must mean that the ionisation of the acid is less raised by heat than that of the base and consequently more depressed by the neutral salts present. No data in support of this are available. When, however, a weak base or a weak acid takes part in the equilibrium, the increased alkalinity observed by Fort (*loc. cit.*) and the increased acidity observed by Lloyd (this J., 1910, 1361) have long been known as a necessary consequence of the law of mass action. The amount of acid or alkaline reaction produced in this way is usually too limited to be of technical importance. When, however, a weak amphoteric substance is present, capable of forming ionisable salts, as in many proteins, skin, wool, and possibly cotton, the case is altered. The stronger acid or base replaces the weaker one in the protein salt, and all the effects may ensue which would be caused by the use of the stronger reagent itself. A practical application of this principle to the "pickling" ot skins has been discussed by the author (this J., 1912, 1193).—J. B.

Rare earths ; Sebacates and cacodylates of the ——. C. F. Whittemore and C. James. J. Amer. Chem. Soc., 1913, **35**, 127—132.

The sebacates of lanthanum, praseodymium, neodymium, samarium, and yttrium were prepared by precipitating solutions of the chlorides with ammonium sebacate, and their chief characters are described. The precipitation of the sebacate forms a means of separating, by a single operation, lanthanum, cerium, or neodymium from sodium or potassium.

The cacodylates of praseodymium, neodymium, and thulium were prepared by dissolving the respective hydroxides in cacodylic acid and crystallising. The yttrium salt was obtained by precipitating yttrium chloride with sodium cacodylate. Lanthanum and cerium cacodylates are very soluble, and hence extremely difficult to obtain pure. Attempts were made to separate the metals by fractionation of the cacodylates, but the results were not entirely satisfactory. Many of the cacodylates combine with the chlorides, etc., of the same metals, to form double salts, which are insoluble in water, and may be used for purposes of separation. Lanthanum chloride cacodylate, cerium chloride and sulphate cacodylates, and neodymium chloride cacodylate are described.—J. T. D.

Carbon monoxide ; Some properties of ——. R. W. Merriman. Chem. Soc. Proc., 1913, **29**, 33—34.

Carbon monoxide was prepared by slowly delivering pure formic acid below the surface of concentrated sulphuric acid kept at 60° C. The gas was passed through four Drechsel flasks containing 30 per cent. sodium hydroxide, and was collected over water in a large gas-holder. Although always described as an odourless and tasteless gas, this specimen had a perfectly definite metallic odour and taste. The idea occurred to the author that it might ontain a small quantity of the unknown formic anhydride. This substance would have the properties of an aldehyde. o the following experiment was performed. The gas was bubbled through a series of Drechsel flasks containing he following solutions : sodium hydroxide, decolorised osaniline, sodium hydroxide, again, Fehling's solution, nd ammoniacal silver nitrate. The decolorised rosaniline was not altered, but the silver nitrate and Fehling's solution were at once reduced. Carbon monoxide prepared from oxalic acid, from potassium cyanide, from sulphuric acid and sodium formate, and from lactic and malic acids, gave similar results. As a final test, 40 litres of carbon monoxide were prepared by slowly passing pure carbon dioxide through a tube 80 cm. long packed with charcoal heated to bright redness. In this experiment formic anhydride could not have been produced. The resulting gas was washed as before, and possessed the same properties. It follows that pure carbon monoxide possesses a perfectly characteristic odour and taste, and readily reduces Fehling's solution and ammoniacal silver nitrate solution. It has no action on decolorised rosaniline.

Neon ; Presence of —— in hydrogen after the passage of the electric discharge through the latter at low pressures. (Preliminary note.) J. N. Collie and H. S. Patterson. Chem. Soc. Proc., 1913, **29**, 22—23.

J. N. Collie had observed previously (see Ramsay, Nature, 1912, **89**, 502) that calcium fluoride under the action of cathode rays emitted a gas, and that the gas contained traces of neon. Since then many more experiments have been made, both with and without calcium fluoride, it being found that so long as there were traces of hydrogen in the tube, neon could always be detected in the gas that had been submitted to the passage of the electric discharge at low pressures. H. S. Patterson, approaching the research from another point of view, had obtained, independently, the same results, and it seemed best to publish the results in a joint paper. The experiments were carried out in an X-ray bulb or in an ordinary large-sized Plücker tube, the hydrogen being obtained either from sodium amalgam and boiled water, or by the electrolysis of barium hydroxide solution. After the hydrogen had been submitted to the electric discharge for several hours, at varying pressures from 1 mm. down to an X-ray vacuum, the pump being kept working most of the time, the collected hydrogen was mixed with excess of pure oxygen, prepared by heating potassium permanganate, and exploded. The residual oxygen was then introduced into an apparatus (invented by Sir W. Ramsay), where the oxygen could be absorbed by charcoal immersed in liquid air (and the authors take the opportunity of calling attention to this invaluable discovery of Sir J. Dewar, without which the neon in the gas could never have been detected) ; the residual gas was then driven up into a narrow capillary bore tube with a platinum wire sealed into the top. By freezing the mercury in the capillary tube, and then allowing a spark to pass through the gas from the mercury to the platinum wire, the spectrum of neon was always noticed. Great care was always taken to be sure that no air leaked into the apparatus during the experiment ; also careful tests were made to see that there was no air either in the hydrogen or the oxygen used, and blank experiments were always made by exploding large quantities of the oxygen and hydrogen employed, and unless the hydrogen had been submitted to the electric discharge, neon was always absent in the residual oxygen. The amount of air necessary to produce the quantity of neon usually found would be about 1 to 2 c.c. In one experiment, where enough neon had been found to give the ordinary flame-coloured appearance when sparked, the oxygen absorbed by the charcoal and liquid air was carefully pumped off and absorbed by phosphorus ; a small bubble of gas the size of a large pin's head remained. This gas, however, when examined in a spectrum tube was found to be not residual nitrogen from an air leak, but hydrogen. The neon therefore found in hydrogen that has been sparked at low pressures in an X-ray vacuum is not due to air leaking into the apparatus during the experiment. In order to be certain that the neon had not leaked in from the outside air, through the glass, when the glass was under the influence of the cathode discharge, a tube was made in which that end of the apparatus was inside another tube. The outside tube was then filled, first with neon, and secondly helium, the inner tube containing the hydrogen. In both cases neon was found in the hydrogen as before and not a trace of helium leaked in. A final experiment was made with an entirely fresh apparatus, in which the whole inner tube was encased in an outer one. Again neon was found in the hydrogen that was sparked in the inner tube. The vacuum in the outer tube was below that of an X-ray bulb for the spark would not pass through it. It was thought worth while to wash out this outer tube after the experiment with 1 c.c. of pure oxygen. The oxygen was then absorbed by charcoal cooled with liquid air, and a residue remained at least fifty times as great as the residue from the gas in the inner tube. It was a mixture of helium and neon, the helium being in excess. If the outer tube is filled with oxygen under 10 cm. pressure, the residual gas in the outer tube, instead of being mostly helium, is mostly neon.

Active nitrogen. (*Preliminary communication.*) E. Tiede. Ber., 1913, **46**, 340.

It is stated that the phenomena observed by Strutt (see this J., 1911, 683; 1912, 70) make their appearance only when the nitrogen is admixed with a certain proportion of oxygen.—A. S.

Germany; Authorised sale of potash during 1913 *in* ——. Board of Trade J., Feb. 27, 1913. [T.R.]

The following table, fixed by the Potash Distributing Bureau, shows the amount of potash authorised to be sold during the calendar year 1913 by the proprietors of potash works:—

Varieties.	For home consumption.	For export.
	100 kilos. of pure potash (K_2O).	100 kilos. of pure potash (K_2O).
Carnallite with 9 to 12% K_2O	72,100	700
Crude potash salts with 12 to 15% K_2O .	3,088,100	1,350,200
Manure salts with 20 to 22% K_2O	22,300	346,100
,, ,, ,, 30 to 32% K_2O	34,000	172,800
,, ,, ,, 40 to 42% K_2O, including potash manure with 38% K_2O	1,658,300	605,500
Potassium chloride	662,000	1,841,000
Potassium sulphate	17,000	574,500
Potassium-magnesium sulphate	1,900	151,200
	5,555,700	5,042,000
	10,597,700	

Patents.

Acid-pump. H. Howard, Boston, Mass. U.S. Pat. 1,051,410, Jan. 28, 1913.

The apparatus comprises a chamber into which extends a plunger and a descending pipe open at the bottom and containing a fluid piston. Inlet and exit conduits, each provided with a check-valve, are connected with the upper portion of the pipe, and the parts are so proportioned that the plunger may move within a body of oil, which is superposed on a body of acid, maintained so as to seal the end of the pipe.—F. Sodn.

Nitric acid; Process for the concentration of ——. E. Collett. Fr. Pat. 447,106, Aug. 10, 1912.

The acid to be concentrated is distilled with sulphuric acid, the mixture being heated indirectly by means of steam, hot gases, etc., and the evolved vapours are led through a column in which the last traces of moisture are removed by contact with heated sulphuric acid, so that practically pure nitric acid, which is readily condensed, escapes from the top of the column. The sulphuric acid leaving the dehydrating column is used in the distillation apparatus, and the residual acid from this is denitrated and concentrated. Advantages offered by the process are the relatively reduced size of the nitric acid condensing plant, the small quantity of sulphuric acid required, and the utilisation of waste heat from the stills in concentrating the latter acid.—F. Sodn.

Sulphurous acid; Preparation of liquefied —— *by direct liquefaction of cooled and dried sulphurous gases.* H. H. Niedenführ. Ger. Pat. 254,362, Aug. 21, 1910. Addition to Ger. Pat. 254,044, Aug. 14, 1910.

In carrying out the process described in the chief patent (this J., 1913, 194), it has been found advantageous to withdraw a portion of the liquefied sulphurous acid, allow it to evaporate and utilise the gaseous sulphurous acid thus obtained to enrich the gases entering the compressor. —A. S.

Salt; Manufacture of ——. J. H. Webster, Carrickfergus, Ireland, and International Salt Co., Ltd., London. Eng. Pat. 22,513, Oct. 12, 1911.

Molten salt is agitated whilst gradually cooling, so that it is converted directly into a granular condition. The process may be carried out in a furnace in which the salt is melted and caused to pass into purifying baths from which it flows into a granulating chamber maintained at a temperature below the melting point of the salt, and on the floor of which it is continually moved or stirred. The different sized grains may then be separated by screening.—F. Sodn.

Salt; Manufacture of —— *and the production of power.* J. Leopold-Brodie, London. Eng. Pat. 28,171, Dec. 14, 1911.

A mechanically stoked furnace, over which is a boiler receiving heat directly therefrom, is combined with a long substantially horizontal flue (suitably baffled and in communication with a suction fan) which is in direct contact with salt pans (open or closed). The salt pans are preferably supplied with brine which has been heated by steam from the closed pans, and this steam is also used to heat the feed water for the boilers; moreover, by means of a by-pass from the main flue, heat may be supplied to drying chambers. Advantages claimed are the maintenance of a high uniform temperature, more particularly in the pans first heated, and the utilisation of excess heat in generating steam, for example, for the production of power.—F. Sodn.

Salt; Process and apparatus for the production of ——. J. F. Seacombe. Fr. Pat. 447,634, Aug. 26, 1912.

Sea-water is submitted, in a suitable vessel, to a high uniform temperature, in such a manner that table salt is produced by direct precipitation, no crushing being required, whilst, at the same time, other grades of salt are produced, if desired, in other vessels. This is effected in a series of vessels, of which some may be closed and others open, heating means being provided which allow all or some of the vessels to be utilised and the temperature control of each to be independent, so that different grades of salt of any desired fineness may be simultaneously produced in different vessels. High-pressure oil burners are preferred as the source of heat, but systems of valved pipes are also arranged, so that the products of combustion derived from one vessel may be used for heating others, being drawn by means of a suction fan through suitably baffled heating spaces below each vessel. The steam from the closed evaporators may be utilised either for heating the sea-water supplied or for heating other evaporators. —F. Sodn.

Alkali metal amides, cyanamides, cyanides, and products such as hydrates (hydroxides); Manufacture of —— *from alloys of alkali metals, and apparatus therefor.* E. A. Ashcroft, London. Eng. Pat. 1002, Jan. 12, 1912. (See also this J., 1913, 199).

The alkali metal is first extracted from the alloy used by means of a fused melt (*e.g.*, of the product to be obtained), and then, quite apart from the heavy metal of the alloy, the necessary reagents are made to react or the solution is subjected to electrolysis so as to separate the alkali metal; the alloy is preferably brought into intimate contact with the fused melt by circulating means and the fused melt caused to spread out in a shallow stream over a large surface of alloy. As an example, sodium or potassium amide is made by bringing a lead alloy, containing over 6 per cent. of sodium or 5 per cent. of potassium, into intimate contact with a body of alkali amide at or about 400° C., and then treating the dissolved metal with ammonia. Sodium or potassium cyanide or cyanamide is manufactured by bringing sodium or potassium, alloyed with lead, into intimate contact with a body of cyanide or cyanamide, at or about a temperature of 600° C., and causing the resulting compound to react with cyanogen or with a substance producing cyanogen, the dissolving of the alkali metal in the melt, in either case, being assisted, if desired, by simultaneously electrolysing the fused body. The apparatus described consists of a reaction cell (which may be provided with an agitator and also a cathode and electrical connection), a circulating pump and passages, and a reservoir for the circulating fused body.—F. Sodn.

Lead oxide; Apparatus for the manufacture of ——. W. Eckford, Rhyl, Flintshire. Eng. Pat. 6002, March 11, 1912.

In apparatus comprising a lead melting pot and settling chambers, especially of the types described in Eng. Pats. 26,257 of 1908 and 30,354 of 1910 (this J., 1909, 1313; 1912, 71), a rotary hopper is fitted in the outlet leading from the melting pot to the settling chambers; this is housed in the casing connecting the two, and its function is to arrest the heavier or grosser particles carried by the stream of air passing from the melting pot to the settling chamber, and to return them to the melting pot. The hopper is preferably a frustum of a cone, the inlet end being larger in diameter than the outlet end, and it may be fitted with a series of vanes disposed longitudinally, one or more of which may be prolonged into the melting pot for maintaining the outlet of the latter free from accumulations of dross. A series of diaphragms (preferably semicircular) are fitted transversely across the hopper, these being arranged in a staggered manner, so that a current of air passing through the hopper (which is made to revolve by any suitable mechanism) is forced to take a zig-zag or helical path; the heavier particles are thus arrested and thrown down to the bottom of the rotating hopper, to be fed back again by its action into the melting pot.
—F. Sodn

Lead sulphate; Process of manufacture of crystallised ——. Comp. Générale d'Electro-Chimie de Bozel. Fr. Pat. 447,230. Aug. 14, 1912.

A substance capable to some extent of dissolving lead sulphate (*e.g.*, an ammonium salt or sodium or potassium hydroxide) is added to a solution of a soluble sulphate (such as gives no precipitate with the substance added), and a salt of lead is then introduced, the mixture being kept hot. For example, sodium hydroxide (in slight excess) is added to a solution of sodium sulphate, and the lead solution (somewhat less than the calculated quantity) gradually introduced into the boiling mixture. The lead sulphate, which at first remains in solution, is ultimately precipitated in fine needles, the best results being obtained with rather dilute solutions.—F. Sodn.

Aluminium nitride; Process for the manufacture of ——. Soc. Générale des Nitrures, Paris. Eng. Pat. 22,435, Oct. 2, 1912. Under Int. Conv., May 18, 1912. Addition to Eng. Pat. 13,086, May 30, 1910 (this J., 1911, 421).

When it is desired to give a preliminary heating to the whole mixture of aluminous products and carbon (previously specified) the upper inclined tube is replaced by a chamber in which the mixture is heated by means of, but out of contact with, the reaction gases. The heating chamber may be in the form of a battery of vertical tubes in which the mixture descends and around which the hot gases circulate, or it may contain winding tubes traversed by the hot gases and surrounded by the mixture which loosely fills the chamber. In either case, a series of perforations in the head of the rotating cylinder secures a steady influx of material from the heating chamber.
—F. Sodn.

Phosphate and nitrate of ammonia; Production of ——. E. Collett and Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Christiania, Norway. Eng. Pat. 26,097, Nov. 13, 1912. Under Int. Conv., Nov. 18, 1911.

The production of ammonium phosphate is combined with that of ammonium nitrate by dissolving calcium phosphate, insoluble in water, in dilute nitric acid, adding ammonium sulphate in such proportion that the calcium is precipitated as sulphate, and treating the solution, which contains substantially only ammonium phosphate and nitrate, in any suitable manner, as, for example, by neutralising with ammonia and fractionally crystallising.
—F. Sodn.

Ammonia-rectifier. A. E. Bossé, Pittsburg, Pa. U.S Pat. 1,051,383, Jan. 28, 1913.

The rectifier consists essentially of a chamber having an inlet and outlet; in the inlet is mounted a deflector formed by a pipe extending into the chamber and having a portion cut away on the side opposite the outlet, so as to direct the gases towards this side. The inlet is preferably at the centre of the base, and the outlet communicates with the chamber near the bottom and at one side, whilst a water-jacket, provided with a supply and removable overflow pipe for maintaining a constant level, may surround the walls of the chamber, for cooling purposes.—F. Sodn.

Ammonia; Process of production of ——. Badische Anilin und Soda Fabrik. First Addition, dated Aug. 13, 1912, to Fr. Pat. 431,295, June 19, 1911 (this J., 1911, 1381).

The original process is modified by passing the nitrogen and hydrogen over the contact substance alternately instead of simultaneously, and specially good results are obtained by mixing the nitrogen employed in the modified process with a certain proportion (*e.g.*, 1—3 per cent.) of hydrogen. A high pressure is preferably maintained, particularly during passage of the nitrogen.
—F. Sodn.

Ammonium sulphate [*and glycerin*]*; Process of preparation of* —— [*from distillery vinasse, etc.*] H. Gouthière et Cie and P. Ducancel. First and Second Additions, dated Oct. 17 and 31, 1911, to Fr. Pat. 442,923, July 1, 1911 (this J., 1912, 1031).

(1) Application of the process described in the principal patent is extended to all residual liquors having a composition approaching that of distillery vinasse (*e.g.*, the liquors derived from the scouring of wool and mother-liquors from sugar refining ["sucraterie"]), crude potash residue ["salin"] from a preceding operation being added to each charge, as already described. The extraction of the glycerin from vinasse may be effected by concentrating it to a pasty consistence, intimately mixing it with its own weight or more of crude potash residue, and extracting the mixture, directly or after drying, with a solvent, such as crude alcohol, the alcohol being then distilled off from the extract and the glycerin refined The residue, after being heated to remove any remaining alcohol, is distilled, as described in the principal patent. Tar resulting from the distillation is re-introduced into the distillation apparatus, so as to augment the supply of ammonia and furnish combustible gas. (2) Methylamines produced in the distillation of vinasse or by heating the ammonium sulphate mother-liquors with alkali, are converted into ammonia by introducing the vapours into a retort containing vinasse and crude potash in process of distillation, preferably during the final period, which corresponds to a temperature of 500°—700° C.
—F. Sodn.

Ammonium sulphate: Manufacture of —— *from ammonium sulphite.* A. Stutzer. Ger. Pat. 255,439, June 13, 1911.

Air or oxygen under an increased pressure of one or several atmospheres is allowed to act upon ammonium sulphite (or its components) at a temperature at which vigorous dissociation of ammonium sulphite takes place. —A. S.

Nitrogen compounds: Process of producing ——. C. E. Acker, New York, Assignor to The Nitrogen Co. U.S. Pat. 1,051,303, Jan. 21, 1913.

A metal capable of combining directly with carbon or nitrogen on heating, or an alloy containing such a metal, is heated with a carbonaceous reagent, and the carbide so produced is acted upon with a nitrogenous reagent and an alkali metal (simultaneously or successively), so as to give an alkali metal cyanogen compound and liberate the first-mentioned metal.—F. Sodn.

Cyanogen [hydrogen cyanide] and ammonia: Process of obtaining —— by the superheating of the nitrogenous compounds produced by the gasification of vinasses or the like. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Ger. Pat. 255,440, Nov. 9, 1911.

The gases containing the nitrogenous compounds are led through highly-heated conduits, free from filling material, and the inner walls of which are constructed of a material *e.g.*, fused quartz or a fused mixture of zirconia and quartz, which remains gas-tight and non-porous at the high temperature employed. It is stated that practically the whole of the nitrogen is obtained in the form of hydrogen cyanide and ammonia, the relative proportions of these two compounds varying with the raw material used.—A. S.

Borax: Process of manufacture of ——. E. Borias. Fr. Pat. 447,056, Aug. 8, 1912.

Boronatrocalcite or calcium borate is mixed into a paste with water and the calculated proportion of potassium or sodium bisulphate (preferably the latter), and the mixture is heated, after which the solution is separated from the precipitated calcium sulphate and evaporated, to obtain borax. The residue may be utilised for the manufacture of plaster or as a fertiliser.—F. Sodn.

Hydrogen and oxygen by the decomposition of water; Economical process of manufacturing ——. G. Teissier and P. Chaillaux. Fr. Pat. 447,688, Aug. 28, 1912.

Barium sulphate and manganous oxide are heated to a red heat in a retort, with the formation of barium sulphide and manganese dioxide, after which the mixture is raised to a white heat with the evolution of oxygen and the regeneration of manganous oxide, barium sulphide remaining unchanged. Steam under pressure is then passed over the mixture of barium sulphide and manganous oxide with the evolution of hydrogen and regeneration of barium sulphate, manganous oxide remaining unchanged. The reactions, which take place, are said to be represented by the following equations: $BaSO_4+4MnO=BaS+4MnO_2$; $BaS+4MnO_2=BaS+4MnO+2O_2$; and $BaS+4MnO+4H_2O=BaSO_4+4MnO+4H_2$. If preferred, barium sulphate may be reduced by means of carbon monoxide in one vessel for the production of hydrogen, and manganous oxide may be oxidised by means of carbon dioxide in another vessel for the preparation of oxygen. The equations then take the form: $BaSO_4+4CO=BaS+4CO_2$, and $4MnO+4CO_2=MnO_2+4CO$.—O. R.

Calcium carbide, in lump or powder; Process for increasing the resistance of —— towards atmospheric moisture. L. Londei. Fr. Pat. 447,805, Aug. 30, 1912. Under Int. Conv., Oct. 25, 1911.

The surface of the carbide is coated with a very thin layer of graphite, lampblack, or other similar material, by introducing the carbide for example, as it leaves the crushing machines, into rotating drums, together with a small proportion of graphite. The material thus treated may be put to all the ordinary uses of calcium carbide. —F. Sodn.

Sulphurous acid; Apparatus for the manufacture of ——. H. H. T. Burbury, Barnsley. Eng. Pat. 2140, Jan. 26, 1912. Under Int. Conv., Jan. 27, 1911.

See Addition of Jan. 27, 1911, to Fr. Pat. 420,596 of 1910; this J., 1911, 1012. Reference is directed under Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2668 of 1870, 667 of 1874, 6461 of 1909, and 8006 of 1910.—T. F. B.

Operations in which hydrogen is employed under pressure and at high temperatures; Apparatus for use in ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1490, Jan. 18, 1912.

See Fr. Pat. 441,695 of 1912; this J., 1912, 922.—T. F. B.

Carbonic disulphide; Process for removing —— from gases, liquids, and so forth. O. Eberhard, Heidenau, Germany. Eng. Pat. 2149, Jan. 26, 1912.

See Fr. Pat. 439,783 of 1912; this J., 1912, 722.—T. F. B.

Cyanogen and ammonia from the gases from vinasses; Process for obtaining ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Fr. Pat. 447,725, Aug. 29, 1912. Under Int. Conv., Nov. 8, 1911.

See Ger. Pat. 255,440 of 1911; preceding.—T. F. B.

VIII.—GLASS; CERAMICS.

Quartz glasses. H. Seger und E. Cramer, Ges.m.b.H. Chem.-Zeit., 1913, 37, 206.

Vitreosil, and two other quartz glasses, one containing 0·05—0·15 per cent. of zirconia and the other 0·11 per cent. of titania, were found to have a silica content of 98·5—98·9 per cent. instead of the 99·5 given by some previous analysts. In order to confirm the statements made by Blake (Glasindustrie, 1911, 3) and by Thomas (this J., 1912, 129) that quartz ware tends to revert to tridymite, crucibles of the various makes were heated in an electric furnace to 1550° C. After one hour, the titaniferous ware was somewhat devitrified on the surface, the zirconia ware slightly less so, and the vitreosil hardly at all. After three hours, the zirconia ware tended to peel off on the surface, the titania ware was more strongly devitrified but did not peel, while the vitreosil also showed no tendency to peel, though it was as strongly devitrified as the zirconia ware. After six hours all showed serious signs of devitrification.—H. H. S.

Production of mirrors by cathodic disintegration. Rümelin. *See* X.

Patents.

Glass making furnaces. G. E. and H. A. Bateson, Liverpool. Eng. Pat. 26,031, Nov. 13, 1912.

The furnace is divided into two parts—a primary furnace, preferably circular, for better-grade glass, and a secondary or tank furnace for the coarser metal; these are heated by a fire common to both, and the tank metal is fed into and initially heated in the primary furnace, before entering the tank. Hollow banks or sieges are arranged on each side of the primary furnace, for supporting the crucibles for the better-grade glass, and these act also as passages for heating the air supplied to the fire-space, whilst auxiliary flues leading to the secondary furnace, communicate with the primary furnace in the rear of the crucibles, thus securing a more effective heating of the crucibles. A hollow air passage through the crown of the primary furnace also serves to heat the air supplied to the fire, and there is a restricted outlet for the melted glass into the secondary furnace, through which the flue gases pass, thus bringing these into close contact with the outflowing metal.—F. Sodn.

Glass ; Apparatus for the treatment of ——. R. de Reytere, Florennes, Belgium. Eng. Pat. 2282, Jan. 29, 1912.

See Fr. Pat. 439,466 of 1912 ; this J., 1912, 724.—T. F. B

Fireproof, electrically conducting moulded bodies ; Process of manufacturing ——. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 16,044, July 9, 1912. Under Int. Conv., July 20, 1911.

See Fr. Pat. 446,142 of 1912 ; this J., 1913, 143.—T. F. B.

Apparatus for separating fine-grained admixtures from sandy or muddy liquids. Eng. Pat. 25,548. *See* I.

IX.—BUILDING MATERIALS.

Wood ; The specific heat of ——. F. Dunlap. U.S. Dept. Agric., Forest Service, Bull. No. 110, Sept. 20, 1912.

The specific heat of a large number of samples of wood was observed by means of a Bunsen ice calorimeter specially adapted for the work. The samples were oven-dried at 105° C., and most of the observations were made between this temperature and 0° C. The detailed results are given in tables, and show that the mean specific heat of oven-dried wood is 0·327, and that this figure remains nearly constant for all kinds of wood. There is practically no variation in samples taken from different parts of the tree, and the location where the wood is grown also has practically no effect. There is a large variation in specific heat with temperature, however, and when represented by a straight line formula the specific heat is indicated by the following equation : Specific heat = $0{\cdot}266+0{\cdot}00116t$.—H. H.

Wood ; Absorption of creosote by the cell walls of ——. C. H. Teesdale. U.S. Dept. Agric., Forest Service, Circular No. 200, Sept. 14, 1912.

The location of creosote absorbed by wood is of importance in that if the cell walls absorb creosote a weakening effect, similar to that produced by moisture in wood, may be expected. A number of samples of wood dried in an oven at 212° F. (100° C.) for 24 hours were treated with creosote for 1½ hours at 180° F. (82° C.) and 150 lb. per sq. in., and then raised to a temperature of 220° F. (104·5° C.) for 5 hours. The volume of the samples was measured before and after the treatment, and the following average increases in volume observed :—Yew : heartwood, 6·81, sapwood, 10·70 ; hemlock, heartwood, 7·30 ; hard maple, heartwood, 8·14 per cent. It is thus seen that a decided swelling takes place in wood impregnated with creosote. This swelling, the tests indicate, is caused by the absorption of the creosote by the cell walls.—H. H.

Determination of natural asphaltum in presence of artificial asphaltum. Marcusson. *See* IIa.

Patents.

Silica material ; Manufacture of fire-resisting ——. J. Campbell, Wimbledon Park, Surrey. Eng. Pat. 1066, Jan. 13, 1912.

A mixture containing about 96 per cent. of powdered silica (as sand, etc.), 2 of quicklime, the equivalent of 2 of sodium oxide (as carbonate, sulphate or chloride), and sufficient water to moisten the whole is moulded under a pressure of 2—4 tons per sq. in. ; after being dried, the bricks, etc., are gradually heated—during 3—5 days—to a temperature of 3000° F. (about 1650° C.).—W. E. F. P.

Rotary [cement] kilns ; Regulation of the air supply to ——. W. Gilbert, London. Eng. Pat. 6603, March 18, 1912. Addition to Eng. Pat. 459 of 1911 (this J., 1911. 1365).

The improvement consists in providing mechanism for raising or lowering the two damper plates simultaneously, so that the inclination of the jet may be varied in a vertical plane, without interfering with the rate at which the powdered coal and air enters the kiln.—W. H. C.

Dry magnesia cement or impermeable and unalterable conglomerates of "xylolith" and artificial stone ; Process for the manufacture of —— *free from magnesium chloride.* A. Emele. Fr. Pat. 447,022, Oct. 16, 1911.

An alum, aluminium sulphate, or sodium sulphate, preferably calcined, is substituted for magnesium chloride in the preparation of Sorel cement, whilst the magnesia may be partially replaced by calcined dolomite, quicklime, or plaster of Paris. Other ingredients, which are claimed to improve the hardness and the setting properties of the products, include borax, boric acid, and sodium phosphate ; to prevent efflorescence, crystallisation, and consequent buckling of tiles and the like. the addition of salts of barium, strontium, calcium, or lead, is recommended, with or without the inclusion of colloidal materials, such as gum, dextrin, mucilage, or the like. The addition of flooring-plaster to magnesia cement is also claimed to yield volume-constancy and a greater carrying power as regards filling materials.—O. R.

Wood ; Treatment of ——. J. W. Illingworth, New York. U.S. Pat. 1,051,596, Jan. 28, 1913.

Green wood containing resins and acids, especially coniferous or evergreen wood of low commercial value, such as second growth pine and spruce, is cut into the desired lengths and, after removing the bark, is immersed in water at a temperature considerably below the boiling point, in order to remove the water-soluble gums and acids. When a starch-like exudation appears on the surface of the wood, it is removed and the wood is dried in the air. It is then sawn into lumber pieces and soaked in lime-water until the pores and ducts are filled with the solution, after which it is again air-dried. The remaining gums and acids are thus fixed in the wood, and the pores and ducts become filled with a deposit of lime.
—F.Sodn.

Wood and other organic materials ; Preservative for ——. H. Monseur. Angleur-lez-Liege, Belgium. Eng. Pat. 23,139, Oct. 19, 1911. Under Int. Conv., Nov. 5, 1910.

See Fr. Pat. 435,732 of 1911 ; this J., 1912, 388.—T. F. B.

Stone compounds ; Method of producing volumetrically permanent artificial ——. J. Billwiller, Goldbach, Switzerland. Eng. Pat. 11,799, May 17, 1912.

See Fr. Pat. 443,991 of 1912 ; this J., 1912. 1130.—T. F. B.

Cement ; Apparatus for producing —— *[from slag].* H. Passow, Hamburg. Assignor to Atlas Portland Cement Co., New York. U.S. Pats. 1,051,627 and 1,051,844, Jan. 28, 1913.

See Fr. Pat. 328,533 of 1903 ; this J., 1903. 999.—T. F. B.

Drying apparatus [for road-making materials, etc.]. Eng. Pat. 29.313. *See* I.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Coke-oven gas ; Use of —— *without preheating. in the manufacture of steel.* O. Simmersbach. Stahl u. Eisen, 1913, **33**, 273—276. (Compare this J., 1912, 75.)

When coke-oven gas is preheated in the gas chambers of an open-hearth furnace, the gas suffers decomposition, and its calorific power is reduced by 25—33 per cent. (see this J., 1913, 186). Decomposition begins at 500°—700° C., and preheating to these temperatures only is of slight benefit. The necessary flame temperature can, however, be obtained by preheating the air only, and cold coke-oven gas has been used with good results at Seraing and also at Chicago:

	Seraing.	Chicago.
Capacity of furnaces (tons)	4, 7, and 12·5	40, and 85
Calorific value of gas	3640	1669
Consumption of gas (cb.m. per ton of steel)	325	—
Consumption of coal in producers when using producer gas (kilos.).	300	—
Increase in output of furnace (per cent.)	15	15

Apart from the greater calorific value, cold coke-oven gas has other advantages over preheated gas. It burns with a longer flame, which is luminous and therefore more efficient for heating the charge. The construction of the furnace is simplified and its cost reduced. With the furnace constructed for preheated gas, however, the waste gases have to pass entirely through one set of regenerators, those for preheating the air, if cold gas is to be used. In order to provide sufficient draught and to prevent the flame being drawn to one outlet, auxiliary air inlets may be provided at either side of the inlet for cold gas. It is concluded that whether coke-oven gas is mixed with blast-furnace gas and preheated, or whether it is used cold, a great reduction in cost is effected, and it is possible to convert pig-iron to steel ready for the rolling mills without further expenditure of fuel.—A. T. L.

Oxygen in iron and steel; Application of the electric resistance furnace to the determination of ——. R. H. McMillen. Met. and Chem. Eng., 1913, **11**, 86—87.

The following modification of Ledebur's method for the determination of oxygen in steel and other materials is given. Hydrogen, generated in a 64 oz. Kipp apparatus from pure hydrochloric acid and pure "mossy" zinc, is purified by passing it through (1) a 7·25 per cent. solution of alkaline pyrogallol, (2) a 50 per cent. solution of potassium hydroxide, (3) sticks of potassium hydroxide, (4) soda lime, (5) pumice saturated with concentrated sulphuric acid, and (6) an electric furnace fitted with a thick-walled quartz tube, $\frac{7}{8}$ in. internal diam. and 24 in. long, containing spirals of platinum gauze by means of which any oxygen in the gas is removed. This furnace is separated by a U-tube containing glass beads and phosphorus pentoxide and fitted with good stopcocks from a similar furnace in which the reduction takes place. The water formed by the reduction of the oxides in the sample is absorbed in a weighed U-tube containing glass beads and phosphorus pentoxide and which is connected with a guard tube containing sulphuric acid. The absorption tube is dried over concentrated sulphuric acid for 15 mins. after passing a current of hydrogen through it for ten minutes and before weighing it. The drillings are sifted and a sample between 20- and 30-mesh is dried for an hour over sulphuric acid. 20 grms. are weighed into a dried porcelain boat, placed in the reduction furnace and hydrogen rapidly passed through the apparatus for fifteen minutes, when the current is turned on and the temperature maintained at 950° C. for one hour, the flow of hydrogen being adjusted to 70 bubbles a minute. A blank is run frequently and the result deducted from the weight of water obtained; the correction usually varies from 0·0015 to 0·0025 grm.—A. H. C.

Osmosis of hydrogen through iron; Reactions which accompany the ——. G. Charpy and S. Bonnerot. Comptes rend., 1913, **156**, 394—396.

Further experiments on the osmosis of hydrogen through iron (see this J., 1912, 284), have shown that the gas is not absorbed by the metal, the volume of gas extracted by heating *in vacuo*, even after prolonged passage of hydrogen, being found, as a rule, to be less than that obtainable before osmosis, and the conclusion is drawn that iron and steel which have been manipulated without special precautions, in contact with air are generally saturated with hydrogen. This is explained by supposing that the nascent hydrogen, continuously produced at the surface of the metal each time it is heated, owing to reaction with atmospheric moisture, immediately penetrates the metal. As might be expected, therefore, the properties of iron are not found to be sensibly affected by the osmosis of hydrogen, unless passage of the gas is very prolonged, when a gradual softening of the metal is observed. This latter is due to the reducing action of the hydrogen which removes such impurities as phosphorus and sulphur in the form of hydrides, desulphurisation being especially marked. Carbon monoxide is also generally present in the gas after osmosis, this being attributed to the action of water vapour (formed by the reduction of oxidised substances present in the metal) on the carbon or iron carbide also present, and hydrocarbons are formed by the direct action of hydrogen on iron carbide. The reducing action of hydrogen is quite distinct at 700° C. and increases rapidly with rise of temperature, so that osmosis may be used as a means for getting rid of the last traces of certain impurities from iron, and it is pointed out also that modification by hydrogen must go on in any ferrous metal which is submitted to successive heating and cooling, it being considered that hydrogen probably plays an important part in connection with many changes which may be brought about in the solid metal and which must often be accompanied by the absorption or elimination of hydrogen.

—F. Sodn.

Ferrovanadium and its products; Technical analysis of ——. [*Determination of aluminium.*] W. W. Clark. Met. and Chem. Eng., 1913, **11**, 91—92.

Various methods for the determination of aluminium in ferrovanadium are discussed, and the following is given as being accurate under all conditions and rapid enough for a busy laboratory:—0·5 grm. of the finely divided material is dissolved in 40 c.c. of strong hydrochloric acid and 5 c.c. of strong nitric acid, and the solution transferred to a separating funnel, the beaker being rinsed with dilute hydrochloric acid (2 : 1). 75 c.c. of ether are added and after shaking for 2 mins., and allowing to separate, the lower layer is run into a 400 c.c. beaker, care being taken to get the drainings from the sides of the funnel. The dissolved ether is evaporated off, 1 grm. of sodium chlorate is added, the solution is boiled for 1 min., diluted to 300 c.c. with boiling water and sufficient excess of sodium hydroxide solution added to insure all vanadium and aluminium passing into solution. If nickel be present, bromine is added until the precipitate turns black, the liquid is boiled for 2 mins., 25 c.c. of hydrogen peroxide are added, and after again boiling for 2 mins., the precipitate is collected on a close filter, a platinum cone being used to prevent the paper from breaking. The precipitate is washed with hot water, and the filtrate is boiled and, if any precipitate forms, re-filtered. The filtrate is acidified with dilute hydrochloric acid, treated with 25 c.c. of hydrogen peroxide, and with a slight excess of ammonia, diluted to 800 c.c. and boiled to expel the excess of ammonia. It is then filtered through a loose filter, the precipitate washed with hot water until the washings are free from chlorides, and ignited in a weighed platinum crucible first at a low heat and then over the blast flame for a few minutes. After cooling, the residue is treated with a few drops of sulphuric acid and 10 c.c. of hydrofluoric acid, evaporated to dryness to remove silica, ignited until all sulphates are decomposed, and weighed. A blank determination is also made. When oxidising with hydrogen peroxide in the final precipitation, an excess must be used, vanadium precipitating with the aluminium if the peroxide be not in excess, turning it a light yellow, which may be removed by adding more peroxide and ammonia and again boiling. The precipitate of aluminium hydroxide filters very rapidly and will contain no vanadium when washed free from chlorides. The results of some test analyses are given.—A. H. C.

Zinc ores; The igneous concentration of ——. F. L Clerc. Eng. and Min. J., 1913, **95**, 222—226.

For treating ores the value of which lies chiefly in their zinc content and from which the zinc can be expelled without melting the residues into a fluid slag, the author proposes a modification of the Taylor revolving-bottom gas-producer to be used as a continuous sintering sublimation kiln. A cold blast enters at the bottom, and a heated blast through small tuyères near the top. Complete oxidation of the gases would be ensured by introducing additional air into a flue. The charge would be, as in the Wetherill oxide furnace, a mixture of ore and coal. Probably a considerable proportion of blende might be introduced with the oxidised ores without interfering with the working of the furnace. The running of the latter would be regulated by varying the proportion of fuel in the charge and also by regulating the blast.—R. W. N.

Tin and antimony ; Analysis of alloys of ——. M. Pontio. Ann. Chim. Analyt., 1913, **18**, 47—48.

When copper is not present in large amount, 0·5 grm. of the alloy in a fine state of division is treated with nitric acid (sp. gr. 1·33). After prolonged boiling the liquid is evaporated to a syrup, water is added and the solution is allowed to stand for 12 hours. The mixed oxides of tin and antimony are then filtered off, ignited and weighed, care being taken to avoid reduction. Another portion of 0·5 grm. is treated in the same way with nitric acid, and the liquid evaporated. 1 c.c. of concentrated sodium hydroxide solution and 60 to 70 c.c. of sodium monosulphide solution (sp. gr. 1·14 to 1·16) are then added, and the liquid digested without boiling until the oxides are dissolved. After cooling, the sulphides of lead, etc. are filtered off, if present, and the metals estimated in the usual way. 20 c.c. of a 20 per cent. solution of pure potassium cyanide are added to the solution, which, after agitation, is electrolysed by a current of 0·3 ampère at 4 volts, a platinum gauze cathode being used. The deposit of antimony is washed first with cold water, then with alcohol, and after drying at 100° C., is weighed. The deposit is then attacked with nitric acid and the resulting oxide ignited and weighed. This weight is deducted from that of the mixed oxides in order to calculate the tin. When copper is present in the alloy, the latter is treated with hydrochloric acid in excess and a very little nitric acid. The solution is evaporated to 5 c.c., 50 c.c. of nitric acid (sp. gr. 1·33) added, and the solution boiled until no more nitrous fumes are evolved. Several grms. of potassium chlorate are then slowly added to the boiling liquid, and the boiling continued for 20 to 25 minutes. An equal volume of water is then added and the solution allowed to stand for 12 hours. The mixed oxides are thus obtained free from copper, and their subsequent treatment is as described above.—T. St.

Manganese in rock, slags, ores, and spiegels ; Volumetric determination of ——. F. J. Metzger and L. E. Marrs. J. Ind. Eng. Chem., 1913, 5, 125—126.

The method described previously (this J., 1911, 689) for the determination of manganese in iron and steel, has proved useful also in the analysis of other materials. *Rock, and ores, slags, etc., insoluble in hydrochloric or nitric acid.* From 2—5 grms. of the sample are boiled with 5—15 c.c. of sulphuric acid (1 : 2), then 5—15 c.c. of hydrofluoric acid are added, and the mixture is boiled until the material is completely decomposed. After adding 5—10 c.c. of nitric acid (1 : 1) and 2 or 3 c.c. of concentrated sulphuric acid, the solution is removed from the source of heat, treated with about 1 grm. of ammonium persulphate in small portions, and when evolution of gas has ceased, evaporated until fumes of sulphur trioxide appear. It is then cooled, treated with 50 c.c. of water, boiled, cooled, transferred to a wax beaker, treated with 5 grms. of ammonium fluoride and 25 c.c. of hydrofluoric acid (making a total volume of about 100 c.c.) and titrated with permanganate as previously described (*loc. cit.*). *Slag.* From 0·2 to 1 grm. is treated as just described, but if the manganese content be high, a brown colour will appear towards the end of the titration. In the case of products containing more than 40 per cent. of manganese, it has been found best to use for the titration about 150 c.c. of solution containing 60 mgrms. of manganese ; it is stated that this quantity can be titrated accurately with $N/10$ permanganate notwithstanding the brown colour. With products high in manganese, also, a permanganate colour may appear when the solution is being evaporated until fumes of sulphur trioxide appear. In such cases, the solution is decolourised by addition of hydrogen peroxide, drop by drop, and boiled for 10 minutes before adding ammonium fluoride and hydrofluoric acid. *Pyrolusite.* From 0·5 to 1 grm. is dissolved in the least possible quantity of hydrochloric acid (1 : 1), evaporated with 15 c.c. of sulphuric acid (1 : 2), cooled, treated with 10 c.c. of nitric acid (1 : 1) and 1 grm. of ammonium persulphate, and then, when evolution of gas has ceased, again evaporated till white fumes appear, cooled, diluted with water, and made up to 250 c.c. An aliquot portion is treated with 5 grms. of ammonium fluoride, 10 c.c. of sulphuric acid (1 : 2), and 25 c.c. of hydrofluoric acid, diluted to 150 c.c., and titrated with permanganate. *Spiegels and ferromanganese.* From 0·2 to 1 grm. is dissolved in 5—10 c.c. of nitric acid (1 : 1), treated with 1 grm. of ammonium persulphate, and then evaporated with 15 c.c. of sulphuric acid (1 : 2), cooled, treated with 50—100 c.c. of water, heated until ferric salts have dissolved, diluted to 250 c.c., and an aliquot portion treated as described under pyrolusite and titrated with $N/10$ permanganate.—A. S.

Mirrors ; Device for the production of —— *by cathodic disintegration.* G. Rümelin. Physik. Zeits., 1912, **13**, 1222—1223. Chem. Zentr., 1913, **1**, 485.

The plate upon which the mirror is to be produced is used as anode and is placed upon a small table in juxtaposition to a plate of the metal to be disintegrated, which serves as cathode, the whole being enclosed in a glass bell resting on a ground glass plate. The space is first exhausted, then a current of hydrogen is sent through by means of a Gaede pump. An opaque silver mirror can be produced in 30 seconds. Mirrors of silver, gold, platinum, copper, iron, nickel, palladium, and iridium have been produced in this way.—A. S.

Colloidal solution ; Formation of new colloids in a —— *in which a metal plate is immersed.* M. Philippson. Bull. Acad. roy. Belg., Classe des sci., 1912, 580—582. Chem. Zentr., 1913, **1**, 383.

Carefully cleaned plates of platinum and zinc were introduced into solutions of colloidal copper, whereupon it was observed that the optical properties of the solution altered, the colour of the Tyndall light-cone changing, in a short time, from red to white. The conclusion drawn, which was supported by ultramicroscopic examination, is that the colloidal copper is precipitated in a metallic condition and is replaced by a colloid formed from the precipitating metal (platinum or zinc).—A. S.

U.S. pig iron production in 1912. Board of Trade J., Feb. 20, 1913. [T.R.]

According to a Bulletin, dated 30th January, issued by the American Iron and Steel Institute, the production of pig iron in the United States in 1912 was as follows, the figures for the two previous years being added for purposes of comparison :—

	1910.	1911.	1912.
	Tons.	Tons.	Tons.
Bessemer and low phosphorus	11,245,642	9,409,303	11,667,656
Basic	9,084,608	8,520,020	11,394,477
Charcoal	396,507	278,676	347,025
Ferro-manganese	71,376	74,482	125,379
Spiegeleisen	153,055	110,236	96,346
Foundry, ferro-silicon, &c.	6,352,379	5,256,830	6,096,254
Total	27,303,567	23,649,547	29,727,137

French iron and steel production. 1912. Board of Trade J., Feb. 20, 1913. [T.R.]

According to the Bulletin of 21st January of the "Comité des Forges des France," the amount of iron and steel produced in France in 1911 and 1912 by the members of the association was as follows:—

	1911.	1912.
	Metric tons.	Metric tons.
Pig iron	4,426,469	4,826,553
Steel ingots	3,680,613	4,136,942
Steel products—		
Blooms and billets	1,744,148	2,064,072
Merchant steel	709,131	675,259
Girders and shapes	621,249	641,720
Rails	449,818	492,767
Sheets and plates	449,234	501,859
Other products	409,052	444,031

Influence of lead on the ferrocyanide titration of zinc. Lenher and Meloche. *See* XXIII.

Patents.

[*Steel*] *Furnaces; Metallurgical* ——. S. Cornthwaite, Sheffield. Eng. Pat. 2709, Feb. 2. 1912.

Steel furnaces of the open-hearth type, fitted with air and gas ports, and regeneration chambers, are provided with suitable openings in the roof to admit of the introduction of electrodes. A trolley carrying electrodes runs on rails behind the furnaces so that the electrodes may be transferred from one furnace to another as desired. The trolley is fitted with the necessary gear for raising and lowering the electrodes, and with a transformer, if necessary. When the trolley has to move a substantial distance, it is desirable to arrange terminals, connected with high-tension mains, opposite each furnace. The charge in a furnace is melted and taken to any desired stage by gas heating, then the gas and air ports are closed by dampers, and the subsequent treatment of the charge is carried out by electrical heating. The furnaces are worked so that as one furnace becomes ready for tapping, another reaches the stage for electrical heating. With tilting furnaces it is desirable to arrange that the whole trolley moves with the furnace, and for this purpose, a section of the trolley rails is fixed to each furnace. Where furnaces are back to back, a suitable arrangement for rotating the trolley is provided.—T. St.

Steel ingots; Treatment of ——. B. Talbot, Middlesbrough. Eng. Pat. 6391, March 14, 1912.

To obviate the formation of a cavity or pipe in the upper part of a steel ingot, the latter, while still fluid at the interior, is heated to soften the outer crust and then subjected to a pressure sufficient to reduce considerably the cross-sectional area, especially of the upper portion; the solidified ingot is reheated before final treatment. —W. E. F. P.

[*Manganese*] *Steel; Method of making* ——. H. D. Hibbard, Plainfield, N.J. U.S. Pat. 1,051,840, Jan. 28, 1913.

A charge of manganese steel scrap is heated by auxiliary heating to red heat, and is then covered with molten decarbonised iron containing not appreciably more than 0·15 per cent. of carbon. The melting of the scrap is completed by electrical heating, the iron protecting the manganese from oxidation during fusion. After the whole charge is melted, ferromanganese is added to give the desired proportion of manganese.—T. St.

Steels; Method of manufacture of high tensile, special, etc. ——, *and the steels obtained by this method.* F. Thuand. Fr. Pat. 447,522, Oct. 30, 1911.

Before any of the special metals desired in the finished steel are added to the steel bath, titanium to the amount of 0·10 to 1·20 per cent. is added in the form of ferrotitanium (50 per cent.). Oxidation, and loss of the special metals, are thereby reduced, and the steel is more homogeneous. It is stated that excellent results have been obtained with a steel containing: C about 0·35, Ni 12 to 15, Cr 1·20 to 1·60, V 0·25 to 0·30, Ti and Mn together about 0·80 per cent. The two latter may vary between the following limits:—Mn 0·30 to 0·60, Ti 0·05 to 0·80 per cent.—T. St.

Cementation by diffusion. G. Sirovich. Fr. Pat. 447,606, Aug. 24, 1912. Under Int. Conv., March 4, 1912.

In introducing other metals such as chromium, etc., into steel by diffusion, claim is made for the use of binary, ternary, etc., alloys, in combinations similar to those in which they will be contained in the finished special steel. —T. St.

Reaction apparatus [*for refining crude iron by means of iron oxide*]. H. D. Hibbard, Plainfield, N.J. U.S. Pat. 1,047,052, Dec. 10, 1912.

In an apparatus for facilitating chemical reactions between fused reagents of different specific gravities (*e.g.*, for reducing iron oxide by the means of the metalloids of crude iron as described in U.S. Pat. 885,248 of 1908; this J., 1908, 509), a practically closed vessel, mounted to permit of any desired degree of tilting or rocking, is divided into two or more compartments or "pockets" by means of a hollow, water-cooled dam. Each pocket is sufficiently large to contain the whole of the charge which, by adjusting the motion of the vessel, is caused to be continuously poured from one "pocket" to another until thorough mixing is attained.—W. E. F. P.

[*Iron.*] *Metalliferous substances; Process for the reduction of* ——. G. L. Fogler. Fr. Pat. 447,218, Aug. 14, 1912.

In a process for the reduction of iron and other ores, a mixture of the latter with appropriate fluxes, a small quantity of carbon and a compound of aluminium, magnesium or other metal having a greater affinity for oxygen than the metal to be reduced (*e.g.* bauxite, felspar, kaolin, etc.) is heated to bright redness when, it is stated, reactions of the aluminothermic type occur, whereby the charge attains a temperature nearly equal to that of the electric arc, the ore being reduced and the resulting metal becoming suspended in finely divided form in the molten mass, from which it is subsequently allowed to settle. —W. E. F. P.

[*Iron and steel.*] *Welding; Process of* ——. D. Arkwright, jun., Youngstown, Ohio. U.S. Pat. 1,051,980, Feb. 4, 1913.

In a process for uniting high-speed or tool steel to a stock of softer metal, the surface of the latter is covered with a powdered mixture of ferromanganese and ferrous carbonate upon which the harder metal is placed in position. The metals are then subjected for about 10 minutes to a temperature of about 2300° F. (1260° C.) which is afterwards increased to about 2500° F. (1371° C.) when, it is stated, the union is effected with or without the aid of pressure.—W. E. F. P.

Iron surfaces; Process for protecting —— *from corrosion.* S. O. Cowper-Coles, London. Eng. Pat. 26,484, Nov. 27, 1911.

The process consists in depositing electrolytically, upon the clean iron or steel surface, first a substantial coating of pure or practically pure iron and then a coating (usually thinner) of zinc or zinc-iron alloy. It is stated that these coatings may be advantageously deposited, in succession, from a single electrolyte consisting of a solution of iron and zinc sulphates, the nature of the metallic deposit being governed by the density of the current employed. The coated articles are finally heated or baked.—W. E. F. P.

Aluminium; Coating iron with ——. S. Uyeno, Tokio, Japan. Eng. Pat. 11,836, May 18, 1912.

The iron article to be coated is first galvanised or tinned, and is then immersed in molten aluminium at about 700° to 800° C., and during immersion, the surface is swept by steel brushes. The tin or zinc thus passes into

the molten aluminium, and becomes replaced on the iron surface by aluminium. The article is treated in this manner in two or more such baths, the greater part of the tin or zinc being left in the first bath. It is claimed that by this means the aluminium is caused to adhere to the surface of the iron so well that it will not come off, or tarnish, or corrode, under the action of air, water, or heat, and cannot be stripped off by mechanical means.
—T. St.

Metallic [iron and steel] articles ; Metallic coating for ——. H. J. Lohmann, Jersey City, N.J., Assignor to The Lohmann Co., New York. U.S. Pat. 1,052,156, Feb. 4, 1913.

Claim is made for a metallic article (iron or steel) coated with lead containing about 1 per cent. of tin, the covering metal penetrating the article to a measurable depth, for the purpose of protecting the latter from corrosion.
—W. E. F. P.

Articles consisting wholly or mainly of silicon ; Manufacture of ——. T. B. Allen, Niagara Falls, U.S.A. Eng. Pat. 14,020, June 15, 1912. Under Int. Conv., June 26, 1911.

See U.S. Pat. 1,037,713 of 1912 ; this J., 1912, 923. The addition may consist of an alkali metal or magnesium.
—T. F. B.

Ferrosilicon ; Process of effecting reduction and producing ——. E. A. Byrnes, Washington, D.C., Assignor to Electro-Metallurgical Co., Chicago, Ill. U.S. Pat. 1,051,194, Jan. 21, 1913.

Claim is made for a process of "reducing a granular charge" by disposing the latter in a vertical column, the upper half of which is heated by hot gaseous products of combustion while the lower portion is submerged in "an electrically-heated liquid."—W. E. F. P.

Ferrochromes and other iron alloys ; Treatment of ——. L. Pilla. Fr. Pat. 447,225, Oct. 21, 1911.

Claim is made for a method of decarburising iron alloys by blowing air or oxygen through the molten metal. The furnace is drum-shaped, and capable of being rotated about its longitudinal axis. The blowing apparatus is fixed to the furnace, and consists of a number of water-cooled tubes. The pipe conveying the air or oxygen, and those through which the cooling water is fed and carried away, are made flexible to allow of the furnace being turned. Air and gas for heating the charge are admitted at one end of the furnace, also through flexible pipes. The hot gases pass away through a fixed shaft in which a fresh charge is stacked to receive a preliminary heating. The charge having been melted, the furnace is turned so as to bring the blowing apparatus just beneath the level of the molten metal. Air is then turned on, and the furnace is slowly rotated backwards and forwards in order to subject all portions of the molten metal to the action of the air.—T. St.

Alloys for casting. F. de Buigné, Magdeburg, Germany. Eng. Pat. 1346, Jan. 17, 1912.

Alloys (type-metal) designed for casting under pressure should be capable of remaining for a long time in the molten condition without changing in composition, and should not give rise to dirt or dross in the casting channels or moulds. Alloys composed of aluminium, copper, and tungsten, and free from zinc, fulfil these conditions. Satisfactory results are given by the alloys :—(1), Al 80 to 90, Cu 8 to 10, W 1 to 10 parts ; and (2), Cu 90 to 95, Al 3 to 10, W 0·1 to 5·0 parts. Both alloys must be free from zinc.—T. St.

Ores or oxides ; Reduction of tin and similar ——. H. Tomkins, Stockton-on-Tees. From A. V. Kemp, Singapore. Eng. Pat. 1814, Jan. 23, 1912.

The reducing chamber is an annular space surrounding a fire-tube, in which producer gas or similar reducing gas, after passing through the reducing chamber, is burnt with air on the regenerative principle. Horizontal and vertical forms of furnace are described. In the horizontal forms, agitation of the ore is brought about either by rotating the reducing chamber round the fire-tube, or by means of revolving arms or diaphragms ; in the vertical form, by providing the annular shaft down which the ore descends, with a series of baffles. In the vertical form, the ore falls into a hopper from which it is continuously removed by an endless chain of buckets, and again charged into the top of the chamber. The ore is heated entirely by radiation and conduction from the fire-tube, and reduction is effected solely by the action of the reducing gas, thus avoiding the production of slag. The ore may be subjected to a previous roasting or oxidation by sending a current of air through the chamber, the reducing gas being fed at such times directly into the fire-tube. When the desired roasting is complete, the reducing gas is substituted for air, and reduction of the ore at once begins. Transference of the charge between the two stages is thus avoided, and the loss of heat is a minimum. The reduced ore may be discharged as "matte," "prill," or metal, according to the temperature of working, and in any case can be obtained in ingot form by heating in crucibles or tank furnaces, and running into moulds in the usual way.—T. St.

Muffles ; Continuous annealing ——. G. B. A. Gibbons, Lower Gornal, Staffs., and R. Masters, Dudley, Worcester. Eng. Pat. 7202, Mar. 25, 1912.

The apparatus (for annealing metal sheets, etc.) consists of a muffle, through which the metal sheets are continuously conducted by means of mechanically-driven rolls, a pair of which is situated at each end of the chamber. The annealed metal is discharged into an airtight cooling-chamber ; and the muffle is heated by means of producer gas, the producer being built in the basement of the muffle and arranged upon the regenerative principle.
—W. E. F. P.

Bronze alloy. F. Springorum, Berlin. Eng. Pat. 9953, April 26, 1912.

An alloy of Cu, Al, Fe, Ni and Mn, in which the Cu and Al together amount to 90 per cent. of the total, the Al not exceeding 11 per cent. The Ni, Fe or Mn (together amounting to 10 per cent.) may be partly replaced by Cr, W, Mo or Va. The alloy is stated to possess great tensile strength and ductility.—W. E. F. P.

Ores ; Apparatus for roasting or sintering ——. J. E. Greenawalt, Denver, Colo., U.S.A. Eng. Pat. 14,805, June 25, 1912.

The apparatus consists of a cast-iron roasting pot divided into upper and lower compartments by a grate carrying a porous layer, upon which the pulverised ore rests. The pot is supported on trunnions, one of which is hollow and connected with a suction fan, so that the ignition of the charge proceeds downwards, and the products of combustion are drawn off. The charge should contain sufficient combustible material (10 per cent. of sulphur or 6 per cent. of carbon) to maintain the proper temperature after being ignited. The igniter consists of a cover shaped to fit closely when lowered on the top of a pot. It is provided with air inlets, and spray nozzles through which oil under pressure is forced, the oil being thereby atomised and readily ignited. The oil is fed from a tank to the igniter through a flexible conduit. The flame of burning oil is sucked down on to the charge, which becomes uniformly ignited over the whole surface. The igniter may be suspended from a rail above a line of pots, so that when one charge has become ignited the igniter may be readily moved over a fresh charge, the oil in the meantime being shut off by means of a cock. When roasting is complete, the pot is rotated on the trunnions, and the charge drops on to a shoot provided with upwardly projecting flanges. The ore is thus broken up and passes through openings at the bottom of the shoot into receiving cars.—T. St.

Vanadium ; Process for separating —— from uranium. W. F. Bleecker, Canonsburg, Pa., Assignor to The Standard Chemical Co., Pittsburg, Pa. U.S. Pat. 1,050,796, Jan. 21, 1913.

A solution containing uranium and vanadium, obtained, for example, by making a solution of alkali uranyl carbonate and alkali vanadate, heating so as to precipitate a mixture of alkali uranate and uranyl hydroxide, dissolving the precipitate with acid, and making the resulting solution slightly alkaline, is subjected to electrolysis, so as to precipitate the vanadium and give a solution of uranium salts free from vanadium.—F. Sodn.

Ores : Apparatus for treating —— in preparation for magnetic separation. J. B. Etherington, Winthrop, Mass., Assignor to Campbell Magnetic Separating Co. U.S. Pat. 1,051,494, Jan. 28, 1913.

The ore is fed through an unlined metallic rotatable furnace, and is heated by means of a fire situated outside the furnace. The flame is blown from the fire into the furnace, and a predetermined amount of air is admitted independently, whereby oxidation of the ore is materially restricted.—T. St.

Furnace ; [Zinc] Ore-reducing ——. P. E. Peterson, Butte, Mont. U.S. Pat. 1,051,512, Jan. 28, 1913.

The condenser of a zinc furnace consists of a chamber opening into the upper portion of the retort, and tubes extending downwards from the chamber into a receiving chamber situated below. The tubes are cooled by air flowing around them, the air being admitted at the upper ends of the tubes and escaping at their lower ends. The cooling air thus passes in the same direction as the zinc vapours, the hottest portions of the tubes being subjected to the coolest air.—T. St.

Zinc and other metals ; Treatment of sulphide ores of ——. Imbert Process Co. Fr. Pat. 447,338, Oct. 24, 1911.

The ore is mixed with iron oxide, coke, and a flux, and is heated in an electric furnace at a temperature of 1300° to 1400° C. Metallic iron is first produced, which immediately reacts with the zinc sulphide, the products being carbon monoxide, metallic zinc, and iron sulphide. The carbon monoxide provides the necessary pressure to drive the zinc vapours forward to the condenser. If lead sulphide is present in the ore, the resulting metallic lead will be chiefly left in the furnace, where it settles below the molten iron sulphide and still lighter slag. Roasted pyrites is a convenient form of iron oxide to use, and the resulting iron sulphide may be roasted to regenerate the oxide and to yield sulphur dioxide.—T. St.

Tin ; Electrolytic refining of —— applicable to any conducting material containing tin. G. Michaud and E. Delasson. First and Second Additions, dated Aug. 24 and 28, 1912, to Fr. Pat. 435,936, Nov. 4, 1911 (this J., 1912, 395).

(1) The process may be applied to any material containing tin, or covered with tin, for the purpose of recovering and refining the metal. (2) The deposits of refined tin formed on the bottom of the bath on the cathode are pushed forward by collectors, or brushes, carried on an endless chain, the metal being swept into a suitable side chamber. The anode may be formed from a conducting material, supporting the tin-plate waste, the movable anode being supported by an apron provided with chains, so that the material is carried through the liquid, then delivered on to a second travelling apron and thence to a second bath.—B. N.

Metal ; Special ——, for use in the manufacture of apparatus for chemical and other industries. O. Delfosse. First Addition, dated Aug. 8, 1912, to Fr. Pat. 439,004, Jan. 15, 1912 (this J., 1912, 647).

The metal previously described is melted, and to it is added a mixture very rich in silicon, and, finally, a greater proportion of zinc chloride. The proportions of the various ingredients are as follows :—First mixture : ferrosilicon (16 per cent.) 94 parts, pure hæmatite iron 5, ferromanganese 1. Second mixture : ferrosilicon (25 per cent.) 47 parts, ferrosilicon (45 per cent.) 3, ferrosilicon (85 per cent.) 2, silicomanganese free from carbon 1, iron 1. Each mixture is melted separately, and the second poured into the first. Finally, 1 part of melted zinc chloride is added, and the whole well stirred. The further addition of silicon is stated to yield a metal of finer grain, which completely resists the attack of acids, is very light, and is capable of withstanding very high temperatures.—T. St.

[Tungsten and molybdenum] Metals ; Process for rendering —— ductile. The Westinghouse Metal Filament Lamp Co., Ltd. First Addition, dated Sept. 4, 1912, to Fr. Pat. 445,208, June 7, 1912 (this J., 1912, 1186). Under Int. Conv., Sept. 14, 1911.

The metal (tungsten or molybdenum) is heated and allowed to cool slowly in an inert atmosphere under high pressure. —W. E. F. P.

Tungsten ; Preparation of malleable and ductile bodies composed of an alloy of ——. H. Bresler. Fr. Pat. 447,584, Aug. 23, 1912.

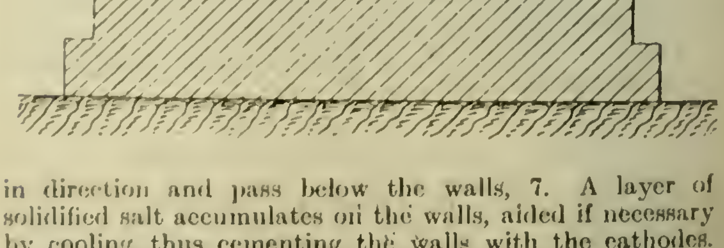
Finely divided tungsten is mixed into a paste with from 2 to 7 per cent. of thorium tungstate, and an organic binding material. The paste is formed into rods, which are first carbonised, and then heated in a reducing atmosphere to a temperature above the melting point of thorium. Oxygen and carbon are thus eliminated, and the thorium melts and alloys with the surrounding tungsten. The product is ductile, and may be rolled into plates or drawn into wire.—T. St.

Tungsten ; Preparation of malleable and ductile bodies composed of ——. H. and U. Bresler. Fr. Pat. 447,585, Aug. 23, 1912.

Tungstic acid heated to redness is exposed to the action of a stream of dry ammonia until no more water is formed. The soft black powder remaining, which contains hydrogen and nitrogen, can be easily compressed into bodies of high mechanical solidity. Rods thus formed are first heated carefully to incandescence in an inert atmosphere, when they become good conductors of electricity, and are then heated in a reducing atmosphere until free from hydrogen and nitrogen. The tungsten thus obtained is extremely ductile, and may be rolled into plates or drawn into very fine wire.—T. St.

Alkali metals ; Manufacture of —— by electrolysis of fused halogen compounds. Usines Électriques de la Lonza. Fr. Pat. 447,224, Aug. 14, 1912.

One or more insulating walls, 7, completely independent of the rest of the furnace, are pressed against the collecting cathode, 2, in such a way that the current lines are changed in direction and pass below the walls, 7. A layer of solidified salt accumulates on the walls, aided if necessary by cooling, thus cementing the walls with the cathodes. By increasing the intensity of the current the layer



of salt may be softened, thus enabling the insulating walls to be changed without interrupting the passage of the current.—B. N.

Furnace ; Electric resistance ——. C. R. J. Louis. Fr. Pat. 447,715, Aug. 28, 1912.

Fixed electrodes form the base of a shaft furnace, and the electrodes are separated by a refractory insulating wall which prevents the reduced metal from short-circuiting them.—B. N.

Burnt pyrites, etc. ; Electrolysis of solutions obtained by lixiviating ——. O. Spinzig and A. Wannag. Ger. Pat. 255,454, Jan. 26, 1911.

The electrolyte is forced between the anode and the surrounding cylindrical cathode and then through the ore to be lixiviated. In this way the lixiviation of the ore and the electrolysis are effected in a single operation, and injurious secondary actions on the deposited metal are avoided. In order to prevent injurious effects due to ferric salts or the like, sulphur dioxide is forced in through the hollow perforated anode against the surrounding cathode. In the apparatus described. the cathode consists of a vertical cylinder, open at both ends, enclosing a rotary anode consisting of a coiled perforated tube: at the lower end of the anode is a propeller, the blades of which are provided with channels leading to the periphery. —A. S.

Armour-plates ; Manufacture of ——. J. L. Benthall, Chesterfield, Assignor to Vickers, Ltd., Westminster. U.S. Pats. 1,051,380 and 1,051,799, Jan. 28, 1913.

See Eng. Pat. 6664 of 1910 ; this J., 1911, 961.—T. F. B.

Furnace ; Electric —— *[for making steel and iron alloys]*. G. Massip. Fr. Pat. 447,434, Aug. 21, 1912.

See Eng. Pat. 19,172 of 1912 ; this J., 1912, 1134.—T.F.B.

Iron and steel surfaces : Process and apparatus for hardening and treating ——. W. S. Simpson. Fr. Pat. 447,781, Aug. 10, 1912. Under Int. Conv., Sept. 21. 1911.

See Eng. Pat. 20,917 of 1911 ; this J., 1913. 146.—T. F. B.

Iron and steel from iron ores ; Furnaces for the direct production of ——. W. S. Simpson and H. Oviatt. Fr. Pat. 447,892, Nov. 9. 1911.

See Eng. Pat. 18,679 of 1910 : this J., 1911, 1456.—T. F. B.

Aluminium or its alloys ; Treatment of surfaces of —— *for the deposition of metals thereon.* Q. Marino, Golder's Green. Eng. Pat. 2136, Jan. 26, 1912.

See U.S. Pat. 1,045,718 of 1912 ; this J., 1913, 30.—T.F.B.

Furnaces : Electric ——. L. Gonnet, Lyons, France. Eng. Pat. 19,287, Aug. 22, 1912. Under Int. Conv., March 15, 1912.

See Fr. Pat. 441,588 of 1912 ; this J., 1912. 932.—T. F. B.

Metallic bodies : Production of —— *by means of electro-deposition.* S. Consigliere, Genoa, Italy. U.S. Pat. 1,051,556, Jan. 28. 1913.

See Eng. Pat. 20,776 of 1910 : this J., 1911, 494.—T. F. B.

Metallurgical furnaces ; Slag pocket for ——. T. S. Blair, jun. Fr. Pat. 447,018, July 5, 1912. Under Int. Conv., July 10, 1911.

See U.S. Pat. 1,012,236 of 1911 ; this J., 1912, 78.—T.F.B.

Foundry sand ; Process of regenerating ——. Poulson's Foundry Specialities, Ltd. Fr. Pat. 447,097, Aug. 9, 1912. Under Int. Conv., Sept. 12, 1911.

See Eng. Pat. 20,204 of 1911 ; this J.; 1912, 994.—T.F.B.

Ores ; Treatment of ——. E. Kerr. Fr. Pat. 447,192. Aug. 13, 1912. Under Int. Conv., Feb. 8, 1912.

See U.S. Pat. 1,032,007 of 1912 ; this J., 1912, 780.—T.F.B.

Sulphide ores or metal-bearing solutions ; Treatment of ——, *and production of ammonia or its salts and other nitrogen compounds.* E. A. Ashcroft. Fr. Pat. 447,321. Aug. 7. 1912. Under Int. Conv., Nov. 15, 1911.

See Eng. Pat. 25,506 of 1911 ; this J.. 1913, 29.—T. F. B.

Zinc ; Process for recovering —— *from substances containing it, by treatment with sulphurous anhydride.* C. A. Beringer. Fr. Pat. 447,427. Aug. 21, 1912. Under Int. Conv., Sept. 21, 1911.

See Ger. Pat. 250,283 of 1911 ; this J., 1912. 994.—T.F.B.

Metallisation of articles of cast iron, wood, plaster, paper, and other porous materials ; Process for the superficial ——. P. Marino. Fr. Pat. 447,946, Sept. 4, 1912. Under Int. Conv., Sept. 8, 1911.

See Eng. Pat. 20.012 of 1911 ; this J., 1912, 192.—T.F.B.

XI.—ELECTRO-CHEMISTRY.

Electrochemical reductions. III. Reduction of nitrosamines. Backer. *See* XX.

Patents.

Electrolytic apparatus. J. T. Niblett. London. Eng. Pat. 1671, Jan. 20, 1912.

In electrolytic apparatus in which aqueous solutions of salts are decomposed, the electrodes are provided with a porous coating, formed by first applying to the surfaces a suitable adherent graphite mixture and then rendering the mixture porous by the application of heat.—B. N.

Salt solutions ; Electrolysis of ——. J. Billiter. Fr. Pat. 447,785, Aug. 13. 1912.

The anode chamber is closed below by cathodes disposed nearly horizontally and arranged in the form of bands so that the electrolyte may be directed at first exclusively or in greater part towards the base. perpendicularly to the surface of the cathode, and through the intervals between the cathode bands. By means of one or more perforations the liquid passes to a side pocket, from which it may be exhausted. The cathodes may be separated and bound by insulating bands, the upper edges being inclined to facilitate the escape of gas, and the insulating bands are made wedge-like in form so that by placing them in a flexible tube or pipe, this may be stretched. thus forming a membrane or screen surrounding the cathode bands. A circulation of electrolyte is secured through the spaces. below and above the cathodes, formed by the membrane, which may be in the form of metallic wire tissues of fine mesh, the screens aiding the descent of residues which are deposited during the process, and at the same time preventing the accumulation above of a volume of gas of relatively large transverse section. Frictional resistances may be arranged to prevent variations of levels of the electrolyte, due to variations in the pressure of the gases. by offering a resistance to the passage of the liquid.—B. N.

Colloidal and finely sub-divided substances ; [Electrically] Separating ——. G. B. Schwerin. Frankfort-on-the Maine, Germany. Eng. Pat. 14,369. June 19. 1912 Under Int. Conv., June 19. 1911.

Colloidal, soluble or finely sub-divided substances are separated from matter serving as a carrier by subjecting the mixture to electro-osmosis. A diaphragm, which is indifferent or of the same sign as the pole, is inserted before the latter so that the colloidal or soluble substance wanders through the diaphragm. The substances may be fractionated according to the sizes of the particles by employing diaphragms of different porosity. In order to prevent the ions discharged at the pole from decomposing the substances to be isolated and migrating towards the pole, the latter may be surrounded by a second diaphragm, so that the substances may be separated in the space between the two diaphragms.—B. N.

Depolarising agents for galvanic cells. The British Ever Ready Electrical Co., Ltd., London. From A. Heil, Frankfort-on-the-Maine, Germany. Eng. Pat. 25,784, Nov. 9, 1912.

THE depolarising agent comprises a mixture of graphite and manganese dioxide, the latter being in the form of granules smaller than 0·5 mm. diam., but larger than fine powder or flour (*e.g.*, 0·1 mm. diam.), the best result being obtained with granules of about $\frac{1}{6}$ mm. diameter. —B. N.

Gases or vapours; Electrical treatment of ——. W. T. Hoofnagle, Glen Ridge, N.J. U.S. Pat. 1,051,810, Jan. 28, 1913.

SEVERAL vacuum chambers are connected with an exhaust pump, means being provided for restricting the flow of gas or vapour into each chamber alternately, so as to cause a partial vacuum therein, and the charges are withdrawn successively and intermittently. Separated electrodes are arranged in each chamber to produce an electrical discharge when the circuit is closed, and means are provided for operating intermittently in synchronism with the movements of the pump piston, so as to close each circuit whenever a charge of gas or vapour is drawn into the chamber.—B. N.

Furnace; Electric —— *with electrodes.* L. Gonnet. First Addition, dated Aug. 10, 1912, to Fr. Pat. 441,588, March 15, 1912 (this J., 1912, 932).

THE ends of the electrodes outside the furnace are gripped by pieces, which are mounted on wheels travelling on suitable iron supports. The movement of the electrodes is controlled by a means of transmission perpendicular to the axis of the electrodes. This consists of a wheel mounted on an endless screw gearing with a helical wheel, the latter being supported on a female thread gearing with a male thread attached to the gripping pieces.—B. N.

Current lead to magnetite electrodes; Preparation of a ——. Chem. Fabr. Buckau. Ger. Pat. 254,560, Jan. 13, 1912.

THE metallic current lead introduced into the interior of the electrode is surrounded with iron, which is then converted *in situ* into magnetite, *e.g.*, by heating to 1000° C. in an atmosphere of carbon dioxide and steam. The magnetite thus produced is more or less firmly combined with the magnetite of the electrode and the joint may be protected by a coating of enamel.—A. S.

Electrodes for electrolysing apparatus. J. Effgen. Ger. Pat. 254,764, June 17, 1911.

THE electrodes consist of plates fixed in frames and assembled within the electrolysing chamber in the manner of a filter-press. Between the electrodes are sheets of asbestos for insulating purposes. The frames are of such shape that they form, together with the electrodes, gas-collecting chambers, from which any gases evolved during electrolysis may be led off. The electrodes are fixed to the frames only at the upper end, whilst at the lower end, a free space is left for the circulation of the electrolyte. —A. S.

Electrolysis of liquids. J. G. Paulin, Landskrona, Sweden. Eng. Pat. 6261, March 13, 1912.

SEE Fr. Pat. 441,316 of 1912; this J., 1912, 825.—T. F. B.

Electrolysis of metal-salt solutions. N. V. Hybinette, Kristiansand, Norway. U.S. Pat. 1,052,256, Feb. 4, 1913.

SEE Fr. Pat. 438,846 of 1912; this J., 1912, 649.—T. F. B.

Furnaces; Electrical ——. I. Rennerfelt, Halmstad, Sweden. Eng. Pat. 7367, March 26, 1912.

SEE Fr. Pat. 444,947 of 1912; this J., 1912, 1188.—T. F. B.

Wood for use in electric storage batteries; Process of treating ——. B. Heap, Clifton Junction, Assignor to The Electric Storage Battery Co., Philadelphia. U.S. Pat. 1,051,580, Jan. 28, 1913.

SEE Eng. Pat. 1420 of 1908; this J., 1908, 1070.—T. F. B.

XII.—FATS; OILS; WAXES.

Linseed oil; Hexabromide numbers of fatty oils and the determination of rape oil in ——. A. Eibner and H. Muggenthaler. Farbenzeit., 1912, **18**, 131—134, 175—177, 235—237, 356—357, 411—413, 466—468, 523—525, 582—583, 641—643. Chem. Zentr., 1913, **1**, 567—568.

As the result of an exhaustive study of the influence of varied experimental conditions, the authors recommend the following method of carrying out the determination of the hexabromide number of linseed oil. *Preparation of the fatty acids.* Three quantities of 3·5 grms. of the oil are each separately saponified in round evaporating dishes of 220 c.c. capacity with 45 c.c. of $N/2$ alcoholic potassium hydroxide on the water-bath. The soap solutions are evaporated to dryness, and the residues dissolved each in 50 c.c. of water, the water used for washing one dish being used for dissolving the soap in the next dish. The united solutions (180 c.c.) are poured whilst lukewarm into a 1-litre separating funnel having marks at 180 c.c. and 340 c.c. respectively. After cooling, 20 c.c. of $5N$-sulphuric acid are added, followed by 140 c.c. of ether (up to the 340 c.c. mark). The whole is vigorously shaken, allowed to settle, and the ethereal solution run off and allowed to stand over night in contact with 70 grms. of anhydrous potassium sulphate. The ethereal solution is then filtered, the potassium sulphate washed several times with ether, the ethereal solution distilled, and the last traces of ether removed from the residue by a current of hydrogen which has first passed through an alkaline lead solution and concentrated sulphuric acid. The fatty acids thus separated are dried *in vacuo* over sulphuric acid and dissolved in anhydrous ether to a solution of about 10 per cent. concentration. *Bromination.* 20 c.c. of the solution of fatty acids (=1·9—2·0 grms. of fatty acids) are introduced into a 100 c.c. Erlenmeyer flask with a wide neck, cooled in a refrigerating mixture to—10° C., and 1 c.c. of bromine is added in the course of half an hour, one half one drop at a time, and the second half two drops at a time, the mixture being shaken vigorously after each addition. The flask is then corked and allowed to stand for 2 hours at —10° C. The brown solution is next decanted off through a weighed asbestos filter, the precipitate shaken with 5 c.c. of ether at—10° C., allowed to settle, and the solution decanted through the filter. The precipitate is then transferred to the filter with the aid of 5 c.c. of cooled (to —10° C.) ether, and the flask and precipitate washed three times with portions of 5 c.c. of cooled ether. After draining for 1 min. with the aid of the pump, the hexabromide precipitate is dried for 2 hours at 80°—85° C. Pure linolenic acid hexabromide should be white and granular and melt at 177° C. Determinations made with a large number of raw linseed oils showed that the average values for the hexabromide numbers of oils of different origin are: Dutch oils, 51·73; La Plata oils, 51·66; Indian oils, 50·50; and Baltic oils, 57·96. The hexabromide number is not appreciably altered by bleaching the oil. When the method described above was applied to other oils the following values were obtained: poppy oil, 0; Chinese wood oil, 0; perilla oil, 64·12; ocumi oil, 60·98; rape oil, 6·34; soya bean oil, 7·17.

Determination of rape oil in linseed oil.—When the presence of rape oil in linseed oil has been detected by the erucic acid test, the approximate proportion of the adulterant can be ascertained by a determination of the hexabromide number. An addition of 10 per cent. of rape oil depresses the hexabromide number of linseed oil by about 4·4 per cent. From the amount of rape oil found, 4 per cent. should be deducted for the permissible contamination of linseed by seeds of *Cruciferæ*.—A. S.

Chinese wood oil tests. Reihl. Oil, Paint, and Drug Rep., Jan. 6, 1913.

For the detection of adulteration, the author makes use of the waterproof character of dried films of Chinese wood oil. The sample of oil is heated quickly to 260° C., cooled (so that it does not polymerise), mixed with 1 per cent. of the linolate of cobalt or lead, and spread on a piece of glass. After 36 hours the glass, with the dried film, is immersed in water for 12 hours. Films from pure wood oil remain clear and bright, but those from adulterated oils become more or less white and opaque according to the degree of adulteration. For determining the amount and nature of the adulterant, the oil is placed in a shallow vessel which is introduced into an oil-bath at 290° C. The temperature of the bath is allowed to fall to 280° C. and is kept at that point for 12—15 mins., until the oil has solidified to a hard mass. The latter is removed from the vessel, crushed, weighed, and the adulterant recovered from the insoluble polymerised wood oil by extraction in a Soxhlet with petroleum spirit.—A. S.

Horse-chestnut; Preparation of a saponin-like substance from the ——. Rousset. Les Matières Grasses, 1913, **6**, 2980—2981.

Although several attempts have been made to utilise the horse-chestnut in the preparation of detergents none of them have been adopted as industrial processes. It should be practicable, however, to use the residue left after the extraction of the oil, for the preparation of saponin and starch. The kernel of the nut, after removal of the shell, which is rich in tannin, contained the following proportions of extractives: Oil, 6·6; æsculic acid, 3·2; carbohydrates, 10·8; reducing sugars, 5·2; gums, 1·2; and proteins, 1·0 per cent. The oil extracted with petroleum spirit from the dried powdered material was of a pale yellow colour and had the following characteristics:—Sp. gr., 0·925; Hehner value, 93·3; and iodine value, 97 to 98. The residue extracted with dilute alcohol yielded an extract containing 15 per cent. of æsculic acid, a saponin-like substance which differs from saponin in its solubility in alcohol. The final residue could be utilised in the preparation of a white starch (about 30 per cent.)—C. A. M.

Patents.

Train oil; Process for deodourising ——. E. C. R. Marks, London. From Sudfelt und Co., Melle, Germany. Eng. Pat. 17,430, July 26, 1912.

An addition of higher fatty acids, which may be derived from train oil itself, is made to the crude oil to be deodourised, and the mixture distilled at a low temperature *in vacuo* until the escaping vapours are free from objectionable odour. Under these conditions the oil does not become overheated, and is consequently not discoloured.—C. A. M.

Oil; Means for removing —— *from the press plates of oil presses.* L. Hoffmann, Vienna. Eng. Pat. 18,835, Mar. 26, 1912.

The oil is removed from the press plates by means of a current of air, which is introduced under pressure through holes in that part of the frame of the press where the ram pushes out the plates. The air, carrying with it the oil, escapes through holes at the opposite side of the frame, and then comes in contact with a shield to prevent the oil being carried further. The outer end of the air outlets may also be directed downwards within the outer wall of the press and communicate with channels through which the oil blown out passes to join the oil that has been pressed out through the usual perforations in the press plates.—C. A. M.

Process for making hydrogenation products from unsaturated compounds. Fr. Pat. 447,420. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pigments; Tests on the opacity and hiding power of ——. G. W. Thompson. J. Ind. Eng. Chem., 1913, 5, 120—123.

The terms "hiding power" and "opacity" of paints have been defined as follows by Committee D1 of the American Society for Testing Materials. *Hiding power.* The power of a paint or paint material, as used, to obscure optically a surface painted with it. *Opacity.* The obstruction to the direct transmission of visible light afforded by any substance, comparison being made with sections of equal thickness. The opacity in the case of pigments should be considered as referable to their opacity in a vehicle under standard conditions. The author emphasises the point that in comparisons of opacity the values should be referred to a definite volume (not weight) of the pigment in a definite volume of vehicle, *e.g.*, 25 per cent. by volume of pigment to 75 per cent. by volume of linseed oil. The coefficient of opacity is defined as the proportion of light, expressed in a decimal fraction of unity absorbed during transmission through a thickness of 0·01 mm. of paint, and from this the total opacity for any given thickness can be calculated. Hurter and Driffield (this J., 1890, 455) have shown how to construct plates varying in opacity and the opacity of which can be determined, but in testing white paints, the reflecting power must be taken into consideration.

The author uses a photometer disposed above two tubes, the lower ends of which are covered with plano-plano lenses. Below these lenses are two other similar lenses, and below these are two total reflection prisms which direct light from a series of incandescence lamps up through the tubes to the eye-piece. The tubes holding the upper lenses have micrometer milled wheels on them, so that the distance between each set of lenses can be controlled and measured. Paint placed between one set of lenses is compared with a standard paper, the opacity of which has been determined on a photometer bench, and then a second test is made with a different standard paper. New formulæ have been derived. A few results obtained with different pigments by this method are given, but it is not claimed that the results represent the average quality of the pigments:—

Pigment.	Coefficient of opacity, for layer of 0·01 mm.	Reflection.
White lead, Dutch	0·0671	0·935
White zinc, American process	0·0794	0·956
White zinc, French process	0·0645	0·964
Lithopone	0·0578	0·947
Calcium carbonate	0·0136	0·969
Basic lead sulphate	0·0813	0·927
China clay	0·0190	0·823
Asbestine	0·0090	0·859
Calcium sulphate	0·0030	0·856
Silica	0·0102	0·793
Barytes	0·0114	0·856

—A. S.

Pigment colours from coal tar dyestuffs; The fastness to light of ——. P. Krais. Z. angew. Chem., 1913, **26**, 74—79.

The author has made comparative tests of oil colours in the same way in which he has previously treated the water colours (this J., 1912, 1085), exposing samples painted on maple wood under glass and in the open.

Each pigment was tested alone in admixture with different quantities of white lead. The results of experiments with 81 pigments are published in tabular form. Alizarin lake shows a surprising superiority over natural madder lake. In general the results obtained under glass and in the open agree, but there are some interesting differences. It is noteworthy that there are now more than twenty coal-tar lakes which compare favourably with the fastest mineral colours. —I. B.

Artists' colours: Action of light on ——. II. The composition of Turnbull's blue. A. Eibner and L. Gerstacker. Chem.-Zeit., 1913, **37**, 137—139, 178—179, 195—197. (See also this J., 1912, 1041.)

The authors discuss the work of previous investigators regarding the composition of the various iron-cyanogen compounds, and their conversion one into another. The light-reactions of Turnbull's blue and Prussian blue were investigated, and the behaviour of these substances, freshly prepared, with sodium carbonate, ammonium carbonate, and other reagents. The results showed that the two substances are not identical, and that Turnbull's blue is a ferricyanide. Experiments made to ascertain the effect of light on the ferricyanides of the heavy metals, both alone, and mixed with zinc oxide, showed that the ferricyanides of ferric iron (Berlin green), zinc, cadmium, lead, and copper, are all more unstable than Turnbull's blue. The effect of the zinc oxide was to render all the ferricyanides except those of silver and copper more stable. The ferrocyanides were found to be more stable in diffused light than the ferricyanides; in the case of the copper salts only, was no change apparent. Copper ferrocyanide is thus in a class apart with Prussian blue. The reactions of the various ferricyanides with reducing agents ran parallel with the light reactions.—T. St.

Clay- and talc-colours. Rohland. Farbenzeit., 1912, **18**, 522—523. Chem. Zentr., 1913, **1**, 473—474.

Pigments obtained by the adsorption of complex colouring matters by clays (including kaolin) and talc are faster to light than the colouring matters in their original condition. The talc pigments appear to be somewhat inferior to the clay- and kaolin-pigments in regard to covering power.—A. S.

Rapid testing of the fastness to light of dyestuffs and pigments. Gebhard. *See* IV.

Patents.

Pigment. R. Hochstetter, Cincinnati, Ohio. U.S. Pat. 1,052,145, Feb. 4, 1913.

When diazotised *p*-nitro-*o*-toluidine is combined with an alkali salt of β-hydroxynaphthoic acid in "distinctly" acid solution, an acid salt of *p*-nitrotoluene-*o*-azo-β-hydroxynaphthoic acid is obtained in the form of a bluish-red substance, insoluble in water but soluble in alcohol. It cannot be reduced by means of zinc and hydrochloric acid or stannous chloride and hydrochloric acid.—T. F. B.

Zinc white paste and process of manufacturing it. L. Petit-Devaucelle. Fr. Pat. 447,188, Oct. 20, 1911.

Calcined calamine, blende, or other zinc ore is heated with caustic soda solution in an autoclave under pressure, whereby zinc and aluminium go into solution as sodium zincate and sodium aluminate respectively; to the filtered solution freshly precipitated aluminium hydroxide is added with constant stirring for several hours; in this way, it is stated, all the aluminium is precipitated as hydroxide: after filtering off the latter, the filtrate is treated with carbon dioxide under pressure with the separation of a hydrated, basic zinc carbonate, which is filtered off, lightly dried, and heated with a mixture of saponifiable oils, such as glyceryl oleate or margarate, with the formation of zinc oleate and margarate in the form of an unctuous white paste of great stability. If the use of non-saponifiable or mineral oils is preferred, these may be employed by adding to them a small quantity of a saponifiable oil or of the acid constituent of such oil, *e.g.*, oleic acid.—O. R.

Compound substances [artificial resins and the like], and process for their manufacture. W. A. Beatty. Fr. Pat. 447,647, Aug. 26, 1912.

Phenol and acetone are condensed by warming with an acid such as hydrochloric acid. The product is treated with formaldehyde and a suitable condensing agent at a temperature of 100° C., when a resin is produced of complex composition. Hexamethylenetetramine can be used in place of formaldehyde, and homologues of phenol and acetone can also be utilised.—F. Shdn.

Mass capable of drying and soluble in fats and oils; Manufacture of a ——. J. Lifschütz. Ger. Pat. 253,965, Aug. 1, 1911.

It has been proposed previously (Ger. Pat. 234,502), to utilise saponified wool fat for the manufacture of a product capable of drying, and hence suitable for use in the manufacture of varnish and polishes, and for other purposes. It has now been found that the requisite properties are possessed in the most pronounced degree by the unsaponifiable portion of wool fat. According to the present patent, the unsaponifiable portion of wool fat is heated to a temperature above its melting point and then treated with air, oxygen or other oxidising agents, or it may be treated with air or other oxidising agent at the ordinary temperature whilst exposed to the light. The unsaponifiable matter may be applied to a surface or fabric and then oxidised.—A. S.

Paint and varnish coatings; Process for removing ——. S. Jankowski. Ger. Pat. 254,623, Dec. 29, 1912.

Neutral or faintly acid aqueous solutions of salicylic acid in caustic alkalis, alkali carbonates, or ammonia are used. —A. S.

Paints; Water —— made with hydraulic cement. W. P. D. Moross. Fr. Pat. 447,079, Aug. 9, 1912. Under Int. Conv., Aug. 14, 1911.

See Eng. Pat. 18,095 of 1912; this J., 1913, 97.—T. F. B.

Resins; Apparatus for the regular and continuous distillation of ——. L. B. Castets, Laluque, France. U.S. Pat. 1,052,214, Feb. 4, 1912.

See Fr. Pat. 391,835 of 1908; this J., 1908, 1163.—T. F. B.

Manufacture of chromium compounds of [hydr]oxyanthraquinonesulphonic acid, and of colouring matters, inks, colour lakes, etc., therefrom. Eng. Pat. 7892. *See* IV.

Azo colour. U.S. Pat. 1,951,565. *See* IV.

Use of bird-lime from holly and carbon tetrachloride in the treatment of rubber, gums, and guttapercha. Additions to Fr. Pat. 443,018. *See* XIV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber exports from Federated Malay States in 1912. Board of Trade J., Feb. 20, 1913.

The following official statistics show the exports of cultivated rubber from the Federated Malay States during 1911 and 1912:—

	1911.	1912
	Lb.	Lb.
Perak	5,553,277	10,470,289
Selangor	10,487,916	17,900,138
Negri Sembilan	3,615,174	6,230,823
Pahang	38,963	116,765
Total	19,695,330	34,718,015

Rubber exports from the Amazon Basin, via Parà. Board of Trade J., Feb. 20, 1913.

The quantity of rubber exported from Parà, Manaos. Iquitos, and Itacoatiara, *via* Parà, during the year 1912, was as follows:—

	Fine.	Medium.	Coarse.	Caucho.	Total.
	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
To the United States	9,295,688	2,026,531	6,492,823	3,317,217	21,132,259
To Europe..	12,289,941	1,462,240	2,818,736	5,156,127	21,727,044
Total, 1912 ..	21,585,629	3,488,771	9,311,559	8,473,344	42,859,303
Total, 1911 ..	18,839,656	3,114,586	7,675,888	6,411,556	36,041,686

Patents.

Rubber, gums and guttapercha; Use of bird-lime from holly and carbon tetrachloride in the treatment of ——. M. J. M. Bouffort. First and Second Additions, dated Aug. 14, 1912, to Fr. Pat. 443,018, April 19, 1912 (this J., 1912, 1043).

Carbon tetrachloride is employed: (1) as an uninflammable substitute for other and inflammable solvents, in the extraction of rubber, gums (resins), guttapercha, and bird-lime from resins, wood, latex, and industrial waste products, and for the purification of the extracted products; (2) as a substitute for benzine, benzol, toluene, toluidine, alcohol, etc. for making solutions, pastes, varnishes, polishes, etc., with rubber, gutta-percha, bird-lime, resins and gum-resins. —E. W. L.

Rubber; Process for the manufacture of artificial —— [*rubber-like substance*]. L. Velasquez. Fr. Pat. 447,411, Oct. 26, 1911.

A mixture of starch (or other carbohydrate having similar properties), and formaldehyde, in equal proportions, is heated at a temperature of 60°—80° C. in free air, and the plastic material formed is rendered permanent by heating in an autoclave for about six hours at a pressure of about three atmospheres. Formic acid is then removed by washing between rollers in a stream of warm water, and the washed sheeted product is "polymerised" by curing it with smoke charged with the vapours of resins and creosote.—E. W. L.

Rubber; Process for the manufacture of artificial —— [*rubber substitute*]. Thomas, Bazin, Casanova et Cie. Fr. Pat. 447,904, Sept. 2, 1912.

Oil is mixed with 4 per cent. of its weight of flowers of sulphur and sulphur chloride is added to the mixture in the proportion approximately of 160 to 180 grms. of the latter per kilo. of the former; the exact proportions will vary with the kind of oil employed. The mixture is carefully stirred during the addition of the chloride. The temperature rises gradually to 85°—90° C. The product obtained is stated to be resistant to dry and moist heat as well as to great cold, and being at first in a liquid state it can be readily used for filling pneumatic tyres, and for other similar purposes.—E. W. L.

Caoutchouc; Process for producing a substance similar to ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 447,152, Aug. 12, 1912. Under Int. Conv., Aug. 31, 1911.

See Eng. Pat. 8065 of 1912; this J., 1913, 35.—T. F. B.

Depolymerisation of turpentine or turpentine oil. [*Preparation of isoprene, etc.*]. Eng. Pat. 1953. *See* XX.

Process of preparing isoprene. U.S. Pat. 1,050,354 *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Oakwood-extract; Natural organic acids in ——. J. Jedlicka. Collegium, 1913, 33—39.

Oakwood extract (25° Be., sp. gr. 1·210) contains 0·2—0·3 per cent. of free acetic acid; by boiling, a further 0·5—1·0 per cent. of this acid is liberated, probably from acetates present in the extract, Leached liquors yield still larger quantities on concentrating, about 20—25 kilos. of calcium salts being obtained from 10,000 kilos. of oakwood; about 5 per cent. of the total acids is formic acid, the rest being acetic acid; higher homologues are not present. During the extraction of the wood, oxalates pass into the extract. On evaporation they separate and remain, partly on the steam-pipes of the evaporator and partly in suspension in the extract, from which they may be removed by settling. From 10,000 kilos. of wood, 3—4 kilos. of oxalic acid as oxalates appear in the crude extract. The steam from the evaporators contains appreciable quantities of carbon dioxide and a further quantity is obtained by boiling the extract, probably owing to a decomposition of the tannin. A small quantity will be derived from the carbon dioxide dissolved in the water supply and from the calcium carbonate contained in the wood.—D. J. L.

Chestnut-oak bark before leaching; Storing of ——. C. C. Smoot. J. Amer. Leather Chem. Assoc., 1913, 8, 107—109.

Comparative tests with two parcels of chestnut-oak bark (about 3,000,000 lb. each), one 6—9 months old and the other 30—33 months old, which were ground and leached under similar conditions, gave results leading to the following conclusions: (1) New bark produces more liquor but of a poorer quality. (2) The amount of actual tannin obtained is practically the same from both kinds of bark, showing that there is no appreciable loss of tannin caused by age up to the time limit of this test. (3) There is a difference in the solubility of the tannin in old and new bark. That in old bark being more easily soluble gives the better quality liquor. Therefore when the cost factor does not prevent, bark should not be ground until thoroughly aged, the time required being different for different localities.—D. J. L.

Sulphite-cellulose extract; Report of the Committee of the American Leather Chemists' Association on the analysis and detection of ——. F. H. Small. J. Amer. Leather Chem. Assoc., 1913, 8, 63—89.

No substance with the properties of tannin can be extracted from sulphite-cellulose extracts with alcohol, acetone or ethyl acetate. While alcohol dissolves an appreciable proportion of the material, the solution does not give any of the characteristic tests for tannin after evaporation of the alcohol and re-dissolving in water. On adding gelatin the solution becomes cloudy but no flocculent precipitate is produced. The residue from an ethyl acetate extract when dissolved in water gave a negative result on testing with iron-alum. Experiments made to show whether sulphite cellulose extracts responded to tests for the tannin in sulphited-quebracho extracts proved that this was not the case. The evidence is conclusive that some at least of the sulphite-cellulose extracts do contain a certain amount of some vegetable materials which will actually combine with hide (not by mere absorption) and will make the hide imputrescible, pliable, and opaque, *i.e.*, transform it into leather, not necessarily merchantable. The variation in the amount of material absorbed from the sulphite-cellulose extracts when different amounts of hide-powder are used is more than double that found when a tannin-containing material is analysed. This seems to show that in the analysis of sulphite-cellulose extracts, a much greater proportion of the material is physically absorbed than in the analysis of tannin extracts. From tanning experiments carried out on hide powder with sulphite-cellulose liquor compared with tannin extracts, the evidence was conclusive that the former possesses but little value as a tanning material, the hide fixing but one-fifth as much as from the poorest of the other materials. From experiments made on the washing out of the material from tanned hide-powder, it was found that under similar conditions, as shown by the hide-powder method of analysis, the combining value of sulphite-cellulose extract is not much more than half that of tannin-containing extracts. The Procter-Hirst aniline test (this J., 1909, 293) was found perfectly reliable for the detection of the presence of sulphite cellulose extract when as much as 5 per cent. was present in a mixture. It was found that it was necessary for the success of the test that the aniline should be pure and reasonably fresh; an old sample was found to give a precipitate when no trace of sulphite-cellulose was present. Another test for the presence of the extract is as follows: 40 c.c. of 2 per cent. gelatin solution are mixed with 30 c.c. of glacial acetic acid. 7 c.c. of this solution are added to 10 c.c. of the solution to be tested of the usual strength for analysis. If wood-pulp liquor is present a precipitate is formed which persists even on heating. The Committee finds that: Sulphite-cellulose extracts contain no appreciable amount of tannin or sulphited tannin and that they therefore cannot be legitimately analysed by a method of tannin analysis. Sulphite-cellulose extracts do contain some material which will combine with hide and make leather as defined, but the combining value of this material is much less than that of tannin under like conditions, and it is at least doubtful whether the hide-powder method of tannin analysis estimates the quantity of this material with even approximate accuracy. The Committee recommends that the Association resolve that the official method of tannin analysis shall be limited in its use to the analysis of vegetable materials or extracts therefrom which contain tannin and to those cases where the method estimates with reasonable accuracy the probable content of tannin. —D. J. L.

Neutral salt reactions. Procter. *See* VII.

Patents.

(1) *Vegetable leather and* (2) *artificial leather; Manufacture of* ——. L. Velasquez. Fr. Pats. 447,701 and 447,702, Nov. 4, 1911.

(1) Sheets or layers of fibrous cellulose matters, *e.g.*, waste obtained in carding cotton, are placed one above the other so that the fibres are crossed. The mass is impregnated with a solution of caoutchouc, sulphur, and resin in a solvent such as benzene, compressed, the excess of solvent recovered, and the resulting mass submitted to the usual processes of dyeing, etc. The sulphur may be omitted from the impregnating solution, the mass instead being vulcanised subsequently. (2) Sheets of fibrous cellulose, with which hard materials, such as carborundum, sand, etc., have been incorporated, are placed one above the other, with the fibres crossed, and the mass is treated as described above.—J. R. B.

Glue; Manufacture of liquid ——. H. Wolf. Fr. Pat. 447,737, Aug. 30, 1912.

Liquid glue is prepared from ordinary Cologne glue by soaking 100 kilos. in water for 48 hours, boiling for 2 hours with 100 kilos. of water and adding 100 kilos. of calcium chloride with vigorous stirring. On cooling, the glue remains liquid without losing its characteristic properties.—J. R. B.

Tanning fish skins and the like; Process for ——. Skindfabriken Unicum, K. Bendixen, P. Bendixen & Co., and K. Bendixen, Copenhagen. Eng. Pat. 3481, Feb. 12, 1912.

See Fr. Pat. 440,092 of 1912; this J., 1912, 738.—T. F. B.

Tanning; Manufacture of materials suitable for use in ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 8511, April 10, 1912, and 21,369, Sept. 19, 1912.

See Fr. Pat. 443,730 of 1912; this J., 1912, 1045.—T. F. B.

Extracts containing tannin; Process for decolourising vegetable ——. W. Hildt. Fr. Pat. 447,084, Aug. 9, 1912.

See Eng. Pat. 18,436 of 1912; this J., 1912, 1193.—T.F.B.

Leather-board; Processes for the production of stock for ——. W. P. Thompson, Liverpool. From Hide-Ite Leather Co., Brockton, Mass., U.S.A. Eng. Pat. 14,527, June 21, 1912.

See U.S. Pat. 1,033,538 of 1912; this J., 1912, 890.—T.F.B.

XVI.—SOILS; FERTILISERS.

Manganese; Distribution of —— *in the vegetable kingdom.* F. Jadin and A. Astruc. J. Pharm. Chim., 1913, 7, 155—161.

A table is given showing the manganese-content of 85 plants or plant portions representing 32 botanical families. The water- and ash-contents of the materials are given in all cases, and the manganese-content is calculated on the fresh and on the dried substance, and also on the ash. Manganese is of quite general occurrence in plants, and the table shows amounts ranging from 4·2 to 909 mgrms. per 100 grms. of ash, but considerable variations may be observed between different plants of the same family and even between different specimens of the same plant. There is no general relation between the manganese-content of a parasite and that of its host. The parts of a plant which contain chlorophyll appear, as a rule, to contain more manganese than the subterranean parts.—J. H. L.

Experiments on the use of nitrogenous and potash manures [in the cultivation of the sugar beet]. Saillard. *See* XVII.

XVII.—SUGARS; STARCHES; GUMS.

Nitrogenous and potash manures; Experiments on the use of —— *[in the cultivation of the sugar beet].* E. Saillard. Suppl. Circ. hebd. Syndic. Fabr. France, 1913, No. 1243.

To compare the value of certain fertilisers, experiments were carried out in 9 different districts of the North of France. To 7 plots, each of 10 ares (0·25 acre), the several fertilisers were applied as follows: (1) sodium nitrate, 300 kilos.; potassium sulphate, 200 kilos.; and superphosphate, 600 kilos. (2) Derome fertiliser (containing: nitrogen, 5—6, phosphoric acid, 9—10, and potash, 3—4 per cent.), 820 kilos.; potassium sulphate, 142 kilos.; superphosphate, 80 kilos. (3) Calcium nitrate, 346 kilos.; potassium sulphate, 200 kilos.; superphosphate, 600 kilos. (4) Sodium nitrate, 300 kilos.; superphosphate, 600 kilos. (5) Sodium nitrate, 300 kilos.; potassium sulphate, 70 kilos.; kainite, 500 kilos.; superphosphate, 600 kilos. (6) Calcium nitrate, 346 kilos.; potassium sulphate, 70 kilos.; kainite, 500 kilos.; superphosphate, 600 kilos. (7) Sodium nitrate, 700 kilos.; potassium sulphate, 200 kilos.; superphosphate, 600 kilos. It was found that plot 6 gave the richest roots (containing 17·17 per cent. of sugar), and plot 7 the least rich (containing 17·05 per cent. of sugar). Plot 5 gave the largest yields of sugar (5·49 kilos. per hectare, or 4·9 lb. per acre), and plot 3 the lowest (4·91 kilos. per hectare, or 4·4 lb. per acre). The objectionable nitrogen in beets grown on the 7 plots varied between 0·10 and 0·15 in 1910, and between 0·21 and 0·25 in 1911. These figures explain why the loss of alkalinity during evaporation, and the amount of molasses per ton of roots sliced, were less in the 1912–13 campaign than in that of 1911–12. Further, these results and others obtained by the author (this J., 1912, 740) show the great influence of climatic conditions on the composition of the beet, and on the facility with which it may be worked in the factory. During 1912, for example, the weather was particularly favourable for the production of a desirable type of root (*cf.* also this J. 1913, 100—101).—J. P. O.

Saturation [*carbonatation*] *in its chemical aspect.* K. Andrlík and V. Staněk. Z. Zuckerind. Böhm., 1913, **37**, 231—253.

(1) *Extent and nature of the alteration of the original polarisation of the diffusion juice after heating with lime and carbonatating.* Diffusion juices were polarised before and after the ordinary single carbonatation process, using 1 per cent. of lime, and the alteration in polarisation observed. Using juices from 5 different Bohemian factories, it was found that there was an appreciable decrease in the polarisation resulting from the clarifying treatment. The decrease observed varied from 0·065 to 0·120 per cent., expressed as sucrose in the juice, but the figures vary considerably according to the season and the method of working, being especially influenced by the manner in which diffusion is conducted and by the amount of lime used in defecation. The alteration is partly due to the presence of optically-active non-sugars which are either precipitated or decreased in rotation by the action of lime, and partly to the decomposition of sucrose itself. In a second series of experiments diffusion juices were polarised before and after triple (Karlík) carbonatation, using different amounts of lime, namely, 1, 2, and 3 per cent., and saturating to a final alkalinity of 0·05 per cent. (calcium oxide), the scums, residues, and washings being collected, and the sucrose determined in these as well as in the clarified juices. As in the case of ordinary single carbonatation, there was a decrease in the polarisation, but it was more marked, varying in the same 5 factories between the following limits for 1, 2, and 3 per cent. of lime respectively: 0·071—0·122, 0·37—1·47, and 0·47—1·58 per cent., expressed as sucrose in the juice. (2) *Triple carbonatation, using different amounts of lime, with regard to the purity and composition of the juice.* Juices obtained in the last series of experiments were examined for purity and nitrogen content, then evaporated to a syrup. From the results it appears that in general increasing the amount of lime from 1 to 3 per cent. has a beneficial action, the purity and especially the colour being favourably influenced. Nevertheless, this increased clarifying effect is not always in direct proportion to the additional amount of lime used, being in fact often small. It would seem from the experiments made that juices of more than 90° apparent purity do not show any appreciable increased clarifying effect when defecated with more than 1 per cent. of lime, and if the scums can be readily filtered, no greater amount of lime is necessary; but that with juice of low purity, for example, less than 88°, more than 1 per cent. of lime may effect a notably greater purification, although this may not always hold true. (3) *Clarifying effect with varying large amounts of lime.* For judging the clarifying effect of carbonatated juices as compared with the original raw juices, the authors agree with Claassen (Deut. Zuckerind., 1910, 385) that the comparison of the purity values should not be used, but that a more reliable indication is to be obtained from the weight and composition of the scums, especially from the organic non-sugar content of these. According to Claassen, the organic non-sugars may be found with sufficient accuracy by deducting the percentages of carbon dioxide, of sugar, and of water liberated at 105° C. from the total loss on ignition. By adopting this procedure, the conclusion drawn by the authors is that with the larger additions of lime a greater amount of non-sugar is removed from the juice, an increase from 1·5 to 3 per cent. of lime, for example, removing 0·25 per cent. of organic non-sugars from the juice. It is, however, pointed out that this method of examination may not give altogether trustworthy results, since all the water contained in the scum is not liberated at 105° C., and indeed not entirely at 125° C., somewhat too high values for the organic non-sugars thus being obtained.—J. P. O.

Hydrosulphites; Application of —— in the [*beet and cane*] *sugar factory during* 1912—1913. R. Dutilloy. Intern. Sugar J., 1913, **15**, 76—79.

According to the author, when sodium hydrosulphite ("Blankit") and calcium hydrosulphite ("Fredo"), are used for the decolourisation of juices, syrups and unexhausted molasses, there is always a recolouration of the product if the hydrosulphite be employed in a strongly alkaline medium, but an economical and lasting effect is obtainable by the process of "hydrosulphitation," in which calcium hydrosulphite is used as a complementary purifying agent to sulphur dioxide. The excessive alkalinity of the juice, syrup, or other product is first diminished by sulphitation carried out in the ordinary way, this operation being pushed as far as possible and litmus paper used as indicator, after which calcium hydrosulphite to the amount of 25—30 grms. per hectolitre is added, and the product mixed and filtered. On applying this process to unexhausted molasses before reboiling or returning them, it has been found that owing to the increased purity and diminished viscosity, white sugars of superior quality and final molasses of the maximum degree of exhaustion result. When hydrosulphites are applied to diffusion juices according to the "Menoseal" process (Fr. Pat. 427,890; this J., 1911, 1179), in which calcium hydrosulphite is used, an important economy in the amount of lime generally employed can be effected, and other advantages are realised. During the past two campaigns in the Port Salut factory at Verberie, it has been found that by applying this process: (1) there is a decrease of at least 1 per cent. in the customary amount of lime; (2) there is a clarifying effect at least as good as with the maximum quantity of lime; (3) there is obtained an increased *rendement* of sugar, a fully exhausted molasses, and a considerably decreased amount of incrustation in the effect apparatus. Whilst thus treating the diffusion juices, sulphitation and hydrosulphitation is also applied to the syrups and unexhausted molasses, although to a smaller extent. The cost of employing hydrosulphites and sulphurous acid in this way is stated to be between 10 and 20 centimes (about 1d.—2d.) per ton of beets, depending upon the richness and purity of the latter. Similar good results may be obtained in the treatment of raw mill cane juices.—J. P. O.

Milk-sugar. J. Pedersen. J. N.Z. Dept. of Agric. Chem. and Drug., Mar. 1, 1913. [T.R.]

The manufacture of milk-sugar was originally started in Switzerland, but the trade there has diminished in consequence of the establishment of factories in the U.S.A. The European production is likely to diminish owing to the increasing demand for milk for consumption in the large cities. Although the present price is high and unlikely to decrease, the demand for milk-sugar is limited, and overproduction should be avoided.

The following is a summary of the German and Swedish systems of manufacture:—

German system.—The whey is neutralised with milk of lime and condensed about 60 per cent. in a vacuum pan, or until its sp. gr. is 30° to 32° B. The thick syrup is run into shallow vats, and occasionally stirred during the first ten hours. In about two and a quarter hours' time the temperature should be about 68° F. To separate the crystals the sticky mass is mixed with cold water and centrifuged and the lactose crystals are washed in the drum. Two-thirds of the milk-sugar is extracted in this way, the remainder being left in the syrup. The latter is heated to boiling, the coagulated albumen skimmed off, and the liquid again concentrated *in vacuo* to 35° B. After cooling, the lactose is separated and well washed, from 0·3 to 0·7 per cent. being recovered. About 4 per cent. of raw milk-sugar is obtained from the whey. To remove albumen, traces of fat, etc., the crude lactose is dissolved in water at 112° F. to make a syrup of 15° B., which is heated to boiling point after the addition of 1 per cent. of powdered charcoal and 0·2 per cent. of acetic acid; it is then passed while still hot through a filter-press, and the clear syrup concentrated *in vacuo* to 35° B., crystallised, and the milk-sugar separated, washed, and dried in rotary inclined cylinders or in vacuum dryers. After cooling the dried sugar is finely ground in a pebble-mill, and packed in cases containing 100 lb. to 200 lb. The percentage of refined sugar obtained from whey is 2·5 to 2·6 per cent.

The Swedish system consists in scalding fresh whey, skimming off albumen and fat, and evaporating to one-third of the original volume in an open cheese-pan. It is further concentrated *in vacuo* at 143° F. to a suitable consistency, and the product run into large enamelled pans with slow rotary stirrers. It cools within forty-eight hours to 78° F. Crystallising and refining follow the German method outlined above, with the exception that some alum is added to the decolorised solution of milk-sugar before filtration.

The total cost of production of 1 ton of milk-sugar in Sweden is given at £20 per ton from whey valued at ½d. per gall. This does not take into account the value of by-products, of which albumen only is of material value. The machinery to handle about 4,000 galls. of milk a day costs about £2,000. The following shows the prices ruling for milk-sugar during recent years: 1900, £45 per ton; 1902, £40; 1904, £52; 1906, £61; 1907, £60; 1908, £49; 1909, £46; 1910, £43 per ton.

Patents.

Maple-sap evaporator. G. H. Soule, Fairfield, Vt. U.S. Pat. 1,049,935, Jan. 7, 1913.

A heater and an evaporating pan are disposed side by side over a furnace, the pan having a flat bottom, whilst the heater has pockets or wells extending downwards nearly to the bottom of the furnace. Adjacent to the heater is a supply regulator from which the sap passes by a delivery pipe extending to near the bottom of the heater, so that the sap is preheated before being delivered into the heater. On opposite sides of the heater, and communicating with the interior thereof, are boxes from which the heated sap passes to the pan. In the pan is a series of baffles so disposed that the sap is caused to take a tortuous path from the inlet to the other end of the pan and then back again to the outlet. The valved inlets and outlets are arranged in pairs, so that the direction of flow of the sap from the heater through the pan may be reversed. —A. S.

Sugar; Process of decolourising ——. M. Barrios Y Carballeda. Fr. Pat. 447,206, Aug. 14, 1912.

Raw sugar is treated, in the solid state and at the ordinary temperature, with a liquid such as glycerin which may or may not be saturated with sulphuric acid. Colouring matters and other impurities are thus removed, and white pure sugar is obtained.—L. E.

Sugar; Process for refining ——. H. Wiese, Wallaceburg, Canada. U.S. Pat. 1,052,113, Feb. 4, 1913.

See Eng. Pat. 12,642 of 1911; this J., 1912, 653.—T. F. B.

Gum or mucilage from locust beans; Process for making a ——. A. Pinel. First Addition, dated Nov. 3, 1911, to Fr. Pat. 443,275, July 10, 1911.

See Eng. Pat. 15,860 of 1912; this J., 1912, 1089.—T. F. B.

Multiple-effect evaporating apparatus. U.S. Pats. 1,049,424-6. *See* I.

Preparation of ammonium sulphate [and glycerin, from distillery vinasse, etc.]. Additions to Fr. Pat. 442,923. *See* VII.

XVIII.—FERMENTATION INDUSTRIES.

Aluminium; Influence of —— on yeast and beer. H. Zikes. Allgem. Z. Bierbrau. u. Malzfabr., 1913, **41**, 71—74, 83—87. (See also this J., 1912, 87, 199, 247, 789.)

Experiments on the influence of aluminium on yeast (Frohberg type), indicate that the use of aluminium for fermentation vats has no prejudicial effect upon the yeast but appears rather to stimulate the fermentative and generative functions to a slight extent. The metal employed contained 99·45 per cent. of aluminium, 0·27 of silicon, 0·28 per cent. of iron and a trace of arsenic. In worts which had been heated for six hours in an aluminium vessel, the rate of multiplication of yeast was found to be slower than in worts which had been similarly heated in vessels of glass, copper, iron or tinned copper.—J. H. L.

Comparative fuel values of gasoline and denatured alcohol in internal combustion engines. Strong and Stone. *See* IIa.

Synthesis of α-glucosides by the action of α-glucosidase, an enzyme present in air-dried bottom-fermentation yeast. α-Methyl- and α-ethylglucosides. Bourquelot and others. *See* XX.

Patents.

Beer; Process and apparatus for the extraction of hops in the manufacture of ——. H. Schneider. Fr. Pat. 447,382, Aug. 19, 1912. Under Int. Conv., Dec. 15, 1911.

A vessel, provided with means for disintegrating the hops and with a sieve serving as a false bottom, is used. The wort and drainings pass from a settling back to the upper part of the vessel, percolate through the hops, and are then pumped to the copper. The downward flow of the wort through the hops insures efficient extraction, and, owing to the fact that the hops do not come into contact with boiling wort, extraction of undesirable constituents is avoided. If, to obtain a beer possessing a special hop aroma, part of the hops is added to the wort in the copper, the boiled wort is returned to the extracting vessel, the hops retained there being further extracted by the wort from a subsequent brewing. —L. E.

Yeast; Process and apparatus for the manufacture of —— from potato pulp treated with barm. H. Menz and O. Stiebler. Fr. Pat. 447,600, Aug. 24, 1912.

The apparatus includes a closed vessel fitted with a vertical rotatable shaft. A perforated coil, connected with an air-pump, is disposed at the bottom of the vessel, and a horizontal perforated rasp is situated immediately above the coil. A rake and a scraper, attached to the shaft, traverse the surface of the rasp. Boiled and cooled potatoes are placed in the vessel, which is then filled with boiling water. The potatoes are pulped by the rasp, and the pulp is aerated by compressed air from the coil. A pipe, leading from the upper part of the vessel, is fitted with a cock controlled by a spring; this cock is opened periodically by a cam mounted on a part of the shaft extending beneath the vessel. That portion of the pulp which is not removed from the rasp by the scraper, is removed, each time that the cock is opened, by compressed air from the coil, and the rasp is thus made ready to deal with further portions of the material. The hot pulp is transferred to bottles and pitched with yeast when cold; the thorough aeration of the pulp during the pulping process insures a rapid growth of the yeast. —L. E.

Grains or starchy residues; Process and apparatus for treatment in the distillery of crushed or whole —— with acid, and in contact with air. H. Cambron, jun. Fr. Pat. 447,845, Aug. 31, 1912.

The apparatus includes a battery of say six maceration vessels fitted with false bottoms, and a corresponding number of steep tanks situated above these vessels. The material, *e.g.* maize, is steeped for 24 hours at say 75°—85° C. The steeping liquor, which may be water, vinasse, or dilute maceration juice, etc., is treated with an antiseptic or acidified, *e.g.*, to 0·04 per cent. with hydrochloric acid. Means are provided for keeping the liquor in each tank in circulation, and thus maintaining a uniform temperature in all parts of the tank. After steeping, the liquor is run from the first tank to the first maceration vessel, being introduced beneath the false bottom. This liquor is acidified to 0·6—0·9 per cent. with hydrochloric acid and heated to boiling; the grain from the first tank is then added, and the whole is boiled for 2 hours. The liquor from the second tank (supplemented with hot water or dilute juice if necessary) is then introduced at the bottom of the first maceration vessel; the liquor thereby displaced from this vessel passes through an overflow pipe to the second maceration vessel, where it serves, after being acidified and heated to boiling, to macerate the grain from the second tank. The cycle is repeated with the remaining members of the battery, the liquor passing through the maceration vessels in succession. When the contents of the fourth maceration vessel have been boiling for 2 hours, the withdrawal of liquor may be begun, an equal volume of hot water or vinasse, etc., being run into the first maceration vessel of the series.—L. E.

Distillation; Processes and apparatus for ——. E. A. R. Chenard. Second Addition, dated July 31, 1912, to Fr. Pat. 443,499, May 7, 1912 (this J., 1912, 971).

The reflux condenser includes a tube, the first part of which is only slightly inclined, whilst the second part leads to the upper part of the first element of a condensing coil. This coil consists of a series of connected vertical pipes, and the condensed liquid which collects at the lower junctions of these pipes is returned to the slightly inclined part of the reflux tube by reversed siphons.—L. E.

Wines and distillery vinasses; Treatment of ——. L. Rivière. Fr. Pat. 447,138, Oct. 18, 1911.

The wine or vinasse is macerated with sodium silicofluoride or treated with an alcoholic solution of sodium chlorate, the potassium salt precipitated thereby being washed with vinasse. The residual solution is concentrated to a paste at about 100° C. or at a lower temperature under reduced pressure. The paste is treated with 90 per cent. alcohol or with phlegms of high purity, in order to dissolve the glycerin, and the solution is freed from proteins, gums, etc., by a filter-press. The press-cake is washed with a small quantity of alcohol, dried and powdered; the cake derived from grain vinasse is washed with a dilute solution of sodium carbonate and may be used in the manufacture of fodder. The glycerin is freed from the alcohol by distillation, and is then purified by distillation, preferably at a temperature of about 160° C., in a current of inert gas. If desired, the process above described for recovering the potash may be applied to the glycerin instead of the vinasse.—L. E.

Sour or acid liquid; Manufacture of a ——. R. Wahl. Fr. Pat. 447,734, Aug. 29, 1912. Under Int. Conv., Sept. 5, 1911.

See U.S. Pat. 1,028,508 of 1912; this J., 1912, 655.—T.F.B.

Fermented beverages; Process and apparatus for improving the quality of ——. J. F. Wittemann. Fr. Pat. 447,754, July 9, 1912.

See U.S. Pat. 1,029,838 of 1912; this J., 1912, 697.—T.F.B.

Preparation of ammonium sulphate [and glycerin, from distillery vinasse, etc.]. Additions to Fr. Pat. 442,923. *See* VII.

Process of obtaining cyanogen [hydrogen cyanide] and ammonia by the superheating of the nitrogenous compounds produced by the gasification of vinasses or the like. Ger. Pat. 255,440. *See* VII.

XIXa.—FOODS.

Patents.

Beverages; Manufacture of ——. C. H. Field, London. Eng. Pat. 4359, Feb. 21, 1912.

Separated milk, or whey from which the casein has been removed, is fermented to a limited extent and blended with fermented malt extract. The milk or whey may also be peptonised before the fermentation.—C. A. M.

Milk and other liquids easily altered by heat; Sterilisation of ——. O. Lobeck. Fr. Pat. 447,458, Aug. 22, 1912.

The milk is subjected to sudden changes in temperature, gradually increasing, whereby it is gradually sterilised and afterwards is maintained at a temperature of 50° C. and then cooled, during which process it may be submitted to ultra-violet rays. Principally the patent refers to an apparatus in which the milk is sprayed into an inner chamber, surrounded by a jacket through which hot air or other agent is passed to keep the walls of the inner chamber at the requisite temperature. The floor of the inner chamber is in the form of an inverted cone or contains plates; on either of these heated surfaces the spray of milk falls from the top wall of the chamber and is retained for any time up to 30 seconds. The sterilised milk is then led off by a pipe and cooled.—J. H. J.

Butter products and substitutes; Manufacture of ——. F. Kronenberger and H. Handrich, New York. Eng. Pat. 4412, Feb. 21, 1912.

See U.S. Pat. 1,024,009 of 1912; this J., 1912, 508.—T.F.B.

Beverage extract. W. H. Post. Assignor to Postum Cereal Co., Ltd., Battle Creek, Mich. U.S. Pat. 1,051,445, Jan. 28, 1913.

See Eng. Pat. 3010 of 1912; this J., 1913, 157.—T. F. B.

Bassia seeds and their press-residues; Process for extracting the nutritive elements from ——. Holstein-Oelwerke G.m.b.H. Fr. Pat. 447,894. Nov. 10, 1911.

See U.S. Pat. 1,030,674 and Eng. Pat. 23,595 of 1911; this J., 1912, 697, 1092.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Carbon dioxide in water: Application of phenolphthalein and rosolic acid to the determination of free ——. H. Noll. Z. angew. Chem., 1913, **26**, 85—87.

The merits of phenolphthalein and rosolic acid as indicators for the determination of free carbon dioxide in water are compared, and with regard to the latter the author confirms the conclusion of Tillmanns and Heublein (see this J., 1911, 744; 1912, 1049) that it is unsuitable for this purpose. A certain proportion of carbon dioxide is not indicated by the rosolic acid and this bears a fixed relation to the amount of carbon dioxide present in the form of bicarbonate, decreasing, however, with increasing dilution of the indicator.—J. B.

Patents.

Clarification tanks for potable water. L. Linden. Fourth Addition, dated Aug. 2, 1912, to Fr. Pat. 391,100, June 11, 1908.

In tanks in which "sugar-works filters" are made use of, there is added a perforated pipe which can be moved along the filter surfaces and through which water or air can be ejected to remove the deposited mud without opening the tank. The water used for cleaning may have a disinfectant added to it. A hollow cover may also be provided, through which a suitable refrigerating agent circulates around the exit channels of the filters. The frames supporting the filter bags may be replaced by pipes of similar shape through which the refrigerant circulates. In the bottom of the tank may be placed a refrigerating arrangement for cooling the water before filtration.—J. H. J.

Water and other liquids: Purification of ——. E. G. Henry. Fr. Pat. 447,357, Aug. 17, 1912.

The filter is enclosed above, leaving a space which is filled with air or other gas under pressure. The exit pipe from the filter opens into a closed tank containing the filtered water, and from the bottom of which an outflow pipe leads to the distributing mains. The air-space above the water in the tank communicates by a pipe with the air-space above the filter. This enables the filtered water to pass to the distributing mains at the same pressure as is maintained above the filter. In a complete installation regulating chambers controlling the supply of water are provided above and below the filter chamber proper, all closed, and the air-space in each connected with the air-space above the filter, thus maintaining the same pressure throughout.—J. H. J.

Waste-water: Mechanical purification of —— by sedimentation. O. Stock. Fr. Pat. 447,516, July 24, 1912. Under Int. Conv., Mar. 5, 1912.

The apparatus consists of a cylindrical tank with conical bottom to the centre of which the incoming water is led by an inclined channel leading to the base of a cylinder supported in the upper portion of the tank. Heavy matter in the water sinks around the base of the cylinder down into a sludge compartment in the apex of the cone. The upper portion of this compartment consists of a wall sloping from the cylinder to the conical sides of the tank. The incoming water flows from the base of the cylinder through the upper portion of the tank and over into an exit channel running round the tank, while the fine suspended matter settles out and falls through slits in the upper wall into the sludge compartment. Floating matter collects inside the cylinder. The sludge compartment is emptied by a pipe from the apex running up the side of the tank to a little below the level of the overflow channel.—J. H. J.

Sterilising apparatus. C. de Bock, Zele, Belgium. U.S. Pat. 1,052,210, Feb. 4, 1913.

See Eng. Pat. 5156 of 1911; this J., 1912, 405.—T. F. B.

Waste waters: Apparatus for treating ——. Hammond Engineering Co. Fr. Pat. 447,168, Aug. 13, 1912.

See U.S. Pat. 1,035,797 of 1912; this J., 1912, 837.—T.F.B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Electrochemical reductions. III. Reduction of nitrosamines. H. J. Backer. Rec. Trav. Chim. Pays-Bas, 1913, **32**, 39—47.

The electrolytic reduction of nitrosamines dissolved or suspended in dilute sulphuric or acetic acid or in sodium sulphate solution, using a tinned copper cathode, forms a satisfactory means of preparing the corresponding hydrazines, the yields being better in many cases than by chemical reduction, as is shown in the following table:

Substance.	Method of reduction.	Yield.
		per cent.
Nitrosopiperidine	Electrolytic, Sn, H_2SO_4	81
,, ...	Chemical, Zn, CH_3CO_2H	82
Dinitrosopiperazine...	Electrolytic, Sn, Na_2SO_4, aq	72
,, ...	Chemical, Zn, CH_3CO_2H	55
Phenylmethylnitrosamine ...	Electrolytic, Sn, CH_3CO_2H	79
,,	Chemical, Zn, CH_3CO_2H	33
Methylnitrosourea	Electrolytic, Sn, H_2SO_4	95

—A. S.

Morphine in opium and its preparations; Determination of ——. G. Guérin. J. Pharm. Chim., 1913, **7**, 162—163.

Morphine in opium. 7·5 grms. of opium powder, dried at 60° C. and prepared in accordance with the Pharmacopœia (French), are carefully triturated with 3 grms. of very finely sifted quicklime. The mixture is transferred completely, together with 75 c.c. of water, into a flask in which it is shaken at frequent intervals during 2 hours. After filtration, 52 c.c. of the filtrate are mixed with 5 c.c. of pure acetone in a wide-necked flask of 110—120 c.c. capacity. One grm. of ammonium chloride is added and dissolved by shaking, and the flask is then covered and left for 24 hours to allow the morphine to crystallise out. The crystals are transferred without loss to a funnel containing two filter papers which have been counterpoised against each other and subsequently moistened and drained. The crystals are washed with a saturated aqueous solution of morphine until the washings are quite colourless and show no chloride reaction, and finally four washings (15 c.c. each) of a saturated solution of morphine in pure acetone are poured on the filter. After drying at 100° C., the excess weight of the filter containing the morphine crystals represents the quantity of morphine present in 5 grms. of opium. *Morphine in opium extract.* Three grms. of the extract, dissolved in 75 c.c. of water, are agitated with 3 grms. of quicklime, at frequent intervals during 2 hours. After filtration, 65 c.c. of the liquid, representing 2·5 grms. of opium extract, are treated as described above. *Morphine in laudanum and tincture of opium.* 75 grms. are evaporated to dryness on a water bath, and the residue is left in contact with 75 c.c. of water and 3 grms. of quicklime for 2 hours with frequent agitation. After filtration, 52 c.c. of the liquid, representing 50 grms. of laudanum or tincture, are treated as described above.—J. H. L.

Dihydroisoquinoline syntheses. H. Decker, W. Kropp, H. Hoyer, and P. Becker. Annalen, 1913, **395**, 299—320. (See this J., 1912, 483, and 953.)

Acyl derivatives of phenylethylamine such as $C_6H_5.CH_2.CH_2.NH.COR$ are capable of condensation to derivatives of dihydroisoquinoline. The acyl compound is dissolved in benzene or toluene and boiled with phosphorus pentachloride or oxychloride dissolved in or mixed with the same solvent. In order to secure a good yield, moisture must be carefully excluded. The condensation products (phosphates) separate as a solid on the walls of the vessel. Owing to partial hydrolysis, phenylethylamine bases are formed at the same time. The dihydroisoquinoline bases can be readily separated owing to the small solubility of the picrates. Treated in this way, formylphenylethylamine gave a small amount of dihydroisoquinoline, the picrate of which crystallises from alcohol in dark yellow leaflets, m.pt. 174°—176° C. 1-Benzyl-dihydroisoquinoline was prepared from phenacetylphenylethylamine; the picrate melts at 182° C. Benzoylphenylethylamine condensed to 1-phenyl-3, 4-dihydroisoquinoline, giving a hydrochloride melting at 225° C. When oxalylphenylethylamine is condensed, partial ring formation takes place with the production of the phenylethylamide of dihydroisoquinolyl-(1)-carboxylic acid, $(C_9H_8N).CO.NH(CH_2)_2.C_6H_5$. The picrate of this substance melts at 167°—168° C., and the hydrochloride at 191°—193° C. Piperonyl-norhydrastinine (norhydrastinine being methylenedioxy-dihydroisoquinoline), $CH_2:O_2:C_6H_3{\cdot}CH_2{\cdot}C_{10}H_8O_2N$, obtained by the condensation of homopiperonoyl-homopiperonylamine, gives a picrate melting at 220°—223° C., and a platinichloride decomposing at 180° C. Homopiperonylamine benzoate melts at 115° C., and the corresponding benzoyl derivative at 122° C. The latter was condensed with the formation of 1-phenylnorhydrastinine, $C_{16}H_{13}O_2N$, the picrate melting at 188°—190° C. By the condensation of formylhomopiperonylamine, norhydrastinine and aminomalonyl derivatives are produced. Norhydrastinine melts at 90°—91° C. and distils without decomposition under reduced pressure. The picrate melts at 237°—238° C., and the hydrochloride at 192° C.—F. Shdn.

Hydrastinine and its N-homologues; Synthesis of ——. H. Decker. Annalen, 1913, **395**, 321—328.

Hydrastinine can be readily formed by the methylation of norhydrastinine. The ethiodide of the latter base melts at 222° C. N-Ethylnorhydrastinine gives a picrate melting at 175° C. The chlorobenzylate of norhydrastinine melts at 215° C.—F. Shdn.

Cotarnine and hydrastinine; Synthesis of ——. H. Decker and P. Becker. Annalen, 1913, **395**, 328—342.

The formyl derivative of homomyristicylamine melts at 105°—106° C., and yields norcotarnine when condensed with phosphorus oxychloride in toluene. Cotarnine can then be made from norcotarnine by methylation. Benzalhomopiperonylamine was prepared by the condensation of formaldehyde and homopiperonylamine. It crystallises from alcohol in light yellow needles melting at 36° C. The methiodide can be readily hydrolysed to give N-monomethylhomopiperonylamine, boiling at 156°—158° C. at 24 mm. The hydrochloride of the latter base melts at 183°—185° C. and the picrate at 166°—167° C. The formyl derivative was prepared and condensed with the formation of hydrastinine. N-Monoethylhomopiperonylamine gave a hydriodide melting at 126°—128° C., and a picrate melting at 135°—136° C. The formyl derivative was condensed in the usual way with phosphorus oxychloride when N-ethylnorhydrastinine was formed. When benzalhomopiperonylamine is methylated in benzene solution at 140° C. instead of at 100° C., the hydriodide of dipiperonylamine is produced, which melts at 234°—236° C. The corresponding free base melts at 72°—75° C.—F. Shdn.

Pseudolaudanine. H. Decker and T. Eichler. Annalen, 1913, **395**, 377—381.

The quaternary salt obtained by the interaction of papaverine and dimethyl sulphate was boiled with an aqueous solution of barium hydroxide in a current of hydrogen. The barium was then removed by means of carbon dioxide, when a phenolbetaine of N-methylnorpapaverinium was obtained. The latter substance was reduced by means of tin and hydrochloric acid with the production of pseudolaudanine, $C_{20}H_{25}NO_4$. This differs from the laudanine of opium by having the free phenolic hydroxyl in the benzene nucleus of the isoquinoline ring, whilst in the natural alkaloid the hydroxyl is attached to the toluene residue. The base crystallises from light petroleum in the form of a white powder, melting at 112° C. The picrate melts at 162°—163° C.—F. Shdn.

Xanthoxylum brachyacanthum; The alkaloids of ——. H. A. D. Jowett and F. L. Pyman. Chem. Soc. Proc., 1913, **29**, 26.

The bark of *Xanthoxylum brachyacanthum* was shown to contain 0·06 per cent. of γ-homochelidonine, and a quaternary base, which was isolated in the form of its chloride, $C_{21}H_{24}O_4NCl,H_2O$, in a yield of 1·85 per cent. The properties of this salt suggested that it was one of the methochlorides of *l*-canadine. A quantity of the latter alkaloid was therefore methylated, and the α- and β-*methochlorides* were separated, when it was found that the former was identical with the salt from *X. brachyacanthum.* The physiological examination of *l*-canadine α- and β-methochlorides, showed that both possessed a curare-like action.

α-Glucosides; Synthesis of —— by the action of α-glucosidase, an enzyme present in air-dried bottom fermentation yeast. α-Methyl- and α-ethylglucosides. E. Bourquelot, H. Herissy and M. Bridel. J. Pharm. Chim., 1913, **7**, 145—154.

The glucosides obtained from alcohols and dextrose by the action of emulsin (see this J., 1912, 660, 739, 800, 949) are lævorotatory, and in aqueous solutions they can be practically completely hydrolysed by the same enzyme (emulsin); they belong to the β-glucosides of E. Fischer. When dissolved in the corresponding alcohols saturated with hydrochloric acid gas, they are transformed into their dextrorotatory isomerides, the α-glucosides. Emulsin has no action on the α-glucosides, but they are hydrolysed by an enzyme which is present in air-dried bottom fermentation beer yeast, in maceration juice obtained therefrom, and in the precipitate thrown down from such juice by addition of alcohol. This enzyme, which the authors term *a-glucosidase*, is also capable of synthesising the α-glucosides from dextrose and the appropriate alcohols, but it exerts neither synthetic nor hydrolytic action in solutions conaining less than about 70 per cent. of water. This last statement has been verified only for α-methyl- and α-ethylglucosides, both of which the authors prepared by the synthetic action of α-glucosidase.—J. H. L.

Primula glucosides and oil. A. Goris, M. Mascré, and C. Vischniac. Bull. Sci. Pharmacol., 1912, **19**, 577—598, 648—670. Chem. Zentr., 1913, I., 310—311.

For the preparation of considerable quantities of the glucosides, the sterilised powdered root (see this J., 1910, 42) is extracted with boiling acetone in presence of calcium carbonate, the solvent is distilled off from the solution, the residue taken up in water, the solution washed with ether till the latter is no longer coloured and then evaporated *in vacuo* and the residue dissolved in anhydrous ethyl acetate to which 10 per cent. of 95 per cent. alcohol has been added. The two glucosides are separated from one another by fractional crystallisation from 95 per cent. alcohol and anhydrous ethyl acetate. The fresh roots of *Primula officinalis* yield 0·1 per cent., and those of *P. Kewensis*, Hort. 0·2 per cent. of crude glucosides. Primverin, $C_6H_3(OCH_3)(COOCH_3)O.C_{11}H_{19}O_9$, melts at 206° C. (corr.), $[\alpha]_D = -71° 53'$ (0·331 grm. dissolved in 20 c.c. of water), is slightly soluble in cold water, soluble in alcohol and acetone, very slightly soluble in anhydrous and easily soluble in aqueous ethyl acetate. It is hydrolysed by dilute acids and by the enzyme, primverase (*loc. cit.*), with the formation of 1 mol. of the methyl ester of β-methoxyresorcylic acid and in the first case 2 mols. of monoses and in the second, 1 mol. of a biose, primverose, $C_{11}H_{20}O_{10}$. The latter melts at 209°—210° C. on the Maquenne block and exhibits mutarotation, $[\alpha]_D$ changing in 24 hours from + 23° 01′ to —2° 03′ (1·846 grms. dissolved in 75 c.c. of water) or from + 23° 11′ to —3° 17′ (1·35 grms. dissolved in 26 c.c. of water); it reduces Fehling's solution and yields an osazone melting at 204°—207° C. (224°—226° C. on the Maquenne block). Primulaverin, isomeric with primverin, could not be isolated in a pure state, but an isomorphous mixture of the two glucosides melted at 163° C. (corr.), $[\alpha]_D = -66° 65'$ (in water, $c = 4·41$), and yielded on hydrolysis with dilute sulphuric acid the same two monoses as were yielded by primverin, together with the methyl esters of β-methoxyresorcylic and *m*-methoxysalicylic acids. The essential oil of the root of *P. officinalis* consists exclusively of the two esters just mentioned, the ester of β-methoxyresorcylic acid (the so-called primulacamphor) predominating: the oil from the flowers contains also 10—15 per cent. of an unsaponifiable substance. The enzyme, primverase, is identical with, or very closely allied to, the betulase of *Gaultheria procumbens*, L., *Betula lenta*, L., and *Monotropa Hypopytis*, L. Both enzymes act on the same group of glucosides, namely, those which yield esters of salicylic acid or of hydroxysalicylic acids. Primverase is present in most species of *Primulaceae*; it acts upon the glucosides, which are more or less closely allied to those of *P. officinalis*, with the formation of different essential oils. There is a close resemblance between the *Ericaceae* and *Primulaceae* in regard to the nature of their enzymes and the chemical constitution of their glucosides.—A. S.

Bupleurol. The alcohol of the oil of Bupleurum fruticosum. L. Francesconi and E. Sernagiotto. Atti. R. Accad. dei Lincei, Roma, 1913, **22**, I., 34—40, 148—154.

The authors succeeded in isolating from the higher-boiling fractions of the oil of *Bupleurum fruticosum* (see this J., 1912, 202), an optically inactive alcohol, *bupleurol*, sp. gr. 0·8490 at 17° C., $n_D = 1·4508$, b.pt. 209°—210° C. at 762 mm. Bupleurol has a faint odour of roses. It contains one double linkage in its molecule and yields an urethane melting at 45° C. It is probably a dihydro-derivative of nerol, of the constitution,

$(CH_3)_2CH(CH_2)_3.C(:CH_2).CH_2.CH_2OH$.—A. S.

Pharmaceutical substances; The nature of some mixtures of incompatible ——. E. Quercigh and G. W. Cavagnari. Boll. Chim. Farm., 1912, **51**, 705—706. Chem. Zentr., 1913, **1**, 560.

Experiments by the method of thermal analysis gave the following results:—*β-Naphthol-antipyrine.* The eutectic contains 61·5 per cent. of antipyrine and melts at 17·5° C· *β-Naphthol-salol.* The eutectic contains about 10 per cent. of β-naphthol and melts at 34·5° C. With more than 82 per cent. of β-naphthol solid solutions are formed. *Thymol-acetanilide.* Mixtures in any proportions form a pasty or liquid mass above 18·5° C.; the eutectic contains 67·3 per cent. of thymol. *Thymol-phenacetin.* All mixtures are pasty or liquid above 30° C.; the eutectic contains 28·5 per cent. of phenacetin. *Thymol-sulphonal.* Liquefaction occurs above 29° C.; the eutectic contains 72 per cent. of thymol. *Salol-sulphonal.* The eutectic contains 7·5 per cent. of sulphonal and melts at 34° C. *Salol-antipyrine.* The eutectic contains 89 per cent. of salol and melts at 31·5° C. *Salol-phenacetin.* Mixtures in all proportions are crystalline below 37·5° C. The eutectic contains 96 per cent. of salol. *Acetanilide-menthol.* The eutectic contains about 90 per cent. of menthol and melts at 29·5° C. *Resorcinol-antipyrine.* The compound, $C_{11}H_{12}N_2O.C_6H_6O_2$, m.pt. 104° C., is formed. Mixtures of this with antipyrine become liquid below 62° C., and mixtures of it with resorcinol become liquid below 55·5° C. (See also this J., 1913, 108.)—A. S.

Spirit of camphor; Application of miscibility curves to the analysis of ——. H. Rosset. Ann. Chim. Analyt., 1913, **18**, 49—56.

Following the method of Louïse (this J., 1910, 438; 1911, 556, 965, 1137), the author has prepared curves by means of which the alcoholic strength and the camphor content of spirit of camphor may be determined. For the camphor estimation a standard turpentine is used, and for the alcoholic strength, a standard nitrobenzene.—T. St.

Ethylenic acids; Action of alkali sulphites on [and determination of] ——. J. Bougault and Mouchel-la-Fosse. Comptes rend., 1913, **156**, 396—398.

Many ethylenic acids are found to combine with sodium bisulphite giving the sodium salts of sulphonic acids, and the stronger the acid, the easier and more rapid is the fixation of bisulphite at the ethylenic linkage. For example, benzoylacrylic acid reacts at once, in the cold, and fumaric acid fairly rapidly on heating, but even prolonged heating causes no combination with oleic acid. Cinnamic acid also combines more readily than its homologues. The sulphonic acids obtained are all very soluble in water, and when heated with caustic soda solution at 160° C., they decompose, giving the original acid again. The results obtained have been applied to the separation of reactive ethylenic acids (*e.g.*, cinnamic acid, coumarin, and caffeic acid) from saturated acids (such as benzoic acid, vanillin, and protocatechuic acid) and to the determination of the former in presence of the latter. The determination is carried out by heating the mixed acids on the water bath with a solution of sodium sulphite and subsequently ascertaining the quantity of combined sulphite by titration with iodine, a control experiment being made in which only the sulphite solution is used. —F. Sodn.

Patents.

Turpentine or turpentine oil; Depolymerisation of —— *[preparation of isoprene, etc.].* A. Heinemann, London. Eng. Pat. 1953, Jan. 24, 1912.

Steam, preferably superheated, is passed into a heated vessel containing crude turpentine or turpentine oil, and the steam and vapours are then led through a tube, retort, or other apparatus heated to the temperature necessary for depolymerisation, *e.g.*, 650° to 900° C. The steam and vapours are caused to travel over a sinuous path in the depolymerising apparatus. Good results are said to be obtained by using a vertically arranged tubular structure having a cross section of about 0·25 sq. metre, and provided with about twelve suitably fixed baffle-plates; the steam produced by evaporation of about 200 litres of water may be passed during each hour through the turpentine, and the depolymerising temperature may be about 750° C. The yield of hydrocarbons boiling below 100° C. is said to be 40 to 50 per cent. of the weight of material used, two-thirds of the yield consisting of isoprene.—T. F. B.

Isoprene; Process of preparing ——. R. B. Earle, Assignor to Hood Rubber Co., Boston. U.S. Pat. 1,050,354, Jan. 14, 1913.

A mixture of chlorotrimethylethylene, sodium palmitate, and alcohol is heated in a closed vessel, cooled, filtered, and the alcohol removed by distillation. Isoprene may be obtained from the resulting palmitic ester of dimethylethylene-carbinol by dry distillation, preferably in a current of inert gas. The efficiency of the process is stated to be about 60 per cent.—T. F. B.

Dihalogen-hydrocarbons; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3870, Feb. 15, 1912.

2.3-Dihalogen-2-methylbutane and its homologues can be obtained by treating with chlorine the vapours of 2-halogen-2-methylbutane or of its homologues which are 2-methyl derivatives; the reaction may be facilitated by working under reduced pressure or by the aid of actinic rays or the silent electric discharge. The preparation of dichloro-2-methylbutane (b. pt. 60° C. at 60 mm.), dichloro-2-methylpentane (b. pt. about 60° C. at 60 mm.), and dichloro-isobutane (b. pt. 108°—109° C.) is described in detail.—T. F. B.

Chlorides of carbon; Method of treating ——. A. Henning and E. Brühl, Leytonstone. Eng. Pat. 7259, March 25, 1912.

The term "carbon chlorides" here signifies every compound of carbon and chlorine alone or together with hydrogen. Many such compounds, especially carbon tetrachloride, are decomposed under the influence of light and air, hydrochloric acid being evolved, which is undesirable when the compounds are to be used for dry-cleaning, etc. To neutralise this, about one per cent. of commercial ammonia is added to the carbon chloride or mixtures thereof with other liquids.—T. F. B.

Salvarsan emulsion; High per cent. ——. C. Schindler, Berlin-Schöneberg, Germany. U.S. Pat. 1,051,520, Jan. 28, 1913.

Dihydroxydiamino-arsenobenzene (salvarsan) is emulsified with iodised sesamé oil.—T. F. B.

3.4-Di[hydr]oxyphenyl-1-alkylenediamine-1.2 and process of making same. E. Grether, Assignor to A. Betzing, Detroit, Mich. U.S. Pat. 1,051,577, Jan. 28, 1913.

3.4-Dihydroxyphenyl-1-glyoximes are reduced by means of a suitable amalgam in presence of acid (*e.g.*, sodium amalgam and hydrochloric acid): the product consists of a 3.4-dihydroxyphenyl-1-alkylenediamine-1.2 of the formula, $(HO)_2C_6H_3.CH(NH_2)$-alkylamine, and possesses the property of raising the blood pressure.—T. F. B.

3.4-Di[hydr]oxyphenylglyoximes and process of preparing same. E. Grether, Assignor to A. Betzing, Detroit, Mich. U.S. Pat. 1,051,578, Jan. 28, 1913.

3.4-Dihydroxyphenylglyoximes, $(HO)_2C_6H_3.C_nH_{2n-1}O_2N_2$, are obtained from the corresponding 3.4-dihydroxyphenyl-halogen-alkyl ketones by heating in aqueous solution with hydroxylamine hydrochloride and sodium carbonate. The products are soluble in water and in alcohol, insoluble in petroleum spirit.—T. F. B.

Phenylethylbarbituric acid; Alkali salts of ——. H. Hoerlein, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,051,586, Jan. 28, 1913.

The alkali salts of phenylethylbarbituric acid (see Ger. Pat. 247,952 of 1911; this J., 1912, 795) are white crystalline powders, soluble in water, soluble with difficulty in alcohol, and insoluble in ether. They are valuable hypnotics. The sodium salt is claimed specifically. —T. F. B.

Hydrogenation products from unsaturated compounds; Process for making ——. A. Skita. Fr. Pat. 447,420, Aug. 20, 1912. Under Int. Conv., Sept. 18, 1911.

The hydrogenation of unsaturated substances is effected by treatment with hydrogen, in presence of small quantities of compounds of metals of the platinum group, in solution. The substance to be hydrogenated may be dissolved or suspended in a liquid, if necessary. *Example:* To a solution of 13·6 grms. of camphene in 300 c.c. of alcohol are added 5 c.c. of a 1 per cent. solution of palladium chloride, 45 c.c. of water, and 10 c.c. of dilute (1 : 3) hydrochloric acid, and hydrogen is passed through the mixture at a pressure of one atmosphere. The product consists of dihydrocamphene. Other examples describe the hydrogenation of olive oil, phenyl vinyl acetate, castor oil, and codeine.—T. F. B.

Hydrogenising unsaturated compounds; Process for ——. A. Skita, Karlsruhe, Germany. Eng. Pat. 18,996, Aug. 19, 1912. Under Int. Conv., Sept. 18, 1911.

See Fr. Pat. 447,420 of 1912; preceding.—T. F. B.

Plaster for therapeutic purposes; Manufacture of ——. Gebr. Schubert, Berlin. Eng. Pat. 26,182, Nov. 14, 1912. Under Int. Conv., Jan. 26, 1912.

A resin plaster is prepared with mastic and benzol or other suitable volatile solvent which has no irritating action on the skin, with the addition of a liquid ester of an aromatic acid. Part of the mastic may be replaced by other suitable resins, gum-resins, balsams and the like. The esters increase the adhesive power of the mastic benzol solution.—F. Shdn.

Acid anhydrides [organic]; Manufacture of ——. W. A. Beatty. Fr. Pat. 447,646, Aug. 26, 1912.

The anhydride of a strong mineral acid is allowed to act at a suitable temperature upon a halogen derivative of a paraffin hydrocarbon, such as carbon tetrachloride, and the products thereby obtained (*e.g.*, a mixture of carbonyl chloride and sulphuryl or disulphuryl chloride) are allowed to act upon the salt of the organic acid from which the anhydride is intended to be made. Acetic anhydride can be prepared in this way from the alkali or alkaline-earth salts of acetic acid.—F. Shdn.

Glycerophosphates of ammonium and calcium; Manufacture of ——. Darrasse Frères and L. Dupont. Fr. Pat. 447,776, Nov. 6, 1911.

A mixture of ammonium phosphate and glycerin is heated to 150° C., with the formation of ammonium glycerophosphate. The solution may be treated with lime to form calcium glycerophosphate.—F. Shdn.

Paste for dressing wounds and for use as a cosmetic. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 9500, April 22, 1912. Under Int. Conv., July 25, 1911.

See Fr. Pat. 440,686 of 1912; this J., 1912, 838.—T. F. B.

Calcium salt of acetylsalicylic acid; Process for making the ——. Fabr. de Prod. Chimiques Gedeon Richter. Fr. Pat. 447,282, July 10, 1912. Under Int. Conv., Sept. 16, 1911.

See Eng. Pat. 4986 of 1912; this J., 1912, 844.—T. F. B.

Purification of hydrocarbons [paraffins, benzene, terpenes] by means of charcoal and oxygen. Addition to Fr. Pat. 421,277. *See* IIa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Platinum toning; Comparative action of various mineral and organic acids in ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1913, **59**, 60—64.

The action of various acids in platinum toning has been studied, both as regards the colour of the resulting image, and from the point of view of the keeping qualities of the toning baths. It appears that potassium platinichloride toning baths made with sulphuric, hydrochloric, nitric, phosphoric, and lactic acids all possess good keeping properties, both in the light and in darkness; on the other hand, the use of boric, acetic, tartaric, and oxalic acids, as well as of certain substitutes such as resorcinol, gives rise to unstable toning baths, whilst with formic acid the platinum salt is completely reduced in a very short time. As regards tone of the prints, sulphuric, nitric, phosphoric, citric, and lactic acids all give good blacks and pure whites, the differences being inappreciable. The authors prefer to use sulphuric acid, rather than phosphoric acid, owing to its being obtainable of definite strength.—T. F. B.

Sulphide toning. J. Desalme. Bull. Soc. Franç. Phot., 1913, **59**, 56—58.

Bromide prints may be toned to sepia shades in the cold by means of solutions of alkali polysulphides; sodium bi-, tri-, and tetrasulphide give good results, preference being given to the first two, prepared by boiling 6 and 12 grms., respectively, of sulphur with a solution of 50 grms. of crystallised sodium sulphide in 50 c.c. of water. The toning bath is prepared by diluting the resulting solutions to 1000 c.c. Toning is complete in about 30 minutes. The process of sulphide toning described in Ger. Pat. 252,337 (this J., 1913, 47) is stated to owe its efficiency to the formation of sodium bisulphide, and not to colloidal sulphur, since it is shown that the oxidation of sodium sulphide solution by hydrogen peroxide gives rise to the bisulphide, and not to free sulphur, the bisulphide being subsequently oxidised to thiosulphate (compare Lumière and Seyewetz, this J., 1913, 110).—T. F. B.

Patents.

Colour photography. M. Obergassner, München, Bavaria. Eng. Pat. 1549, Jan. 19, 1912. Under Int. Conv., Jan. 21, 1911.

See Fr. Pat. 438,746 of 1911; this J., 1912, 606.—T. F. B.

Films for use in kinematography. J. Campbell, Wimbledon Park, and T. Thompson, Middlesbrough. Eng. Pat. 18,098, Aug. 6, 1912.

The surface of finished kinematograph films is protected by applying a solution of sodium silicate, *e.g.*, a 10 per cent. solution. When the films are to be coloured, the colour may be mixed with the silicate solution. An apparatus for applying the solution is described.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Nitrocelluloses; Determination of nitrogen in —— by Devarda's method. Kœhler, Marqueyrol, and Jovinet. Ann. Chim. Analyt., 1913, **18**, 45—47.

Nitrocellulose (0·7 grm.) is first moistened with a little alcohol and then treated with 30 c.c. of hydrogen peroxide (12 vols.), 60 c.c. of distilled water, and 50 c.c. of sodium hydroxide solution (sp. gr. 1·3) in a 700 c.c. flask. The mixture is warmed on the water-bath with frequent agitation until the nitrocellulose dissolves. It is then heated strongly until oxygen ceases to be evolved, when it is allowed to cool. 5 c.c. of alcohol and 2·5 grms. of Devarda's alloy (aluminium 45, copper 50, zinc 5) in a finely divided state are then added, and immediately a distillation tube dipping to the bottom of a flask containing 25 c.c. of *N*/3 sulphuric acid and 50 c.c. of distilled water is attached. After about 20 minutes the evolution of hydrogen slackens and the flask is gently warmed to complete the reaction. About half the contents of the flask are then distilled, in from 30 to 35 minutes, the condenser being kept cool. The excess of sulphuric acid may be titrated with freshly standardised *N*/5 ammonia solution, using a 1 per cent. alcoholic solution of methyl red as indicator. A blank test must be made with the reagents. Results are given which show that the method gives concordant and accurate results.—T. St.

Patent.

Explosive and method of manufacturing the same. F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,568, May 15, 1912.

See Fr. Pat. 441,419 of 1912; this J., 1912, 845.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Diphenylcarbazide; Use of ——, as indicator in titrating iron with bichromate. O. L. Barnebey and S. R. Wilson. J. Amer. Chem. Soc., 1913, **35**, 156—162.

A solution of the indicator containing 0·1 grm. per litre is used. After solution of the ore and reduction by stannous chloride in the usual manner, the volume is made up to 500—600 c.c., mercuric chloride solution is added, then 20 c.c. of manganese sulphate solution (200 grms. of sulphate, 1100 c.c., of 1 : 3 sulphuric acid, and 100 c.c. of phosphoric acid of sp. gr. 1·70 made up to 2 litres), and 2—3 c.c. of the indicator. The first drops of bichromate strike a deep red colour, which changes to purple and gradually fades, changing sharply at the end into the pure green of the chromic salt. A blank experiment with the indicator and ferric chloride must be made, as the indicator is itself a reducing agent and uses up bichromate in proportion to its quantity.—J. T. D.

Manganese; Rapid determination of —— in presence of iron. E. Pozzi Escot. Ann. Chim. Analyt., 1913, **18**, 56—58.

The solution containing iron and manganese is precipitated while boiling by an excess of sodium hydroxide and about 1 grm. of persulphate. The precipitate is washed by decantation and then on a crimped filter until the washings are neutral. The wet filter and precipitate are then introduced into a long-necked flask of 200 to 250 c.c. capacity, 20 c.c. of hydrochloric acid added, and the flask closed with a ground stopper fitted with absorption bulbs and a capillary tube extending to the bottom of the flask. The bulbs contain 3 grms. of potassium iodide and 5 grms. of sodium acetate in solution, and 4 to 5 grms. of zinc oxide in suspension. The solution in the flask is boiled whilst a slow current of carbon dioxide is passed through. When the manganese present is small in amount, the chlorine liberated by the manganese dioxide is all evolved in 2 or 3 minutes. The liberated iodine in the bulbs is titrated with an $N/10$ solution of sodium thiosulphate. A blank test should be made on the reagents. It is stated that the method yields very accurate results.—T. St.

Zinc; Influence of lead on the ferrocyanide titration of ——. V. Lenher and C. C. Meloche. J. Amer. Chem. Soc., 1913, **35**, 134—138.

In titrating lead by the ferrocyanide method, acetic acid solution must be used, and mineral acids must be absent. For this reason, lead does not affect the ordinary ferrocyanide titration of zinc, in which hydrochloric acid is usually present. In the technical examination for zinc of ores containing lead, iron, etc., the lead need not be removed. 0·5 grm. of the sample is dissolved in 10 c.c. of hydrochloric acid and a little nitric acid, the solution is diluted, iron, etc., precipitated by excess of ammonia, the precipitate is filtered off, redissolved in hydrochloric acid, reprecipitated, filtered and washed, and the combined filtrates acidified with hydrochloric acid and evaporated down to about 200 c.c. The solution should contain about 10 grms. of ammonium chloride and 6—10 c.c. of hydrochloric acid, and should be titrated hot.—J. T. D.

Cupferron; Use of —— in quantitative analysis. [Determination of titanium.] I. Bellucci and L. Grassi. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 30—34.

The authors have found cupferron (the ammonium salt of nitrosophenylhydroxylamine, see this J., 1910, 115, 721, 1179; 1911, 1090) an excellent reagent for the gravimetric determination of titanium. A 6 per cent. solution of cupferron is added to the solution of titanium chloride or sulphate, which has been made distinctly acid with hydrochloric or sulphuric acid, until a white precipitate (of nitrosophenylhydroxylamine), easily distinguishable from the yellow precipitate of the titanium compound, begins to form. The precipitate is filtered off, washed with cold water, dried, and the paper and precipitate incinerated in a porcelain crucible, covered at first. The residual titanium dioxide is ignited till of constant weight. Preliminary experiments have shown that titanium can be accurately determined in presence of aluminium by means of cupferron.—A. S.

Determination of calorific value by experiment and by calculation. Von Jüptner. *See* IIA.

Determination of natural asphaltum in presence of artificial asphaltum. Marcusson. *See* IIA.

Determination of cotton, wool, and silk in mixed fabrics. Villavecchia and Cappelli. *See* V.

Presence of selenium in sulphite pulp digestion liquor. Klason and Mellquist. *See* V.

Distinguishing direct and developed blacks from sulphide or Aniline Blacks on dyed cotton. Holden. *See* VI.

Delicate colour reactions of gold salts. Saul. *See* VII.

Application of the electric resistance furnace to the determination of oxygen in iron and steel. McMillen. *See* X.

Technical analysis of ferrovanadium and its products. [Determination of aluminium.] Clark. *See* X.

Volumetric determination of manganese in rock, slags, ores, and spiegels. Metzger and Marrs. *See* X.

Analysis of alloys of tin and antimony. Pontio. *See* X.

Hexabromide numbers of fatty oils and the determination of rape oil in linseed oil. Eibner and Muggenthaler. *See* XII.

Chinese wood oil tests. Reihl. *See* XII.

Report of the Committee of the American Leather Chemists' Association on the analysis and detection of sulphite-cellulose extract. Small. *See* XV.

Application of phenolpthalein and rosolic acid to the determination of free carbon dioxide. Noll. *See* XIXB.

Determination of morphine in opium and its preparations. Guerin. *See* XX.

Application of miscibility curves to the analysis of spirit of camphor. Rosset. *See* XX.

Action of alkali sulphite on [and determination of ethylenic acids]. Bougault and Mouchel-la-Fosse. *See* XX.

Determination of nitrogen in nitrocelluloses by Devarda's method. Kœhler and others. *See* XXII.

Patents.

Gases in laboratories and the like; Means for dealing with obnoxious ——. A. Philip, Portsmouth. Eng. Pat. 9929, April 26, 1912.

The gas generator is connected with a supply pipe and an exhaust pipe leading to an arrangement for rendering the

gas innocuous, and means are provided for passing air through the testing vessel before removal. Liquid seals may be employed at suitable points in the arrangement. In the case of hydrogen sulphide the exhaust pipe may be terminated in a flame, such as that of a Bunsen burner.
—F. Shdn.

Specific gravity of gases ; Apparatus for determining the ——. G. A. Schultze and A. Dosch. Fr. Pat. 445,802, July 5, 1912. Under Int. Conv., July 5, 1911.

See Ger. Pat. 242,704 of 1911 ; this J., 1912, 305.—T. F. B.

Books Received.

Inorganic Chemistry. By Hamilton P. Cady, Ph.D., Professor of Chemistry in the University of Kansas. McGraw-Hill Book Company, 239, West 39th Street, New York. 6, Bouverie Street, London, E.C. 1912. Price 10s. 6d. net.

This volume ($8\frac{3}{8}$ ins. by $5\frac{5}{8}$ ins.) contains a frontispiece (plate of spectra), and 607 pages of subject matter, with 46 illustrations. The text is divided into thirty chapters, including a final one on "Radioactivity." There is an alphabetical index of subjects.

The Principles of Organic Chemistry By John F. Norris, Ph.D., Professor of Chemistry in Simmons College. McGraw-Hill Book Company, 239, West 39th Street, New York. 6, Bouverie Street, London, E.C. 1912. Price 10s. 6d.

The book measures $8\frac{3}{4}$ ins. by $5\frac{5}{8}$ ins., and contains 565 pages of subject matter, with 3 illustrations. Besides the usual routine of a text-book on organic chemistry, special attention is given to the methods used in the identification of organic substances, and examples are given. There is an alphabetical index of subjects.

Qualitative Analyse auf Präparativer Grundlage. Von Prof. Dr. W. Strecker. Julius Springer's Verlag. Berlin. 1913. Price M. 5. Bound M. 5.60.

Volume measuring $9\frac{3}{4}$ ins. by $6\frac{3}{8}$ ins., and containing 176 pages of subject-matter, with 16 illustrations, and an alphabetical index of subjects. The text is classified as follows :—I. Most important acids and the metals of the alkalis. II. The alkaline earths. III. The elements of the ammonium sulphide group. IV. Elements of the hydrogen sulphide group. V. The elements of the hydrochloric acid group. VI. The organic acids. VII. Systematic method of analysis. VIII. Tables.

Wissenschaftliche Grundlagen der Erdölbearbeitung. Von Dr. Gurwitsch, Laboratoriumschef bei der Verwaltung der Naphthaproduktionsgesellschaft Gebr. Nobel in St. Petersburg. Julius Springer's Verlag. Berlin. 1913. Price M. 9. Bound M. 10.

Volume measuring $9\frac{3}{4}$ ins. by $6\frac{1}{2}$ ins., and containing 275 pages of subject matter, with 12 illustrations and 4 tables. There is an alphabetical index of subjects. The text is classified thus : I. Crude material. a. Chemistry. b. Physics, including specific gravity, viscosity, optical properties, thermal, properties, solubility, etc. c. Brief characteristics of the principal petroleums. d. The origin of petroleum. II. Manufacture. a. Distillation. b. Refining, with sulphuric acid. with alkali. Results of refining. Value of by-products in refining. Refining by selective solubility. Refining by adsorption. III. Products. (Benzine, burning oils, lubricating oils, paraffin, vaselines.)

The Organometallic Compounds of Zinc and Magnesium. By Henry Wren, M.A., D.Sc., Ph.D. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1913. Price 1s. 6d. net.

Volume, $7\frac{1}{2}$ ins. by 5 ins., and containing 91 pages of subject matter, a bibliography (6 pages), and an alphabetical index of subjects. The text is classified as follows :—I. General notes on Grignard's reaction. II. Products formed by the aid of Grignard's reagents. III. Theoretical. IV. Zinc organometallic compounds.

Notes on Sampling and Testing. The Handbook of the Manchester Chamber of Commerce Testing House and Laboratory. Marsden and Co., Ltd., Mercury Works, Manchester, 1913. Price 1s. Bound in cloth 1s. 6d.

Volume, measuring $8\frac{7}{8}$ ins. by $5\frac{3}{4}$ ins., and containing 94 pages of subject-matter, with tables, two illustrations. and an alphabetical index. Arrangements have recently been made whereby a specially constructed testing laboratory is now under controlled conditions of humidity, and the testing house is open to the public. This volume sets forth all the methods, conditions, etc., for determining moisture in yarns, and other fibres, besides cotton. as carried out here. The influence of humidity on the count of yarn, and its strength, are dealt with in a special chapter, and a summary of results is given. Other chapters treat of chemical tests applied to yarns and textiles, and also to mill stores, dyers' drugs, etc. Next follow coal analyses and waters for boiler purposes; also moisture tests in wood pulp, etc.

Who's Who in Science (International), 1913. Edited by H. H. Stephenson. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 8s. net.

This biographical dictionary and directory contains 572 pages of subject matter, as against 323 pages in the first issue (this J., 1912, 156). It measures $9\frac{1}{8}$ in. × $5\frac{1}{4}$ in., and, commences with a frontispiece (portraits of Van't Hoff, Hooker, Lister, Poincaré, and Strassburger, who died in 1912). This is followed by a list of abbreviations used, an obituary (1912) and condensed tabulated lists of the world's universities, and the world's societies. The biographies, alphabetically arranged, now follow, and continue from page 93 to page 532, where a Supplementary List is found. These are followed, and the work concluded, by a classified index of names of scientists, under the different branches of pure and applied science they represent and in the different countries to which they belong.

Year Book of the Indian Guild of Science and Technology for 1912. General Secretaries : M. A. Ramni Paniker, National Provincial Bank of England, Savoy Court, London, W.C. ; K. M. Pardhy, 9, Easy Row, Birmingham.

The object of the Guild is "to co-operate in promoting the knowledge and application of Pure and Technological Science in India, with a view to the improvement of the methods of economic production and the amelioration of the sanitary condition of the people." Its Genera President is Prof. Arthur Smithells, F.R.S., of Leeds. The Year Book is a volume (9 ins. by $5\frac{3}{4}$ ins.), and containing 182 pages of subject matter (Rules, etc., of the Guild, papers and abstracts), and list of names of members. Amongst the original articles may especially be mentioned that on "Universities and Applied Science," by Prof. A. Smithells, F.R.S., p. 72. Besides this are contributions on "Coal Mining in India" (J. R. R. Wilson), "Ancient Hindoo medicine" (Dr. J. D. Comrie), "Science and Empiricism in Leather Manufacture" (Ed. Stiasny), and "Cassia Auriculata, or Tarwar bark" ; Analysis and use (P. V. Mehd). "Examination of the oil from the seeds of Camellia theifera (Tea)" (A. K. Menon). Abstracts of the two last mentioned articles appear in this J., 1913, 201, 205.

Kolloidchemische Beihefte. Monographien zur reinen und angewandten Kolloidchemie, herausgegeben von Dr. Wo. Ostwald. Band IV. Heft 6—7. Verlag von T. Steinkopff. Dresden and Leipzig. 1913. Price M. 1.20.

This volume, $9\frac{3}{16}$ by $6\frac{1}{4}$ in., contains :—(1) "Preparation of a dispersoid solution of any substance," by P. P. von Weimarn (20 pages). (2) "Investigations on some physical properties of colloidal solutions," by Jos. Frank (34 pages) (3) "The nature of the electrical synthesis of colloids," by C. Benedicks (32 pages and 4 plates).

REPORT FROM THE JOINT SELECT COMMITTEE OF THE HOUSE OF LORDS AND THE HOUSE OF COMMONS ON GAS AUTHORITIES (RESIDUAL PRODUCTS). Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 9d.

THE volume contains 201 foolscap pages, and in addition to the Report of the Committee, gives the minutes of evidence and eight appendixes (see this J., 1912, 1170).

COAL, AND THE PREVENTION OF EXPLOSIONS AND FIRES IN MINES. JOHN HARGER, Ph.D., M.Sc. Andrew Reid and Co. Ltd., Newcastle-upon-Tyne. Longmans, Green and Co., 39, Paternoster Row, London and New York, Bombay and Calcutta, 1913. Price 3s. 6d. net.

8vo. volume (8¾ ins. by 5¾ ins.), containing 176 pages of subject matter, with two illustrations, and an alphabetical index. The subjects considered are as follows:—I. Nature of coal and its occluded gases. II. Combustion. III. Respiration. IV. Mechanism of explosions. V. Rôle of coal dust in explosions. VI. Prevention of explosions. VII. Gob fires and their phenomena. VIII. Their treatment. IX. Fireproofing of timber, etc.

THE FREEZING POINT, BOILING POINT, AND CONDUCTIVITY METHODS. HARRY C. JONES. (Second Edition.) The Chemical Publishing Co., Easton, Pa., U.S.A. 1912. Price $1.00.

THIS volume (7¼ ins. by 5¼ ins.) contains 75 pages of subject matter, which is arranged as follows:—I. The freezing point method and its applications: (*a*) to the determination of molecular weights in solution, and (*b*) to the measurement of electrolytic dissociation. II. The boiling point method, and its applications: (*a*) to the determination of molecular weights in solution with "Results for a few substances," and (*b*) to the measurement of electrolytic dissociation. III. The conductivity method. Its application to the measurement of electrolytic dissociation.

ACHIEVEMENTS OF CHEMICAL SCIENCE. JAMES C. PHILIP, M.A., D.Sc., Imperial College of Science and Technology, London. Macmillan and Co., Limited, St. Martin's Street, London. 1913. Price 1s. 6d.

THIS small volume (6⅞ ins. by 4¾ ins.) contains 217 pages of subject matter, with 43 illustrations. The subject matter deals with the following themes:—I. Pioneer work. II. Old ideas and new facts about a common substance. III. Combustion. IV. Sources of power. V. Secondary fuels. VI. Chemistry and the safety of human life. VII. Raw materials, refuse, and by-products. VIII. "Chemical laboratory in competition with nature." IX. Synthetic chemical results. X. Chemistry in the service of the public. XI. Interest of the insignificant. XII. Scientific and technical chemistry. XIII. Chemistry and other sciences.

EXPLOSIVES. A SYNOPTIC AND CRITICAL TREATMENT OF THE LITERATURE OF THE SUBJECT AS GATHERED FROM VARIOUS SOURCES. DR. H. BRUNSWIG. Translated and annotated by CHARLES E. MUNROE, Ph.D., etc., and ALTON L. KIBLER, Ph.D., etc. George Washington University. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1912. Price 12s. 6d. net.

THIS volume (8¼ ins. by 5¾ ins.) contains 322 pages of subject matter, with 45 illustrations and a list of references, etc., followed by alphabetical indexes of names of authors and of subjects. The subject matter is classified as follows:—I. General behaviour of explosive systems (exothermal reactions; sensitiveness; initial impulse, etc.). II. Velocity of explosive reactions. III. Explosion pressure. IV. Temperature of explosions. V. Gases from explosive reactions. VI. Explosions by influence. VII. Flame of an explosion. VIII. Characteristics of particular explosives. IX. Propellants. X Blasting explosives.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Clerk*, D., and *Burls*, G. A. The Gas, Petrol, and Oil Engine. Vol. II. The Gas, Petrol, and Oil Engine in Practice. New and revised ed. 8vo., pp. 848. Longmans. London. 1913. Net 25s.

Fuchs, P.: Wärmetechnik des Gasgenerator- u. Dampfkessel-Betriebes. Die Vorgänge, Untersuchungs- u. Kontrollmethoden hinsichtlich Wärmeerzeugg. u. Wärmeverwendg. im Gasgenerator- u. Dampfkessel-Betrieb. 3. erweit. Aufl. (VIII, 191 S. m. 43 Fig.) 8°. Berlin. J. Springer. 1913. Cloth M. 5.

Pohlhausen, A.: Die Dampfmaschinen. (Kolbendampfmaschinen u. Dampfturbinen.) Lehr- u. Handbuch f. Studierende, Techniker, u. Ingenieure. In 2 Bdn.) II. Bd.: Die Dampfturbinen. (VIII, 339 S. m. 251 Fig. u. 18 Taf.) Lex. 8°. Mittweida, Polytechn. Buchh. 1913. Cloth M. 12.

Seufert, F.: Anleitung zur Durchführung v. Versuchen an Dampfmaschinen, Dampfkesseln, Dampfturbinen u. Dieselmaschinen. Zugleich Hilfsbuch. f. den Unterricht in Maschinenlaboratorien techn. Lehranstalten. 3., erweit. Aufl. (VII., 105 S. m. 43 Abbildgn.) 8°. Berlin. J. Springer. 1913. Cloth M. 2.20.

Gramberg, A.: Wirkungsweise u. Berechnung der Windkessel v. Kolbenpumpen. (III, 62 S. m. Fig.) 1912. Lex. 8°. Berlin. J. Springer. M. 2.

Gröber, Dr. H.: Der Wärmeübergang v. strömender Luft an Rohrwandungen. Lex. 8°. Berlin. J. Springer. 1912. M. 2.

IIA. *Lemberg*, H.: Jahrbuch der Steinkohlenzechen u. Braunkohlengruben Westdeutschlands. Nach zuverläss. Quellen bearb. u. hrsg. Ausg. 1913. 19. Aufl. (169 S.) 8°. Dortmund. C. L. Krüger. M. 4.

Schwackhöfer, Prof. F.: Die Kohlen Österreich-Ungarns, Preussisch-Schlesiens u. Russisch-Polens. 3. Aufl. Neubearb. v. Drs. Adf. Cluss u. Jos. Schmidt. (197 S. m. Abbildgn.) Lex. 8°. Wien, Gerold & Co. 1913. Cloth M. 13.60.

Schreiber, F.: Ueber Zerstörungen v. Koks- u. Gaskammerofensteinen, sowie deren Ursachen. (20 S. m. 7 Abbildgn. im Text. u. auf 2 Taf.) 8°. Essen. G. D. Baedeker. 1913. 50 Pf.

Siegfried, Dr. E.: Die Naphthalagerstätten der Umgebung v. Solotwina. Ein Beitrag zur Tektonik des Karpathenrandes in Ostgalizien. Mit 42 Abbildgn., 1 (farb.) geol. Karte u. 1 Profiltaf. (VIII, 72 S.) Lex. 8°. Berlin. Verlag f. Fachliteratur. 1912. M. 6.

VI. *Reimann*, Dr. M.: Leichtfassliche Chemie. Kurzes Lehrbuch der anorgan. u. organ. Chemie unter besond. Berücksicht. der chem. Vorgänge in Färberei, Bleicherei, Druckerei u. Appretur. 4. völlig neu bearb. Aufl. v. Dr. A. Ganswindt. (V, 374 u. XVIII S.) 8°. Leipzig. M. Koch. 1913. Cloth M. 6.

VII. *Kali-Industrie*, Uebersichtskarte der deutschen. 1913. Hrsg. v. dem Bankgeschäft Gebr. Dammann, Hannover. 1 : 450,000. 92.5 × 56.5 cm. Farbdr. Nebst Beilage: Verzeichnis der deutschen Kali-Unternehmngn. (III, 79 S.) 8°. Hannover, Bankgeschäft Gebr. Dammann. 1913. M. 3.50.

VIII. *Haenig*, A.: Emery and the emery industry; a technical study of modern abrasives and the development of the modern grinding machine industry; tr. from the German by C. Salter, with 45 illustrations. N.Y., Van Nostrand. 1912. 10+103 p. D. $2.50.

IX. *Gary*, Prof. M.: Versuche üb. das Rosten v. Eisen in Mörtel u. Mauerwerk, ausgeführt im königl. Materialprüfungsamt. zu Berlin-Lichterfelde-West in den J. 1907—1912. Bericht. Mit 15 Abbildgn. u. 5 Zusammenstellgn. (III, 47 S.) Lex. 8°. Berlin. W. Ernst & Sohn. 1913. M. 2.80.

Bach, Prof. C., u. O. *Graf*: Widerstand einbetonierten Eisens gegen Gleiten. Einfluss der Haken. Mit 16 Abbildgn. u. 1 Zusammenstellg. (V, 31 S.) Lex. 8°. Berlin. W. Ernst u. Sohn. 1913. M. 1.

Reinforced concrete, Properties and design of: Instructions, authorised methods of calculation, experimental results and reports by the French government commissions on reinforced concrete; tr. and abr. by Nathaniel Martin. N.Y., Van Nostrand. 1912. 14+119 p. (2½ p. bibl.) O. $2.50.

Hydraulischen Bindemittel, Normen f. e. einheitliche Benennung, Klassifikation u. Prüfung der. Hrsg. v. der schweiz. Materialprüfungs-Anstalt in Zürich. Neudr. der 4. Aufl. 1901. (17 S.) kl. 8°. Zürich. E. Speidel. 1912. 50 Pf.

Bonhomme, J., et E. *Silvestre*: Constructions métalliques, in 4°. Dunod et Pinat. Paris. 1913. Bds. 19 fr. 50.

Schwidtal, Prof.: Technische Mechanik., nebst e. Abriss der Festigkeitslehre f. Bergschulen u. andere technische Lehranstalten. 3. Aufl. (VI, 82 S. m. 80 Fig.) 8°. Leipzig. F. Brandstetter. 1912. Cloth M. 2.

X. *Allen*, R. C.: Mineral resources of Michigan, with statistical tables of production and value of mineral products for 1910 and prior years. Lansing, Mich., Mich. Geolog. and Biolog. Survey. 465 p. pls. fold. tabs., O. (Geological ser.) pap. 1913. $1.16.

American Rolling Mill Company, Middletown, O. Methods for the analysis of iron and steel, used in laboratories of the American Rolling Mill Co. Middletown, O., Am. Rolling Mill Co. 9—62 p. il. O. 1913. gratis.

Hearson, H. R.: The Manufacture of Iron and Steel. Cr. 8vo, pp. 104. Spon. London. 1913. Net 4s. 6d.

XIV. *Hillen*, Dr. G.: Ueber Kautschuk- u. Guttapercha-Harze. (95 S.) gr. 8°. Bern, Akadem. Buchh. v. M. Drechsel. 1913. M. 2.75.

XVI. *Auld*, S. J. M., and *Ker*, D. R. E.: Practical Agricultural Chemistry. Cr. 8vo., pp. 268. J. Murray. London. 1913. Net 5s.

XVII. *Zuckerindustrie*, Bericht der Versuchsstation f., in Prag f. d. J. 1911. (XVI., IX., 170 S. m. 6 Taf.) Lex. 8°. Prag. Fr. Řivnáč. 1912. M. 3.

Grobert, de, G. *Labbé*, *Manoury* et O. *de Vreese*: Traité de la fabrication du sucre de betteraves et de cannes, publ. par M. Fritsch, fig., et pl., 2 vol., in-8°. Paris. J. Rousset. 1913. Souscription, 50 fr.

XVIII. "*Gambrinus*." Adressbuch der Bierbrauereien u. Malzfabriken im Deutschen Reiche, enth. die Adressen der Bierbrauereien m. Kraftbetrieb, der Malzfabriken u. e. Auswahl der m. diesen Branchen in Verbindg. steh. Geschäfte Deutschlands, nebst Bezugsquellen-Verzeichnis. 2. Aufl. (99 u. 62 S.) kl. 8°. Leipzig (-Eu., Wilhelminenstr. 17), Böhme & Lehmann. 1912. Cloth M. 5.

XIXa. *Amos*, P. A.: Processes of flour manufacture; with 12 illustrations. N.Y., Longmans. 10+280 p. figs. D. (Longmans technical handicraft ser.) 1913. $1.50.

Röttger, Prof. H.: Lehrbuch der Nahrungsmittel-Chemie. 4., verm. u. verb. Aufl. (In 2 Bdn.) 2 Bd. (XVI. u. S. 603—1350.) gr. 8°. Leipzig. J. A. Barth. 1913. Cloth M. 16.

Zipperer, Dr. P.: Die Schokoladen-Fabrikation. Eine Monographie der Kakaofrucht u. ihrer Verwertg. 3., neu bearb. u. erweit. Aufl., hrsg. v. Dr. H. Schaeffer. (XI., 349 S. m. 132 Fig., 21 Tab. u. 3 Taf.) Lex. 8°. Berlin. M. Krayn. 1913. Cloth M. 10.

XIXb. *Christie*, W. W.: Water; its purification and use in the industries. N.Y., Van Nostrand. c. 1912. 11+219 p. il. diagrs., tabs., D. $2.

XXIII. *Leduc*, E., et G. *Chenu*: Matériaux de gros œuvre (Coll. de manuels pratiques d'analyses chimiques), in 8°. rel. Paris. Ch. Béranger. 1913. 6 fr.

XXIV. *Chazel*, : Prof. A. Lehrbuch der Chemie u. chemischen Technologie f. Handelsakademien. 1. Tl. Mit 52 Fig. u. 1 (farb.) Spektraltaf. (VI., 225 S.) gr. 8°. Wien. C. Fromme. 1912. Cloth M. 3.20.

Gautier et *Charpy*: Leçons de chimie à l'usage des élèves de la classe de mathématiques spéciales, 5e édition rev., avec 95 fig., in 8°. Paris. Gauthier-Villars. 1913. 10 fr.

Küster, Prof. F. W.: Logarithmische Rechentafeln f. Chemiker, Pharmazeuten, Mediziner u. Physiker. Im Einverständnis m. der Atomgewichtskommission der deutschen chem. Gesellschaft u. der internationalen Atomgewichtskommission f. den Gebrauch im Unterrichtslaboratorium u. in der Praxis berechnet u. m. Erläutergn. versehen. 13., neu berechnete Aufl. (107 S.) kl. 8°. Leipzig. Veit & Co. 1913. Cloth M. 2.80.

Neuberg, Prof. C.: Chemische sowie physikalisch-chemische Wirkungen radioaktiver Substanzen u. deren Beziehungen zu biologischen Vorgängen. (23 S.) Lex. 8°. Wiesbaden. J. F. Bergmann. 1913. M. 1.

Marggraf, A. S.: Einige neue Methoden, den Phosphor im festen Zustande sowohl leichter als bisher aus dem Urin darzustellen, als auch denselben bequem u. rein aus brennbarer Materie (Phlogiston) u. e. eigentümlichen, aus dem Urin abzuscheidenden Salze zu gewinnen. Aus dem Lat. u. Franz. übers. u. hrsg. v. G. Mielke. (54 S. m. 5 Fig.) Ostwald's Klassiker der exakten Wissenschaften. 8°. Leipzig. W. Engelmann. 1912. Cloth M. 2.25.

Planck, Prof. M.. Vorlesungen üb. die Theorie der Wärmestrahlung. 2., teilweise umgearb. Aufl. (XII., 206 S. m. 7 Abbildgn.) gr. 8°. Leipzig. J. A. Barth. 1913. Cloth M. 7.80.

Planck, Prof. M.: Vorlesungen üb. Thermodynamik. 4. Aufl. (VIII., 288 S. m. 5 Fig.) gr. 8°. Leipzig. Veit & Co. 1913. Cloth M. 7.50.

Roozeboom, Prof. H. W. Bakhuis: Die heterogenen Gleichgewichte vom Standpunkte der Phasenlehre. III. Heft. Die ternären Gleichgewichte. 2. Tl. Systeme m. 2 u. mehr Flüssigkeiten ohne Mischkristalle u. ohne Dampf v. Prof. Dr. F. A. H. Schreinemakers. (Deutsch v. Dr. J. J. B. Deuss.) (XII., 348 S. m. 148 Abbildgn.) gr. 8°. Braunschweig, F. Vieweg & Sohn. 1913. M. 11.
Heft II. pts. 2, 3 not out yet.

Technologie, Chemische, der organischen Verbindungen. Bearb. in Gemeinschaft m. Prof. P. Askenasy, Dr. E. Bontoux, Dr. G. Ellrodt u. a. u., hrsg. v. Prof. R. O. Herzog. (XI., 732 u. Atlas IV., 136 S. m. Abbildgn. u. 1 Taf.) gr. 8°. Heidelberg. Carl Winter. 1912. Cloth M. 22.

Chemical Manufacturers' Directory (The) of England, Wales, and Scotland, with some of the Firms in Ireland. 1913. 8vo, bds. London. Simpkin. 1913. Net 2s. 6d.

Dissertations.

[Prices vary, ranging from two to three shillings.]

IIa. *Bretschger*, M.: Beitrag zur Kenntnis des Phosphorwasserstoffs, Acetylens und Aethylens. Zürich. 1911. 71 S. 8°.

Hiller, F.: Ueber den Innenkegel gespaltener Kohlenwasserstoffflammen. Karlsruhe. 1912. 38 S. m. 3 Fig. 8°.

III. *Lenhard*, F. W.: Zur Kenntnis der schwefelhaltigen Derivate des Anthrachinons. Freiburg. 1911. 118 S. 8°.

Pay, A. de: Ueber Derivate des Benzophenons. Stuttgart. 1912. 46 S. 8°.

Schilling, H.: Zur Sulfurierung gechlorter Anthrachinone. Berlin. 1912. 51 S. 8°.

Weipert, H.: Ueber Bromderivate des Phenanthrens und Phenanthrenchinons. Stuttgart. 1912. 62 S. 8°.

IV. *Blumenreuter*, C.: Ueber Derivate des p-Dimethylindigos. Rostock. 1911. 60 S. 8°.

Dür, E.: Beiträge zur Kenntnis der Dioxychalkone. Bern. 1911. 34 S. 8°.

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Liverpool Section.

Meeting held at the University, on Wednesday, January 15th, 1913.

PROF. F. G. DONNAN IN THE CHAIR.

THE GINGER PLANT ORDER (ZINGIBERACEÆ). ITS VALUE FOR PAPER MAKING.

BY CLAYTON BEADLE AND HENRY P. STEVENS.

The possible value of this Order of plants for the manufacture of paper came to our notice about two years ago when we started an investigation on *Hedychium coronarium*.[*] Recent reference is made to *Hedychium* and other members of the same Natural Order, more particularly to their mode of growth, habitat, etc., in Kew Bulletin, No. 9, 1912, p. 373.

In previous references to the subject no mention has been made of peculiarities of certain papers produced from *Hedychium*. These peculiarities have only recently come to light as the result of further tests. Transparent and crackly paper with a "tinny" rattle, possessing, as it were, the combined qualities of Kraft and vegetable parchment, has recently been produced. Such paper of a substance of 30 lb. Demy (equal to 110 grms. per sq. meter), if tested for bursting strain often shows a resistance of over 100 lb. per sq. in., which is exceptionally high. The dials of many bursting strain testing machines are not graduated beyond 100 lb., nor are they required to be for ordinary purposes. Moreover, the "plastic elongation" is so great as to exceed the compass of the ordinary machine for testing bursting strain. When this paper is treated with the ordinary plunger testing machine with the application of somewhat less pressure than is necessary to burst the sheet, a characteristic cup-shaped depression is produced which is not noticeable except with very strong and elastic papers, and only with such papers as possess a high "plastic elongation." By the application of sufficient tension to produce a marked "plastic elongation" this paper is converted into a paper of quite different physical qualities and general appearance. Paper possessing a substance of about 30 lb. Demy requires a tension of 30 lb. per inch width of web, which results in a permanent "plastic elongation" of about 5 per cent. After this treatment the paper is no longer transparent and "rattly" but opaque and fibrous-looking, and in general appearance resembles a strong Manila cable paper.

On account of its peculiar qualities we describe the unstretched paper as "hide-bound." The ink-bearing and greaseproof qualities of the "hide-bound" paper are not destroyed by conversion into normal paper on stretching. A hide-bound paper of the above description is capable of great adaptation on account of its ability to meet stresses and strains when submitted to rough usage.

Table I.

Showing the effect of conversion of "hide-bound" into normal Hedychium paper by stretching.

	"Hide-bound" (transparent).	Normal (opaque).
Substance in grms per square meter	116 grms.	110 grms.
,, ,, lb. per Demy (480) ..	31¼ lb.	29¾ lb.
Thickness of sheet in millimeters ...	0·15 mm.	0·14 mm.
Breaking length in meters	6040 m.	5740 m.
Elongation at break	17·3%	12·1%
Breaking strain in lb. per inch width	39·3 lb.	37·3 lb.
Bursting strain in lb. per square inch	over 100 lb.	97·2 lb.

The preceding table gives detailed tests of "hide-bound" and normal *Hedychium* papers, the one produced from the other by stretching as above described. In all cases the normal paper (2nd column), as might be expected, shows slightly lower figures than the hide-bound, the greatest proportionate difference being in the "elongation at break."

In consequence of the success achieved by the treatment of the *Hedychium*, both in the dry and green condition, Sir David Prain, F.R.S., the Director of the Royal Botanic Gardens, Kew, suggested that we should make similar trials with two other members of the same Natural Order, namely, *Amomum hemisphericum* and *Alpinia nutans*. Besides belonging to the same Natural Order, the habit of growth of these plants is quite similar to that of *Hedychium* and, in the opinion of the Kew authorities, they should grow well under similar conditions. The stems of *Amomum* reach sometimes to a height of 16 ft. and those of *Alpinia* 8 to 10 ft. Specimens of these plants in the green state were furnished to us from Kew—The stem of the *Amomum* was found to weigh 2,500 grms. and that of the *Alpinia* 552 grms. They were both passed through heavy crushing rollers to express the juices and were obtained in the condition of a moist tow equal to about half the weight of the uncrushed stem. The material was in each case boiled with 20 per cent. of caustic soda on the dry weight of the fibre for 5 hours at 3 atmospheres, the amount of consumed soda determined, also the yield of unbleached and bleached pulp. The results expressed respectively upon the green and dry weight of stem are contained in the following table, together with the mean length of the ultimate fibre as found in the isolated pulp (average of 10 readings). In addition to which, for purposes of comparison, some figures for *Hedychium* are given.

Table II.

Comparing members of the Natural Order Zingiberaceæ.

	Hedychium.	Amomum.	Alpinia.
On green stem as received.	per cent.	per cent.	per cent.
Yield of wet crushed	—	53	50
,, ,, dry ,, ...	—	12·78	11·86
,, ,, boiled unbleached..	—	7·44	5·93
,, ,, ,, bleached....	—	6·36	4·95
Percentage of ash	—	0·7	0·6
Soda consumption (NaOH) .	—	2·0	1·96
Bleach consumption	—	0·8	0·65
On dry stem.			
Yield of boiled unbleached .	60	58·2	50
,, ,, ,, bleached ...	43	49·6	41·5
Soda consumption (NaOH) .	5	16·1	16·5
Bleach consumption	—	6·26	5·5
Percentage of ash	4·5	5·5	5·1
Length of fibre	2·61 mm.	2·54 mm.	2·21 mm.

The *Amomum* and *Alpinia* soda consumptions are very similar to that of spruce, and the unbleached yield of both is quite equal to spruce or poplar. The boiling in each case does not appear to offer any difficulty. The colour of each on bleaching is excellent. The bleaching causes the fibre bundles to disappear, without the aid of beating, with the formation of a pulp consisting of separated ultimate fibres.

From an examination of these pulps it would appear that *Amomum* and *Alpinia* are capable of producing a strong paper with a long tear; both are readily bleached to a good colour with a reasonable amount of bleaching powder. Neither of these fibres, however, possesses the natural advantages to be found in the case of *Hedychium*. We should regard them as being more suitable for the manufacture of white papers and as yielding a fibre which might compare favourably with strong sulphite wood pulp. The length of ultimate fibre in all three cases is approximately equal to that of strong Manila and sulphite papers.

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[*] Beadle and Stevens, Int. Cong. Appl. Chem., 1912, **13**, 39.

In conclusion we beg to tender our thanks to Sir David Prain and to Mr. Arthur Hill of Kew Gardens for assistance and facilities afforded us.

Discussion.

Dr. Rule asked whether any representatives of this order of plants were grown in this country, or if the authorities at Kew held out any hope of the possibility of its culture here.

Mr. Farrow said that he believed that New Zealand flax fetched £30 a ton, whilst the paper making pulp cost usually £1 to £3 10s. a ton. It seemed therefore that the price prohibited the use of that substance in the paper industry.

Mr. A. Carey asked whether the cells left in the paper were cellulose. Was there any available supply of the plant in the East as well as in Brazil? Were large quantiries of caustic soda used on the fibre in the same way as in paper making from esparto or straw, *i.e.*, by boiling under pressure?

Professor E. C. C. Baly asked what was the total area of land under *Hedychium* cultivation in Brazil. Also how much available land there was for future planting and for how long could it supply the world? The question as to the influence of certain cells on the quality of the paper had also been mentioned. If those were washed out the paper became opaque. The difference in the breaking tension in the two varieties of paper must be due to variation in the amount of coagulation of the colloids. The greater the coagulation the greater the decrease in the breaking strain.

Professor Donnan asked whether Mr. Beadle had made any chemical examination of the two species of fibre.

Mr. Clayton Beadle in replying said that they had so far had no opportunity of investigating the chemical properties of the cells. On separation from the fibre these cells were found to be peculiarly light and flocculent. He thought that the peculiar nature of the paper was occasioned by the agglomeration of those flocculent cell particles. When the mass of cells, after separation from the fibres, was allowed to dry, a very hard substance was produced which would not separate and could not be broken with a hammer. It could, however, be gradually softened by boiling in soda. Such an agglomeration of parenchyma cells remaining in a solid mass, even after prolonged wetting, was, he thought, unknown. Probably they filled up the interstices between the fibres and adhered in such a way as to give the paper its crackly feel and transparent appearance. When the paper was extended under tension the cells filling the interstices were, in his judgment, more or less separated, causing the paper to become opaque. If cellulose regenerated from cellulose xanthate (viscose) were decolourised by acetic acid it became in time a jelly. If that jelly soon after its formation was broken up into small pieces and brought together by pressure a continuous film was again produced. If on the other hand the particles of jelly were kept for some time they would not coalesce on application of pressure. The agglomeration of *Hedychium* parenchyma cells, which were of a highly jellified and flocculent nature, he regarded as somewhat similar, only that they did not appear to lose their power of agglomeration on standing. That peculiar hydration effect was brought about by boiling *Hedychium* in soda. If the juices were not expressed from the fibre before it was dried for shipment, it pulverised owing to fermentative or other changes, and became useless. The same was to be noticed in attempts to introduce other fibres in a green state, such as Manila. The climatic conditions were quite unsuitable for growing plants of this order in England. The plant required an average temperature of about 70° F. and a humid atmosphere, and thrived well with roots under water in a melon or cucumber house but its growth was entirely arrested if the temperature fell. The use of New Zealand flax had many times been suggested for papermaking and was tried about the time of the Indian and Colonial Exhibition (1886) when the possibility of its utilisation was discussed. It made a very strong and good paper but it was far too expensive and valuable for textile purposes to be used for the manufacture of paper. The *Hedychium* with stems at an average distance of 4 inches apart yielded, when harvested once per annum, fibre sufficient for the production of 10 tons of paper per hectare per annum. That represented the conditions of growth as the authors had had it under observation at Kew. There was in the locality referred to in the Kew Bulletin sufficient material for the production of 30,000 tons of paper per annum. Taking the case of pulp wood, it would be necessary to have about 25,000 hectares under cultivation, for the perpetual production of 300 tons of paper per week, *i.e.*, 12 cwt. of paper per hectare per annum. The great difference between the yield per annum of the two was due to the difference in intervals of cropping, with *Hedychium* once a year, with wood once in forty years.

So far as he could discover the plant had not spread extensively in any country but Brazil. The soda consumption was about 5 per cent. NaOH per ton of paper. By the time the boiling was completed no free soda remained, and the liquors from the boiling could with advantage be added to the stuff during the beating operation.

London Section.

Meeting held at Burlington House on Monday, March 3rd, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

NOTES ON CHINESE ANTIMONY ORES, CRUDE AND REGULUS.

BY W. R. SCHOELLER.

This paper contains a few notes on Chinese antimony ores and products obtained therefrom, and the record of a chemical investigation made in the laboratory of Messrs Alff & Co., at Hankow. Unfortunately the experimental work has not been brought to a definite conclusion, and if I communicate it in a fragmentary form it is because I have no present opportunity to pursue it.

Antimony ores occur in the South of Hu-peh and part of Sze-chuen province and in the provinces of Hu-nan, Kwei-chow, Kwang-si and Yun-nan. Roughly speaking, this vast antimony belt comprises the entire western half of China south of the Yang-tsze-kiang.

Each provincial government includes a Board of Mines, whose duty it is to develop and control the mining industry. However, of the provinces enumerated, only two have made any real progress towards utilising their mineral wealth, Kwang-si and Hu-nan.

In the Journal of this Society (1908, p. 754) is an abstract reporting the establishment of a large antimony smelting and refining works at Woo-chow, an important city on the West River. This plant reduces the ore mined in the province of Kwang-si, exports from which are shipped to Canton and Hong-Kong.

A British Consular Report abstracted in this Journal, 1910, p. 700, gives information concerning the trade of Chang-sha, the capital of Hu-nan province and the formation of the Hua Ch'ang Antimony Company, whose important and up-to-date smelting works use the volatilisation process in the manufacture of regulus. This process is also used at Woo-chow. Exports from Hu-nan are shipped viâ Hankow and Shanghai.

My experience in Chinese antimony materials being confined to those obtained from Hu-nan, it is to them that the remarks which follow are specially meant to apply.

At Chang-sha and also in other parts of the province, crude antimony is obtained from high-grade ores by liquation. The process is carried out in furnaces each of which holds two clay crucibles, the charge for each crucible being 50 lb. of ore. The crucibles are inclined and perforated at the bottom; they are fired for two hours, the liquated sulphide collecting in a cavity at the back of the furnace from where it is ladled into iron moulds and allowed to solidify. The pasty liquation residue is dumped into loose iron frames formed of two L-shaped pieces, in which it cakes together on cooling.

The Chinese estimate the value of a parcel of ore by putting a 100 lb. sample through the actual process, weighing the ingots obtained and expressing the yield in per cent. For instance, a 70 per cent. ore is one yielding 70 per cent. of its weight of crude, disregarding the antimony lost in the residues.

In assaying such ores I found that a yield of 70 per cent. of crude corresponds to an actual Sb content of 58 per cent. This figure is also found by calculation as follows :—

An ore yielding 70 per cent. of crude leaves 30 per cent. residue containing 26 per cent. Sb.

		Per cent.
Antimony in crude :	$\frac{70}{1{\cdot}4} =$	50
,, ,, residue :	$30 \times 0{\cdot}26 =$	7·8
	Total	57·8

High-grade ores from Hu-nan usually run about 58 per cent. Arsenic seldom exceeds 0·1 per cent., lead. copper and zinc 0·05 per cent., iron 0·5 per cent. The ores are thus remarkably pure.

In the assay of crude antimony obtained from these ores I repeatedly noticed the percentage of antimony to slightly exceed 71·43 per cent., which is demanded by the formula, Sb_2S_3, and this in spite of the fact that small quantities of impurities are always present, which should lower the antimony content.

If antimony is present in excess of the theoretical amount, the sulphur must necessarily be below it or in other words, the antimony is not all combined with sulphur.

In order to find out whether or not this was the case I analysed two samples of crude and obtained the following results :—

TABLE I.

	Crude Sample I.	Crude Sample II.	Regulus.
	per cent.	per cent.	per cent.
Antimony	71·60	71·70	98·20
Arsenic	0·069	0·048	0·148
Iron	0·821	0·14	0·146
Copper	0·015	not deter-	0·025
Lead	0·011	mined	0·006
Zinc	0·071	0·02	0·025
Insoluble	0·408	0·24	0·076
Sulphur	21·60	24·92	0·370
Total	94·595	97·068	98·996

For the purposes of this paper the silver content may be disregarded ; in Crude Sample II. it amounted to 0·87 oz. per ton.

The determination of sulphur was made in triplicate using three different methods.

1. Fusion with sodium carbonate and potassium chlorate. Filtration from insoluble sodium antimoniate, precipitation with barium chloride. Found, 21·57.

2. Oxidation with nitric and two evaporations with hydrochloric acid. Precipitation of antimonic acid with hot water, filtration and precipitation with barium chloride. Solution of the antimonic acid in hydrochloric and tartaric acids, separation of sulphur globules, weighing, igniting and subtracting ash, adding the weight of sulphur to that found in the barium sulphate. Found, 21·59.

3. Complete oxidation of 0·625 grm. with nitric acid and potassium chlorate, three evaporations with hydrochloric acid, addition of 1 c.c. hydrochloric acid and 100 c.c. boiling water to precipitate antimonic acid ; transferring to a graduated 250-c.c. flask, filtering 200 c.c. and precipitating with barium chloride. Found, 21·64.

The figures obtained by the three methods are in close agreement. Average, 21·60.

These deficiencies may be explained by assuming that the crude contains oxygen. In Sample I., 21·6 S require 54·0 Sb, leaving 17·6 Sb not as sulphide. In Sample II., 24·92 S require 62·3 Sb, leaving 9·4 Sb free. If the balance of the antimony is combined with oxygen, one would expect the presence of the lowest oxide. Curiously enough, the deficiency in both cases agrees fairly well with the quantity of oxygen necessary for the formation of Sb_2O_5 :—

	Sb not as sulphide	O required for Sb_2O_5.	Deficiency.
I.	17·6	5·8	5·4
II. ...	9·4	3·1	2·9

Bearing in mind the solubility of the oxides of antimony in tartaric acid, I tested the behaviour of Sample I. to sodium bitartrate solution. The latter was prepared as follows : 50 grms. of tartaric acid was dissolved in 500 c.c. distilled water, 250 c.c. neutralised with caustic soda, the two solutions mixed and made up to one litre. One grm. of crude antimony was placed in a folded filter fitting into a small beaker, and digested for 24 hours with 40—50 c.c. bitartrate solution. The filter was then placed in a funnel, washed twice, and replaced in the washed beaker. The antimony in solution was estimated, the residue re-treated with bitartrate at intervals stated in Table II.

The test was carried out simultaneously on a high-grade stibnite ore, a liquation residue, and a sample of regulus, all crushed to pass a 100-mesh. An oxide ore assaying 56·98 per cent. was tested in the same way ; it remained practically unattacked.

The amount of antimony dissolved is shown in Table II.

TABLE II.

	Crude.	Stibnite.	Liquation Residue.	Regulus.
After 24 hours	6·89	0·07	2·42	3·08
,, 2 days	1·46	0·12	0·31	1·26
,, 3 ,,	0·48	0·09	0·11	1·41
,, 10 ,,	0·65	0·45	0·17	4·01
Total Sb dissolved	9·48	0·73	3·01	9·76

The stibnite used in the experiment assayed : antimony, 57·31 per cent. ; sulphur, 22·56 per cent. Its composition is normal, as 57·31 Sb require 22·90 S to form Sb_2S_3. It will be seen from the figures that the behaviour of crude antimony to bitartrate solution is quite different from that of the natural sulphide.

The liquation residue contained antimony, 26·58 per cent. ; sulphur, 9·55 per cent. ; 9·55 S require 23·87 Sb to form Sb_2S_3, leaving 2·7 Sb uncombined. This is the amount dissolved by bitartrate in two days, after which time the action becomes insignificant.

One grm. of this liquation residue boiled for a short time with dilute tartaric acid solution lost 3·95 per cent. Sb, which is more than what we may assume to be present as oxide (2·7).

The regulus was analysed. The results are given in Table I. Small amounts of sulphur in regulus are conveniently estimated as follows :—

2·5 to 5 grms. are oxidised with *aqua regia*, the acid is evaporated and the nitric acid expelled by two evaporations with hydrochloric acid. The residue is dissolved in about 1 c.c. of hydrochloric acid and the antimony precipitated by addition of a large quantity of boiling water ; the liquid is transferred to a graduated 500 c.c. flask, cooled, made up to 500 c.c. and 400 c.c. filtered ; the filtrate is boiled and precipitated with barium chloride. With small amounts of sulphur the precipitate of barium sulphate separates out on cooling.

The deficiency of 1 per cent. and the solubility in bitartrate solution might be explained by the presence of oxide, but on the other hand the amount of dissolved antimony is much larger than expected.

Another test illustrating the solubility of regulus in bitartrate solution was made, but without using a folded filter as in the previous experiment; 1 grm. was digested with 50 c.c. bitartrate solution and shaken from time to time. In this manner an increased surface resulted, as the figures obtained are still higher than those shown in Table II. Three tests extending over three days were carried out. In the first the bitartrate was renewed every day; in the second, on the second and third day; and in the third the same solution acted all the time. The following amounts of antimony were found in solution:—

Table III.

Test.	After 1 day.	After 2 days.	After 3 days.	Total Sb.	c.c. bitartrate used.
I.	9·24	3·94	6·30	19·48	50 + 50 + 50
II	—	10·30	8·35	18·65	50 + 50
III.	—	—	12·82	12·82	50

The residues from these tests digested with fresh bitartrate solution gave copious precipitates with hydrogen sulphide after another day's standing, showing solution of the metal to go on to a still greater extent.

In the heat the action is more rapid; 14·70 per cent. of antimony was dissolved by 150 c.c. bitartrate solution in one hour at boiling heat.

Hydrochloric acid (10 c.c. of strong acid diluted with 65 c.c. of water) acting on 1 grm. regulus dissolved 1·42 per cent. in the cold; after filtering, the residue was again digested for three quarters of an hour at 100° C. with the same quantity of acid; 1·80 per cent. were dissolved. Total, 3·22 per cent.

These are the experimental data so far available. The literature on the subject is very scanty; some analyses of German and Hungarian crude antimony are recorded, but according to the figures given all the antimony is present as Sb_2S_3. Hering, in a paper on the recovery of antimony from liquation residues (Dingler's Polyt. J., **130**, 253) gives the composition of a sample of residue, which I reproduce here: Sb_2S_3, 20·40 per cent.; FeS, 2·87 per cent.; FeS_2, 1·23 per cent.; SiO_2, 59·84 per cent.; Al_2O_3, 4·65 per cent.; CaO, 5·22 per cent.; CO_2, 4·10 per cent.; Alkali, carboneous matter, 1·69 per cent.

The results of this investigation may be summarised as follows:—

1. The amount of sulphur found in the crude antimony under examination does not correspond to that required by the formula, Sb_2S_3.
2. The deficiencies in the results of the complete analyses of crude may be caused by the presence of oxygen.
3. Unlike stibnite, the liquated sulphide of antimony is strongly attacked by sodium bitartrate solution.
4. The liquation residue examined contains oxide of antimony which is dissolved by the bitartrate.
5. The regulus examined apparently also contains oxide; but the amount of antimony dissolved by sodium bitartrate solution is considerable, and much greater than the quantity of oxide assumed to be present.
6. In the sulphur assay of antimony sulphides, a convenient way for eliminating antimony is the precipitation of antimonic acid by means of hot water.

Discussion.

The Chairman said that apparently in the regulus the antimony dissolved its own oxide.

Mr. Hemingway asked whether in the analysis, gold had been looked for. In some samples of Sb_2S_3 he had found that when all the antimony was taken out there was as much as two ounces of gold left.

Dr. Schoeller in reply said he had only once found an antimony ore from Hunan to contain gold and that was one-tenth of an ounce per ton.

Mr. Hemingway asked whether that was out of the ore, or after the antimony had been extracted.

Dr. Schoeller replied that it was the ore. He had once found an antimony liquation residue to contain one-hundredth of an ounce of gold and one-tenth of an ounce of silver. The ores of Hunan did not contain more than one ounce.

Scottish Section.

Meeting held at Glasgow, on Tuesday, January 28th, 1913.

DR. THOMAS EWAN IN THE CHAIR.

THE ACTION OF ANIMAL CHARCOAL ON CANE SUGAR SOLUTIONS.

BY WILLIAM B. CLARK, F.I.C.

The well known property possessed by animal charcoal of absorbing colouring matters and other substances from solutions, which finds extensive application in sugar refining, has been the subject of previous investigations, but there is a lack of definite information as to the exact rôle which the charcoal plays in the process, especially when large quantities of material are dealt with. Small experiments, while useful for comparative purposes, do not form a trustworthy basis for making deductions of a definite character, owing to the totally different conditions prevailing on a manufacturing scale.

In refining sugar, a hot solution of a density of about 50° Brix is passed through filter presses or bag filters, and then slowly run on to animal charcoal, contained in cisterns about 20ft. high and 8ft. in diameter and holding about 30 tons. For 20 to 40 hours the liquid percolates through the charcoal, after which hot water is turned on to wash out all the sweet matters. The absorbent properties of the successive layers of the charcoal are gradually brought into play, the upper portions becoming soon saturated with impurities, whilst the lower portions only become charged after a considerable time. The liquor which runs off at first, is quite colourless and serves for the manufacture of the highest quality of white sugar. In the course of a few hours it becomes slightly yellowish, and as filtration proceeds, there is a gradual increase in colour intensity, until at the end of the operation, it is of a more or less brownish yellow colour and can only be utilised for making lower qualities of refined sugars. About one ton of charcoal is used per ton of sugar. Without a well purified sugar liquor, a large yield of the best quality of white sugar cannot be obtained from the massecuite, owing to the loss of sugar crystals in the centrifugal machines from the subsequent excessive washing with water which is necessary to remove adhering coloured syrup. The decolourising power of the charcoal is more or less affected by the nature of the impurities present in raw cane sugars, and it is a matter of common experience that sugars having practically the same polarisations are not equally serviceable from a refining point of view. This may be due to the variety of sugar cane crushed, the soil on which the cane has been grown, or to the process of manufacture of the raw sugar. The wide variations in the amount of colour in different raw sugars are exemplified by the following tests:—

Origin of sugar.	Pol.	Colour values (50 per cent, solutions, 1-inch cell)
(1) Java........................	98·4	80
(2) Do.	97·7	331
(3) Do........................	97·2	101
(4) Peru	96·2	63
(5) Demerara	96·6	82
(6) Cuba	96·1	118

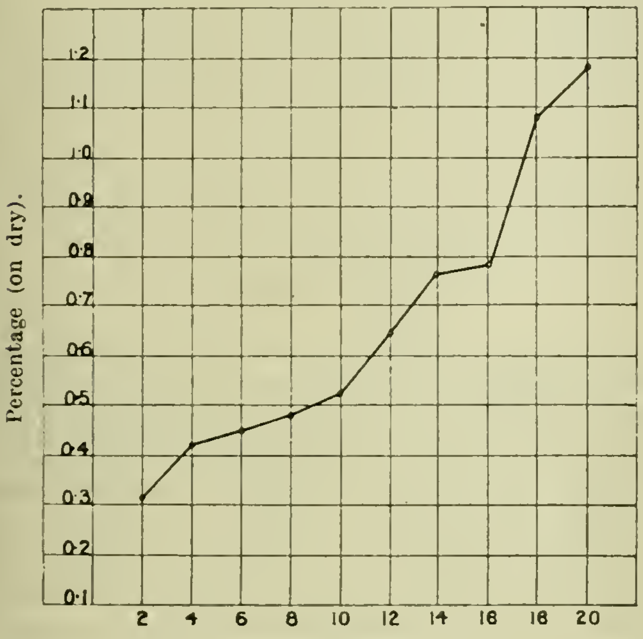
The colour values were obtained by comparing 50 per cent. solutions of the sugars with the standard glasses of the Lovibond tintometer and calculating the results to a 1 inch cell basis, as hereafter described. It is well known that, in matching colours with the Tintometer, the values obtained are not strictly proportional to the depth of cell used, and there is a difficulty in assigning numbers to different solutions which will truly represent their relative colour intensities. An approximate method, and one which yields fairly satisfactory results, is to multiply the value of the red glass by 4 and add the product to the value of the yellow glass and then bring the result to a 1 inch cell basis.

For example, a 50 per cent. solution of sugar gave the following colour values when read in $\frac{1}{4}$ in. and $\frac{1}{16}$ in. cell respectively.

	Inch.	Red.	Yellow.	Units
(*a*)	$\frac{1}{4}$	4·0	15·2	125
(*b*)	$\frac{1}{16}$	1·25	2·9	126

If the colour values obtained in the $\frac{1}{16}$ in. cell are simply multiplied by 4, we get, for the $\frac{1}{4}$ in. cell, 5·0 red + 11·6 yellow and it is impossible to say whether this is equal to (a) or not. By treating the colour values according to the method suggested, it will be seen that the colour units are almost identical. Provided that the colours are not too intense, so that they can be accurately matched with the standard glasses, the results agree well with those got by the use of Nessler tubes. In most cases, when dealing with raw sugars, it is necessary to dilute the solutions with known quantities of distilled water before matching the colours with the standard glasses. Operating in this manner, it is obvious that the range of the instrument for making direct readings is distinctly limited.

No. 1.—*Ash.*



Time (in hours).

For the purpose of investigating the action of animal charcoal on sugar solutions, sugar (in 50 per cent. solution) having the following composition, was passed through charcoal for 24 hours.

Composition of Liquor.

	Percentage on the dry substance
Crystallisable sugar	95·10
Reducing sugar	2·25
Ash	1·02
Unknown organic matters	1·63
Colour units	125

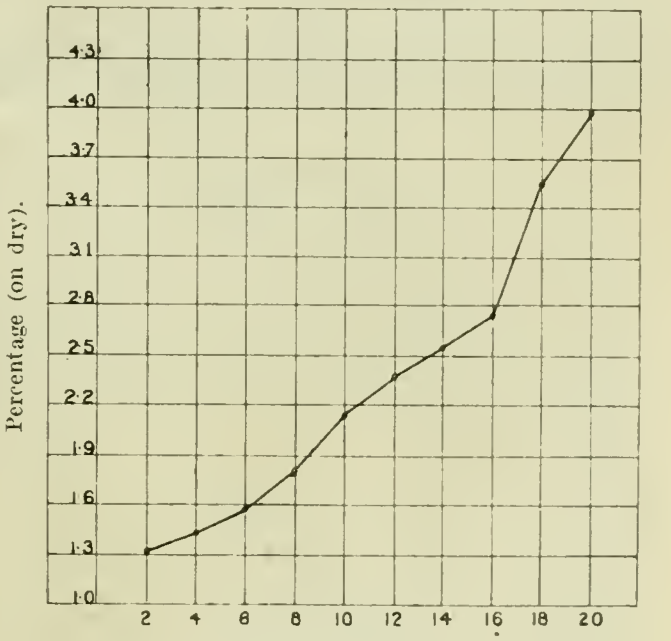
Samples of the liquor, which percolated through the charcoal were taken every 2 hours, over a period of 20 hours, and tested for reducing sugar and ash. The colour of each sample was also matched with the standard glasses of the tintometer and the amount of decolourisation calculated. The results obtained are shown graphically. Reducing sugar and ash determinations are calculated to the dry substance:

By reducing sugar, a mixture of varying proportions of dextrose and laevulose is meant.

	R.S.	Ash.	Colour removed.
	per cent.	per cent.	per cent.
First Sample	1·30	0·32	98·6
Second ,, ...	1·40	0·43	95·5
Third ,, ...	1·58	0·45	94·1
Fourth ,, ...	1·82	0·48	91·5
Fifth ,, ...	2·14	0·55	89·0
Sixth ,, ...	2·38	0·64	86·1
Seventh ,, ...	2·54	0·77	84·5
Eighth ,, ...	2·74	0·77	82·7
Ninth ,, ...	3·54	1·08	77·1
Tenth ,, ...	3·98	1·18	74·2

The animal charcoal through which the sugar liquor was passed had been in use for a considerable time and contained 18·5 per cent. of "complex carbon." When treated with strong sulphuric acid, the acid became very slightly brownish in colour, indicating that little organic matter, besides "complex carbon," was present.

No. 2.—*Reducing Sugar.*



Time (in hours).

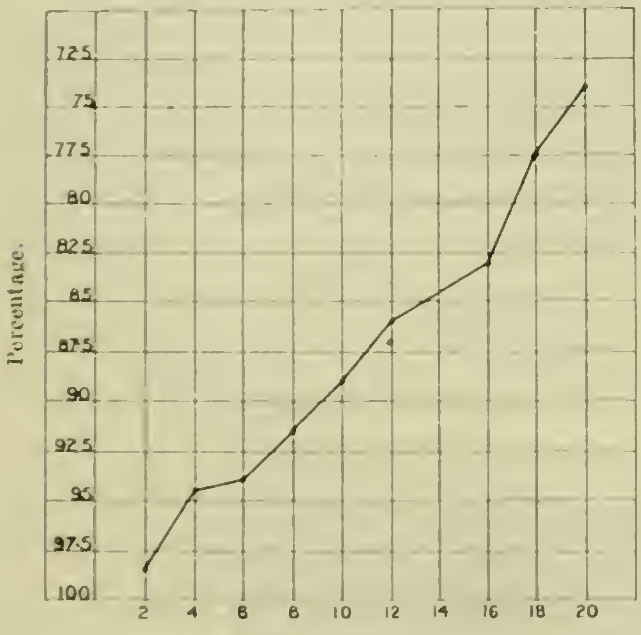
Inspection of these diagrams shows that the reducing sugar and ash in the sugar solution are absorbed at first by the charcoal, and, as filtration proceeds, are given up in gradually increasing amounts. Towards the end of the filtration it will be observed that the fruit sugar and ash constituents are higher than in the liquor taken for the experiment, and, with increase in these impurities, there is a gradual falling off in the decolourising power of the charcoal. This is highly characteristic of the action of animal charcoal: a bad decolourisation is invariably obtained when fruit sugar and salts are present in considerable quantities, and it is evident that there is a close relationship between the substances other than crystallisable sugar and the degree of decolourisation which a liquor undergoes in its passage through the charcoal. It will be observed that the graph of No. 4 chart which shows determinations of reducing sugar in liquor of a different quality running off another charcoal cistern, is a straight line and that of No. 2 is more or less broken. The explanation of this is that, in the one case, the liquid has been percolating through the animal charcoal at a constant rate, whereas in the other, it has been making channels through the charcoal and consequently different quantities have been running off at regular intervals. Fluctuations in the rate at which sugar liquors, more especially when gummy matters are present, percolates through charcoal are of common occurrence. Given two sugar solutions of the same colour intensity, but one containing more salts and reducing sugar, animal charcoal will decolourise the one with the lesser quantity of salts and reducing sugar more effectively than the other. A solution of raw sugar, having a certain colour intensity but little reducing sugar and salts, may, after passing through animal charcoal, part with 95 per cent. of its colour, as measured by the tintometer, whilst another raw sugar solution having approximately the same colour, but more reducing sugar and salts may show no more than 85 per cent. decolourisation after contact with charcoal.

Small experiments, in which sugar solutions were heated in closed bottles in a water bath for 2 hours also show this clearly.

	Percentage on the dry.			Colour units.	Colour units after char.	De-colouri-sation.
	Pol.	R.S.	Ash.			per cent.
No. 1 sugar	97·7	0·89	0·52	135	9	93·1
No. 2 ,,	93·6	4·23	0·70	147	19	87·1

Hence, the testing of animal charcoal with caramel solutions is of little value. The advantage of subjecting highly coloured and grainy sugars to a preliminary washing or steaming treatment, in order to remove adhering molasses, before dissolving them and running the solutions on to charcoal is apparent when a large yield of white sugar is aimed at.

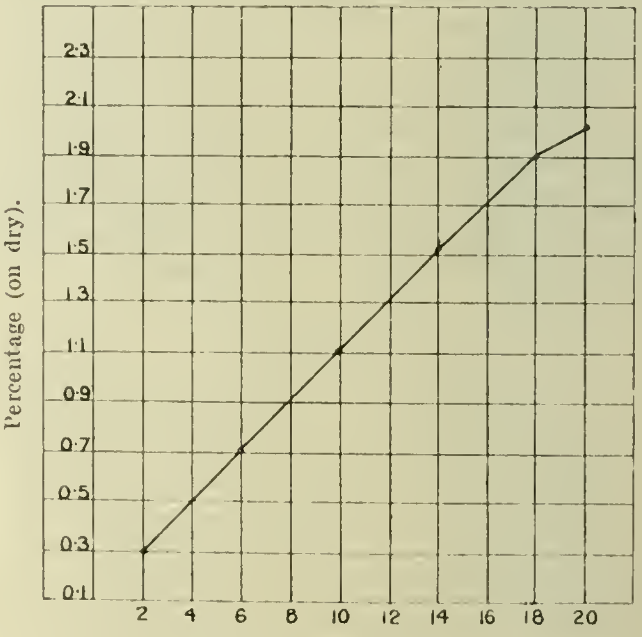
No. 3.—*Decolourisation.*



Time (in hours).

In examining the tests of the sugar liquor after filtration through the charcoal, the phenomena bear a close resemblance to those of diffusion, the charcoal appearing to act as a porous membrane, permitting the crystallisable sugar to diffuse through it more rapidly than the other bodies with which it is associated. The first portion of the filtered liquid only contains about 60 per cent. of the reducing sugar and 30 per cent. of the ash originally present, and, from the uncrystallisable character of the salts of the sugar cane it might be inferred that they would diffuse at a slower rate than the reducing sugar. At the end of the operation, when hot water is used to wash out the sweet matters, reducing sugar and salts are present in greatest amounts. There is always some loss of these bodies, due to partial oxidation of reducing sugars and retention of salts by the charcoal. When invert sugar is filtered through animal charcoal, there is moreover a slight decomposition of the laevulose constituent of the invert sugar. A sugar solution containing about 30 per cent. reducing sugars and 20 per cent. cryst. sugar had a specific rotatory power of $[a]_D+16{\cdot}5$; after percolating through the charcoal the first portions of the filtered liquid had a specific rotatory power of $[a]_D+18{\cdot}3$ and some hours elapsed before the specific rotatory power of the liquid fell to the former figure, at which it remained until all the sweet matter was washed out by hot water. This has an important bearing on the determination of small quantities of starch glucose in table syrups: it is quite impossible to estimate an amount of, say 2 per cent., starch glucose from polarisations before and after inversion of the syrup. Attempts to do so have been made on the erroneous assumption that the invert sugar present in the syrup consists of equal proportions of dextrose and laevulose, whereas, in most cases, there is an excess of dextrose, especially when the raw material is derived from the sugar cane, and this difference between the two constituents of the reducing sugar is further increased by the action of animal charcoal during filtration.

No. 4.—*Reducing Sugar.*



Time (in hours).

It seems highly probable that the first slight oxidising action of the charcoal is due to occlusion of oxygen in the pores of the charcoal, for, generally speaking, charcoal exercises a reducing action on the colouring matters of sugar. While much of the colouring matter is absorbed and retained by animal charcoal, some of it is reduced and passes through with the sugar liquor. This reducing action can be readily demonstrated by setting aside in a test tube, some of the last portions of coloured liquor derived from low sugar running off a char tank when, after a few hours exposure to air, a brown ring, due to absorption of oxygen, will be seen at the top of the tube, which will gradually extend downwards and become darker the longer the liquid is exposed to air. The decomposition of invert sugar is specially marked when the liquor is passed through new charcoal, and, invariably, there is less decolourisation. New charcoal only attains its maximum efficiency as a decolouriser after being washed and burnt several times. By repeated revivifications charcoal loses much of its porosity, and organic matters, other than carbon, are reduced to a small amount. Calcium carbonate which usually amounts to 9 per cent. in new charcoal, may amount to no more than 3 per cent. in a working char. Provided that charcoal is well washed before revivification, its decolourising power lasts for a long time and the falling off in decolourisation is very gradual. It has been assumed that the lowering of the efficiency of charcoal is due to the deposition of vegetable carbon on the surfaces of the particles of animal carbon of a complex nature, and while that, no doubt, is true to a large extent, it does not afford a complete explanation of the matter in question. Treatment of charcoal in the cold with dilute hydrochloric acid, considerably improves its decolourising power and the effect of this treatment is to dissolve out some lime and phosphoric acid and slightly raise the carbon content. The following experiment shows this plainly:—100 grms.

of charcoal were treated in the cold with 500 c.c. of one per cent. hydrochloric acid and the solution tested for calcium and phosphoric pentoxide. It contained 2·8 grms. calcium and 3·0 grms. phosphoric pentoxide. By this treatment the carbon in the char was raised to 20 per cent. (approx). A low refinery syrup, containing 50 per cent. solid matters, was then heated with treated and untreated charcoal on the water bath in closed bottles for 2 hours and the amount of decolourisation ascertained. Quantities of liquor and charcoal taken for the tests were exactly the same in both cases, so that the results are strictly comparable. The untreated charcoal removed 69·8 per cent. of the colour, and the charcoal after treatment with acid, and subsequent washing with water to neutrality, removed 84·6 per cent. of the colour from the solution. If the carbon were the only agent taking part in removing colour, it is difficult to understand why treatment with dilute acid should have improved its power of decolourisation so markedly. Calcium carbonate in the charcoal taken for the experiment amounted to 3·5 per cent. and the total calcium present was approximately the same as that in new charcoal. It is evident that some of the other constituents of the charcoal have an important influence on the decolourising efficiency. With repeated revivifications, carbonate of lime, as has already been stated, becomes reduced from 9 per cent. to about 3 per cent., and the rest of the calcium is found as calcium oxide in stable combination with phosphate of lime, so that it cannot be converted into calcium carbonate by simply moistening with ammonium carbonate. Attention has been drawn to this compound by different experimenters (Watts' Dict., 2nd Supp. page 974. Patterson, this Journal, **22**, 609). Treatment with dilute acid partly decomposes this basic phosphate of lime, and as it is after removal of part of this compound that the decolourising power of the charcoal is improved, there is a strong presumption that this substance, as well as vegetable carbon, has a considerable influence in reducing the efficiency of animal charcoal.

Another theory is that the decolourising power of animal charcoal is more especially due to nitrogenous organic matters as well as "complex nitrogenous carbon," but, in view of the fact that charcoal only attains its maximum power as a decolouriser after repeated washings and reburnings, when much of the nitrogen combined with organic matters, disappears, it is difficult to accept this theory as satisfactory; we should expect its maximum power to be exerted when nitrogenous organic matters were present in greatest excess. The organic matters in animal charcoal are not soluble in pure sugar solutions, but they are soluble in dilute alkalis, giving rise to yellow coloured solutions. As sugar liquors after percolating through new charcoal, which has been thoroughly washed and burnt before use, are invariably alkaline, although neutral when drawn on to the charcoal, it is probable that some portion of the organic salts present in raw sugar suffer some dissociation or decomposition in contact with the charcoal, with the result that some of the organic matters derived from bones pass into solution in the slightly alkaline liquid which contains free ammonia and communicate a "bloom" to the yellow sugars of the refinery. At the end of the filtration, the sweet water has invariably an acid reaction. After several revivifications, the alkaline reaction of the first portions of the filtered liquor from new charcoal practically disappears and the decolourising power increases.

In contrast to the action of animal charcoal on sugar solutions, containing saccharose, dextrose, laevulose, and organic salts, when corn syrups are passed through animal charcoal, they can be obtained perfectly colourless. Such starch syrups only contain small amounts of salts, and there is a strong presumption that it is to the absence of laevulose and organic salts that their complete decolourisation is due. If there were any solution of organic matters from charcoal during filtration it would be impossible to obtain such syrups in a colourless condition. By subjecting animal charcoal which has been used for decolourising sugar solutions, to a thorough washing with hot water and thus removing organic salts and other matters which it has absorbed, it is possible to use the charcoal again without revivifying it, and its power of decolourising resh quantities of sugar solutions is only slightly inferior to that of freshly burnt charcoal. Such washed charcoal still retains organic matters, which can be extracted by caustic soda solution, but, with the removal of the organic salts, the charcoal largely recovers its decolourising and absorbent properties.

Yorkshire Section.

Meeting held at Leeds, on Monday, February 3rd, 1913.

MR. G. WARD IN THE CHAIR.

THE EIGHTH REPORT OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL, 1898.

Standards and tests for sewage and sewage effluents.

BY DR. H. T. CALVERT.

I have before me a report prepared by Dr. Maclean Wilson and myself, and it is intended that this shall form the basis of our discussion this evening.

The Eighth Report is the most important yet issued by the Royal Commission, so far as regards the work of the West Riding Rivers Board, and it may be useful to examine its recommendations and the reasons which have led the Commission to their adoption.

At present there is no statutory standard or limit of impurity for sewage discharges, by compliance with which a Sanitary Authority is relieved of liability to prosecution under the Rivers Pollution Prevention Acts.

The Rivers Pollution Commission of 1868 recommended the adoption of certain standards; their final recommendations being given in their Fifth Report, page 49, where they say:—

"We now recommend, therefore, that the following liquids be deemed polluting and inadmissible into any stream:—

(a) Any liquid which has not been subjected to perfect rest in subsidence ponds of sufficient size for a period of at least six hours, *or* which, having been so subjected to subsidence, contains in suspension more than one part by weight of dry organic matter in 100,000 parts by weight of the liquid, *or* which, not having been so subjected to subsidence, contains *in suspension* more than three parts by weight of dry mineral matter, or one part by weight of dry organic matter in 100,000 parts by weight of the liquid.

(b) Any liquid containing in solution more than two parts by weight of organic carbon, or 0·3 part by weight of organic nitrogen in 100,000 parts by weight.

(c) Any liquid which shall exhibit by daylight a distinct colour when a stratum of it one inch deep is placed in a white porcelain or earthenware vessel.

(d) Any liquid which contains, *in solution*, in 100,000 parts by weight, more than two parts by weight of any metal except calcium, magnesium, potassium, and sodium.

(e) Any liquid which in 100,000 parts by weight contains, *whether in solution or suspension*, in chemical combination or otherwise, more than 0·05 part by weight of metallic arsenic.

(f) Any liquid which, after acidification with sulphuric acid, contains, in 100,000 parts by weight, more than one part by weight of free chlorine.

(g) Any liquid which contains, in 100,000 parts by weight, more than one part by weight of sulphur, in the condition either of sulphuretted hydrogen or of a soluble sulphuret.

(h) Any liquid possessing an acidity greater than that which is produced by adding two parts by weight of real muriatic acid to 1000 parts by weight of distilled water.

(i) Any liquid possessing an alkalinity greater than that produced by adding one part by weight of dry caustic soda to 1000 parts by weight of distilled water.

(k) Any liquid exhibiting a film of petroleum or hydrocarbon oil upon its surface, or containing in suspension, in 100,000 parts more than 0·05 part of such oil.

Provided always, that no effluent water shall be deemed polluting if it be not more contaminated with any of the above-named polluting ingredients than the stream or river into which it is discharged."

In another paragraph they say:—

"We feel it necessary in the interest of the miner to recommend the suspension of Standards (d) and (e), which relate to more or less poisonous metals in solution. . . . We are by no means without hope that, when increased attention is directed to the prevention of rivers pollution, practical methods will be devised by which those drainages may be so far cleansed as to bring them within those standards of purity which we cannot at present recommend to be enforced against them."

Parliament in passing the Rivers Pollution Prevention Act, 1876, found it impracticable to set up a statutory standard. Section 3 of that Act is as follows:—

"Every person who causes to fall or flow or knowingly permits to fall or flow or to be carried into any stream any solid or liquid sewage matter, shall (subject as in this Act mentioned) be deemed to have committed an offence against this Act.

"Where any sewage matter falls or flows or is carried into any stream along a channel used, constructed, or in process of construction at the date of the passing of this Act for the purpose of conveying such sewage matter, the person causing or knowingly permitting the sewage matter so to fall or flow or to be carried shall not be deemed to have committed an offence against this Act if he shows to the satisfaction of the Court having cognisance of the case that he is using the best practicable and available means to render harmless the sewage matter so falling or flowing or carried into the stream."

Thus any person who discharges solid or liquid sewage matter into a stream commits an offence, except that, if the sewage matter reaches the stream by a channel which was in existence in 1876, he does not commit an offence if he uses the best practicable and available means to render the sewage matter harmless, and this may be said to be the only approach to a legal standard for sewage discharges.

Section 17, however, of the Public Health Act, 1875, also deals with the matter as follows:—

"Nothing in this Act shall authorise any Local Authority to make or use any sewer, drain or outfall for the purpose of conveying sewage or filthy water into any natural stream or watercourse or into any canal, pond or lake, until such sewage or filthy water is freed from all excrementitious or other foul or noxious matter, such as would affect or deteriorate the purity and quality of the water in such stream or watercourse, or in such canal, pond or lake."

Section 7 of the West Riding of Yorkshire Rivers Act, 1894, is very similar to Section 3 of the Act of 1876 quoted above, but the Clause allowing the defence that the best practicable and available means are being used has not been re-enacted.

Since 1876 there have been frequent demands by Sanitary Authorities for some fixed standard with which the effluents from their sewage works must comply, and since the establishment of County Councils and Rivers Boards their officers who have supervision of sewage works have found themselves obliged to set up certain standards as a means of comparison of different effluents. Some of these are as follows:—

Derbyshire County Council. Sidney Barwise, M.D., D.P.H. (Royal Commission on Sewage Disposal, 1898, Fifth Report, Appendix VII, page 7).

Albuminoid Ammonia.—A good effluent is one which contains less than 0·1 part per 100,000 of albuminoid ammonia.

Nitrogen as Nitrates.—An effluent should contain more than 0·5 part per 100,000 of nitrogen as nitrates.

Incubator Test.—A good effluent should be so thoroughly oxidised that it does not absorb more oxygen after incubation for one week than it does at the time of collection.

Shake Test.—A simple test, which can be readily applied, is to shake vigorously for one minute a bottle half filled with effluent. All frothing should disappear in three seconds.

Opacity Test.—A good effluent is one which is so transparent that Pearl type can be read by a person with normal sight, through a column 10 inches in depth.

Essex County Council. John C. Thresh, M.D., D.Sc., F.I.C. ("The Surveyor," 1910. Vol. 37, page 429).

An effluent is good which gives upon analysis—suspended matter, not exceeding 3 parts per 100,000; albuminoid ammonia, not exceeding 0·1 part per 100,000; oxygen absorbed in four hours, not exceeding 1·0 part per 100,000. This standard represents an impurity figure* of 10.

An effluent is regarded as passable which gives upon analysis—suspended matter, not exceeding 4 parts per 100,000; albuminoid ammonia, not exceeding 0·14 parts per 100,000; oxygen absorbed in four hours, not exceeding 1·4 parts per 100,000. This standard represents an impurity figure* of 14.

Mersey and Irwell Joint Committee. Frank Scudder F.C.S., F.I.C. (Royal Commission on Sewage Disposal, 1898, First Report, Vol. II., page 328).

The limits of impurity allowed in sewage effluents are:—

Albuminoid ammonia, 0·1 grain per gallon.

Three minutes' permanganate test, 0·25 grain oxygen absorbed per gallon.

Four hours' permanganate test, 1·0 grain oxygen absorbed per gallon.

The permanganate test is carried out with $N/80$ permanganate at or about 60° F.

Ribble Joint Committee. E. Halliwell, F.I.C.—

Effluents are judged on the albuminoid ammonia present, and are classed as:—

Good—when the albuminoid ammonia does not exceed 0·1 part per 100,000.

Fair—between 0·1 and 0·15.

Unsatisfactory—between 0·15 and 0·20.

Bad—over 0·2.

Thames Conservancy. Charles E. Groves, F.R.S. (Royal Commission on Sewage Disposal, 1898, Fourth Report, with evidence, 1903, page 176).—

A *good* effluent is one which does not give more than 0·02 per 100,000 (0·2 per million) of albuminoid ammonia.

An effluent which gives more than 0·2 per 100,000 (2·0 per million) is a *bad* effluent.

West Riding Rivers Board.—

The working standard which has been adopted in the Laboratory of the Rivers Board is as follows:—

(a) In the absence of nitric nitrogen (or with less than 0·1 part per 100,000):—

The effluent is classed as:—	When the Oxygen absorbed from N/80 permanganate in 4 hours at 80° F. in parts per 100,000 is:—
Good.	Not more than .. 0·5
Fair.	Between .. 0·5 and 1·0
Unsatisfactory.	Between .. 1·0 and 2·0
Bad.	More than .... 2·0

(b) In the presence of nitric nitrogen (0·1 part per 100,000 or over):—

The effluent is classed as:—	When the oxygen absorbed from N/80 permanganate in 4 hours at 80° F. in parts per 100,000 is:—
Good.	Not more than ... 1·0
Fair.	Between .. 1·0 and 2·0
Unsatisfactory.	Between .. 2·0 and 2·5
Bad.	More than .... 2·5

No effluent is considered satisfactory if it contains more than 4 parts per 100,000 of suspended matter.

It will be noted that these standards of comparison all vary to some extent, although the variation is more in the nature of the tests applied than in the stringency of the standards, and it may be at once admitted that it is advisable that they should be brought into line.

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* The impurity figure is obtained by taking the mean of 10 times the oxygen absorbed figure, and 100 times the albuminoid ammonia figure.

In several instances where proceedings have been taken in the Law Courts, a standard has been fixed by the Court for the particular case under consideration. Two of these are quoted in a paper by Dr. Thresh (The Surveyor, 1910, Vol. 37, page 429). They are not based upon any single determination, but upon somewhat detailed analysis.

The present Royal Commission have obtained a large amount of information upon the advisability of fixing a standard by Statute. They have had before them many witnesses, including officials of Sanitary Authorities, chemists in public and private practice, and officers of the various County Councils, Boards and Committees which are entrusted with the enforcement of the Rivers Pollution Prevention Acts.

In 1903 they issued a circular to a large number of these persons asking for their opinions and suggestions, and it is interesting to note that, without exception, all the officers of the Rivers Authorities, including County Councils, who replied, stated they they did not think it was practicable to fix a legal standard. This is significant, as it would obviously be to the advantage of these officers and would simplify their work if such a standard were practicable.

The criticism will probably at once arise that although these officers have all objected to the establishment of a legal standard, they have been obliged to set up standards for themselves. The two things are very different. If a legal standard is fixed, then a Rivers Authority could presumably successfully take proceedings in Court with regard to the discharge of any sewage effluent which might not comply with it, but the foregoing standards of comparison have no such weight of authority, and, in fact, a Rivers Authority taking proceedings has to convince the Court of the polluting character of the discharge objected to. The Judge has discretionary power and would refuse to make an Order against, or inflict a penalty upon, a defendant, unless he were convinced that the stream receiving the sewage discharge was being injured. It has always, therefore, of necessity been the practice of the Authorities in applying their standards of comparison to take into consideration the local conditions and particularly the effect of any effluent upon the river into which it may be discharged. The working standards are only guides to show what an Authority could accomplish in the purification of their sewage, if they were to adopt " the best practicable and available means."

In spite of the adverse opinion of the officials of Rivers Authorities and many other witnesses, the Commission have come to the conclusion that a legal standard can be fixed, and the present report suggests what this should be and gives the reasons which have guided them in the matter. The summary of their report is set out as follows (par. 62) :—

"(*a*) The law should be altered so that a person discharging sewage matter into a stream shall not be deemed to have committed an offence under the Rivers Pollution Prevention Act, 1876, if the sewage matter is discharged in a form which satisfies the requirements of the prescribed standard.

(*b*) The standard should be either the general standard or a special standard which will be higher or lower than the general standard as local circumstances require or permit.

(*c*) An effluent in order to comply with the general standard must not contain as discharged more than 3 parts per 100,000 of suspended matter, and with its suspended matter included must not take up at 65° F. (18·3° C.) more than 2·0 parts per 100,000 of dissolved oxygen in 5 days. This general standard should be prescribed either by Statute or by Order of the Central Authority, and should be subject to modifications by that Authority after an interval of not less than ten years.

(*d*) In fixing any special standard the dilution afforded by the stream is the chief factor to be considered. If the dilution is very low it may be necessary for the Central Authority, either on their own initiative or on application by the Rivers Board, to prescribe a specially stringent standard, which should also remain in force for a period of not less than ten years.

(*e*) If the dilution is very great the standard may, with the approval of the Central Authority, be relaxed or suspended altogether. Our experience leads us to think that as a general rule, if the dilution, while not falling below 150 volumes, does not exceed 300, the dissolved oxygen absorption test may be omitted, and the standard for suspended solids fixed at 6 parts per 100,000. To comply with this test no treatment beyond chemical precipitation would ordinarily be needed. If the dilution while not falling below 300 volumes, does not exceed 500 the standard for suspended solids may be further relaxed to 15 parts per 100,000. For this purpose tank treatment without chemicals would generally suffice if the tanks were properly worked and regularly cleaned. These relaxed standards should be subject to revision at periods to be fixed by the Central Authority, and the periods should be shorter than those prescribed for the general or for the more stringent standards.

(*f*) With a dilution of over 500 volumes all tests might be dispensed with, and crude sewage discharged subject to such conditions as to the provision of screens or detritus tanks as might appear necessary to the Central Authority."

In fixing the tests to be carried out, the Commission have almost entirely set aside those recommended by the Rivers Pollution Commission, 1868, and those which have been adopted in the above-mentioned standards of comparison and the results obtained from the Commission's tests bear no fixed ratio to those obtained from the other tests, so that practically the whole of the analytical results accumulated since the passing of the 1876 Act will be more or less useless if these recommendations are adopted.

It must be admitted that all the former tests fall short of perfection, but these now recommended are no nearer the ideal. The few advantages claimed for them do not outweigh the many disadvantages.

A full discussion of the tests to be employed is not possible until the Appendix to the Report is available, for although the Report (par. 1) professes to deal with them, nothing is said as to the exact manner of conducting them. Certain criticisms may, however, be offered at this stage.

Little fault can be found with the general standard as to suspended matter. It is, in fact, less lenient than the one which has been used as a working standard in the laboratory of the Rivers Board, where regard has always been paid to the recommendations of the 1868 Commission, that no effluent can be considered satisfactory which contains more than 4 parts of suspended matter per 100,000.

The Commission do not, however, seem to have recognised one great difficulty in the application of this standard. Certain effluents, particularly those in which small amounts of iron are present, yield an increased amount of suspended matter on standing, so that the results of analysis depend upon the time which elapses between the taking of the sample and the application of the test. It would obviously be impracticable for a Rivers Authority to test the samples at the time they are taken.

The further test consists in incubating the sample with fully aerated tap water for 5 days at 65° F., and observing at the end of that period how much dissolved oxygen has been consumed by the sample. The standard suggested is perhaps more stringent than any of those which have been adopted as working standards by the various Rivers Authorities.

The Commissioners claim the following advantages over the quicker permanganate test, which is that chiefly used at present. They say (par. 9) :—

" (1) We have found in practice, that the 5 days' test reflects more accurately than the permanganate test the observed conditions of the streams."

" (2) The 5 days' test represents more naturally the actual process by which the more readily oxidizable constituents of the polluting matter absorb the oxygen dissolved in the river water. Permanganate, on the other hand, is a vigorous oxidizing agent which may oxidize substances contained in the polluting matters, which would not take up dissolved oxygen under natural conditions, at all events, not at a rate which would deoxygenate a stream."

" (3) Laboratory experiments have shown that it is the more delicate test of the two, *i.e.*, it shows smaller differences in quality of water. For example, the permanganate test may give approximately the same figure for a water polluted with tank liquor, and for a water polluted with filter effluent, while the 5 days' dissolved oxygen test applied to the same liquids would give a higher figure for the water polluted with the tank liquor, thus indicating differences in kind as well as in degree of pollution."

As regards (1), this is not borne out by any evidence, nor does the report indicate any reason for the statement, although it is possible that the promised appendix may throw more light upon the matter.

As regards (2), the endeavour to devise a test which shall be in accordance with natural conditions cannot be said to have succeeded when it is borne in mind that most of the effluents discharged into English rivers will have reached the sea in less than five days, and that during their course to the sea they are constantly being mixed with fresh volumes of stream water and exposed to the air and sun. The test they propose is perhaps slightly more in line with natural processes than the ordinary permanganate test, and if it were anything like so easy of application or so reliable many chemists would willingly adopt it.

As regards (3), this is a decided advantage in favour of a test based on the absorption of dissolved oxygen, as compared with the permanganate test above, but if the permanganate test is backed up, as it should be, by the albuminoid nitrogen and nitric nitrogen determinations, this advantage disappears and a better estimate can be formed of the polluting character of the effluents, and of the extent to which purification has progressed, by the application of the older tests. In fact, no single test has yet been devised which can be considered reliable for determining the impurity of an effluent.

With respect to the actual details of the tests, the Commission were extremely unfortunate in their Fifth Report in suggesting the use of a particular method of carrying it out, which has been rejected by most chemists as altogether unreliable. They also at the same time recommended (par. 322) that the test should be carried out upon the filtered effluents, after removal of all suspended matter. They have fortunately seen their mistake in time, for, it is obviously only just, as they now recommend, that the test should be applied to the effluents as they reach the streams. Since the publication of the Fifth Report they have issued amended instructions to several chemists as to the method of carrying out the test (Aug., 1910), and it is understood that these still remain in force and are to be incorporated in the promised appendix.

The five-day period of incubation is a serious objection, for the results of the analysis are not available for 5 or 6 days after the sampling. Moreover, since no work is to be expected in the laboratory on Saturday afternoon or Sunday, no samples can be dealt with on these days, thus no new samples can be dealt with on the Monday afternoon and Tuesday, and there will be none for which the 5 days' test is completed on the Thursday afternoon and Friday. There is, therefore, the equivalent of three full days in every week unavailable for carrying out the test.

Again, if the sample contains green algae which give off oxygen, the 5 days' incubation, especially in the presence of light and at the warm temperature stipulated, favours the growth of the algae, when the liberated oxygen would disturb the course of the process and could not be properly allowed for. It is difficult to see why 5 days was the period chosen in place of 24 hours. In their Fifth Report they gave the choice of three periods, 24 hours, 48 hours, or 5 days, with standards of 0·5, 1·0, and 1·5 of dissolved oxygen absorbed for each period respectively. A period of 7 days would interfere much less with the work of a laboratory than the 5 day period chosen.

The temperature of 65° F., which has been adopted, is supposed to represent a maximum summer temperature of the streams, but many in the West Riding of Yorkshire, the waters of which are used for condensing, reach a much higher temperature, for instance, the River Don below Sheffield, has been found to have a temperature of over 90° F. in the summer. Then again, 65° F. is higher than the laboratory temperature in winter and below the summer laboratory temperature, so that there would be considerable difficulty in maintaining a large incubator at the constant temperature. If a temperature somewhat higher were used, say 80° F., at which the permanganate test is carried out in the laboratory of the Rivers Board, this difficulty would disappear. The permanganate test is carried out by various authorities at laboratory temperature, at 60° F., or at 80° F. The Commission have chosen another temperature without any convincing reason.

To obtain comparable results, the relative volumes of sample and tap water incubated must be fixed, and of this no mention is made in the Report. Experiments have shown that the same sample incubated with 2 volumes and with 9 volumes of tap water gave results as follows :—

Period of incubation (days).	1		2		5	
Dilutions.	2	9	2	9	2	9
Dissolved oxygen taken up by three samples. (*Parts per* 100,000).	0·09	0·74	0·29	1·38	0·78	2·34
	0·21	0·68	0·41	1·21	0·71	2·21
	0·35	1·21	0·68	2·25	1·73	3·52

It is, therefore, obvious that if the results of different workers are to be comparable the tests must be carried out under identical conditions as to dilution.

The Report states (par. 10) that the Commission "are satisfied that with a little practice any well-trained chemist can use the test with ease and obtain accurate results." This is by no means the general experience, and it would be interesting to know whether the Commission have compared the results of analysis of the same effluent in different laboratories. There is probably no chemical test which is more liable to give different results in the hands of different analysts.

To test the truth of this statement samples were taken of a well-purified sewage effluent and sent to a number of different analysts, all of them chemists of repute and accustomed to the analysis of sewages. All were requested to make their analyses in the same way. The results showed extraordinary divergence. Thirty-eight determinations were made and the mean gave an average of 0·907 parts per 100,000 of dissolved oxygen absorbed, the maximum being 1·96 and the minimum a negative amount of 0·18. The latter figure must have been the result of errors in manipulation, and omitting this the minimum was 0·176, the results thus showing a variation from the mean of 116 per cent. and 81 per cent. respectively; nor are these different results due to any personal factor, for more than one of the analysts reported that he was unable to make the results of his duplicate analyses tally. Obviously a test which yields such discordant results cannot be considered as a satisfactory one to set up by statute.

Generally, the test is more difficult to carry out than the permanganate test. It cannot be followed easily, as there is no indication as to the rate at which the dissolved oxygen is being absorbed, and if anything goes wrong, five days have been lost, and the sample, five days old, must be tested again. In the permanganate test the rate at which the colour of the permanganate disappears can be observed, and more permanganate added as required, or the test immediately repeated.

In carrying out the test it will be necessary to do a blank test with each sample, whereas with the permanganate test only one blank is necessary for all the samples tested on any one day; and if the test is duplicated in each case the work is at once doubled, and if two or three dilutions are to be made, the work is again doubled or trebled, so that instead of one bottle for each sample, 8 or 12 may be necessary, and as half of these must be kept for 5 days, the incubator will have to be of a large size. This objection is not so great in the case of sewage works where only one or two samples are analysed daily, but, in the laboratory of a Rivers Board, 12 or 15 are often analysed in one day, and the incubator would have to be of such a size as to hold several hundred bottles. The extra trouble and expense involved in the application of the new test would, of course, be a small matter if the results to be obtained were sufficiently valuable, but this is by no means the case.

A large number of tests have been carried out side by side, using the Rivers Board's method and the method advocated by the Royal Commission in their Fifth Report, and the results have shown that the adoption of one or other method makes little appreciable difference in the classification of the effluents tested. As soon as the precise conditions of the new method of testing are published these experiments will be repeated. Dr. Thresh also ("Surveyor," 1910, Vol. 37, p. 247) says that any effluent which complies with the standard which he has adopted would comply with the provisional standard suggested by the Royal Commission in their Fifth Report, which was similar to that now recommended. He considers the tests now suggested as troublesome and unnecessary, and this view will be endorsed by many chemists.

Had the Commission concluded by suggesting the above chemical standard, the objections to the adoption of their recommendations, although serious, would not have been insurmountable. In effect, their standard would have been substituted for the standards of comparison already mentioned, and as has already been suggested it would be well if an authority such as the Royal Commission could, after consultation with the chemists experienced in sewage analysis make a pronouncement as to the characteristics of a well purified sewage effluent and standardize the various tests in use.

It is, however, impracticable to make any fixed standard statutory, for everyone will admit that it would be unfair to fix a hard and fast standard to be applicable in every case, and that it would therefore be necessary to vary the standard according to local circumstances. This would necessitate each case being decided on its own merits.

From the questions put to several of the witnesses who appeared before them it may be gathered that the Commission at one time intended that standards, where varied, should not be altered for any particular town or sewage works, but that different standards should be set up for different streams, or for different stretches of the same stream. This intention does not, however, appear in the present report, nor is it practicable. Our streams are so small and their condition varies so rapidly that such an expedient would practically mean that every separate case would have to be considered by itself.

It would, therefore, be unfair to set up a statutory standard applicable in all cases, and it is impracticable to vary standards to suit individual cases or different streams.

It has been urged that fixed standards have been found of use in the Alkali Works Regulation Acts in dealing with gaseous emanations; but these impurities are discharged into the atmosphere, where any polluting matter is rapidly diffused and where the conditions do not vary as they do in the streams. When liquid discharges are dealt with (Section 5 of the Act of 1906) an offender is only called upon to use the best practicable and reasonably available means for the abatement of a nuisance.

There are many reasons which make a fixed statutory standard impracticable, such as the varying velocity, volume and quality of the streams; the varying uses to which the stream water is put; and the exceptional difficulty in certain cases of purifying a peculiarly strong sewage. It is also difficult to agree upon the tests to be adopted, and at the present day there is no sufficient single test.

The Commission not only recommend a general statutory standard, but proceed to suggest that this standard should be variable according to the dilutions provided by the dry weather flow of the stream into which an effluent is to be discharged. They thus at once encounter the difficulty, to quote from their own Report (par. 15, a), of such a system "requiring, in effect, a different standard of purity for the sewage or effluent of each place, and it will be readily understood that multiplication of standards multiplies the difficulties of administering them."

In the summary of the conclusions quoted above no mention is made of the Commission's views as to the quality of the diluting water being a factor needing consideration, and their views as to this, given in the body of the report, are so conflicting that various paragraphs read as if they had been drawn up by different authors.

For example, in par. 15, c, they say distinctly that quality of river water should be taken into account: in par. 16, they consider "that variations in the quality of the diluting water should not be taken into account": again, in par. 17, they think that "the quality of the diluting water should be assumed to be constant": and in par. 25, they suggest that the standard should be relaxed when the river water is "of such a quality, &c." Which view they actually hold it is difficult to discover, but it is evident that in any proceedings taken into Court the contending parties will be able to choose quotations from this report in support of diametrically opposite opinions.

The law as it stands at present does not look upon the polluted condition of a stream as an excuse for further pollution. Liquids are to be treated as polluting if they interfere with what was the original character of the stream (see West Riding of Yorkshire R.B. v. Hainsworth (1902), 5 L.G.R., 356). "It must not be said 'see what a lot of filth other people put into it (the stream), and, therefore, you must excuse us.' . . . Everyone could make that answer and the river would not be purified at all" (see Staffordshire C.C. v. Seisdon R.D.C. (1907) 96 L.T. 328; 71 J.P. 185; L.G.R. 347). It seems in fact absurd to say that because a river is polluted the measures to be taken for its purification must be less stringent than if it were a natural pure stream. On the other hand the view taken by the Commissioners (see pars. 13 and 25), that when a sewage effluent is discharged into a pure stream the standard of purification may be relaxed, does not commend itself to common sense, and the decision of the Law Courts seems to be the proper one.

In their conclusions the Commission recommend that the chemical standard advocated should be generally applicable, but that a higher or lower special standard should be adopted where local circumstances require or permit. The only local circumstance they mention there is the dilution afforded by the stream affected, but in the body of the report they seem to suggest that other circumstances must be taken into account. For example in par. 25, they mention also the quality of the river water and the presence of other pollution, and in par. 49, the velocity of the stream and the position of the outfall.

Taken literally (par. 62, c.) they seem to recommend that the general standard alone is to be in force for ten years, for no modification is to be allowed at an earlier date, and a special standard would evidently be a modification. This, however, is impracticable, for it would evidently be unfair, impossible indeed, to insist that a Local Authority should treat its sewage completely, if there were a probability that ten years hence a less complete treatment would suffice. Again, however, it is impossible to say with certainty what their intention is.

In addition to the recommendation of special standards the Commission recommend (par. 62, e) that, with the approval of the Central Authority, any standard may be relaxed or even suspended altogether, and the power of doing this they say (par. 53) "will require to be freely exercised when first the new machinery is set up." This will inevitably bring about a chaotic state of matters, which the Commission evidently foresee in a small degree. They say (par. 53):—

"It will be the duty of each Rivers Board in the first instance, to prepare a scheme for the whole of their watershed. In preparing this scheme they will have to consider many claims for exceptional treatment, some of which will, after local investigation, be found to justify the alteration of the general standard; while in other cases where such claims are either not made or are made and disallowed, the existing works will be found inadequate to meet the demands of the general standard. Time will obviously be needed for the settlement of these points and for the erection of new or the improvement of existing works."

The recommendations with regard to relaxation of the standards (par. 62, e) are still more objectionable than the preceding, and the suggestion (f), that in cases where there is a dilution of 500 volumes all tests might be dispensed with and nothing but screening or detritus tank treatment required, is most reactionary.

It is a well-ascertained fact that the nuisance caused by a polluted river comes chiefly from the polluting suspended matters in its waters. But in spite of this the Commission would allow large amounts of these objectionable solids to be discharged from sewage works. In our Yorkshire streams, obstructed as they are by numerous weirs, these solids would be deposited above the weirs and would there putrefy and give off offensive gases and pollute the waters of the stream—a process which can now be seen going on in any of our more polluted streams.

Their last suggestion, as to the discharge of crude sewage in certain cases, seems to have been arrived at (par. 38) after consideration of one apposite case only, in which their suggested minimum amount of dilution existed.

It is to be regretted that the Commission did not make themselves better acquainted with our Yorkshire rivers before they formulated their recommendations. Excluding the cases of the County Boroughs, the gross pollution of the streams is not due to one or two isolated discharges, but to a long series. The suggested relaxation or suspension of standards, if decided by the amount of dilution alone, would apply to a great majority of these, and at a large number of sewage works on the main streams no treatment could be demanded beyond such screening or detritus tank treatment as might appear necessary to the Central Authority. At another large number, the only treatment that could be enforced would be tank treatment, or at most chemical precipitation. If this principle is also to be applied to the treatment of trade refuse, the combined effect of the resulting polluting discharges will be very great and the state of the rivers will be worse than it is to-day.

If, on the other hand, local circumstances other than the amount of dilution are to be considered, each case will involve a difficult and prolonged investigation before a conclusion can be arrived at, and this in not a few instances. There are over 400 sewage works under the supervision of the Rivers Board. It may be taken for granted that whenever fault is found with any one of these, it will be urged that the Board have not taken into consideration the Commission's recommendations.

The Commission suggest (par. 54) that where an Authority has works capable of meeting the requirements of the general standard, although they might claim indulgence on the ground of the dilution which their effluents receive, the Superior Authorities will rightly hesitate to countenance any relaxation which might involve discontinuing the use of existing works. But what will be the practical outcome of this attitude of the Superior Authorities? If two towns are similarly circumstanced it will be impossible to insist that one shall purify its sewage to a higher degree than the other. They will inevitably revert to the cheapest purification allowed under the standard which applies in such circumstances.

The Report does not state whether it is the intention of the Commission that the provisions of Section 17 of the Public Health Act, 1875, should be repealed or annulled; nor if private riparian rights are to be interfered with. If these remain in force, compliance with a statutory standard will not avail the polluter of a stream as a defence in legal proceedings brought by a riparian owner. In the Fifth Report, however (par. 318) it is recommended that no action should be allowed to be brought in respect of damage alleged to be due to the discharge of an effluent which complies with the standard fixed.

From the point of view of public policy this seems very objectionable. In any particular case a standard is to be fixed by the Central Authority, presumably on the advice of their officers, who certainly would not claim to have a professional or local knowledge so great as to override the views of others without question. This standard having been fixed the action of the Central Authority is to protect a Sanitary Authority complying with it from any legal action on the part of a person injured or aggrieved. Thus questions affecting large and important private rights are to be decided without appeal by a Government bureau and its officials.

It is suggested (par. 55) that there is no need for a Rivers Board to deal first with the pollutions of the upper reaches of a stream, but rather that they should give attention first to the larger pollutions, which generally occur lower down on the streams. The advice is given that meanwhile some of the smaller communities should abandon the water carriage system and adopt dry conservancy, advice which will be entirely in opposition to the views of almost all Health Officers. The purity of the rivers is a sufficiently important subject, but even more important is the sanitary condition of the surroundings of dwellings, which will certainly not be improved if this advice is followed. In practice, however, no householder who has experienced the convenience of the water carriage system will ever willingly revert to the other.

In the concluding paragraphs of the report, a few other matters are dealt with, some of which are important. It is suggested that Local Authorities should take periodical samples of their sewage effluents and should keep records of the analyses, which should be open to inspection by Rivers Boards: that facilities should be provided for the taking of samples and for gauging sewage flows: and that Rivers Boards should have enlarged powers of entry upon and inspection of works.

Paragraph 60, which deals with the discharge of storm water sewage, is important. To such discharges it is suggested that no standards should apply and that an Authority should only be required (Fifth Report, pars. 294 and 295), with regard to storm water overflows on branch sewers, to alter them at the instance of the Rivers Authority when that body is of opinion that they "permit an excessive amount of unpurified sewage to flow over them;" and, with regard to storm water sewage reaching sewage works, that up to three times the dry weather flow should be treated like ordinary sewage, and that the excess should be treated in stand-by tanks, with an overflow from these tanks. It is recommended that in all these arrangements for dealing with storm water sewage the Rivers Authority should have power to require alterations, and that the Local Authority should have the right to appeal to the Central Authority in any case in which they consider the requirements of the Rivers Authority unreasonable.

On consideration of this Eighth Report, the question naturally arises: What will be the duty of the Rivers Board in the event of these recommendations being adopted by the legislature and passed into law? The Commission say (par. 47):—

"In order to simplify administration the normal standard should be prescribed by Statute or by Order. This standard should apply to all sewage discharges into non-tidal waters, except where local circumstances are shown to the satisfaction of the Central Authority to justify a special standard.

"Compliance with this standard should be obligatory in regard to all discharges of sewage into non-tidal waters, and should be enforced by the Rivers Board as a matter of routine, except in cases where it is shown to the satisfaction of the Central Authority that in view of local circumstances it is expedient to prescribe either an easier or a more stringent standard. In such cases the Central Authority should be empowered to approve special standards to be enforced by the Rivers Boards in place of the general standards."

As already suggested, it appears as if they intend that this general standard is to be in force and to apply generally for ten years. It will, however, as has been pointed out, be impossible of enforcement in cases in which it is at all likely that a special standard will afterwards apply.

It will be the duty of the Rivers Board, in the first instance (par. 53), to prepare a scheme for the whole of their area. This involves gauging the streams at every point where a sewage effluent is discharged, and although the Commission state (par. 11) that only the dry-weather flow of the river is to be taken into consideration, they give no definition of what they mean by this. It may be the minimum flow in such a dry time as the summer of 1911, or the average summer flow, or the flow after a certain number of dry days. In any case it is evident that a long series of gaugings, coupled with observations of the rainfall in all parts of each valley, will be necessary before any reliable figures can be arrived at. Even then the conclusion will be open to dispute, for the accurate gauging of a stream is a most difficult operation, and it will probably be necessary to engage a number of skilled engineers, whose services will only be required during the drier seasons of the year. It will also be necessary to gauge exactly and for considerable periods the flow of sewage at each outfall. If it should be necessary to take into consideration the velocity of the stream, and the presence of weirs or pools, and to estimate the purity of its waters down to the next source of pollution, as suggested in pars.

25 and 49, this will add greatly to the mass of information which must be obtained. These observations will have to be made over considerable periods at 400 different points scattered over 1,000 miles of stream.

Not until these observations are complete in each case will the Board be in a position to agree or object to a special standard being fixed there. Meanwhile, although apparently the Local Authority may legally be asked to comply with the general standard, it will often be impossible in practice to insist on this, as no Court would penalise an Authority who could allege with any appearance of justification that in a short time the works demanded of them would be more than necessary to enable them to comply with the law.

Moreover, if a Local Authority applies to the Local Government Board for their sanction to a scheme of sewage disposal, an Inquiry must be held as to the special standard with which they must comply, as upon that will depend the extent and nature of the works required. No Local Authority, indeed, is likely to make any move in the matter until they are told authoritatively what standard they are required to attain. There will, therefore, be a great delay in carrying out any new sewage works or extensions of those existing.

The Board's laboratory staff will have to be considerably increased. It is at present barely able to cope with the work, and the proposed new tests will take considerably longer and will require more attention in carrying out, while the investigations into local conditions of streams at sewage outfalls will entail much extra work. An increase in the staff will, therefore, be unavoidable, and as the laboratory building is only just sufficient for the present staff, the Board must be prepared to add to it considerably. As already suggested the increased trouble and expense would be small matters if there were to be any commensurate gain, but, as has been attempted to be shown, the proposals of the Commission, if carried into effect, will rather hamper than assist the Board in its work, and it is difficult to see how they will benefit the Sanitary Authorities under its supervision.

As a final consideration reference may be made to a few concrete cases in the West Riding which will have to be decided should the Commission's recommendations be embodied in a Statute.

In the cases of Leeds and Sheffield, the outfalls of the sewage works are on the Rivers Aire and Don respectively at points immediately below weirs, by which in dry weather nearly the whole flow of river water is diverted into canal cuts, so that it does not reach the river again in one case for 1½ miles, in the other for 8 miles. Are these towns then to be compelled to comply with the most stringent standard, seeing that they are not assisted by any dilution of their effluents, and will they submit to this, while their near neighbours are let off with much more lenient treatment.

Again, Wakefield possesses two sewage works, one, the principal, on the left bank of the Calder; the other, for a suburb, on the right bank, and these are nearly opposite one another. The volume of sewage at the former works is about 2 million gallons a day, and at the latter about 150,000 gallons. According to the recommendations of the Commission it would appear that the standard for the larger works should be altogether different and much more stringent than that for the latter, inasmuch as the available dilution is very much greater in the latter case.

In the case of Horsforth, on the River Aire, even a more ridiculous proposition must be decided. The bulk of the district is sewered, and the sewage is disposed of at works which yield an effluent in which fish have been found to thrive. About 100 houses are not connected to the sewage works, but discharge their sewage untreated to the river by several outlets. At any one of these, or indeed reckoning them all together, there is much more than 500 dilutions of the sewage. Is there then to be no necessity for the Sanitary Authority to treat this sewage?

Instances like these could be multiplied by scores. It is hoped, therefore, that these recommendations, like those of the 1868 Commission as to standards, may never pass into law. Whether they do or not, they will tend to raise difficulties in the work of the Rivers Board. It is easy to foresee that they will be quoted in every case taken into Court, and, as has been pointed out, there will be no difficulty in choosing quotations in support of quite opposite views. Something of this kind of trouble is already being experienced, for at Newark, it is reported, ("Municipal Journal," 29th Nov., 1912, p. 1513), the Corporation are considering an application for the rescission of an Order of Court which the Notts County Council have obtained against them for polluting the River Trent, their plea now being that the dilution of their sewage is so great that, according to the Royal Commission, it requires no treatment. In Staffordshire, too, ("Sanitary Record," 27th December, 1912, p. 27), this report has already been made the excuse for not proceeding with a sewage scheme which had been prepared for the approval of the Local Government Board.

It is easy to bring forward destructive criticism upon proposals such as those of the Commission, but more difficult to suggest a better plan. At present a Prosecuting Authority, in taking a case before the Courts under the Rivers Pollution Prevention Act, 1876, must prove that there are polluting effluents discharged to a stream, but under Section 3, as previously shown, the person charged is not to be deemed to have committed an offence if he is using the best practicable and available means to render the sewage harmless, provided that the sewage is being discharged by a channel in existence in 1876. The Court, under Section 10, may remit to skilled parties to report on these means, and under Section 12, a certificate granted by an Inspector of the Local Government Board to the effect that the means used are the best or only practicable and available is to be taken as conclusive evidence. Why should not these provisions be slightly altered and made general? If a Rivers Authority take proceedings against a Sanitary Authority or other persons it might well be a defence to say that they are using the best practicable and reasonably available means (the words used in Section 4 with regard to trade refuse) for the purification of their sewage. A dispute upon this point, might very well be referred by the Court, or directly without application to the Court, to the proposed Central Authority, whose opinion should be decisive, and whose certificate should be accepted as conclusive evidence and a bar to all proceedings under Rivers Pollution Prevention Acts. If the circumstances of the case were to alter, or if better methods of sewage purification were discovered, the case might again be referred to the Central Authority for their decision. It may be urged that this plan is practically embodied in existing legislation, and has scarcely ever been brought into use, but the reason for this is obvious. No Sanitary Authority which has been prosecuted has been able to advance any real claim that they were using the best practicable and reasonably available means to purify their sewage.

Proceeding on the above lines there would be no need to set up a statutory standard, but as already suggested it would be well if the Central Authority, after a little experience, were to state what are the characteristics of a well-purified sewage, not, however, in terms of one test alone.

The case where a Sanitary Authority is about to construct sewage works and desires to know what amount of purification is requisite can be dealt with by existing machinery. Daily the Local Government Board are deciding this question in regard to applications for loans for the construction of sewage works.

In conclusion I wish to express my thanks to those chemists who have so greatly added to the interest of the paper by their kindness in performing the analyses to which reference has been made.

SUMMARY.

There is at present no statutory standard for sewage effluents. Sanitary Authorities must use the best practicable and available means to render their sewage harmless.

The officers of Rivers Authorities have adopted standards of comparison which ought to be brought into line with one another, but all are of opinion that a statutory standard is impracticable.

The Commission suggest that a general standard should be fixed, but that, in some cases, according to local circumstances, a more stringent standard should be adopted, and in others that the standard should be relaxed or suspended.

The first test adopted is the amount of suspended matter present; the second is the amount of dissolved oxygen taken up from tap water during 5 days' incubation. The first test is reasonable; the second is unnecessarily troublesome, and likely to yield discordant results, and renders useless the analytical results hitherto accumulated.

The suggested variation of standards will necessitate a decision in each case, apparently after consideration of all the local circumstances.

The suggested relaxation or suspension of standards is most reactionary, and will cause increased pollution of the streams.

If the views of the Commission are adopted by the legislature the work of the Rivers Board will be greatly increased, and an increased staff and increased laboratory accommodation will be necessary.

In any case, the recommendations will add greatly to the difficulties of the Board's work, and to the delays of Sanitary Authorities in carrying out schemes of sewage disposal.

Finally a plan is suggested whereby, with very little alteration of existing legislation, Sanitary Authorities may be safeguarded by the proposed Central Authority against undue requirements of Local Rivers Authorities.

Discussion.

The **Chairman** said that there would appear to be difficulty in fixing any statutory standard for the purity of sewage effluents to be available in all cases. The conditions varied so much in different localities that possibly the best course to adopt would be to give more discretionary power to local authorities.

Mr. W. McD. **Mackey** considered that the Commission's Report was a good attempt to deal with a very difficult question. As regards analytical methods, no doubt the five days incubation was a difficulty, but he did not consider it a serious difficulty; and though there were discrepancies in the results given by the different chemists who had been asked to test the sample of sewage effluent yet they must remember that the test was a new one to all the chemists. It was not difficult in a laboratory fitted up for the work; its usefulness must be the first consideration, and from what was said in the Report it appeared to be useful. He did not agree with Dr. Calvert in objecting to the recommendation of the Commissioners that sparsely inhabited areas might with advantage discontinue the water carriage system and adopt dry treatment.

Mr. F. W. **Richardson** said that there was one paragraph in the report of the Local Government Board which indicated that the suggestion of the West Riding Rivers Board had been accepted in regard to shaking up the sewage before analysing. In his opinion it was impossible to homogenise crude sewage, and when one took 50 c.c. quantities it was quite possible that in one of these there might be some small insect or small piece of faecal matter which would give a considerable quantity of albuminoid ammonia; whereas another 50 c.c. taken from the same bottle might not contain the lump of impurity and would show a corresponding difference in regard to this important constituent. Sewage managers naturally liked to show as much purification as possible. Mere sedimentation in a bucket would show a considerable degree of purification, all of which was credited to the method of treatment used at the sewage works. He had always treated the sediment and the suspended matters quite separately from the clear filtered liquid and had been able to obtain uniform results. It was also surely advisable to know what the impurities were both in the sediment and in the filtrate, and to consider these quite apart from each other.

Dr. **Gilbert Fowler** (Manchester) said that it was important that chemists should come to some agreement as to the real meaning of the analytical figures in a sewage analysis. The same numerical results might mean totally different things, according, *e.g.*, as an effluent was derived from weak or strong sewage or was produced by different methods of treatment. These differences became apparent in the case of "strong" sewage but were often lost sight of with ordinary dilute town sewage. Thus, working in India with a sewage of only 10 gallons per head strength, much less dilution than was usual in England, effluents had been obtained which could not have passed any of the standards hitherto in use, but which had been discharged into a small pond for years without any nuisance. Sometimes an effluent, *e.g.*, from a percolating filter treating strong sewage, was full of living organisms, larvae, infusoria, &c., which would give very high nitrogen figures and which yet were assisting in the further purification of the effluent. Again it was possible by preliminary anaerobic treatment of sewage, followed by filtration, to get apparently more breaking down of organic matter than was possible by equivalent aerobic treatment, but it was often at the cost of serious nuisance. So long as the effluent from aerobic treatment was non-putrefactive the actual analytical figures appeared of comparatively small moment. For all these reasons he welcomed the dissolved oxygen test as a standard of comparison, as giving a more accurate measure of the real purification attained than many tests now commonly used.

Mr. J. H. **Wright** said that the 5 days incubation test was one that in inexperienced hands might give very erroneous results. Moreover, a works manager could not wait 5 or it might possibly be 10 or more days before he could learn how his tanks and beds were working. If the 4 hours oxygen absorption test were taken along with the albuminoid ammonia test one could gauge results in a few hours. A fixed standard could not in fairness be adopted for all sewage works and farms; this matter ought to be left to the various Rivers Boards. Full power was given to County and District Councils and why not to Rivers Boards. By the time a Royal Commission had finished its labours it was time for another enquiry. He was surprised to hear the dry closet system advocated in preference to the water closet system. It was well known that since the water closet system had been generally adopted contagious diseases had been less prevalent. One means of keeping down the common house fly was by insisting on the water closet system.

Mr. W. D. **Scouller** said that a new test for sewage effluents should not only be accurate, but should also tell more about the nature of sewage effluents than the present tests. The 5 days' test recommended by the Commission was reliable and accurate. A 5 days' test must represent more naturally than a 4 hours' permanganate test the actual process by which the polluted matter in effluents absorbs oxygen from river water.

The following samples showed that the 5 days' test differentiates between two waters more readily than the 4 hours or albuminoid nitrogen :—

Parts per 100,000.	A.	B.
Free and saline nitrogen	0·68	0·30
Albuminoid nitrogen	0·105	0·088
Nitric nitrogen	0·28	0·87
Oxygen absorbed in 4 hours at 80° F.	1·30	1·15
Oxygen disappearing in 5 days at 18·3° C.	4·45	1·96

These two waters would pass the Mersey and Irwell standard, and would be classed as fair by the West Riding Rivers Board. The New Commission standard would pass B and reject A; and rightly so, because A was a weak sewage while B was a filtered effluent.

The following samples were taken from a river above and below a sewage outfall works :—

Parts per 100,000.	400 yds. above sewage outfall.	Outfall effluent.	50 yds. below outfall.
Oxygen absorbed in 4 hours at 80° F.	0·50	3·15	0·62
Oxygen disappearing in 5 days at 18·3° C.	0·10	10·00	0·50

The river was polluted with 4·5 per cent. sewage effluent by 4 hours' test and 3·7 per cent. by 5 days' test. The increase in 4 hours' test of river water was 24 per cent. and 400 per cent. by 5 days test. Again, by the 4 hours' test the effluent was 6·3 times greater than the river water, while by the 5 days' test the effluent was 109 times greater than the river water. The New Commission test was thus much more delicate than the 4 hours' test, and showed in a striking manner the nature or character of organic matter in waters.

The period of 5 days before obtaining a result was not serious for an administrative body. It was more serious for a works, but a good works manager would soon devise a rapid test to control his plant. The temperature at which the test took place, viz., 65° F., was a convenient one and could easily be maintained all the year round.

Dr. Calvert seemed to argue that the Commission test was invalid because most of the effluents reached the sea in less than 5 days. He also said that the nuisance caused by pollution of rivers came chiefly from polluted suspended matters, and that these solids would be deposited above the weirs and create a nuisance. The effluent could not be in the sea and also above the weir.

Dr. H. M. **Wilson** said that in his opinion, existing legislation, with very slight modification, would meet all the requirements of the case. When there was any dispute between a Rivers Authority and Sanitary Authority as to the efficiency of the purification of sewage by the latter, the dispute should be settled by the proposed Central Authority, who should not, however, be tied hard and fast by any statutory standard. No single chemical test should be relied upon to determine whether a sewage effluent was satisfactory or otherwise.

Mr. W. E. **Speight** said that it would not be reasonable to expect large towns and cities, the sewage of which is large and contains trade waste, to attain extreme purity. If it can produce an effluent which will not give rise to any nuisance when discharged into a stream, they had done all that was reasonably necessary. The Royal Commission were on right lines, in taking into account local conditions, and in recommending a standard of purity, which would safeguard the interests of public health without being difficult of attainment. He thought that the new tests proposed were nearer the ideal than the former tests, because they more nearly approximated the actual conditions which took place in a stream. In the words of the Commission.

The five days' test, represented more naturally the actual process by which the more readily oxidisable constituents of the polluting matter, absorb oxygen dissolved in the river water. Permanganate on the other hand was a vigorous oxidising agent which might oxidise substances contained in the polluting matter which would not take up oxygen under natural conditions, at all events not at a rate which would de-oxygenate a stream.

The author considered the Commission unfortunate in suggesting the use of a particular method of carrying out the Dissolved Oxygen Test in their Fifth Report. Since the issue of the Fifth Report the Commission had issued instructions to various chemists, who had been helping them in connection with the present or Eighth Report, giving exact details of the method to be adopted in carrying out this test. The method suggested was the Rideal-Winkler, and not the one which Dr. Calvert mentioned as being unreliable. The report also stated (footnote p. 6) that details of methods would be furnished in the Appendix to the Report, and he fully believed that these details would follow the lines of those given to the chemists referred to.

The Commission were well advised to substitute a figure giving the dissolved oxygen taken up by the sample as discharged, for that suggested in the Fifth Report viz., the dissolved oxygen taken up by the sample after filtration through paper. Five days was an awkward period of incubation. If the Commission found that the figures given in 24 hours or 48 hours were not sufficiently reliable for the purpose of a standard, 7 days would have been a much more convenient period. Dr. Calvert seemed to object to 65° F. as the temperature of incubation, and would prefer 80° F. He cited the case of the River Don, which in summer had been found to have a temperature of 90° F. due to the presence of condensing water. Surely this was an exceptional case, and in fixing a standard, one should take the conditions obtaining in normal streams, and not abnormal ones. Such cases as that of the River Don could be dealt with on their merits, as the report suggested, and a more stringent standard fixed if the Rivers Board considered it necessary. There was no difficulty in keeping an incubator at 65° F. Hearsons Cool Incubator Model C. worked quite satisfactorily. In the hot summer of 1911 it was necessary to use ice on a few days, but generally speaking, the circulation of cold water through the jacket was quite sufficient. He was surprised at the big divergence in the results obtained when the same sample was incubated with 2 and 9 volumes of water respectively. He admitted that the bigger the dilution the greater was the multiplication of error, but he had made determinations at different dilutions and had not found the same discordance in the results. Was not the permanganate test open to the very same objection? If the same sample were examined by the permanganate test as carried out by, say, The West Riding Rivers Board, The Mersey and Irwell Joint Committee, and the Royal Commission, the discordance of the results would be as marked almost as those quoted by Dr. Calvert.

The report was also said to be not at all clear on the question of quality of diluting river water. There might be some ambiguity about it, but he attached the same meaning to the paragraphs dealing with this point, as most of his colleagues did. If a mixture of effluent and river water taken at a point where the two have thoroughly mingled, absorbed more than 0·4 parts of dissolved oxygen per 100,000 in 5 days, there was danger of a nuisance. If this were adopted as the standard, a local authority, whose works were situated on the lower reaches of a stream, would be penalised if the stream were polluted before it reached the works. The Commission had therefore preferred to fix a standard of purity for the effluent itself, assuming that by the enforcement of the standards set out in the report, the rivers would eventually become much more uniform in quality and would not, alone, absorb more than 0·2 parts of dissolved oxygen per 100,000 in 5 days. The difficulty he saw in that was that in industrial areas the discharge of trade effluents into streams would seriously affect the conditions, unless a similar standard were applied to such discharges.

Dr. Calvert also mentioned weirs, as being likely to provide places where solids might be deposited, in cases where relaxed standards were applied for. The report, however, met this objection by stating that where any relaxation of standards was allowed, there must be a proviso, that the condition of the river must be such, as to prevent the accumulation of solids in any particular spot, etc.

Mr. **Thompson** (Chemist to Leeds Sewerage Committee) agreed that the Eighth Report was somewhat contradictory and displayed a lack of appreciation of the practical side of this difficult problem. It was also unfortunate that the appendix had not yet been issued.

Assuming that it was wise to judge the state of oxidation of an effluent by only one test, that test should be based on the amount of dissolved oxygen absorbed, for this indicated the liability of the effluent to undergo anaerobic fermentative change more accurately than the permanganate test. But the "5 days' test" was too complex for the purpose; the period of incubation was awkward, and did not represent the actual conditions in the stream, for there the mixture continually dissolved more oxygen by agitation with the air and in most cases reached the sea long before 5 days had elapsed. The necessity for dilution with tap water means that tap water "blanks" must be done to insure accuracy and agreement between the results of different chemists. Much labour and time would be saved by taking the "24 hours' test" without dilution as a standard. Leeds experience showed that no putrescent effluent absorbed less than 0—5 parts per 100,000 oxygen in 24 hours. Another important factor which should be considered in judging the quality of an effluent was the amount of dissolved oxygen it contained on leaving the works; a good percolating bed effluent was usually about 80 per cent. saturated and would not deoxygenate the stream at all in many cases.

The standard for suspended solids was too stringent, at any rate for towns where the sewage contained a large and variable quantity of trade waste. The West Ridings Rivers Board standard of 4 parts per 100,000 was more practicable, and this amount would not be detrimental to the stream. Sufficient emphasis had perhaps not been laid on the change in the amount of suspended solids and dissolved oxygen which might take place between sampling and analysis.

Again, the present method of judging the efficiency of a works on one dip sample (often taken at the worst time of the day) collected every two or three months was very unsatisfactory. To obviate this at large works where systematic analyses were performed, would it be feasible to allow the Rivers Board to have access to the results, and then check them two or three times a year by sending a Board chemist for a day to the Works Laboratory to test a series of samples taken at intervals? If such a scheme were possible the Rivers Board Inspectors would have more time for supervising works not under efficient scientific control, and the Board Chemists would be able to acquire practical knowledge of sewage disposal.

The proposal to fix a general statutory standard, especially one as stringent as that indicated in the Report, should be strongly opposed by local authorities, although the Central Authority ought to substitute one standard for the variety of provisional standards used in different districts at the present time.

Dr. L. L. Lloyd said that since different amounts of oxygen were absorbed from the water in daylight and in the dark, the dissolved oxygen figure would be partly dependent upon bacteria. The absorption in daylight being far less than in the dark, the test should be always carried out under the same conditions. Bacteria also thrived or developed more quickly in alkaline than in acid liquids, and since some effluents were acid and others alkaline, there should be standards for each class of effluent. The 5 days' test, although it might serve, along with other tests, as a means of judging the quality of an effluent, should be replaced by a similar test in which the time of incubation was 24 hours.

Mr. George A. Hart said desirable as it was (if practicable) to obtain uniformity of aim for the guidance of Sanitary Authorities in producing harmless sewage effluents, yet he did not think that they had reached that stage of consolidation which would warrant the establishment of a legal statutory standard. Every Royal Commission, appointed to inquire and report on the sewage question during the last 60 years, had advocated some proposal of this nature, but so far it had never passed into law.

It was now proposed to adopt certain tests to be universally used as the index of ascertaining whether an effluent conformed to a definite legal standard, and the views expressed upon the suitability and efficiency of those tests had shown a large divergence. Doubt even had been expressed as to whether the real significance of the chemical indices in relation to defining pollution was sufficiently understood.

If a standard was to be imposed, it ought to be built upon a foundation of fact and not upon hypothesis. They fully appreciated in this Eighth Report the practical difficulties which surround authorities in putting it into operation.

Reference had been made to the anomalous position of some of the towns on the rivers Calder and Aire, if the standards outlined in the Eighth Report were applied to their rivers. For instance, in the case of the Leeds Sewage Works, for which powers were obtained only in 1908, in a dry season, owing to the barrage and weiring of the River Aire and to the prescriptive rights of riparian owners and of a Canal or Navigation Authority to use river water for the purpose of their navigation, there would be long periods during which there would be practically no flow of river water at the point where the sewage effluent from the Leeds Works discharged into it. Another feature which required consideration was the nature of the weirs now constructed across the river which caused accumulation of suspended matter in the time of minimum flow and affect the quality of the river water. Something should be done towards substituting movable or adjustable weirs, such as the "Stoney Sluice," which would prevent these accumulations of deposit.

So far, if an authority had not been taking the best available practical means to prevent pollution of the river with their effluent, the Rivers Board had not hesitated when other means have failed to compel that authority to do its duty. An impracticable legal statutory standard would go far to establish in their minds a sense of injustice which would retard rather than promote a satisfactory solution of the rivers pollution question.

Dr. Calvert, in reply to Mr. Richardson, said that he could not agree that the samples should be settled or filtered before analysis. The chemists who had so kindly carried out the tests were not all new to the work; fully half of them had performed the test almost as a daily routine for the past year or two. In reply to Mr. Scouller's contention that the sewage works manager should devise a rapid test to control his plant, such a test should be the one selected as the basis of a standard. The point raised by Dr. Lloyd as to the bacterial nature of the test was another factor tending to give variable results with different dilutions and according to whether the test was carried out in the presence or absence of light. Dr. Fowler's remarks were very important and would, he thought, lead to the formulation of a standard based upon the percentage purification which a sewage had undergone, but such a standard could not be considered satisfactory from an administrative point of view.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Oil deposits; Formation of —— in the cylinders, etc., of steam engines and motors. H. Schlüter. Chem.-Zeit., 1913, **37**, 221—223.

Numerous examples are cited to show that where deposits of oil occur in the cylinders and working parts of steam engines, etc., the cause, in the majority of cases, is due not to any fault in the lubricating oil but to impurities of dust and the like which have not been removed during the cleaning. Increased friction is thus set up which causes heating and carbonisation of the lubricating oil. For example, a dark brown deposit from the cylinder of a gas engine contained 10 per cent. of substances soluble in chloroform, consisting of 8 per cent. of a dark viscous mineral oil and 2 per cent. of hard asphaltum (insoluble in petroleum spirit). The portion insoluble in chloroform comprised 75 per cent. of carbonaceous organic matter and 15 per cent. of inorganic iron compounds. Comparative tests with two lubricating oils of known behaviour in the same gas engine gave worse results than the oil in question, and the accumulation of the deposit was therefore attributed to the iron particles worn off by the friction and not to any fault in the lubricating oil.—C. A. M.

Patents.

Drying vegetable and other substances ; Apparatus for ——. H. Weise, Magdeburg, Germany. Eng. Pat. 2461, Jan. 30, 1912. Under Int. Conv., Jan. 30, 1911.

In a drying apparatus of the type in which a large number of thin steam pipes extending between two "headers," or end plates, are rotated upon a horizontal axis inside the drying chamber, a strong central tube is fitted in the centre of the cluster with transverse supporting plates, for preventing the thin tubes from sagging and for carrying angle irons to which stirring blades are attached.—H. H.

Dryer. C. Grau. Fr. Pat. 447,238, Aug. 14, 1912. Under Int. Conv., Oct. 30, 1911.

The materials to be dried are placed on a series of superposed metal gauze or lattice work trays, arranged in a chamber. Air enters a compartment on one side of the pile of trays, and passes through openings between alternate trays, and thence in an upward and downward direction, through the trays and materials, and is discharged through openings on the other side into a discharge compartment. One side of each tray communicates with one air chamber only, alternately the inlet and discharge.—W. H. C.

Distillation apparatus. G. K. Davis, Manchester. Eng. Pat. 2572, Jan. 31, 1912. Addition to Eng. Pat. 2113, Jan. 28, 1909 (this J., 1910, 79).

An apparatus for distilling liquids or "gaseous solutions" by means of steam comprises a horizontal cylindrical chamber divided into a number of compartments by transverse vertical partitions. The liquid to be distilled flows slowly in a shallow stream over a series of weirs and through holes at the bottom of the partitions, and is sprayed upwards by rotating scoops constructed as described in the chief patent. The steam passes through the apparatus in a zig-zag path in the opposite direction to the flow of the liquid, the openings in the partitions for the passage of the steam being above the level of the liquid so that the steam passes uninterruptedly through the apparatus.—H. H.

Furnaces. A. Smallwood, London. Eng. Pats. 3152, Feb. 7, and 18,181, Aug. 7, 1912.

The furnace is provided with rotatable perforated tubular fire-bars, through which air, steam, or liquid or gaseous fuel can be brought into contact with the solid fuel in the furnace. Rotatable toothed rods are provided below the bars and serve the double purpose of rotating the bars and pricking and cleaning out the perforations.—W. H. C.

Cooling air, liquids, vapours, gases, and the like ; Method of and apparatus for ——. W. Gensecke, Charlottenburg, Germany. Eng. Pat. 4997 of 1912, date of Appl., Oct. 28, 1911. Addition to Eng. Pat. 23,912 of 1911, dated Oct. 29, 1910 (this J., 1912, 628).

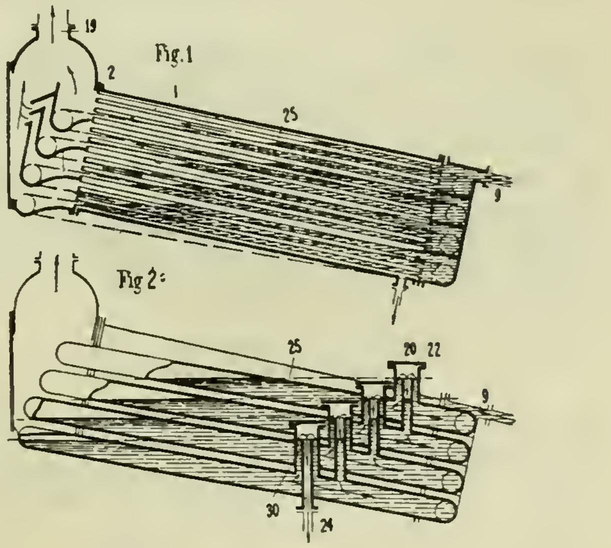
The temperature obtainable in an evaporator cooler according to the chief patent, in which a steam injector is utilised to withdraw the vapours from an evaporator chamber and deliver them into a condenser from which the contents are withdrawn by a water ejector, is lowered by introducing a small quantity of air into the evaporator chamber. The partial pressure of the vapour is thereby reduced and a corresponding reduction in the evaporating temperature of the liquid effected. For example, in the case of water, if the ejector maintains a pressure of 0·006 atmosphere (the pressure of water vapour at 0° C.), and if sufficient air to have a partial pressure of 0·002 atmosphere is introduced, a temperature reduction of —6° C., which is the saturation temperature corresponding to a pressure of 0·004 atmosphere, can be obtained.—H. H.

Moisture from air and gases ; Means for removing ——. P. Schou, Copenhagen, Denmark. Eng. Pat. 16,510, July 15, 1912.

The apparatus consists of two vessels separated by a porous plate. The absorbing liquid is put in the upper vessel and passes through the plate into the lower vessel through which the gas is passed. The porosity of the plate is such that only enough absorbing liquid passes through in a given time to absorb completely the moisture from the gas passing through the lower vessel in the same time. The absorbing liquid, after it has absorbed the moisture, is discharged from the bottom of the lower vessel. —W. H. C.

Evaporating and concentrating liquids ; Apparatus for ——. Soc. d'Exploitation de Procédés Evaporatoires Système Prache et Bouillon, Paris. Eng. Pat. 25,458, Nov. 6, 1912. Under Int. Conv., Nov. 18, 1911.

The apparatus consists of a steam-heated, tubular vessel, 1, which is inclined slightly to the horizontal, and is divided into a number of superposed compartments. The liquid to be evaporated enters the lower end of the upper compartment through the pipe, 9, is raised to boiling point and flows along with the evolved steam or vapour into the trough at the upper end. The vapour, together with the vapour from the other compartments, enters the chamber, 2, and escapes through the pipe, 19. The concentrated liquid returns to the lower end of the same compartment by the external return flow pipe, 25, and again passes through the tube. A portion of the concentrated liquid passes by the adjustable overflow, 20, 22, to the return pipe of the next lower compartment. The apparatus is so adjusted that the quantity of liquid in each compartment increases in the same proportion as the concentration increases, from the top to the bottom compartment. The concentrated liquid is discharged from the lower compartment through the overflow, 30, and the pipe, 24.—W. H. C.



Evaporator. T. E. Kennaird, Roseville, Ky. U.S. Pat. 1,051,959, Feb. 4, 1913.

An open evaporating pan is supported at one end by a cross-bar upon which it is free to tilt, and at the other end is suspended from an overhead cross-bar by rods of adjustable length, by means of which it can be tilted to enable the liquid to be drawn off through an outlet tap. An independently supported heating coil is arranged within the evaporating pan.—H. H.

Evaporator. C. F. Eckart, Assignor to W. G. Hall, Honolulu, Hawaii. U.S. Pat. 1,053,017, Feb. 11, 1913.

A fan is arranged to rotate immediately above the surface of the liquid in an evaporator. In one form of apparatus the rotation is effected by the circulation of the liquid through a central vertical shaft in which works a screw attached to the spindle of the fan.—H. H.

Liquids; Process and apparatus for treating [separating solids from] ——. E. W. Deming. Assignor to Deming Apparatus Co., New York. U.S. Pat. 1,052,220, Feb. 4, 1913.

A continuous process for separating suspended solids from liquids consists in heating the liquid under pressure, reducing the pressure sufficiently to convert a portion of the liquid into steam and to separate dissolved or mechanically retained gases from the residual liquid, and finally separating the solids by gravity from a flowing column of the gas-free liquid. A condenser is placed in the vapour space of the gas eliminator for the purpose of maintaining the reduced pressure and at the same time to effect a partial heating of the liquid to be treated, which is used as the cooling medium in the condenser coils.—H. H.

Concentrating by trickling; Apparatus for ——. J. F. P. Kestner. Fr. Pat. 447,710, Aug. 27, 1912. Under Int. Conv., Sept. 22, 1911.

In tubular evaporators the liquid is raised from the lower reservoir to the upper distribution chamber by an injector actuated by the mixture of air and steam which escapes from the upper part of the steam-chest.—W. H. C.

Fume condensing and regenerative apparatus. W. R. Heslewood, Berkeley, Cal., Assignor to South Fork Smelting Co., Oakland, Cal. U.S. Pat. 1,052,144, Feb. 4, 1913.

The flue gases from a furnace are drawn by a fan through the heating tubes of a steam generator and then through a regenerator chamber used for heating the air supply to the furnace. After passing through the fan the gases are ejected into a body of liquid.—H. H.

Filter. H. Rabenstein, Mannheim, Germany. U.S. Pat. 1,052,958, Feb. 11, 1913.

The surfaces of filter-plates are provided with parallel ribs forming distributing and collecting channels, the ribs being of increasing height so that the distributing channels decrease in cross-section gradually from their inlet ends, and the collecting channels increase in cross-section gradually toward their exit ends.—H. H.

Liquefaction of the permanent gases; Process for the ——. R. Mewes. Fr. Pat. 447,543, Aug. 6, 1912.

The air or gas to be liquefied is passed through an interchanger under an increased pressure and is liquefied by the cold produced by the evaporation of a portion of the previously liquefied gas, which is passed through the interchanger in the opposite direction and under a reduced pressure.—W. H. C.

Receivers and porous apparatus for the slow liberation of the vapour of mercury, etc. P. Perrin. Fr. Pat. 447,938, Sept. 4, 1912.

The mercury or other substance to be vaporised is placed in a hollow vessel formed of porous material, which may be for example paper, parchment, leather, feathers, etc., or formed of similar materials after being powdered and compressed. Organic tissues and natural or agglomerated porous minerals may also be used.—W. H. C.

Ammonia; Method of condensing —— *[for refrigeration]*. L. Block, Mamaroneck, N.Y., U.S.A. Eng. Pat. 3512, Feb. 12, 1912.

See Fr. Pat. 444,688 of 1912; this J., 1912, 1113.—T.F.B.

Drying apparatus. T. Suzuki, Sunamura, Japan. Eng. Pat. 4010, Feb. 17, 1912.

See U.S. Pat. 1,043,982 of 1912; this J., 1912, 1169.—T.F.B.

Boiler scale; Method of preventing the formation of ——. T. Brazda, Amstetten, A. Schückher, and E. Richter, Vienna. Eng. Pat. 5246, March 1, 1912. Under Int. Conv., March 2, 1911.

See Fr. Pat. 440,763 of 1912; this J., 1912, 837.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and its constituents; Microscopic structure of ——. J. Lomax. J. Gas Lighting, 1913, 121, 601.

The appearance under the microscope of sections prepared from different varieties of coal is described. The author has examined English, American, and Continental cannel coals and concludes that all are sapropelic, *i.e.*, formed in or under water, and that the yellow spots in them are definite organic bodies. The ordinary or humic coals have distinct cleavage faces about at right angles to the bedding. The cleavage faces show parallel bands, some bright and others dull, and occasionally there are bands of earthy matter and of iron pyrites. The middle coal measures are the most productive in this country, and then the lower measures. There are few good seams in the upper coal measures.—A. T. L.

Carbon; The mode of combustion of ——. T. F. E. Rhead and R. V. Wheeler. Chem. Soc. Proc. 1913, 29, 51—52.

The authors have shown that carbon dioxide and carbon monoxide are produced together when carbon is burned, and they now describe experiments made to account for this simultaneous production of the two oxides. Carbon, at all temperatures up to 900° C. and probably above that temperature, has the power of pertinaciously retaining oxygen. This oxygen cannot be removed by exhaustion alone, but only by increasing the temperature of the carbon during exhaustion. When quickly released in this manner, it appears, not as oxygen, but as carbon dioxide and carbon monoxide. The proportions in which it appears in these two oxides when completely removed depends on the temperature at which the carbon has been heated during oxygen-fixation. It was shown also that no physical explanation alone can account for this "fixation" of oxygen, but that, in all probability, it is the outcome of a physico-chemical attraction between oxygen and carbon. Physical, inasmuch as it seems hardly possible to assign any definite molecular formula to the complex formed, which indeed exhibits progressive variation in composition; chemical, in that no isolation of the complex can be effected by physical means. Decomposition of the complex by heat produces carbon dioxide and carbon monoxide. At a given temperature of decomposition these oxides make their appearance in a given ratio. Further, when a rapid stream of air at a given temperature is passed over carbon (which has previously been saturated with oxygen at that temperature), carbon dioxide and carbon monoxide appear in the products of combustion in nearly the same ratio as they do in the products of decomposition of the complex at that temperature. It is therefore suggested that the first product of combustion of carbon is a loosely-formed physico-chemical complex, which can be regarded as an unstable compound of carbon and oxygen of an at present unknown formula, C_xO_y. It is probable that no definite formula can be assigned to this complex.

Coal; Spontaneous combustion of ——. W. A. Bone.

In course of discussion (see preceding), W. A. Bone stated that the probable cause of the spontaneous combustion of coal was the oxidation of the constituents extractable by pyridine, which decomposed on heating below 700° C., yielding chiefly paraffin hydrocarbons and a little hydrogen (see this J., 1910, 1291; 1911, 606), and which were probably derived from the resinous matter in the vegetable debris from which the coal originated.

Hydrocarbons; Determination of ethylenic and acetylenic —— in gaseous mixtures. P. Lebeau and A. Damiens. Comptes rend., 1913, **156**, 557—559.

The authors propose new and more convenient reagents for unsaturated hydrocarbons. For absorption of acetylene and its homologues they use 1 c.c. of a solution containing 25 grms. of mercuric iodide and 30 grms. of potassium iodide in 100 c.c. of water. On addition of a fragment of solid potash this reagent will absorb 20 times its volume of acetylene, forming a white precipitate. Olefines are only dissolved by this reagent to the same extent as by pure water. For determination of the olefines, sulphuric acid is used, the absorption being made much more rapid by dissolving 1 grm. of vanadic anhydride or 6 grms. of uranyl sulphate in 100 grms. of sulphuric acid (66° B., sp. gr. 1·84).—W. H. P.

Naphthalene from gas; Oils for removing ——. W. Schweizer. Wasser und Gas, 1913, 215.

Various coal-tar distillates, sold for use in naphthalene scrubbers, contain naphthalene. A suitable method of testing the oil is by distillation. Three fractions are collected, viz., below 120° C., from 120° to 200° C., and from 200° to 270° C. These fractions when cooled to 0° C. should not contain crystals of naphthalene. The oil may be further tested by bubbling through it gas rich in naphthalene, the gas being afterwards passed through picric acid solution. If the gas is passed at about 20 to 25 litres per hour through 100 to 200 c.c. of a suitable oil, no precipitate will be formed in the picric acid solution for several hours or perhaps for some days. The specific gravity of the oil decreases as the amount of naphthalene dissolved in it increases, and this affords a simple test for determining when the oil in the scrubbers needs renewal, the specific gravity of the saturated oil being determined beforehand by a laboratory experiment.
—A. T. L.

Benzine. Distillation of ——. E. Wild. Petroleum, 1913, **8**, 668—675.

The proportion of benzine (*i.e.*, the fractions of the crude petroleum oil distilling up to 150° C.) may show great variations in the course of a few years. Thus in 1898 Boryslaw oil contained 17 per cent. of benzine (by vol.); in 1901, 16 per cent.; and in 1910 only 10·5 per cent. Petroleum oil from Nadworna (E. Galicia) is particularly rich in crude benzine. One sample yielded 42·25 per cent., from which the following amounts of the commercial sorts could be prepared:—Gasoline (32° to 60° C.), 1·65; petrol (60° to 80° C.), 5·90; light extraction benzine (80° to 100° C.), 10·15; and heavy extraction benzine (100° to 120° C.), 11·40 per cent. In West Galicia the crude oils are for the most part free from paraffin wax, and contain considerable quantities of crude benzine (15·75 to 31·75 per cent.), with the exception of Kroscienko oil which contains only 8·5 per cent. Experimental distillations with different apparatus showed that the rectification plant of Huber-Alter does not effect so complete a fractionation as the more modern apparatus. On the average the older apparatus consumed 31·1 kilos. of steam or 4·7 kilos. of coal in the distillation of 100 kilos. of crude benzine. Or assuming a yield of 60 per cent. of rectified benzine from the crude product, 100 kilos. of the former required 51·8 kilos. of steam or 7·5 kilos. of coal. With Hirzel's apparatus it was not found possible to obtain satisfactory results, for the relationship of the still, column and dephlegmator caused the boiling points of the separate fractions to be too far apart and prevented regular working. In Heckmann's apparatus, which is now extensively used in large refineries, these drawbacks are obviated. In comparative distillations of the same crude benzine, Heckmann's apparatus gave a motor petrol boiling within the limits of 54° and 76° C., as compared with a product boiling between 35° and 100° C. obtained from the Huber-Alter apparatus. Moreover, the extraction benzine from Heckmann's apparatus boiled within limits of 27° C. as against 51° C. for the corresponding product from the older apparatus. The heavy benzines, which were formerly of little use, are now readily sold as varnish spirit, turpentine substitutes, etc. However carefully the distillation is carried out with an ordinary rectification apparatus great losses of benzine are unavoidable. It is possible, however, by connecting Heckmann's absorption apparatus with the rectification plant to recover the uncondensable benzine vapours and to obtain light benzine fractions boiling between 25° C. and 80° C. The absorption vessel consists of a cylinder divided into an upper and lower part, and surrounded by a jacket through which circulates a current of cold water. Above this cylinder is a small reservoir, from which benzine is made to fall in such a way as to maintain a constant level in the bottom of the absorption vessel. The vapours from the still, after passing through the rectifying column, dephlegmator, condenser, and water separator, enter the lower part of the absorption vessel, where the uncondensed vapours are absorbed by the layer of benzine. This benzine, after saturation with the uncondensed vapours from the still, is drawn off through a siphon into a receiver.—C. A. M.

Elaterite from the Semirjetschensk district. M. A. Rakusin. Petroleum, 1913, **8**, 729.

A solid bituminous deposit resembling the French and English elaterite occurs as a continuous layer over fine sand in an area about 20 kilom. from Lake Balchasch. According to Sokolow this elaterite has a sp. gr. of 0·995 at 18° C., and is less elastic than the elaterites previously described. Heated on platinum it burns with a white smoky flame and without much previous melting. It contains 3 to 5·1 per cent. of ash, is extremely resistant to the action of sulphuric acid (sp. gr. 1·83), but rapidly decomposed by concentrated nitric acid (sp. gr. 1·5), whilst in nitric acid of sp. gr. 1·36 it becomes white, whilst the acid remains colourless. Organic solvents have no action upon it in the cold, but on heating cause the fragments to swell up. When boiled with alcohol and alcoholic potassium hydroxide the mineral behaves like beeswax. One sample gave an acid value of 4·9 and saponification value of 56·9. It contained 88·9 per cent. of unsaponifiable matter and had the following elementary analysis:—C 78·64, H 10·10, O 6·60, N 0·125, and ash 5·135 per cent.; calorific value, 9408 cals.—C. A. M.

Formation of oil deposits in the cylinders, etc., of steam engines and motors. Schlüter. *See* I.

Patents.

Peat; Method of extracting the natural moisture from bog ——. S. L. Elborne, Peterborough, Northants, and H. Godsal, London. Eng. Pat. 3367, Feb. 10, 1912.

The peat is treated with lime or equivalent substance in the presence of a large volume of water at boiling temperature and at about atmospheric pressure, in order to render it capable of being dried by pressure. For example peat containing 90 per cent. of moisture is disintegrated, and mixed with twice its weight of hot water containing 0·2 per cent. of lime. The mass is boiled and lime added, if necessary, until it is alkaline to litmus. The mass is then filtered and pressed.—A. T. L.

Coke-oven or gas-furnace. W. Feicks, Bethlehem, Pa. U.S. Pat. 1,051,875, Feb. 4, 1913.

The claim is for a coke-oven having vertical combustion and exhaust flues, arranged alternately in the oven walls. A waste-gas chamber is provided beneath the oven, into which the exhaust flues discharge and from which the waste gas is discharged to the main flue and stack. The air is preheated by being passed from a conduit through a series of vertical air-heating pipes, arranged in the waste-gas chamber, and communicating at their upper ends with a flue beneath the sole of the oven from which the heated air is distributed to the lower ends of the vertical combustion flues. It is there mixed with the heating gas supplied by a separate flue and serves to support the combustion.—W. H. C.

Retorts; Means for charging vertical ——. R. Dempster and Sons, Ltd., and H. J. Toogood, Elland, Yorks. Eng. Pat. 3795, Feb. 15, 1912.

The patent relates to retorts worked continuously or for long periods, each retort having a stationary bin arranged above the mouthpiece. According to this invention the bin is made of circular horizontal cross-section and is suspended from the overhead bunkers so as to take the weight from off the retorts. The charging orifices of the bin are closed by a gas-tight plug-valve arranged with its axis vertical. The mouthpiece of the retort is open and is surrounded by a water-trough in which is sealed the open lower end of the bin. The inner wall of the water-trough is of lesser height than the outer one so that any overflow will pass into the retort, and the trough can be removed from the retort and attached to the bin so as to facilitate the cleaning of the ascension pipe.—A. T. L.

Carbon monoxide; Removal of —— from gases and the production of hydrogen, or of mixtures of hydrogen with other gas, or gases. G. W. Johnson, London. From Chemische Fabrik Griesheim Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 13,049, June 3, 1912.

The mixture of gases containing carbon monoxide is mixed with steam and passed upwards through towers packed with pieces of lime and heated to between 400° and 700° C. The lime, when exhausted owing to conversion into calcium carbonate, can be regenerated *in situ* by diverting the stream of the mixture of gases and heating it in any appropriate way.—W. H. C.

Gas producers. A. von Kerpeley, Vienna. Eng. Pat. 29,182, Dec. 18, 1912. Under Int. Conv., Dec. 22, 1911. Addition to Eng. Pat. 20,633, Sept. 18, 1911 (this J., 1912, 676).

The air-tight chamber surrounding the lower part of the producer shaft is arranged so that it can be placed in communication with the blast-supply pipe, in order that the pressure may be equalised when there is water in the rotary pan.—W. H. C.

Oil-gas; Generating high-pressure—. R. Vuilleumier, New Rochelle, N.Y., Assignor to Pintsch Compressing Co., New York. U.S. Pat. 1,053,074, Feb. 11, 1913.

Oil is burned in a chamber packed with chequered brickwork until the temperature of the chamber is raised to 1200° F. (649° C.), and the combustion is then stopped whilst oil is sprayed into the chamber from a separate inlet by means of steam under a pressure of 14 atmospheres. When the temperature has fallen below that necessary for the process, the products remaining in the chamber are displaced by means of high-pressure steam and are passed through a high-temperature coke-scrubber. The operations are then repeated.—A. T. L.

By-products from the gaseous distillation of fuels; Process of obtaining ——. W. Feicks, Bloomfield, N.J. U.S. Pat. 1,051,876, Feb. 4, 1913.

The ammonia-containing gas is collected in two separate portions. One portion, containing much tar, is scrubbed and cooled to recover tar and ammonia water, and is then passed through a saturator containing sulphuric acid to form ammonium sulphate. The other portion of gas, which contains less tar, is passed without cleaning or cooling directly, but by a separate pipe into the same saturator to heat the acid and form ammonium sulphate. The different gases enter the saturator by separate pipes and leave by separate pipes.—W. H. C.

Gas; Apparatus for purifying ——. H. W. Jacobs and H. H. Lanning, Topeka, Kans. U.S. Pats. 1,051,956 and 1,051,957, Feb. 4, 1913.

(1) A gas-washing apparatus comprises a receptacle having a detachable cover carrying a number of pipes dipping into the liquid in the receptacle with rose nozzles at the lower ends through which the gas is injected in a finely divided condition into the liquid. The wash water flows continuously through the receptacle, and is maintained at a constant level by an overflow discharge pipe. The purified gas is withdrawn from a dome-shaped projection at the top of the cover. (2) A gas-washing apparatus similar to the above but having a single inlet pipe for the gas with a large perforated distributor at the bottom, is fitted with a conical filter at the foot of the gas-discharge dome, so arranged that the accumulated foreign material separated from the gas is conveyed to the side of the filter out of the path of the rising gas and discharged into the washing water beneath.—H. H.

Gas-washing apparatus. H. E. Theisen, Munich. U.S. Pat. 1,052,188, Feb. 4, 1913.

A gas-washing apparatus comprises a fixed disintegrator member having a series of parallel rods or bars arranged in concentric circles, and a rotary disintegrator member built up of a number of flat metal rings spaced apart by radial strips and carrying angle irons which rotate between the fixed rods.—H. H.

Shale and other bituminous substances; Distillation of ——. J. Noad, East Ham, Essex. Eng. Pat. 21,441, Sept. 20, 1912.

The bituminous substance is crushed to pass through a sieve of 8 to 3 meshes per inch, and is mixed with water, crude oil or the sludge from the distilled oil so as to cover the granules with liquid. Slaked lime is then mixed with the shale so as to coat the granules, and the shale is distilled in a retort in which it is worked down over a series of step-like ledges. The volatile constituents escaping through the coating of lime are stated to be free from sulphur. The retort may be of the form described in Eng. Pat. 18,334 of 1909 (this J., 1910, 1448).—A. T. L.

Oil; Device for refining and coking ——. A. Dean, Los Angeles, Cal. U.S. Pat. 1,053,282, Feb. 18, 1913.

The apparatus comprises a furnace having a combustion chamber and a coking chamber. Primary and secondary stills for the oil are arranged above the coking chamber. The residue from the secondary still is withdrawn into a coking box which is then placed within the coking chamber. —A. T. L.

Gases produced by distilling coal; Separation of tar and ammonium chloride contained in ——. L. Solvay, Brussels. U.S. Pat. 1,052,853, Feb. 11, 1913.

See Fr. Pat. 439,509 of 1912; this J., 1912, 711.—T. F. B.

Coal-gases; Art of removing tar from ——. W. H. Blauvelt and C. G. Tufts, Syracuse, and C. A. Collins, New York, Assignors to Semet-Solvay Co., Solvay, N.Y. U.S. Pat. 1,053,349, Feb. 18, 1913.

See Fr. Pat. 439,509 of 1912; this J., 1912, 711.—T. F. B.

Gas-purifier. C. Flössel, Munich, Germany. U.S. Pat. 1,053,982, Feb. 25, 1913.

See Fr. Pat. 373,998 of 1906; this J., 1907, 754.—T. F. B.

Process for separating lime from sulphite-cellulose waste lyes to be used for briquetting ores, metallurgical products, or fuels. Ger. Pat. 255,853. *See* V.

Process for dehydrating fats, oils, hydrocarbons, and similar liquids. Ger. Pat. 254,025. *See* XII.

Testing instrument for flue and furnace gases. Eng. Pat. 25,046. *See* XXIII.

Apparatus for gas analysis. Ger. Pat. 256,218. *See* XXIII.

Method and apparatus for testing gas mixtures. U.S. Pat. 1,052,412. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Destructive distillation of organic matters suspended or dissolved in liquids [e.g., waste lyes from wood pulp manufacture]. E. S. Sandberg and G. K. Sundblad, Skutskär, Sweden. Eng. Pat. 24,125, Oct. 22, 1912. Under Int. Conv., Oct. 30, 1911.

Waste lye from the manufacture of wood-pulp, or other liquid containing organic matter is treated in two stages. The liquid is first spread in a thin layer on heated surfaces, whereby about 80 litres of lye per minute are evaporated and the residue partially decomposed and carbonized, the carbon acting so as to remove adhesiveness, the solid residue then being easily and continuously removed by scrapers and passed through heated tubes by means of screw conveyors, or is heated in ordinary retorts so as to be completely carbonised.—A. T. L.

Acetate of lime and wood-alcohol; Manufacture of ——. C. W. Volney (executrix, S. L. G. Volney), Keyport, N.J. U.S. Pat. 1,052,446, Feb. 4, 1913.

Pyroligneous acid vapours from wood distillation are blown through hot water containing finely divided calcium carbonate in suspension, then through thin milk of lime. The vapours leaving the milk of lime are passed through a condenser to retain the alcohol.—J. T. D.

Electric incandescent lamps. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, New York. Eng. Pat. 2468, Jan. 30, 1912.

In tungsten or molybdenum filament lamps a small quantity of a halogen compound of the metal is introduced into the bulb. The halogen compound forms an atmosphere which deposits tungsten or molybdenum on the incandescent filament, with the liberation of gases which absorb the metal expelled by disintegration of the filament. In this way, deterioration of the filament and blackening of the bulb are prevented. Suitable compounds are tungsten hexachloride, WCl_6, or the oxychlorides, WO_2Cl_2 or $WOCl_4$. The pressure in the bulb may be less than 0·01 mm., and in most cases less than 0·001 mm. The leading-in wires may be of platinum or of tungsten.—A. T. L.

Electrodes for arc lamps. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, New York. Eng. Pat. 13,988, June 15, 1912.

In electrodes for flaming arcs made from carbon and cerium titanofluoride, it is necessary to add sodium or potassium titanofluoride to get a steady arc. The colour given to the arc by the sodium or potassium salt is corrected, according to the present invention, by the addition of a barium compound, and the arc gives a light similar in character to daylight. Suitable proportions are:—carbon, 45, cerium titanofluoride, 35, potassium titanofluoride, 10, and barium fluoride, 10 per cent. To prevent the formation of vapours which attack the globe, a sodium compound such as the silicate, borate, carbonate, tungstate or molybdate, or potassium borate may be added.
—A. T. L.

Charcoal; Manufacture of ——. T. McKenna, London. From W. T. Lee, Sydney, N.S.W. Eng. Pat. 17,546, July 29, 1912.

See Fr. Pat. 447,307 of 1912; this J., 1913, 225.—T. F. B.

Metallic filaments for incandescent electric lamps; Decarbonisation of raw ——. A. Lederer, Vienna, Assignor to Westinghouse Lamp Co. U.S. Pat. 1,054,005, Feb. 25, 1913.

See Fr. Pat. 412,443 of 1910; this J., 1910, 1001.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Light; Chemical action of —— [on aromatic hydrocarbons]. XXIV. Autoxidations. III. G. Ciamician and P. Silber. Atti R. Accad. dei Lincei, Roma, 1913, 22, I., 127—132. (See also this J., 1912, 181).

The hydrocarbons were exposed to light in presence of water in glass flasks filled with oxygen. Benzene and naphthalene were found to be unaffected. In the case of the other hydrocarbons examined, the principal oxidation products identified were:—acetophenone and benzoic acid from ethylbenzene, mesitylenic acid from mesitylene, 1·2-dimethyl- and 1·3-dimethyl-4-benzoic acids from pseudo-cumene, phthalic acid from indene and from tetrahydronaphthalene.—A. S.

Dihydronaphthalene. R. Willstätter and V. L. King. Ber., 1913, **46**, 527—535.

Two methods were used to prepare dihydronaphthalene. By the first *ac*-tetrahydro-β-naphthylamine was converted into the quarternary ammonium salt. The ammonium base derived from this was distilled under reduced pressure with the production of dihydronaphthalene. The hydrocarbon can also be produced by reducing the dibromide with zinc powder and alcohol at 55°—60° C. It is a colourless, stable liquid with a pleasant smell. The sp. gr. is 0·9974 at 20°/4° C., and it boils 84·5° C. at 16 mm. and melts at —9° C. When hydrogenated in acetic acid in the presence of platinum, tetrahydronaphthalene is formed first, then perhydronaphthalene. Naphthalene when hydrogenated yields decahydronaphthalene. Ethylcyclohexane, b.pt. 128° C. at 724 mm. is produced by the hydrogenation of styrolene.—F. Shdn.

Nitrations; Catalytic action of mercury in ——. R. Wolffenstein and O. Böters. Ber., 1913, **46**, 586—589.

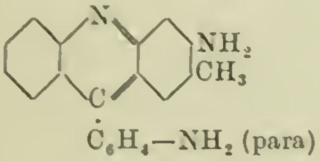
Whilst nitric acid of high concentration or a mixture of nitric and sulphuric acids, when allowed to act on benzene in presence of mercuric nitrate, yields only nitrobenzene, nitric acid of lower concentration acts in the first place as oxidising agent, and yields as final product nitrophenols. For example, a mixture of 100 grms. of benzene, 800 grms. of nitric acid (sp. gr. 1·31), and 15 grms. of mercuric nitrate was heated on the water-bath under a reflux condenser, and with vigorous stirring. Nitrous gases were evolved, and the residue, after cooling, yielded a crystalline mass of 1.2.4-dinitrophenol and picric acid, *i.e.*, the same products as are obtained by the direct nitration of phenol. Benzene derivatives react in an analogous manner. Oxides of nitrogen or nitrous acid may be used in place of nitric acid. 1.2.4-Dinitrophenol in an almost pure condition may, for instance, be prepared directly from benzene by either of the following methods: (1) 120 grms. of benzene are mixed with 20 grms. of mercuric nitrate, and the mixture treated with 270 grms. of nitrogen tetroxide and allowed to stand for some days at the ordinary temperature. (2) 120 grms. of benzene are treated with 10 grms. of mercuric nitrate and 500 grms. of 50 per cent. nitric acid, 50 grms. of nitric oxide are added, and the mixture is stirred and heated to 50° C.—A. S.

IV.—COLOURING MATTERS AND DYES

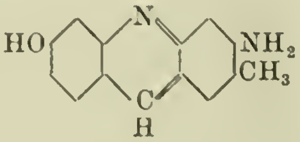
Dyestuffs derived from anhydro-bases. Dyestuffs of the acridine series. H. Terrisse and G. Darier. Sealed Notes No. 1017, Feb. 17, 1898, No. 1025, March 31, 1898, and No. 1059, Oct. 29, 1898. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 672—682.

The anhydro-base obtained from formaldehyde and phenyl-*m*-toluylenediamine, when heated with an amine having a free para position and the hydrochloride of the amine, gives a diphenylmethane derivative which is converted into an acridine dyestuff by heating with an amine and its hydrochloride in the presence of air or an oxidising agent. The author gives the dyestuff the formula (I).

When melted alone the anhydroformaldehydephenyl-*m*-toluylenediamine gives monoaminoacridine. The anhydrobase also condenses with resorcinol in aqueous solution in the presence of mineral acid, giving a diphenylmethane derivative which passes over into an acridine-derivative having the formula (2) when heated alone or in sulphuric acid solution.

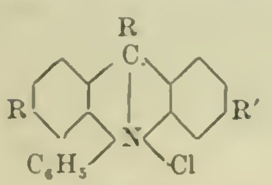


(1)

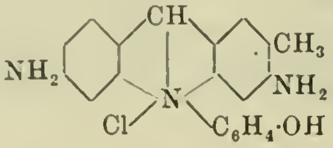


(2)

Diarylimides also can be obtained by acting on the anhydro-bases with aromatic amines or diamines, naphthylamine derivatives such as β-naphthylaminesulphonic acids being suitable. By heating these imides with an aromatic amine and its hydrochloride, acridine derivatives of the type (3) are obtained. These can be transformed into derivatives of the Acridine Yellow and Benzoflavine class by heating with hydrochloric acid under pressure, or into derivatives of the Patent Phosphine type by heating with alcohol and hydrochloric acid. These imides when dissolved in sulphuric or hydrochloric acid are converted into diphenylmethane derivatives which condense with phenols to give acridine-derivatives of the type (4).

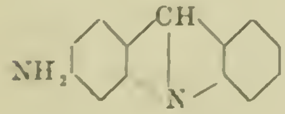


(3)

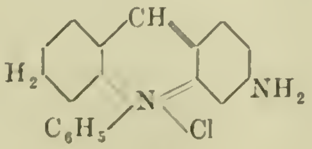


(4)

Dihydroxyphenylacridonium chloride can be obtained by heating the imide obtained from *m*-aminophenol with an amine and its hydrochloride. Diaminodiphenylmethane and its homologues are all converted into acridine-derivatives by melting them with a *m*-diamine hydrochloride. These acridine-derivatives have the general formula (5), and in the case of *p*-diaminodiphenylmethane a migration of the CH_2-group is assumed to explain the reaction. Mixed phenyl-naphthylacridines can be obtained by this method.



(5)



(6)

The report states that these reactions are new. It is pointed out that the substance to which formula (1) is given might well be an acridonium derivative of formula (6). The reactions set out in the second note do not appear conclusively proved. The dyestuffs described in the third note are identical with those of Ger. Pat. 107,517.—J. B.

Dyestuffs ; The preparation and application of new ——. B. Pawlewski. Sealed note 1241, March 29, 1891. Report thereon by E. Noelting. Bull Soc. Ind. Mulhouse, 1912, **82**, 682—684.

By oxidising aniline with ammonium persulphate in acid or alcoholic solution, a black colouring matter is obtained to which the author ascribes the constitution, $O : C_6H_4 : N{\cdot}N : C_6H_4 : O$. The dyestuff can also be produced on the fibre. A derivative having the formula, $C_{20}H_{22}N_4O_2$, and which the author supposes to be a compound of the anilidoquinone type, is formed by boiling the first oxidation product with aniline. *m*-Phenylenediamine oxidises to a black with ammonium persulphate, this body also giving a derivative of higher molecular weight on boiling with aniline. In a similar manner *o*-anisidine gives a brown, benzidine a grey and benzylaniline a black. Formanilide and acetanilide give products identical with that obtained from aniline. The report states that it is improbable that the black dyestuff derived from aniline has such a simple constitution as the one given above. It is more probably a polymeride —$(C_6H_4NO)x$.—J. B.

Basic dyestuffs ; The preparation of yellow ——. E. Suais. Sealed note No. 1214, Oct. 26, 1900. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 686—689.

Crystal Violet, when heated at 160°—180° C. with *m*-toluylenediamine, gives rise to a yellow fluorescent basic dyestuff, dimethylaniline being set free. Magenta, Paris Violet, Malachite Green, and Brilliant Green behave similarly. The leuco bases of dyestuffs of this type may also be used. The report states that the reaction is new, but the dyestuffs are probably identical with those obtained by condensing Michler's ketone with *m*-diamines (Eng. Pat. 1352 of 1895 ; this J., 1896, 28).—J. B.

Dyestuffs ; New red and yellow ——. J. Burda. Sealed note No. 623, Sept. 9, 1890. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 691—692, 702.

Colouring matters of the benzidine series which cannot be used for dyeing wool from an acid bath, for example Congo red and Chrysamine, are stated to become suitable for this purpose after treatment with fuming sulphuric acid at 60°—80° C.—J. B.

Diaminonaphthalenesulphonic acid and new azo dyestuffs. J. Burda. Sealed Note No. 624, Sept. 9, 1890. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 692—694, 702.

1.4-Diaminonaphthalene gives rise to one or more sulphonic acids when treated with fuming sulphuric acid (20 per cent. of anhydride) at 140°—150° C. These are said to give azo dyestuffs when treated with diazo-compounds, tetrazodiphenyl giving a blue for example. The diaminesulphonic acid can also be diazotised and combined with amines, phenols, etc.—J. B.

Nitrobenzidinesulphonic acids and new dyestuffs ; Process for preparing ——. J. Burda. Sealed note No. 625, Sept. 9, 1890. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 694—697, 702.

The product of nitration of benzidinesulphonic acid forms a tetrazo-derivative, giving rise to azo dyestuffs which dye unmordanted cotton in red, orange, violet, and blue shades. They also dye wool from an acid bath.—J. B.

Polyazo derivatives of benzidine or tolidine and new azo dyestuffs ; Process for preparing ——. J. Burda. Sealed note No. 626, Sept. 9, 1890. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 697—699, 702.

Nitrobenzidine, m. pt. 141° C., on reduction with zinc dust and alkali gives what is probably an azoxy compound melting between 220° and 230° C. The new base can be diazotised and combined with phenols, amines, etc., giving rise to dyestuffs which dye unmordanted cotton, also wool from an acid bath.—J. B.

Dyestuffs of the induline series ; Process for the preparation of ——. J. Burda. Sealed note No. 644, Jan. 12, 1891. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 700, 702.

A blue induline, which is soluble in water and dyes mordanted and unmordanted cotton, is obtained by heating at 160°—180° C. tetramethyldiamino-azoxybenzene together with an amine and its hydrochloride. Dialkyl-, tetraalkyl-, diphenyl- and tetraphenyl-derivatives of diamino-azoxybenzene can also be used.—J. B.

Greenish blue dyestuff ; Process for the preparation of a ——. J. Burda. Sealed note No. 645, Jan. 12, 1891. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 701—702.

A new colouring matter which dyes mordanted or unmordanted cotton, wool and silk in blue shades is obtained by heating at 160°—180° C. acetaminobenzeneazohydroxydiethylaniline together with glycerin, naphthylamine hydrochloride and hydrochloric acid. The azo compound is prepared by diazotising *m*- or *p*-aminoacetanilide and combining it with *m*-hydroxydiethylaniline.—J. B.

Triphenylmethane dyestuffs fast to alkalis. E. Suais. Sealed note No. 1220, Nov. 8, 1900. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1912, **82**, 703—705.

The author has found that the property of fastness to alkalis is not confined to the well known dyestuffs containing an acid group in the ortho position to the central carbon atom, but is shared by the *m*-diazosulphonates of the same series. For instance, a green dyestuff fast to alkalis is obtained by oxidising the leuco-base

$$[(C_2H_5)_2N.C_6H_4]_2 : \overset{(1)}{CH}.C_6\overset{(3)}{H_4.N} : N.SO_3H,$$

which is obtained from the corresponding amine by treating its diazo compound with sulphite.—J. B.

Quercetagetin. A. G. Perkin. Chem. Soc. Trans., 1913, **103**, 209—219.

Quercetagetin was isolated from the flowers of the African marigold, *Tagetes patula*, by Latour and Magnier De La Source (Bull. Soc. Chim., 1877 [ii], **28**, 337) who gave to it the formula $C_{27}H_{22}O_{13}$. It is now found that the main quantity of the colouring matter is present in the petals as a glucoside, and the colouring matter itself, $[C_{15}H_{10}O_8]$, was isolated from this. It forms an acetyl compound of formula, $C_{15}H_4O_8(C_2H_3O)_6$, a sulphate, and a hexamethyl ether, and yields protocatechuic acid on fusion with alkali. Proof of its flavonol structure is shown by the products obtained by hydrolysis of its hexaethyl derivative. It is a hexahydroxyflavonol isomeric with myricetin, but differs from this colouring matter, and also from the closely allied quercetin, in that it possesses a tetrahydroxybenzene in place of the phloroglucinol nucleus which they contain. Compared with quercetin it gives tints of yellower shades on the various mordants. —G. H. F.

Ink ; New Prussian regulations for official tests of ——. F. W. Hinrichsen. Chem.-Zeit., 1913, **37**, 265—267.

According to the new Prussian regulations of May 22, 1912, inks are classified into (1) "documentary" and (2) "writing inks," the latter being subdivided into (a) iron-gall inks, and (b) logwood and dyestuff inks. (1) A "documentary ink" is defined as an iron-gall ink which gives dark writing after 8 days' exposure to light and air. It must contain at least 27 grms. of anhydrous gallotannic and gallic acids and 4 grms. of iron (calculated upon the metal) per litre. On the other hand, the amount of iron must not exceed 6 grms., so that the ratio of gallotannic and gallic acids to iron must lie within the limits 4·5 : 1 and 6·75 : 1. The ink must not alter for at least 14 days in the ink-pot, and must flow readily from the pen. The writing done with it must not be sticky immediately after drying, and after 8 days it must remain deep black when washed with water and with alcohol (85 and 50 per cent.). (2) Iron gall "writing inks," (a) must contain at least 18 grms. of gallotannic and gallic acids, and at least 2·6 and not more than 4 grms. of iron per litre (ratio 4·5 : 1 and 6·75 : 1) In other respects they must comply with the requirements of "documentary" inks. Inks of Group B are not officially tested. *Analysis of inks* :—The proportion of gallotannic and gallic acids is determined by shaking the sample with ethyl acetate and weighing the residue left on evaporating the extract. The residue is regarded as gallotannic and gallic acids when 0·1 grm. thereof absorbs, in the presence of 2 grms. of sodium bicarbonate, at least 0·5 grm. of iodine. If less iodine is consumed, the ink is not up to the official requirements. The author discusses the reasons for the changes from the official regulations of 1888, and gives the following details of the methods of applying the official tests :—(1) *Determination of gallotannic and gallic acids* :—Ten c.c. of the ink are mixed with 10 c.c. of concentrated hydrochloric acid, and the mixture shaken with successive portions of 50 c.c. of ethyl acetate in Rothe's shaking apparatus, until the aqueous layer gives no reaction for gallotannic or gallic acids after treatment with sodium carbonate and addition of ferric chloride and ferrous sulphate. The ethyl acetate extract is shaken several times with semi-saturated potassium chloride solution (10 c.c. each time), to remove iron salts, and then evaporated *in vacuo*, and the residue is taken up with a little water, transferred to a weighed crucible, and dried at 105°—110° C. or, preferably, *in vacuo* at about 60° C. until constant in weight. In determining the iodine absorption about 0·1 grm. of the residue is mixed in a stoppered flask with 2 grms. of sodium bicarbonate and 25 to 50 c.c. of a solution of iodine (about 50 grms. per litre), and the flask closed and allowed to stand over night, after which the unabsorbed iodine is titrated with standard thiosulphate solution. Simultaneously a blank determination is made. *Iron* :—Ten c.c. of the ink are evaporated to dryness, and the residue ignited until free from carbon and then heated with 1 to 2 c.c. of hydrochloric acid (sp. gr. 1·124) until dissolved. The solution is treated with 1 to 2 c.c. of chlorine water and evaporated to dryness, the residue treated with 0·5 c.c. of strong hydrochloric acid to dissolve basic iron salts, and the solution cooled and diluted with 20 c.c. of water. About 1 grm. of potassium iodide is then added, and the separated iodine titrated with *N*/10 thiosulphate solution, the liquid being meanwhile rapidly warmed to 55° C. to promote the separation of iodine. *Testing the writing* :—Pieces of standard paper are stretched in a frame inclined at an angle of 45°, and a definite amount of ink made to flow down them from a pipette fixed in a special position with regard to the paper. At the same time a parallel test is made upon the same papers with Schlüttig and Neumann's standard iron-gall ink containing 23·4 grms. of gallotannic acid, 7·7 grms. of crystalline gallic acid, 30·0 grms. of ferrous sulphate, 10·0 grms. of gum arabic, 2·5 grms. of hydrochloric acid, and 1·0 grm. of phenol per litre. This ink is allowed to stand for at least 4 days at 10° to 15° C., and decanted from any deposit. For comparison in the test it is coloured with a suitable dyestuff to match the ink under examination. The paper with the colour strips of the two inks upon it is exposed to the air for 8 days in diffused daylight, and is then cut horizontally into strips which are immersed in water, 50 per cent. alcohol and 80 per cent. alcohol respectively. No perceptible bleaching of the ink should take place.—C. A. M.

Patents.

Colouring matters of the anthraquinone series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3228, Feb. 8, 1912.

See Ger. Pat. 251,709 of 1911 ; this J., 1912, 1117.—T. F. B.

Vat dyes of the anthraquinone series. H. Neresheimer, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,052,507, Feb. 11, 1913.

See Fr. Pat. 446,751 of 1912 ; this J., 1913, 131.—T. F. B.

Anthraquinone series ; Manufacture of derivatives of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,616, May 28, 1912.

See Ger. Pat. 253,089 of 1911 ; this J., 1913, 16.—T. F. B.

Diazotisable [azo] colouring matter. W. Bergdolt, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,052,647, Feb. 11, 1913.

See Eng. Pat. 22,529 of 1911 ; this J., 1912, 529.—T. F. B.

Dyestuffs of the anthraquinone series and process of making same. E. Hepp, Frankfort, R. Uhlenhuth, and F. Roemer, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,052,480, Feb. 11, 1913.

SEE Eng. Pat. 23,110 of 1911; this J., 1912, 326.—T. F. B.

Anthraquinone series; Condensation products of the —— and process of making same. A. Schmidt, Höchst, and G. Kränzlein, Sindlingen. Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,052,520, Feb. 11, 1913.

SEE Fr. Pat. 442,757 of 1912; this J., 1912, 979.—T. F. B.

Indigo-white preparations; Stable —— and process of making same. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,054,039, Feb. 25, 1913.

SEE Eng. Pat. 13,673 of 1912; this J., 1912, 915.—T. F. B.

Dyes of the coerulein series; Manufacture of ——. A. Steiner, Basle, Switzerland. U.S. Pat. 1,054,247, Feb. 25, 1913.

SEE Fr. Pat. 443,377 of 1912; this J., 1912, 979.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Airship envelope fabric. Times Eng. Suppl., Feb. 26, 1913.

RUBBER-COATED cotton fabrics of double thickness are used. In German practice the two fabrics are joined with the threads diagonal: in French practice they are placed parallel. The former method gives a stronger envelope, but it has to be made somewhat heavier owing to the rubber at the joins. Experiments made at the National Physical Laboratory showed that for parallel fabric the limits of a compound stress are (to 5 per cent.) the limits of simple tensile strength of warp and weft. For diagonal material the bursting strength appears to be about 1·4 times the strength determined by simple tensile strength. To preserve the rubber it should be vulcanised and protected from light by a yellow coating. Picric acid is poisonous, lead chromate blackens on vulcanisation, and aniline gives a good but transient result. Exposure experiments showed that, especially with unprotected rubber, there was a marked improvement in gas-tightness at a stage when the material was almost completely perished. Airship sheds should be kept at a uniform temperature as cold affects the rubber. Impurities, such as ozone, in the hydrogen also affect the rubber. Fabrics may be tested by microscopic examination or chemically. Low viscosity, rapidly falling, of the benzene solution of the rubber coating, indicates perishing, as does solubility in acetone. —H. E. P.

Nitro-artificial silks; Acid tendering ["Säurefrass"] in —— and the stability test. J. F. Briggs. Färber-Zeit., 1913, **24**, 73—76.

DISCUSSING Heermann's paper (this J., 1913, 80), the author agrees that the presence of sulphuric acid esters of cellulose is the most probable cause of the phenomena noted. He calls attention to a paper by Cross, Bevan and Jenks (this J., 1901, 1133), in which it was shown that the formation of sulphuric esters is a function of the time of immersion in the nitrating acids; consequently by allowing a longer period for nitration, the tendency to form sulphuric esters may be overcome. Further, a study of the aceto-sulphuric esters of cellulose (this J., 1905, 685, 1251) leads to the conclusion that the sulphuric acid is combined always in the form of an acid cellulose ester of general formula $H.SO_4(X)_n$, where X represents cellulose nitrate or acetate and the value of n determines the amount of sulphuric acid combined. These acid esters form a series with increasing percentages of combined sulphuric acid. The members with little sulphuric acid can be washed with cold distilled water until the washings are neutral, whilst the ester possesses the properties of an insoluble acid. As the percentage of combined sulphuric acid increases, the esters become less stable towards water and the higher members of the series assume a colloidal form and continually split off free acid. If nitro-cotton, containing a small amount of combined sulphuric acid, be boiled for a long time with neutral or acid water, the sulphuric ester is gradually hydrolysed and the cotton becomes stable. But if the washing be effected with alkaline water, the acid sulphuric ester combines with the calcium or other base, giving neutral salts which are comparatively stable towards boiling water. Such nitro-cottons are dangerous from the point of view under discussion, because the sulphuric ester persists in the form of its calcium salt through all the operations of the manufacture of artificial silk, but on treatment with a mineral acid at a subsequent stage, *e.g.* in the hands of the bleacher or dyer, the calcium is removed and the ester is re-converted into the unstable free acid ester. It has been shown that, in the case of aceto-sulphuric esters of cellulose, the combined acetic acid is readily removed by alkaline saponifying agents, but that the whole of the sulphuric acid remains in combination with the cellulose, giving a sodium-cellulose sulphate.—J. F. B.

Papers; Influence of mercerised fibres on the properties of cotton rag ——. C. G. Schwalbe, K. Fenchel and R. Cornely. Wochenbl. Papierfab., 1913, **44**, 757—759.

IN order to ascertain the influence of mercerisation on the properties of papers made from cotton rags, the authors selected a new, bleached unsized cotton fabric, one portion of which was mercerised by immersion in a 23 per cent. solution of sodium hydroxide, whilst the other was left untreated. The two portions were reduced separately in an experimental beating engine to paper pulp under similar conditions and papers were made from the two pulps on a hand-mould. Tensile tests of these papers showed that the sheets made from the mercerised fabric were somewhat inferior both in tensile strength and elongation to the sheets prepared from the original fabric. Absorbency tests, made in the manner employed for testing blotting papers, showed on the other hand that the papers made with mercerised fibres were very decidedly superior to those made with ordinary cotton. The authors explain that mercerisation of the cotton fibre increases the strength of the fibre itself, but converts it into a smooth regular cylinder. Mercerised fabrics are stronger than the original owing to the increased strength of the fibre, but papers made from mercerised rags are weaker because the smooth cylindrical fibres slide apart under tension more readily than the twisted, wrinkled fibres of unmercerised cotton papers. Mercerised rags on the other hand give more absorbent blotting papers because certain water-resisting incrusting matters are removed by the treatment with concentrated caustic lye.—J. F. B.

Parchment papers; Testing of ——. V. Fortini and A. Cecchercelli. Chem.-Zeit., 1913, **37**, 237—239.

GREASEPROOF parchment papers are of two kinds: the "genuine," prepared by the chemical action of sulphuric acid or zinc chloride upon bibulous paper, and the "imitation," which are prepared by mechanical treatment in the beating engine, assisted by the addition of impregnating or special sizing agents. These two kinds of paper may be readily differentiated by determining the tensile or bursting strain in the dry and wet conditions. The paper is steeped in water at 75°—80° C. for half an hour, and the adherent excess of water is removed before testing. With genuine parchment papers the bursting strain of the dry paper is only 1·1 to 1·8 times the bursting strain of the wet paper. With imitation parchment papers, the loss of strength on wetting is very great and the dry paper shows a test 10—15 times higher than the wet paper. Genuine parchment papers show rather variable results when tested in different parts of the same sheet, owing to the variable action of the chemicals, whereas imitation parchment papers are practically uniform in strength all over the sheet. The authors describe a modification of the Vicat needle tester for testing the bursting strain, the paper being clamped over a wooden ring, 95 mm. in diameter inside, and the needle pressing exactly in the centre of the ring.—J. F. B.

The ginger-plant order, zingiberaceæ. Its value for paper making. Beadle and Stevens. *See* Liverpool Section, p. 259.

Erratum.

This Journal, March 15, 1913, page 228, in table, under the heading "Percentage yield of pulp on dry raw material," No. 11, Pulp-wood, the figure should be "45 per cent." not "4 per cent."

Patents.

Yarns, raw wool, cotton and like materials; Machine for drying —— by means of hot air. J. R. Openshaw, Manchester. Eng. Pat. 14,606, June 22, 1912.

In drying machines baffle-plates are arranged in the heating chamber, whereby the air is directed against the steam pipes, in combination with further baffle-plates arranged in the lower part of each drying chamber, whereby the hot air, after leaving the heating chamber, is caused to pass up centrally through the drying chamber to the outlet. The latter plates may be arranged one on each side of the lower part of the chamber, in the same plane, with a properly dimensioned space between them for the passage of the hot air, the plates being also perforated.—J. F. B.

Cotton wool; Preparation of artificial ——. A. Bloch. Fr. Pat. 447,068, Oct. 17, 1911.

The cellulose is first washed with alkali to free it from fatty matters, then bleached in a solution composed of 10 kilos. of chloride of lime, 6 kilos. of aluminium sulphate, 2/3 kilo. of magnesium sulphate, and 200 kilos. of water. After washing and drying in a centrifugal machine, the cellulose is dissolved in Schweitzer's reagent and the solution filtered. The solution of cellulose is then treated with much water to which sulphuric acid may be added in the centrifugal machine, described in Bloch's Belgian patent application of Aug. 18, 1911, and the precipitated fibres prevented from becoming agglomerated by a card of steel points, arranged around the drum of the centrifugal machine.—W. H. C.

Hops; Separation of bast fibres from ——. P. E. Delpeuch. Fr. Pat. 447,400, Aug. 20, 1912.

After the harvest, the hop-vines are cut into lengths of about 1 metre, sorted and dried. Retting is effected by sprays of water, running or stagnant water, hot or cold, but preferably by steam. When the gums have been removed, the material is taken out and the bast is readily separated. The crude fibres may be treated with hydrogen peroxide, acetone or carbon bisulphide; they are then submitted to the action of hot or boiling water or steam, with the addition of tannin. The subsequent operations resemble those adopted in the case of hemp.—J. F. B.

Cellulose plates and films; Hoppers for producing ——. J. E. Brandenberger, Thaon-les-vosges, France. Eng. Pat. 3929, Feb. 16, 1912. Under Int. Conv., Mar. 22, 1911.

In the process of making cellulose plates or films by running cellulose solution directly into a coagulating bath, a hopper is used having a slot with movable lips capable of adjustment by operating suitable mechanism.—J. F. B.

Copper oxide ammonia cellulose solution; Process of producing ——. B. Borzykowski, Charlottenburg, Germany. Eng. Pat. 24,996, Oct. 31, 1912. Under Int. Conv., Dec. 7. 1911.

For the purpose of increasing the proportion of copper oxide in cuprammonium solutions without increasing the proportion of ammonia, solutions of copper sulphate and an alkali are added to the cuprammonium solution. Example: To 50 parts of cuprammonium solution (sp. gr. 1·000—1·004) are added 17 parts of an aqueous solution of copper sulphate of a concentration of 27 grms. per litre; the mixture is thoroughly stirred and 10 parts of a 15 per cent. solution of caustic soda are added. 800 parts of this mixture will dissolve about 107 parts of dry loose cellulose.—J. F. B.

Cellulose; Process of making ——. B. Loomis, Hartford, Conn. U.S. Pat. 1,052,675, Feb. 11, 1913.

Wood or fibrous vegetable matter is subjected in a closed tank to the action of hot water, "thereby forming fatty acids and other solvents"; the water and acids are circulated through the material and through an external heater so as to release the turpentine oils, rosin and gummy matters. The volatile oils are distilled off and condensed, whilst the rosin and gums are carried off with the circulating water and collected in a separate tank. The softened wood is subjected to a beating and grinding action in the same tank in which it is being extracted and in presence of the treating liquor. The liquor is expelled and replaced by water and an alkaline reagent, in which the cleansed material is digested until it is reduced to cellulose. The temperature of the acid water used for treating the wood is about 250° F. (121° C.).—J. F. B.

Cellulose from vegetable substances; Process of obtaining ——. J. H. Fair, Assignor to H. G. Green and A. H. Hancox, Chicago, Ill. U.S. Pat. 1,053,125, Feb. 11, 1913.

The charge of vegetable substances is "pickled" in a bath containing hydrochloric acid and potassium chlorate, with or without nitric acid. The material thus prepared is subjected to the action of boiling water to which caustic potash or soda lye is added.—J F. B.

Cellulose esters and their transformation products: Manufacture of new ——. H. Dreyfus. Sixth Addition, dated Aug. 5, 1912, to Fr. Pat. 432,046, July 5, 1911 (this J., 1912, 24, 225, 329, 1119).

The acetylation may be conducted in hydro-extractors similar to those employed in the manufacture of nitrocellulose, or in revolving churns.. As a basis, a proportion of acetic anhydride equal to 2·5 times the weight of the cellulose may be taken, more or less, according to the proportions of sulphuric acid and moisture present. Comparatively large quantities of water may be present with the object of modifying the nature and solubility of the products. With 35—40 per cent. of water calculated on the weight of cellulose, products directly soluble in dilute acetone may be prepared. A large number of products of different solubilities may be obtained by varying the proportions of water between 5 and 20 or 30 per cent. of the weight of cellulose and interrupting the reaction at various stages, the result also being influenced by the proportion of acetic anhydride, by increasing which more water is required to attain the same results.—J. F. B.

Plastic compositions and method of preparing same. W. A. Beatty. Fr. Pat. 447,645, Aug. 26, 1912.

A plastic composition is composed of an ester of cellulose, *e.g.*, acetate or nitrate, and a condensation product of a ketone with a phenol or their homologues, or a hydroxy derivative of an aromatic hydrocarbon, *e.g.*, dihydroxydiphenyldimethylmethane, with or without a solvent, such as amyl acetate, acetone, chloroform, or a mixture of these. For instance, 80 parts of nitrocellulose with 20 of dihydroxydiphenyldimethylmethane. or 75 parts of cellulose acetate with 25 parts of the aromatic derivative are incorporated with a sufficient quantity of a suitable solvent to form a plastic mass.—J. F. B.

Paper boards, imitation leather or material for packing, insulating or other purposes: Manufacture of ——. H. Jackson. Garstang, Lancs. Eng. Pat. 4332, Feb. 21, 1912.

A fibrous colloid, or cellulose, mechanically produced, preferably by the process described in Eng. Pats. 6019 and 12,933 of 1911 (this J., 1912, 225, 636), is mixed with pulped, partially pulped or unpulped paper stock to produce the articles mentioned in the title, with or without the addition of other substances.—J. F. B.

Paper pulp, cellulose, etc. Manufacture of porous materials to be used for the beating bars employed in the manufacture of ——. H. Helin and C. F. Söderwall. Fr. Pat. 447,558, Aug. 20, 1912.

The beating bars employed in beating engines or refiners used in preparing paper pulp are composed of a porous cast material, prepared by arranging in the mould before casting a quantity of discontinuous metal turnings, gauze or the like, so that when the molten metal is poured in, there is produced a movement throughout the fluid mass, resulting in the formation of bubbles. With the metal turnings or gauze may be incorporated a certain amount of calcium or magnesium carbonate or other substance capable of evolving a gas.—J. F. B.

Paper testing apparatus. The Ashcroft Manufacturing Co. Fr. Pat. 447,562, Aug. 22, 1912.

The paper testing machine has a clamp to hold the paper and a flexible pressure-arrangement connected with an indicator, the flexible pressure member being mounted on a fixed support, whilst the paper carrier is mounted movably in relation to it. The apparatus is characterised by the following points: The flexible pressure member may be adjusted in its position relatively to the paper carrier. A screw or similar organ acts on the support which carries the paper clamp so as to bring it gradually and slowly towards the flexible pressure member. The paper carrier is composed of a fixed jaw and a movable jaw, each provided with an orifice through which the flexible pressure member may pass, the carrier being articulated on a stand which also carries the pressure member and the operating screw. The movable jaw of the paper clamp is composed of a disc working against the fixed jaw by means of a screw.—J. F. B.

Sulphite cellulose waste lyes: Precipitation of the objectionable constituents of —— by means of reagents after concentration of the lye. M. Platsch. Fr. Pat. 447,578, Aug. 23, 1912.

The precipitation of the calcium salts as sulphate can be completely effected only after elimination of the volatile organic acids (acetic acid) by evaporation of the lyes to a syrupy consistence. The reagents then used must be such that their bases form with sulphurous acid only readily decomposable compounds, or else do not combine at all. Aluminium sulphate, for instance, would be suitable, but precipitation may equally well be effected by sulphuric acid provided the liquor be neutralised after the separation of the precipitate of calcium sulphate. —J. F. B.

Sulphite-cellulose waste lyes to be used for briquetting ores, metallurgical products, or fuels; Process for separating lime from —— by means of sulphates. W. Günther. Ger. Pat. 255,853, Dec. 28, 1910.

The lime is precipitated by means of the sulphates of those metals which form the chief constituents of the ores to be briquetted or of the ores to be reduced by means of the briquetted fuel.—A. S.

Cleaning materials, such especially as wool, silk waste, and waste from other materials; Process and apparatus for ——. R. A. G. Fabre, Liguria, Italy. Eng. Pat. 10,260, April 30, 1912. Under Int. Conv., May 2, 1911.

See Fr. Pat. 430,691 of 1911; this J., 1911, 1375.—T.F.B.

Waste liquors of soda and sulphate pulp mills; Process of regenerating the soda as well as recovering valuable by-products from ——. E. L. Rinman, Hamäs, Sweden. Eng. Pat. 6652, March 18, 1912. Under Int. Conv., March 23, 1911.

See Fr. Pat. 441,186 of 1912; this J., 1912, 812.—T. F. B.

Sulphite-cellulose lye; Purifying ——. M. Platsch, Frankfort on Maine, Germany. U.S. Pat. 1,054,141, Feb. 25, 1913.

See Fr. Pat. 447,578 of 1912; preceding.—T. F. B.

Destructive distillation of organic matter suspended or dissolved in liquids [e.g. waste lyes from wood pulp manufacture]. Eng. Pat. 24,125. *See* IIb.

Adhesive (starch) and methods of making same. U.S. Pat. 1,053,719. *See* XVII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Affinity of cotton for dyestuffs; The influence of high temperatures and steam on the —— from the colloid-chemical standpoint. E. Justin Mueller. Färber-Zeit., 1913, 24, 98.

The affinity for dyestuffs is proportional to the colloid activity, which is developed by the moisture normally present in cotton. This moisture may be looked upon as "colloid water," analogous to water of crystallisation in the case of crystalloid substances, and to its presence is due the colloid activity of the cotton. The colloid activity, and consequently the affinity for dyestuffs, is therefore diminished by the influence of heat and steam which tend to remove the normally bound water. The prevention of this loss of affinity by moistening the cloth, or by adding hygroscopic substances before steaming, follows. On the other hand, the use of a sufficient quantity of glycerin may result in increase in affinity by steaming under pressure owing to hygroscopic action. —J. B.

Gelatin in finishing materials; Detection of ——. E. Schmidt. Färber-Zeit., 1913, 24, 97—98.

The author has examined two new reagents for this purpose—ammonium molybdate and a special Nessler solution—and finds them more sensitive than the usual tests—the biuret reaction or precipitation with tannin. The Nessler reagent is prepared by adding sulphuric acid to the ordinary Nessler solution until weakly acid and then filtering. The yellow filtrate is a very sensitive reagent for gelatin. It is used in slightly acid solutions which have been freed from fat, norgine, and albumin by precipitation with nitric acid.—J. B.

Patents.

Dyeing and washing hanks of yarn; Machine for ——. J. Schlumpf, jun., Brugg, Switzerland. Eng. Pat. 3213, Feb. 8, 1912.

A machine is arranged to travel on rails above the vat in which the hanks are suspended in such a manner that it engages the hank supports as it passes over them and turns them through an angle of 360°. (See also Eng. Pat. 13,982 of 1911; this J., 1912, 681.)—J. B.

Dyeing apparatus. J. M. Payne, Lee county, and G. C. Wallace, Russell county, Assignors to Perfection Dyeing Machine Co., Columbus, Ga. U.S. Pat. 1,053,063, Feb. 11, 1913.

The periphery of a hollow warp beam is formed of slats, each of which is capable of moving radially towards or away from the axis of the beam. A reciprocating outward and inward movement is given to alterate slats, or groups of slats, by means of a frame mounted inside the beam, and movable longitudinally, which acts on wedge plates secured on the inside of the slats.—J. B.

Viscose; Printing —— on textile fibres. The Calico Printers Association and E. A. Fourneaux, Manchester. Eng. Pat. 15,080, June 28, 1912.

In order to produce, on cloth, cellulose films having sufficient strength and elasticity, also in order to get sharp impressions, it is necessary to use concentrated viscose solutions containing an excess of alkali. As, however, the method of regenerating the cellulose found to be the most advantageous in this process is the " dry " one, *i.e.*, by means of dry heat or steam. the excess of alkali is a very harmful factor. The invention consists in overcoming this difficulty by impregnating the fabric before printing with a substance capable of neutralising the alkali during the final fixing operation. Ammonium sulphate is specially mentioned for this purpose.—J. B.

Mercerising yarn in skeins ; Machine for ——. P. Hahn, Niederlahnstein, Germany. U.S. Pat. 1,053,911, Feb. 18, 1913.

See Eng. Pat. 22,534 of 1911 ; this J., 1912, 637.—T. F. B.

Dyeing machines. J. Liddle, Glasgow. From The Psarski Dyeing Machine Co., Cleveland, U.S.A. Eng. Pat. 17,636, July 30, 1912. Addition to Eng. Pat. 26,584, Nov. 28, 1911.

See Addition of July 30, 1912, to Fr. Pat. 436,936 of 1911 ; this J., 1913, 134.—T. F. B.

Dyeing skins, hairs, feathers, and the like ; Process for ——, *and materials therefor.* Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 20,926, Sept. 13, 1912. Under Int. Conv., March 19, 1912.

See Fr. Pat. 445,880 of 1912 ; this J., 1912, 1176.—T. F. B.

Dyeing apparatus. J. C. Hebden, Providence, R.I., and F. H. Daniell, Franklin, N.H. U.S. Pat. 1,052,817, Feb. 11, 1913.

See Fr. Pat. 410,551 of 1909 ; this J., 1910, 812.—T. F. B.

Washing, dyeing, and softening machine. W. G. Gibbins, Forest Gate. U.S. Pat. 1,052,911, Feb. 11, 1913.

See Eng. Pat. 15,871 of 1910 ; this J., 1911, 127.—T. F. B.

Apparatus for bleaching and for preparing [electrolytic] bleaching, deodourising, and disinfecting solutions. Eng. Pat. 15,321. *See* VII.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Hydrochloric acid condensation ; Rational ——. T. Meyer. Z. angew. Chem., 1913, 26, 97—102.

The possible attainable strength of a solution of hydrochloric acid depends upon the temperature and upon the partial pressure of hydrochloric acid gas in the atmosphere from which it is to be absorbed. Curves, based upon Hurter's investigations, showing the connection among these quantities, are given in the paper. But it also depends, in industrial practice, upon other circumstances, *e.g.*—the influence of the diluting air on the heat-transformations and on the moisture-content of the gaseous mixture ; the effect of the cooling upon the deposition of moisture and the consequent freeing of latent heat ; the speed of the gaseous current ; the impurities in the gases ; the properties of the materials of the condensing apparatus, etc. Moreover, two ends have to be kept in view : first, the production of an acid as concentrated as possible (more necessary for the electrolytic chlorine process, and for other uses such as the manufacture of aniline salts, than for the Weldon process). and secondly, completeness of extraction, so that the escaping gases shall be as nearly free from hydrochloric acid as possible. The old coke tower is not very efficient, for the great thickness of its walls lessens the cooling action of the atmosphere, and the heat developed by the solution of the gas is so great that really the whole of the condensation has to be done in the upper and cooler parts of the tower. Lunge's plate-towers are an improvement in this respect, and so are the series of "tourills" with a final tower usual in Germany ; but even with these, half the work has often to be done in the tower, and, moreover, the surface of the water in the absorbers or tourills is apt to become covered with a fatty or tarry film, which prevents contact with the gas and consequently absorption. Water-cooling is much more efficient than atmospheric cooling, and is easily applicable with apparatus like the Cellarius absorber, of which the author describes a form devised by himself, which he considers an improvement on the apparatus of Cellarius. A complete system would consist, in the author's view, of one or two water-jacketed absorbers without internal water, simply to cool the gas and allow of condensation of impurities, followed by a stoneware fan to produce the requisite draught (but no more) and a gas-filter filled with granulated acid-proof material ; then a battery of absorbers (or two or more batteries worked in parallel if necessary) ; finally a small circular cylindrical dome-topped stoneware tower, into which the gases enter and which they also leave tangentially, and in the axis of which is a series of atomisers delivering spray. If after this the gases be made to pass another filter to remove spray, they are so free from acid that they may be delivered direct into the atmosphere. The supply to the atomisers is fixed at just a little below the total quantity of water that will be needed to make acid of the required strength, and the additional quantity is added at the last (or, following the stream of water, the first) absorber ; any necessary regulation of the water-supply is easily done at this spot. In regard to pan and furnace condensation, the great differences in concentration of hydrochloric acid in the gases, and the consequent great differences in the volumes of gas to be dealt with for equal quantities of hydrochloric acid, necessitate care in adjusting the dimensions of the apparatus for the furnace condensation so that there shall be throughout sufficient cross-section and hence not too great current-speed.—J. T. D.

Sulphur trioxide in sulphur-furnace gases ; Determination of ——. E. Richter. Z. angew. Chem., 1913, 26, 132—134.

The determination of sulphur dioxide and trioxide in furnace gases by Lunge and Reich's method does not give satisfactory results ; either the reactions with iodine and potassium hydroxide do not take place in the theoretical proportions or else substances are present which combine with a higher proportion of iodine than sulphur dioxide ; at any rate the results for trioxide often work out as a minus quantity. The author describes a method for the determination of the trioxide by condensation. The apparatus consists of a tube of refractory glass surrounded by an iron jacket ; this is connected with a vertical absorption tube, 30—40 cm. long, the inlet tube extending nearly to the bottom. The absorption tube is charged with pieces of broken porcelain surmounted by a layer of garnets, plugs of glass-wool being packed above and below the charge. The tube is surrounded by a freezing mixture and the iron-jacketed tube being inserted in the flue of the furnace, a very slow current of the gases is drawn through the apparatus, and its quantity measured by means of an aspirator. The gas should be passed at the rate of about 1 litre in 25 minutes, and when a sufficient quantity has been treated, a current of pure dried air is drawn through to remove all traces of sulphur dioxide. The contents of the condensation tube are then washed out with water and the sulphuric acid is precipitated as barium sulphate. Tests made to control the method showed that the sulphur dioxide has no influence on the results, but that the tubes used to condense the trioxide yielded, when new, a small quantity of substances precipitated by barium chloride which increased the result. This error of the apparatus was fairly constant and equivalent to 0·0005 grm. of sulphur trioxide. Further, when a current of air is passed for 20 minutes through concentrated sulphuric acid for the purpose of drying it, small quantities of sulphur trioxide are drawn over ; it is advisable therefore to employ phosphorus pentoxide to dry the air. Lastly it was shown that the condensation of the sulphur trioxide in a sufficiently long absorption tube was practically quantitative and there is no necessity to use a second tube as a precaution.—J. F. B.

Persulphuric acid; Iodometric determination of ——. E. Muller and H. v. Ferber. Z. anal. Chem., 1913, **52**, 195—197.

The iodometric determination of persulphate may be rapidly effected in presence of iron and a sufficient proportion of potassium iodide. 5 grms. of potassium iodide and 10 c.c. of ferrous sulphate solution (3 grms. of crystallised salt and 1 c.c. of 2 *N* sulphuric acid to 100 grms. of water) are introduced into a flask, and any iodine separating is removed with thiosulphate. The persulphate is then added, the volume made up to about 30 c.c., the flask closed, and, after 5 minutes, the contents are titrated with *N*/10 thiosulphate. Finally, the air is displaced by carbon dioxide, the flask again closed, allowed to stand for 10 minutes, and the titration completed.—F. Sodn.

Alkalis in rocks; Determination of ——. H. V. Krishnayya. Chem. News, 1913, **107**, 100—101.

In the determination of alkalis in rocks by dissolving the material in hydrofluoric acid, the removal of the metals of the iron group entails much labour and loss of time owing to the double precipitation and prolonged washing of the precipitates which are required. The author claims that by converting the fluorides into sulphates and strongly igniting the latter over a free flame, the alumina and ferric oxide are rendered insoluble: after taking up with boiling water and precipitating with barium chloride and baryta water, the resulting alkali chlorides are separated from excess of barium salts by means of ammonium carbonate and then determined in the usual manner.—O. R.

Lime and aragonite; Alleged existence of a peroxide in ——, *which have been exposed to air.* H. Ditz. J. prakt. Chem., 1913, **87**, 208—227.

Tarugi in 1904 (this J., 1905, 25) and, independently, Vaubel in 1912 (this J., 1912, 1181) have asserted that slaked lime (and according to Vaubel also aragonite), after exposure to air for some time, contains a peroxide; and Vaubel attributes certain corrosive effects of lime on lead to the action of this peroxide. The conclusion is based on the liberation of iodine from potassium iodide by the acidified solution of the lime, the chromic acid and ether reaction, and the turning blue of acidified guaiacum solution; but the two authors are not in accord, Tarugi having observed the last two reactions, whilst Vaubel obtained only very feeble indications or negative results. The author confirms the fact of the liberation of iodine. This occurs to a slight extent with the freshly prepared slaked lime (attributable to a trace of iron present), but increases steadily with the time of exposure to air, up to three or four weeks. It is, however, not due to peroxide, but to nitrite, for:—1. A solution of titanium dioxide gives no colouration, whilst a quantity of hydrogen peroxide capable of liberating the amounts of iodine actually liberated by the lime gives a deep yellow colouration, and 2. Though the diphenylamine test gives but a doubtful indication of nitrous acid, the Griess-Ilosvay reagent (acetic acid solution of sulphanilic acid and α-naphthylamine) shows it clearly, and in amounts increasing with time just as the iodine-liberation increases.—J. T. D.

Aluminium sulphate; Determination of free acid or base in ——. W. N. Iwanow. J. Russ. Phys.-Chem. Soc., 1913, **45**, 57—66.

The method usually employed for the estimation of free acid in aluminium sulphate is that devised by Beilstein and Grosset, which consists in addition of ammonium sulphate to form ammonium alum, treatment with alcohol, evaporation of the filtrate to dryness and titration of the dissolved residue with alkali in presence of methyl orange. The author finds, however, that this method indicates about 0·22 per cent. of free sulphuric acid even after addition to the aluminium sulphate of a quantity of alkali five times as large as should be sufficient to neutralise the free acid originally found. Further, the result obtained varies with the amount of water taken to dissolve the aluminium sulphate and with the amount of alcohol used to wash the precipitated alum. The following method is free from these defects: 1 grm. of the sulphate is dissolved in 50 c.c. of water and into the liquid, heated to 85° C., 12 c.c. of potassium ferrocyanide solution (1 : 12) are quickly added, with constant stirring, from a burette. Immediately afterwards 20 c.c. of barium chloride solution (1 : 10) are pipetted into the liquid, which is kept in vigorous movement. The whole of the liquid and precipitate is introduced into a 100 c.c. flask and the volume made up to 100·25 c.c. in order to allow for the volume displaced by the precipitate. When mixed, the contents are allowed to settle for an hour, 25 or 50 c.c. of the clear supernatant liquid being then titrated with *N*/10 sodium hydroxide in presence of three or four drops of methyl orange solution (1 : 1000). The method was tested by means of a solution of aluminium sulphate to which different known proportions of sulphuric acid were added, and found to give satisfactory results. The reaction with the ferrocyanide is represented by the equation:—

$$2K_4Fe(CN)_6+3H_2SO_4=6HCN+K_2Fe[Fe(CN)_6]+3K_2SO_4.$$

When the clear liquid from the barium precipitate exhibits no acidity, it must be assumed that the substance contains free base. In such case, to a solution of 1 grm. of the aluminium sulphate in 50 c.c. of water are added 2 c.c. of *N*/2 hydrochloric acid, the liquid being then heated to 85° C. and treated as described above. The difference between the amount of acid then found and that corresponding with 2 c.c. of *N*/2 acid is calculated as either aluminium hydroxide or sodium hydroxide. If a rapid but not very accurate estimation of the acidity is desired, the aluminium sulphate solution may be titrated immediately with *N*/2 caustic alkali, a drop of the liquid being removed from time to time and placed on a Schleicher and Schüll filter paper previously soaked in methyl orange solution (1 : 1000) and dried. When the red colour originally formed round the precipitate gives place to an orange colour, the titration is complete. This procedure gives results about 0·2 per cent. too low.—T. H. P.

Chromium sulphates; Violet ——. A. Sénéchal. Comptes rend., 1913, **156**, 552—555.

To obtain chromium sulphate free from alum, fractional precipitation with alcohol is used, which removes first the alum, then the normal salt and finally basic salts. Measurements of vapour pressures and of speeds of dehydration, lead to the conclusion that the following hydrates exist: $Cr_2(SO_4)_3,14H_2O$; $Cr_2(SO_4)_3,15H_2O$; $Cr_2(SO_4)_3,16H_2O$; and $Cr_2(SO_4)_3,17H_2O$. The lowest hydrate is only dehydrated very slowly *in vacuo* over phosphorus pentoxide at ordinary temperatures, and does not seem to possess a definite vapour pressure. At 30° C. it undergoes a distinct change and begins to give off vapour rapidly. When kept at 40° C. *in vacuo* it becomes green, giving first a violet sulphate, $Cr_2(SO_4)_3,12H_2O$, which is then transformed into a green complex. No violet sulphate with less than 12 molecules of water is known, which is in conformity with the views of Werner. The others are looked upon as hydrates of this, $[Cr_2(OH_2)_{12}](SO_4)_3$, with 2, 3, 4, and 5 molecules of water respectively.—W. H. P.

Green iron cyanogen compounds. H. E. Williams. Chem. Soc. Proc., 1913, **29**, 54—55.

A solution of ammonium ferrocyanide when boiled in contact with the air, forms a dull green deposit, which has the formula $Fe_2'''Fe''(NH_4)_8[Fe''(CN)_6]_4,3H_2O$; a similar potassium compound, $Fe_2'''Fe''K_8[Fe''(CN)_6]_4,6H_2O$, is produced by adding very dilute hydrochloric acid gradually to a boiling solution of potassium ferrocyanide, and by substituting ammonium chloride solution for the hydrochloric acid the compound,

$$Fe_2'''Fe''(NH_4)_7K[Fe(CN)_6]_4, 3H_2O$$

is produced. Somewhat similar compounds of ferrosoferric ferrocyanides of a dull blue colour were prepared, agreeing with the formula:—

$$Fe_2'''Fe_2''Na_6[Fe(CN)_6]_4,6H_2O \text{ and}$$
$$Fe_2'''Fe_2''(NH_4)_6[Fe(CN)_6]_4,8H_2O.$$

These compounds can be considered as molecular compounds of the ferric double salts and ferrous ferrocyanides, as in the case of the blue iron cyanogen compounds. Ferric ferrocyanide when boiled with concentrated nitric acid is converted into the green compound, $Fe_7'''[Fe''Fe'''(CN)_{12}]_3,54H_2O$. By boiling ferric potassium ferrocyanide with nitric acid a green compound, $Fe_{13}'''[Fe''Fe_3'''(CN)_{24}]_3,100H_2O$, is obtained; this compound is also produced by passing chlorine through freshly precipitated ferric ferrocyanide. The addition of ferric salts to a solution containing one equivalent of ferrocyanide and more than three equivalents of ferricyanide yields a fine dark green precipitate of the composition: $Fe_{29}'''K_3[Fe''Fe_2'''(CN)_{18}]_9,210H_2O$. When ferrous potassium ferrocyanide, obtained by distilling potassium ferrocyanide with dilute acid, is oxidised whilst still boiling with excess of nitric acid, the violet compound, $Fe_3'''K_2[Fe_2''Fe'''(CN)_{18}],6H_2O$, is produced. Cupric ferrocyanide when boiled with concentrated nitric acid, also yields a ferroferricyanide of the composition $Cu_7[Fe''Fe'''(CN)_{12}]_2,30H_2O$. From a consideration of the formation of these green compounds, and particularly of the copper compound it is probable that they are ferric ferroferricyanides, and not ferrosoferric ferricyanides.

Antimony sulphide, lead sulphide; Study of the system ——. H. Pélabon. Comptes rend., 1913, **156**, 705—707.

Mixtures of antimony sulphide and lead sulphide were examined by the method of thermal analysis and microscopically. The formation of the compounds, zinckenite, $Sb_2S_3.PbS$, and jamesonite, $Sb_2S_3,2PbS$, was detected. These compounds decompose on melting. Zinckenite is not capable of existence above 568° C., nor jamesonite above 610° C. The eutectic solidifies at 482° C. and contains approximately 22 mols. of lead sulphide and 78 mols. of antimony sulphide; it is composed of antimony sulphide and zinckenite.—A. S.

Calcium carbide; Transformation undergone by —— on heating. E. Briner and A. Kuhne. Comptes rend., 1913, **156**, 620—622.

Calcium carbide which has been heated in a closed vessel to 800°—1000° C., contains free carbon. This was attributed by Moissan to dissociation of the carbide into calcium and carbon, and by Erlwein and others (see this J., 1911, 357) to formation of a subcarbide. The authors have found no evidence for the latter view. The heated carbide, when cooled and treated first with water and then with concentrated hydrochloric acid, yields no liquid or gaseous hydrocarbon besides acetylene, and the residue insoluble in acid consists of pure carbon. Moissan's view appears therefore to be correct. The calcium liberated by dissociation disappears, owing to volatilisation and frequently also to interaction with the material of the vessel in which the carbide is heated. —J. H. L.

Radio-products of thorium; Chemical properties and relative activities of the ——. H. N. McCoy and C. H. Viol. Phil. Mag., 1913, **25**, 333—359.

Each radioactive product of thorium is found to have its own characteristic chemical properties, and, based on these, methods have been worked out for the separation of the various products from inactive substances and from one another, as also for the preparation of products completely free from radioactive impurities. The chemical properties of *mesothorium-one* and *thorium X* are essentially identical, those of a solution which has been separated from thorium by ammonia being as follows:—(1) All the mesothorium-one is carried down with the precipitate formed by boiling the solution, after adding a little ferric chloride and excess of sodium carbonate, but (2) if the iron be precipitated by ammonia, the mesothorium is only partially precipitated. (3) Calcium carbonate, formed by adding ammonium carbonate, carries down the mesothorium completely, and (4) the precipitation of barium likewise involves the mesothorium which is not separable from barium by any known reaction. (5) Mesothorium-one is not carried down to an appreciable extent with aluminium hydroxide precipitated by pure ammonia (free from carbonate), nor (6) with lead sulphide precipitated in acid solution. The authors have studied the separation of mesothorium-one from thorium by precipitating a dilute solution of thorium nitrate by means of ammonia, when 80—90 per cent. of the mesothorium remains in solution; also by adding a little ferric chloride to a solution of thorium nitrate in sodium carbonate solution, containing bicarbonate, and heating to 70°—80° C., which throws down all the mesothorium-one and thorium X with the basic carbonate precipitated. No definite separation was effected by precipitating with oxalic acid. *Mesothorium-two* and *radio-thorium* are separated from a solution of mesothorium-one by adding aluminium chloride and introducing pure ammonia gas, dissolving the precipitated alumina in acid, making the solution nearly neutral, and removing radio-thorium by adding a little thorium to the solution and precipitating by means of hydrogen peroxide; the mesothorium-two is left in the filtrate, and the alumina is then precipitated with ammonia two or three times, and finally, thorium B and C are removed by means of mercuric sulphide. This gives radioactively pure mesothorium-two, for which the following reactions are recorded:—(1) It is carried down with aluminium hydroxide (as with zirconium hydroxide and ferric hydroxide) when precipitated by ammonia, and the reaction, which is quantitative, allows an easy and complete separation of mesothorium-two from barium, mesothorium-one, and thorium X. (2) It is not carried down with mercuric sulphide precipitated in slightly acid solution. (3) It very much resembles radio-thorium in chemical properties, but the latter only is precipitated when a little thorium nitrate is precipitated in a neutral solution by means of hydrogen peroxide at 60°—70° C., and this is considered the best method of separating radio-thorium and mesothorium-two, all the former being removed by the thorium which, if precipitated by hydrogen peroxide and reconverted into nitrate before being used, does not introduce any radioactive impurity into the product. (4) It is carried down completely by barium sulphate, precipitated in slightly acid solution. Pure *radio-thorium* is obtained from a preparation of mesothorium-one in barium chloride, being separated by means of alumina precipitated by pure ammonia. After standing a few days for the removal, by decay, of mesothorium-two from the precipitate, thorium X, B, and C are removed by repeated alternate precipitations of the alumina and of mercuric sulphide in the aluminium chloride solution. Radio-thorium, in absence of thorium, is completely carried down (1) with aluminium hydroxide and with ferric hydroxide precipitated by ammonia, (2) also with basic ferric carbonate precipitated by excess of sodium carbonate; (3) it is partially precipitated with barium sulphate and (4) to a slight extent with mercuric or lead sulphide. A single precipitation of an aluminium chloride solution of radio-thorium by pure ammonia carries down all the radio-thorium, leaving nearly all the *thorium X* in the solution, and from this, thorium B and C are completely removed by three or four precipitations of mercuric sulphide. Thorium X may be separated from thorium by the following reactions:—(1) When thorium is precipitated from a nitrate solution by ammonia, pyridine, sodium thiosulphate, potassium chromate, *m*-nitrobenzoic acid, or hydrogen peroxide, nearly all the thorium X is left in solution. (2) Precipitation by means of oxalic acid gives a partial separation. (3) Barium sulphate carries down nearly all the thorium X. (4) Ferric iron removes all the thorium X from a solution of thorium in an excess of the carbonates of sodium, under the conditions given for mesothorium-one. A solution of thorium X, free from thorium, behaves as follows:—(1) Thorium X is carried down completely by barium sulphate, ferric carbonate, calcium carbonate, or ferric phosphate, and (2) is partially precipitated with ferric hydroxide; (3) it is not carried down to an appreciable extent when the hydroxide of aluminium, zirconium, cerium, lanthanum, yttrium, or didymium is precipitated by ammonia, nor (4) when lead, mercury, tin, zinc, or iron is precipitated by hydrogen sulphide. *Thorium B and C* are separated very completely from a thorium solution when mercury, lead, or zinc is precipitated as sulphide, and, from a solution in hydrochloric or nitric acid, obtained from a negatively charged plate exposed to the emanation, they are carried down with aluminium or cerium hydroxide precipitated by ammonia; they are also precipitated with lead iodide or chromate, in slightly acid solution, with ferric iron and excess of sodium carbonate or ammonium acetate, or with bismuth oxychloride, but not with mercuric iodide or silver chloride. The assertion of Moore and Schlundt (Trans. Amer. Electrochem. Soc., 1905, 8, 269), that barium or lead sulphate, precipitated in a solution of thorium B and C carries down the former completely and the latter partially, and that ferric iron, precipitated by pyridine, carries down thorium C and not thorium B, is confirmed, as also that ferric iron, precipitated by fumaric acid from a boiling and nearly neutral solution, carries down thorium C completely with only a small proportion of thorium B; this last separation is complete after three or four precipitations, and the method is recommended for the preparation of pure thorium C. By preparing thorium X entirely free from thorium B+C+D and determining its change of activity with time, the activity of thorium B+C+D was found to be 0·427 of that of thorium X+emanation +A, and, by determining the initial activity of pure radiothorium and its change of activity with time, it was found that the ratio of the activity of the products of radiothorium to that of radio-thorium alone is 5·23. Redeterminations of the periods of thorium X and thorium B have confirmed the accepted values (3·64 days and 10·60 hours respectively), whilst the period of thorium C is found to be 60·8 minutes. Range determinations of thorium X show this to be 4·1 cm., instead of 5·7 cm. (hitherto accepted).—F. SODDY.

Nitric oxide formation in the high-pressure arc; Changes involved in ——. F. Fischer and E. Hene. Ber., 1913, 46, 603—617.

THE authors publish experimental results and data in reply to the criticisms by Koenig (this J., 1913, 194) of their conclusion that activation of the oxygen was responsible for the nitric oxide formation. They state that there was not the slightest evidence of their discharge passing through the mixture of gases outside the sparking tube. Reference is also made to the recent work of Comte (Phys. Zeits., 1913, 14, 74) and Tiede (this J., 1913, 232) according to which the "activity" of nitrogen discovered by Strutt is not exhibited when the gas is carefully freed from oxygen. In support of the view that active oxygen (possibly ozone) may oxidise nitrogen at high temperatures, provided the conditions are such that the ozone is not destroyed by the temperature before the action attains an appreciable velocity, experiments with the silent electric discharge are described. No nitric oxide is produced by the discharge in air at 20° C., but traces begin to appear at about 400° C. and at 700° C. 0·06 per cent. is obtained.—W. H. P.

Phosphorus; Equilibrium-diagram of ——. W. A. Wahl. Öfversigt af Finska Vetenskabs-Soc. Förhandlingar, 54, A. Nr. 9. Chem. Zentr., 1913, 1, 774—776.

MICROSCOPIC examination shows that red phosphorus is, at least in part, vitreous, and other physico-chemical evidence is brought forward to show that the liquids obtained on melting white and red phosphorus respectively are not identical. White phosphorus purified by means of a mixture of chromic and sulphuric acids melts to a colourless liquid, and in the dark this may be heated up to 200° C. without any change, recognisable spectroscopically, taking place. In the light, however, transformation to red phosphorus occurs. The following description of the relations of the different modifications of phosphorus is given. White phosphorus melts at 44·5° C. to a colourless liquid, which boils at 290° C. under atmospheric pressure. Besides this liquid modification, there is another one which has a very high viscosity at ordinary temperatures (vitreous amorphous phosphorus). A condition of equilibrium varying with the temperature exists between these two modifications under ordinary conditions, but in the dark the velocity of transformation is so low at temperatures up to 200° above the melting point of white phosphorus, that no appreciable formation of the red liquid modification takes place; the transformation velocity becomes appreciable at temperatures from about 250° C. upwards, and the red phosphorus produced separates in a flocculent form. It is probable that even at these high temperatures, the red phosphorus has a not inconsiderable solvent power for white phosphorus. The transformation of white into red phosphorus is accelerated by catalysts such as iodine, selenium, and phosphorus tribromide. The red phosphorus formed is brighter in colour the lower its temperature of formation. At higher temperatures devitrification of the red phosphorus begins, probably with formation of Hittorf's crystalline phosphorus.—A. S.

Agricultural value of calcium carbonate recovered from causticising plant. Hendrick. *See* XVI.

PATENTS.

Salt; Manufacture of ——. J. Leopold-Brodie, London. Eng. Pat. 2300, Jan. 29, 1912.

AFTER evaporation in the brine pan to the point of deposition of solid salt, the salt is removed up an inclined channel by means of an open chain or ladder of scraper blades, to a hopper at the top. The whole of this channel above the level of the brine in the pan is steam-jacketed below, so that the salt whilst draining in small detached portions is continuously heated and dried. From the hopper the salt falls into a second channel inclined gently downwards, and also steam-jacketed below, down which it is worked by an open conveyor similar to the first, and at the end of which it falls down a steep incline on to an endless conveyor belt passing through a drying chamber. It is claimed that this apparatus besides economising time and labour directly, delivers the salt in a condition fit for table use or for mixture with rice starch or similar substances without the need for grinding.—J. T. D.

[Electrolytic] bleaching, deodorising and disinfecting solutions; Apparatus for bleaching and for preparing ——. O. Sumner, London. Eng. Pat. 15,321, July 1, 1912.

IN an apparatus for preparing hypochlorite by the electrolysis of brine, the anode and cathode are separated by a wedge-shaped or conical compartment. The cathode stands vertically within the chamber while the anode is arranged outside the chamber at an angle to the vertical and preferably parallel to the partition wall. It is claimed that automatic circulation of the electrolyte is caused by the liberated chlorine owing to this disposition of the anode and partition wall, while the hydrogen liberated at the cathode is conducted away into the air without causing any wasteful secondary reactions.—J. B.

Seaweed or other forms of marine algae; Extraction of iodine, chlorine, potassium hydroxide, and other useful products from the ash of ——. F. K. Cameron, Washington, D.C., and R. B. Moore, Indianapolis, Ind. U.S. Pat. 1,051,984, Feb. 4, 1913.

THE ash is lixiviated, the solution filtered, partially evaporated, and electrolysed in a diaphragm cell. The anode liquor containing iodic acid is then treated with sulphuric acid and iron, or ferrous sulphate, and the iodine thus set free.—J. T. D.

Carbide; Apparatus for producing ——. M. W. Murray, Assignor to G. H. Rosenblatt, New York. U.S. Pat. 1,052,165, Feb. 4, 1913.

THE furnace has a brickwork bottom, in which is a conveyor pit with a conveyor for the raw material. Above this are wire-net diaphragms with refractory packing, and between them a bed of small pieces of highly refractory material. Gas and air are mixed and superheated, and pass into a gas feed-box above the refractory combustion-bed. There is also a carburettor with checker brickwork, above the gas-feed-box, and means for removing and storing the exhaust gases.—J. T. D.

Nitrogenous compounds ; Process of making ——. C. J. Greenstreet, Indianapolis, Ind. U.S. Pat. 1,052,815, Feb. 11, 1913.

Hydrogen is passed over calcium carbide to form calcium hydride and carbon, and nitrogen is then passed over this mixture heated to a temperature above a dark red heat. —O. R.

Hydrogen ; Generation of ——. S. Uyeno, Tokio, Japan. Eng. Pat. 11,838, May 18, 1912.

78—98 parts by weight of aluminium are melted in a crucible and a mixture of 15—1·5 parts of zinc and 7·0—0·5 parts of tin are added to the molten metal, after which the alloy is cast in the form of a plate. For each part of this alloy, 0·12 to 0·025 part of mercury, or a quantity of zinc or tin amalgam containing this amount of mercury, is taken and amalgamated with the upper and lower surfaces of the plate by rubbing it in with a steel brush. The plate is then heated to as high a temperature as possible without volatilising the mercury, until the alloy has become uniformly amalgamated, whereupon it is ready for the manufacture of hydrogen by acting on it with hot water.—O. R.

Hydrochloric acid and alkali silico-aluminate ; Charge mixture for producing ——. A. H. Cowles, Sewaren, N.J., U.S.A. Eng. Pat. 19,604, Aug. 27, 1912.

See U.S. Pat. 1,040,893 of 1912 ; this J., 1912, 1124.—T.F.B.

Hydrochloric acid and alkali silico-aluminate ; Process for making ——. A. H. Cowles, Sewaren, N.J., U.S.A. Eng Pat. 19,605, Aug. 27, 1912.

See U.S. Pat. 1,040,977 of 1912 ; this J., 1912, 1124.—T.F.B.

Radium and other radio-active substances ; Process for the isolation and enrichment of the emanations of ——. E. Ebler, Heidelberg, Germany. Eng. Pat. 3244, Feb. 8, 1912. Under Int. Conv., Nov. 21, 1911. Addition to Eng. Pat. 2155 of 1912, dated March 6, 1911.

See Fr. Pat. 440,236 of 1912 ; this J., 1912, 723.—T. F. B.

Operations in which hydrogen is employed under pressure in iron tubes or vessels, at high temperatures. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8617, April 11, 1912.

See Fr. Pat. 444,455 of 1912 ; this J., 1912, 1126.—T.F.B.

Ammonia ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. (1) Eng. Pat. 9841, April 25, 1912. (2) Eng. Pat. 9842, April 25, 1912. Addition to Eng. Pat. 61, Jan. 2, 1911.

See (1) Fr. Pat. 432,472 of 1911 ; this J., 1912, 432. (2) Addition of Aug. 13, 1912, to Fr. Pat. 431,295 of 1911 ; this J., 1913, 233.—T. F. B.

Tungsten ; Manufacture of —— *and its use in the catalytic production of ammonia.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1161, Jan. 15, 1912.

See Fr. Pat. 439,261 of 1912 ; this J., 1912, 721.—T. F. B.

Ammonia ; Processes of making ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,053,951 and 1,053,952, Feb. 18, 1913.

See Eng. Pats. 61 and 26,749 of 1911 ; this J., 1911, 1057 ; 1912, 431.—T. F. B.

Sulphate of ammonia ; Process of manufacturing ——. E. Collett, Christiania. U.S. Pat. 1,052,797, Feb. 11, 1913.

See Eng. Pat. 16,629 of 1911 ; this J., 1912, 640.—T. F. B.

Ammonium nitrate from ammoniacal gases ; Production of ——. F. Uhde, Gerthe, Germany. U.S. Pat. 1,053,456, Feb. 18, 1913.

See Fr. Pat. 436,768 of 1911 ; this J., 1912, 432.—T. F. B.

Hydrogen, or nitrogen, or mixtures of hydrogen and nitrogen ; Manufacture of material to be used in producing ——. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. Eng. Pat. 12,051, May 21, 1912. Under Int. Conv., May 24, 1911.

See Fr. Pat. 444,044 of 1912 ; this J., 1912, 1126.—T.F.B.

Calcium carbide ; Process for increasing the resistance of —— *to atmospheric humidity.* L. Lendei, Rome. Eng. Pat. 20,274, Sept. 5, 1912.

See Fr. Pat. 447,805 of 1912 ; this J. 1913, 234.—T. F. B.

Boric acid and chlorate of soda ; Manufacture of ——. E. L. Fleming, Chester, and T. L. Miller, Liverpool. Eng. Pat. 23,101, Feb. 26, 1912.

See Fr. Pat. 442,820 of 1912 ; this J., 1912, 1032.—T. F. B.

Hydrogen peroxide ; Apparatus for making ——. A. E. Stoll, Zollikon, Switzerland. U.S. Pat. 1,052,626, Feb. 11, 1913.

See Fr. Pat. 432,235 of 1911 ; this J., 1911, 1451.—T. F. B.

Salt ; Manufacture of ——. J. H. Webster, Carrickfergus, Ireland. U.S. Pat. 1,052,703, Feb. 11, 1913.

See Eng. Pat. 20,706 of 1911 ; this J., 1912, 773.—T. F. B.

Sulphur or like furnaces ; Means for regulating the supply of air to ——. D. N. Hunt, Chesham. U.S. Pat. 1,053,915, Feb. 18, 1913.

See Eng. Pat. 18,895 of 1911 ; this J., 1912, 921.—T. F. B.

Phosphorus sesquisulphide ; Process of obtaining pure ——. A. Stock, Breslau, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,054,250, Feb. 25, 1913.

See Eng. Pat. 22,506 of 1910 ; this J., 1911, 284.—T. F. B.

VIII.—GLASS ; CERAMICS.

Ceramic school ; Report from the laboratory of the Royal Bunzlau ——. A. Berge. Sprechsaal, 1913, **46**, 123—124, 140—142.

The work of the school has been concerned with raw and fritted glazes for earthenware, bricks and terracotta ; glazes for stoneware and porcelain ; bodies, and colours for bodies and fluxes. The type of lead glaze is expressed by the formula : $1{\cdot}8—3{\cdot}0SiO_2,0—0{\cdot}3Al_2O_3,RO$. An earthenware glaze maturing at cone 010 has the formula : $1{\cdot}5SiO_2,0{\cdot}1Al_2O_3,0{\cdot}9PbO,0{\cdot}1K_2O$. It can be made matt by the addition of 8—10 per cent. of rutile. A particularly lustrous glaze is obtained by using the formula : $1{\cdot}5SiO_2,0{\cdot}2Al_2O_3,0{\cdot}85PbO,0{\cdot}10ZnO,0{\cdot}05K_2O$. The crackled effect due to a network of lines of crazing is yielded by using on Bunzlau clay the glaze of formula : $1{\cdot}86SiO_2,0{\cdot}27Al_2O_3,PbO$, and this can be made bright yellow by the addition of 3·5 per cent. of zinc oxide and 1 per cent. of molybdic acid. The presence of 0·1 equivalent of magnesia is useful in lead glazes for the production of red colours. An opaque deep red may be made by adding 10 per cent. of iron oxide to the glaze : $1{\cdot}9SiO_2,0{\cdot}25Al_2O_3,0{\cdot}85PbO,0{\cdot}10K_2O,0{\cdot}05CaO$. All these glazes mature at cone 010 (950° C.).—H. H. S.

Patents.

Mica ; Production of sheet ——, and the like from mica waste and other materials. F. Bölling. Frankfurt-a-M., Germany. Eng. Pat. 21,445. Sept. 20, 1912.

The claim is for a binding material such as is used as a flux or glaze for ceramic ware or pottery, having a melting point between 500° and 950° C. ; lead borates or boro-silicates are mentioned as among such substances. Thin mica layers are covered with the flux material and laid on one another, then submitted simultaneously to high pressure and to a temperature sufficient to melt the binding material. Or a mica sheet is covered with alternate layers of flux and mica dust, and when the desired thickness is reached, another mica sheet is placed on top, and the whole submitted to pressure and heat as above.—J. T. D.

Enamels, glass, and the like ; Clouding agents used in the manufacture of white ——. Verein. Chem. Fabr. Landau. Kreidl, Heller und Co., Vienna. Eng. Pat. 19,849, Aug. 30, 1912. Under Int. Conv., Nov. 4, 1911.

See Fr. Pat. 438,908 of 1912 ; this J., 1912, 643.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Artificial stones ; Process for the production of ——, from natural rock waste. W. Laufer, Cracow, Austria. Eng. Pat. 18,883. Aug. 17, 1912. Under Int. Conv., Nov. 24, 1911.

A mixture of the coarse and fine rock waste (porphyry, basalt, greywacke, granite, etc.) with aluminium phosphate and sodium carbonate, and with or without "precipitated colloidal alumina" is moulded under pressure while in a slightly moist condition and subsequently burnt at a temperature between 1100° and 1200° C.—W. E. F. P.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ; Critical points of ——. W. Broniewski. Comptes rend., 1913, **156**, 699—702.

The author's experiments were made with pure electrolytic iron, the test-pieces being first annealed for 10 hours above 1000° C. In the tests the metal was raised to the required temperature in about 1 hour in an atmosphere of hydrogen in an electric resistance furnace, the temperature being ascertained by a platinum platinum-rhodium thermocouple. Curves representing the thermo-electric power in relation to copper and to platinum were plotted : the former shows a critical point at 730° C., and the latter one at 1020° C. The curve representing the electrical resistance of the iron shows a smooth change of direction between 750° and 850° C. and breaks at 950° C. and 1020° C., with a change of direction between these two points. The curve representing the expansion of the iron shows a maximum at about 950° C., followed by a contraction. (See also this J., 1899, 767, 921 ; 1902, 480, 481 ; 1904, 1029.) The cooling curve shows a halt at 890° C. and a slight change of direction at about 700° C. If the hypothesis recently put forward by Benedicks, that the β-iron of Osmond is a solid solution of γ-iron in α-iron, be accepted, then the smooth change of direction in the electrical resistance curve corresponds to the maximum of the solid solution. This hypothesis, however, affords no explanation of the critical point at 1020° C., and the author assumes the existence of a new solid solution. According to this view, α-iron is stable up to 730° C. (the critical point on the curve representing the thermo-electric power, beginning of the magnetic transformation). There is a β'-iron stable at 950° C. (critical points on the curves representing thermo-electric power and expansion, end of the magnetic transformation), and a γ-iron stable above 1020° C. (critical points on the curves representing electrical resistance and thermo-electric power). β'-Iron forms continuous series of solid solutions with α-iron between 730° and 950° C. and with γ-iron between 950° and 1020° C.—A. S.

Iron ; Some properties of commercial electrolytic ——. L. Guillet and A. Portevin. Comptes rend., 1913, **156**, 702—705.

The authors have carried out some tests with a commercial electrolytic iron containing : Mn, 0 ; Si, 0 ; S, 0 ; P, 0·025 ; and As, 0·011 per cent., and practically free from carbon. The crude metal, as taken from the electrolytic bath, is supersaturated with hydrogen, and is then extremely brittle and shows a characteristic micro-structure, which however becomes normal after annealing for 2 hours in magnesia at 900° C. The critical points on heating and cooling were practically the same for both the (1) crude and (2) annealed metal, viz., on heating : (1) 791°, (2) 788°, and (1) 937°, (2) 932° C. ; and on cooling : (1) and (2), 902° and 778° C. The form of the curves shows that the higher transformation point (A_3) is characterised by a rapid thermal change, whereas the lower one (A_2) corresponds, especially on cooling, to a progressive thermal change. Adopting Benedicks' hypothesis (Eighth Int. Congr. Appl. Chem., New York, 1912), this indicates mutual solubility of α- and β-iron. Electrical resistance determinations, corrected for the phosphorus and arsenic content of the iron, gave the mean value for the annealed metal 9·98 microhms per cm. cube. According to Benedicks the correct value is 7·6 microhms at 16° C., and higher values obtained by previous workers have been due to the presence of hydrogen. If this view be accepted, the annealed iron of the authors contains 0·008 per cent. of hydrogen in solid solution, and the crude metal (resistance, 11·92 microhms) an additional 0·006 per cent.—A. S.

Cast iron and Mannesmann tubes ; Rusting of ——. Part II. H. Wölbling. Ferrum, 1913, **10**, 161—167.

In continuation of previous work (this J., 1911, 1258), cast iron and steel and drawn tubes have been exposed to the action of moist oxygen either when embedded in moist sand or when wrapped in muslin, and the oxygen absorption over a period extending to thirteen months measured. The results are tabulated and graphically illustrated and do not agree with those observed by Arndt (this J., 1911, 898). For a tube surface of 650 sq. cm. an average absorption of 6 c.c. occurred on the first day steadily, falling to 0·1 c.c. at the end of five months. The conclusion is arrived at that drawn tubes do not rust more strongly than cast tubes. From the rapid retardation of the speed of absorption it is concluded that the rusting ceases before any serious damage is done. In the experiments with tubes wrapped in muslin the rusting of cast iron tubes ceased after five months, whilst that of drawn tubes continued for some little time longer, but even then did not reach that of the cast tubes.—A.H.C.

Triferrous carbide (Cementite). O. Ruff and E. Gersten Ber., 1913, **46**, 394—400.

In view of a determination of the heat of formation of cementite by Jermilow (J. Russ. Metall. Ges., 1911, 357), whose result was +2·27 Cals., whilst the authors (this J., 1912, 233) had obtained −15·1 Cals., they have repeated their work, making a determination of the heat of combustion of FeO to Fe_3O_4, for which in their earlier work they accepted Le Chatelier's figure of 25·7 Cals. (for $FeO+1/3O=1/3Fe_3O_4$). The result of their determination was 28·6±1·8 Cals. Using this figure instead of Le Chatelier's, they obtain as the molecular heat of formation of Fe_3O_4 267·1±0·2 Cals., of FeO 60·4±1·8 Cals., and of Fe_3C (from α-iron and graphite)—15·3±0·2 Cals.—J. T. D.

Platinum minerals of the Urals; Some anomalies observed in the analysis of ——. H. C. Holtz. Ann. Chim. Phys., 1912, [8], **27**, 559—566. Chem. Zentr., 1913, **1**, 561—562.

In the analysis of platinum minerals from the Urals the author has observed anomalies which point to the probable presence of a new metal (see this J., 1912, 29, and following abstract), the oxide of which is insoluble in mineral acids, including *aqua regia*, but dissolves in sodium hydroxide to a yellow solution, which remains yellow on acidifying with hydrochloric acid. The acid solution thus obtained gives neither a precipitate nor a colouration with potassium iodide, but is decolourised by stannous chloride. The oxide is not affected by fusing with sodium carbonate and potassium nitrate. The metal dissolves in fused potassium bisulphate, but when the reddish brown melt is dissolved in water no white basic sulphate separates as in the case of rhodium. The metal is soluble in nitric and hydrochloric acids; its hydrochloric acid solution is not precipitated by ammonium chloride.—A. S.

Platinum [and "canadium"]: Reported discovery of —— *[in the ores of the Nelson district, British Columbia].* Annual Report of Minister of Mines (British Columbia) for year ending Dec. 31, 1911, 165—170.

Authentic samples of the dyke in which the presence of platinum metals and a new metal termed "canadium" had been reported by French (see this J., 1912, 29), and also of concentrates, from the crushed material, caught on a Wilfley table, were obtained from the owners of the mine, and were submitted for analysis to representative firms of assayers, to the Canadian Geological Survey, and to the British Columbia Government Laboratory. In all cases not even traces of platinum metals could be detected, nor could any evidence be obtained of the presence of the alleged new metal "canadium."—A. S.

Copper matte; The treatment of plumbiferous ——. W. Menzel. Metall u. Erz., 1913, **10**, 193—206 and 219—239.

The simplest way of treating copper matte containing lead would appear to be a modification of the precipitation process, if it were possible to cause the separation of metallic lead sufficiently free from copper. The use of iron alone as a desulphurising agent is only applicable within limits owing to the formation of lead matte. It is known that the addition of alkali or alkaline earth, or salts of these, to the desulphurising agent increases its efficacy. The experiments described by the author with the fullest detail were carried out on Otavi matte made at Tsumeb, and containing: Cu 40·81, Pb 23·65, Fe 10·45, S 17·99, Ag 0·04, Zn, 1·88, Mn 0·2. As 0·2, Sb 0·1, SiO_2 2·57, CaO 1·17, and Al_2O_3 0·84 per cent. In this matte the sulphur is not sufficient to form sulphides with all of the copper, lead, and iron present, and in making up the charges it was assumed that all the sulphur was combined with lead. An excess of carbon was always present. Attempts to separate by producing a light copper matte and a heavy lead matte by the addition of salts of alkalis or alkaline earths to a charge of matte and carbon failed to effect any segregation. Smelting the matte with lime and carbon can only result in a partial reduction of the lead, as (according to Schenck) double sulphides of lead and calcium are formed. Tests made on these lines showed that addition of the amount of lime theoretically necessary to form sulphides of iron and calcium results in an extraction of 50 per cent. of the lead in metallic form. Increasing the amount of lime increases the extraction of lead but also its copper content, which is about 4 per cent. with 50 per cent. lead extraction. Speiss is always formed if more than the theoretical amount of lime be present. Iron was then added, in the form of ferric oxide and carbon, in an endeavour to increase the yield of lead. When the theoretically necessary amounts of lime and iron were added, a yield of 63 per cent. of the lead was obtained, this latter containing 4·67 per cent. of copper and 92·42 per cent. of lead. Matte smelted with powdered iron oxide alone yielded 70 per cent. of the lead in the metallic form, assaying 93·62 per cent. of lead and 2·93 per cent. of copper. Charges composed of matte, barium sulphate, ferric oxide and carbon were studied, and the results were more favourable than those obtained with calcium sulphate, though these substances are both to be avoided. After obtaining these results in gas-fired furnaces corresponding to the reverberatory in actual practice, electric smelting was studied. On smelting matte with limestone and carbon, it was found that owing to the good conductivity of the matte it was difficult to obtain a sufficiently high temperature by resistance heating, while the local overheating due to the arc caused great losses especially in the absence of a protective slag. A special form of furnace was evolved and found to give satisfactory results. Micrographic investigation tends to show that in the Otavi matte the lead sulphide is not chemically combined, crystallising out on cooling. The author considers the methods indicated as commercially advantageous. The copper-lime matte formed, is brittle and easily treated by known methods.—R. W. N.

German silver; Microstructure of ——. O. F. Hudson. Inst. of Metals, March, 1913. [Advance proof.]

Samples of German silver containing Cu 58·0, Ni 18·5, and Zn 23·5 per cent., annealed under ordinary works conditions for varying lengths of time at 700° C. were polished and etched for micro-examination, a strongly acid solution of ferric chloride being used for etching. The usual crystalline growth on annealing was shown to take place, and the cold-rolled alloy still showed the original cored structure of the cast material, even after 48 hours annealing at 700° C. After 72 hours annealing at 700° C. the alloy was practically homogeneous. These observations were also confirmed on material prepared in the laboratory and treated similarly. A coarse crystalline structure due to prolonged annealing showed also in itself no sign of inferior rolling qualities, all the annealed specimens rolling easily and well. When tested for hardness by the Shore sclerescope no decrease in hardness was observed beyond that due to the normal annealing operation. The paper is illustrated by twelve microphotographs.—A. H. C.

Muntz metal; Influence of impurities on ——. F. Johnson. Engineering, 1913, **95**, 283.

A number of alloys were prepared containing Cu 60·83, Zn 38·64, Fe 0·45, Pb 0·08 per cent., and in addition either Sb 0·02—0·60, As 0·02—0·61, or Bi 0·31, or As 0·02—0·04 and Sb 0·02—0·04 together, in order to determine the influence of these impurities on the working properties of the alloy. Two ingots were poured from each melt and were hot forged down to 0·2 in. thickness, rolled cold to 0·14 in. after annealing for 20 min. at 700° C., and then by three stages reduced to 0·03 in. thickness. The results are tabulated and it is concluded that the influence of antimony is far more detrimental than that of arsenic, and that bismuth is not so injurious in Muntz metal as it is in copper. The effect of the combination of 0·03 per cent. of both antimony and arsenic is however infinitely worse than that of 0·10 per cent. of antimony in the absence of arsenic The micro-structure of the cold-worked specimens showed marked twinning in the alpha phase, but a complete absence of it in the beta phase.—A. H. C.

Gun-metal; Practical heat treatment of Admiralty ——. H. S. and J. S. G. Primrose. Inst. of Metals, March 1913. [Advance proof.]

The authors have studied the influence of quenching and annealing at different temperatures, on the microstructure, ultimate tensile strength, and elongation of Admiralty gun-metal (Cu 88, Sn 10, Zn 2 per cent.). Tests were made on bars cast (1) in sand, (2) in chills of solid metal, and (3) in chills in close proximity to a large body of metal cast and cooled at the same time. Almost in every case, the changes in tensile strength and elongation were parallel. Quenching lowered both the strength and the elongation, metal quenched at 700° C. giving the lowest values, but annealing was beneficial, the best results being obtained in all cases by annealing at 700° C. The duration of annealing was found to be capable of variation within fairly wide limits, but the best results were obtained by annealing for 30 minutes. Annealing was found also to improve the homogeneity of the metal, particularly as regards the capability of castings to withstand pressure. These results are considered to be due to the removal of the eutectic from the microstructure, which, after annealing, shows only the crystals of a solid solution. This change appears to be complete at 700° C. Annealing at higher temperatures induces crystal growth, and a consequent falling-off in both the tensile strength and the elongation. The authors anticipate that annealing will also minimise corrosion difficulties. The paper is illustrated by 15 microphotographs.—T. St.

Corrosion ; Contributions to the history of ——. *Pt. II. The corrosion of distilling condenser tubes.* A. Philip. Inst. of Metals, March, 1913. [Advance proof.] See also this J., 1912. 134.

Pure water is obtained on board ship by the distillation of sea water which is heated by passing high-pressure steam through coils immersed therein. The steam thus generated is condensed by passing through condenser tubes (usually vertical), which are cooled by sea water circulating around them and contained in a steel shell. Corrosion of the tubes on the sea water side is practically unknown, but trouble has been experienced from the corrosion of the insides of the tubes, and the still heads, etc., resulting in the presence of copper in the distilled water. The author has demonstrated the presence of free hydrochloric acid in such distilled water, by precipitating all the chlorides present with pure silver sulphate solution, and evaporating the filtrate to a small bulk. Free sulphuric acid was then detected therein by its action in blackening sugar. Investigation showed that where hydrochloric acid was formed, the brine in the evaporators was strongly alkaline, and magnesium hydroxide was present in the incrustations found on the walls, etc., of the evaporators. Also that in the worst cases of corrosion, the primary steam coils were not wholly immersed in the brine. The cause of this form of corrosion is therefore considered to be due to the formation of free hydrochloric acid by the decomposition of magnesium chloride, which is deposited on the unimmersed portions of the primary steam coils by the splashing of the brine, and is thereby strongly heated.—T. St.

Copper alloys ; Solubility of sulphur dioxide in fused ——. A. Sieverts and E. Bergner. Z. physik. Chem., 1913, **82**, 257—270.

The authors assume that when sulphur dioxide dissolves in molten copper (see this J., 1910, 1161), the following reaction takes place : $SO_2+6Cu=Cu_2S+2Cu_2O$. The reaction is reversible, for on reducing the pressure of the sulphur dioxide, evolution of sulphur dioxide from the metal takes place. If this assumption be correct, the solubility of sulphur dioxide in molten copper should be depressed more by addition of cuprous oxide or sulphide than by addition of another substance. Experiments were therefore made with molten alloys of copper with gold (silver, platinum), and with oxygen and sulphur, and it was found that the solubility of sulphur dioxide therein varied according to the temperature and pressure in the same manner as the solubility in molten copper, *i.e.*, it increased with rising temperature and was approximately proportional to the square root of the pressure ; in the case of alloys containing large proportions of cuprous oxide, however, the solubility was approximately proportional to the pressure, *i.e.*, in accordance with Henry's law. In agreement with the view expressed above, it was found that the solubility was depressed to a far greater extent by cuprous oxide and sulphide than by gold. In the solubility experiments, just as in the previous experiments with pure copper, the whole of the absorbed sulphur dioxide could not be recovered on reducing the pressure. The small loss of sulphur dioxide was traced to a reaction between cuprous oxide and the porcelain containing tube the corresponding quantity of cuprous sulphide remaining dissolved in the metal.—A. S.

Electrolytically precipitated metals ; The forms of ——. *I. Black silver.* V. Kohlschütter and T. Toropoff. Z. Elektrochem., 1913, **19**, 161—168. (See also this J., 1912, 188, 248, 589 and 777).

The so-called " black " silver which may be obtained by electrolytic methods occupies a mean position between ordinary crystalline silver and the amorphous colloidal metal. It is itself crystalline, but exhibits in many other respects, particularly in its behaviour towards electrolytes, characteristic colloidal properties. In its electro-deposition there is a definite colloidal phase, while on the other hand it rapidly reverts when the current is cut off into a white definitely metallic form. The conditions for the formation of black silver are determined by the conditions for crystallisation, *i.e.*, the relative velocities of nucleus formation and crystallisation. These conditions are best studied by observation of the variations in the difference of potential, using a small cathode and a large anode. In this way it has been established that the existence of black silver depends upon the nature of the solution, which probably modifies the degree of dispersion and the distribution of nuclei. The reversion to crystalline metal when the current is broken is possibly due to electrostatic causes.—W. H. P.

Electrolytically precipitated metals ; The forms of ——. *II. Silver precipitated by other metals.* V. Kohlschütter and W. Pfauder. Z. Elektrochem., 1913, **19**, 169—172.

In the reduction of silver salts by other metals the silver is separated in various forms, depending on the particular metal chosen and on the nature of the silver solution, but characteristic for each reaction. The differences are probably due to the different velocities with which the deposition takes place and depend primarily on the crystallisation conditions (nucleus formation and velocity of crystallisation). The progress of the deposition can be followed by noting the change with time of the potential of the precipitating metal. The conditions which regulate the appearance of the different forms are not, however, entirely determined by crystallisation factors.—W. H. P.

Electrolytically precipitated metals ; The forms of ——. *III. The influence of foreign substances on the separation of silver.* V. Kohlschütter and H. Schacht. Z. Elektrochem., 1913, **19**, 172—181.

In the electrolysis of an ammoniacal solution of silver nitrate containing traces of salts of other metals (copper, cadmium, lead, beryllium, chromium, aluminium and thallium), the silver is obtained in different forms characteristic of the added metal. The actual structure of the deposits is illustrated by photomicrographs. The effect of the added reagent can be referred to the existence in the solution of colloidal hydroxides, and is consequently influenced to some extent by the age of the solution. The silver deposits are heavier than would be expected from the consumption of electricity, the excess consisting of silver which has not been deposited electrolytically ; this excess does not increase in proportion to the total amount of metal deposited. The foreign metals are not found in the free state and only in small quantity in combination in the silver deposits. The effect is probably due to adsorption of the colloidal hydroxide which exercises a characteristic influence on the distribution of nuclei on the electrode.—W. H. P.

Electrolytically precipitated metals ; The forms of ——. *IV. Separation of silver from solutions of its complex salts.* V. Kohlschütter. Z. Elektrochem., 1913, **19**, 181—184.

In the first stage of the electrolysis of complex silver salts, colloidal particles similar to the " subhalides " or " photo halides " are obtained. These primary particles which vary to some extent in nature with the particular electrolyte in use, determine the form of the subsequently deposited metal, even if it is precipitated from an entirely different solution. The important agent is a thin mechanically removable film on the cathode, which represents the colloidal deposit during the first stage of electrolysis. This film remains when the silver is dissolved in acid and is sufficient of itself to decide the form of a subsequent deposit. This explanation of the phenomena is exactly parallel to that obtained previously by the author for the mechanism of the formation of mirror silver, and with that which accounts for the characteristic effects produced by foreign metals in the electrolysis of ammoniacal silver solutions (see preceding abstract).—W. H. P.

Aluminium ; Corrosion of ——. G. H. Bailey. Inst. of Metals, March, 1913. [Advance proof.]

In an investigation of the corrosion of aluminium of good commercial quality by potable waters and solutions of sodium chloride (up to 15 per cent. strength) corrosion was found to be entirely due to oxidation of the metal by oxygen dissolved in the liquid, except in cases where the latter contained a notable quantity of free acid or alkali; no corrosion occurred when the metal was immersed—for prolonged periods—in water or sodium chloride solution from which the dissolved air had been expelled. The corrosive action of the liquid—which, generally, decreased as the purity of the metal increased—was noticeably accentuated by the presence of copper or sodium in the metal, by impurities (especially free alkalis) in the water, and at high temperatures. In the case of aluminium containing more silicon than iron, the corrosive action of water and acids was less pronounced than that of sodium chloride solution. The author is of opinion that the results obtained by acting upon aluminium with acids or alkalis afford no definite indication of the behaviour of the metal in water or aqueous solutions. The method of conducting the experiments and of determining the extent to which corrosion had occurred were as follows:—A sheet of aluminium of at least 100 sq. cm. surface was cleaned by the application of ether, dilute sodium hydroxide solution and dilute nitric acid in succession, well washed with water, dried at 100° C. and weighed. It was then completely immersed in the corroding liquid at a known temperature and maintained therein, with occasional agitation, for at least 48 hours. The material deposited upon the metal was subsequently removed as far as possible by rubbing, and, together with that suspended in the liquid, filtered off, ignited and weighed. It is stated that with good, ordinary sheet almuinium the suspended and deposited material consists almost entirely of aluminium hydroxide and, after ignition, may be regarded—for the present purpose—as containing half its weight of metal. Ignoring the adherent deposit, the weight of the sheet of metal—originally W—should now be $W - w$, w being half the weight of the ignited material obtained. The metal was then heated for some hours at a temperature of about 200° C. (to render the deposit of alumina anhydrous) and weighed; the latter weight being w^1, the weight of the adherent deposit was consequently $w^1 - (W - w)$, one half of which was metallic aluminium. The total weight of metal removed by corrosion was therefore $w + \frac{w^1 - (W - w.)}{2}$ It is stated that, except when very impure metal or solutions are employed, the results obtained by this method, in the hands of different workers, are reliable and comparable, but it is pointed out that the method serves only as a means of ascertaining the amount of metal removed by corrosion.—W. E. F. P.

Manganese and nickel ; Carbides of ——. O. Ruff and E. Gersten. Ber., 1913, **46**, 400—413.

Trimanganese carbide, Mn_3C, was prepared by heating manganese, prepared by the thermite process, in a carbon crucible at 1600° C. for 20 minutes. The manganese contained 98·7 per cent. of metal and its melting-point in three experiments was found as 1242°, 1247°, 1239° C. The carbide mass, after pulverising, and removing contained graphite by flotation on acetylene tetrabromide, corresponded exactly in composition with the formula, Mn_3C. It is a soft (hardness between 1 and 2 of Mohs' scale) black substance, crystallising in needles, of sp. gr. 6·888 and hence molecular volume 25·70 (calc. 29·80). Its molecular heat of formation (from manganese and graphite) was determined by the authors to be $12{\cdot}9 \pm 2{\cdot}14$ Cals.; that calculated from Le Chatelier's figures is 9·34 Cals.

Trinickel carbide, Ni_3C. Ruff and Martin have already shown (this J., 1912, 285) that the solubility of carbon in nickel reaches a maximum at 2100° C., when the composition of the product corresponds with the formula, Ni_3C, but that the dissociation of the carbide is very rapid with falling temperature; so that even a quenched product contains but a small proportion of trinickel carbide, and this, moreover, cannot be separated from the dissociated graphite because of the extreme toughness of the quenched substance, which cannot be powdered. In determining the calorific value, then, the substance was analysed, the percentages of nickel, of combined carbon, and of graphite being determined, and allowance was made for the graphite and the nickel in excess of the formula, Ni_3C. The molecular heat of formation was found to be -394 ± 10 Cals.

The heats of formation of the three carbides (manganese $+12{\cdot}9$, iron $-15{\cdot}3$, nickel -394) are in conformity with the stability of the first, the slight instability of the second, and the high instability of the third; and they confirm Ruff and Martin's views on their formation. The softness of the two carbides (iron and manganese) which have been obtained pure is interesting, as showing that the hardening effect of carbon is not due to these carbides themselves, but must be due to their solid solutions in the metals. —J. T. D.

Thiogen process [Sulphur recovery] ; Present status of ——. S. W. Young. Eng. and Min. J., 1913, **95**, 369—370.

The thiogen process for the elimination of sulphur dioxide from smeltery fume depends upon the reduction of the sulphur dioxide by ethylenic hydrocarbons according to the reaction:—$3SO_2 + C_2H_4 = 3S + 2CO_2 + 2H_2O$, which however is very slow and incomplete. In the presence of calcium sulphide containing small quantities of iron compounds, the following cyclic reaction occurs:—$2CaS + 3SO_2 = 2\,CaSO_3 + 3S$; $2CaSO_3 + C_2H_4 = 2CaS + 2CO_2 + 2H_2O$. The roaster gases containing about 8 per cent. of sulphur dioxide pass first through a dust settler to a fore-chamber where a certain amount of oil is introduced and in which the excess of oxygen in the gases is burnt out. Thence the gases pass to the contact chamber where more oil is introduced, the total amount being that necessary to burn out the oxygen and reduce the sulphur dioxide. The contact material is made up from plaster of Paris which is mixed with water containing iron salts, allowed to set and broken into lumps. The chief chemical difficulty is the contact mass being rendered inactive either by (1) the presence of flue dust, or (2) too high a temperature in the contact chamber destroying its porosity. In a series of experimental trials on one unit of a battery of eight 6-hearth McDougal roasters, the same charge of contact material was run for periods of from ten to twelve days without loss of activity, the exit gases containing practically no sulphur dioxide. The exit gases from the contact chamber pass through a cooling and condensing apparatus where the sulphur is deposited.—A. H. C.

Metals ; Experimental investigation of the physical conditions of the crystallisation of ——. E. Giurgea. Bul. Ṣoc. de Ṣtiinṭe din Bucureṣti, 1912, **21**, 192—207. Chem. Zentr., 1913, **1**. 677—678.

If a zinc rod contained in a porous cell be immersed in a solution of copper sulphate, copper is deposited as a crystalline precipitate on the outer surface of the cell. Crystalline deposits of other metals may be obtained in an analogous manner—for example, lead from lead acetate solution by means of zinc, and silver from silver nitrate solution by means of copper, and the method may be used, in the same manner as electrolysis, to obtain one or another metal from a mixture of different salts. It is probable that certain natural deposits of regulus-like, crystalline metals may have been produced in this way. If some metal powder or granules be mixed with sand and the mixture moistened from below with a solution of copper sulphate, crystalline copper will be found in the mass after some days.—A. S.

Notes on Chinese antimony ores, crude and regulus. W. R. Schoeller. *See* London Section, p. 260.

Patents.

Iron ; Method of extracting —— from what are commonly known as iron sands. S. L. Elborne, Peterborough, and H. Godsal, London. Eng. Pat. 3368, Feb. 10, 1912.

Peat in the presence of a large volume of water for rendering it "capable of being dried by pressure" is treated at boiling temperature with sufficient lime to render the mixture completely alkaline to litmus. After removal of a portion of the liquid, the iron sand is incorporated with the remaining mass, the mixture being finally pressed into briquettes, which are smelted in a suitable furnace. —W. E. F. P.

Sheet iron ; Manufacture of —— by electrolysis. G. Tischenko, St. Petersburg. Eng. Pat. 8668, April 12, 1912.

The iron is deposited upon a continuously rotated, horizontal lead-lined drum and is separated from the latter near its line of emergence from the electrolyte and guided to a water bath ; from the latter the metal band is caused to pass successively through a glowing-furnace, a grinding or polishing machine, a corroding vat, a hot water bath, and finally to a reel upon which it is wound.—W. E. F. P.

Copper ; Method of purifying ——. A. G. Sundberg, Helsingborg, Sweden. Eng. Pat. 4692, Feb. 24, 1912.

In a process for removing (as sodium compounds) arsenic, sulphur, etc., from copper, finely powdered sodium carbonate (or/and potassium carbonate) and a solid or gaseous fuel are simultaneously forced through the molten metal by means of a current of air or gas. It is stated that in the treatment of common raw copper by this process an arsenic content of 0·02 may be readily reduced to one of 0·002 per cent., the consumption of sodium carbonate being less than 0·5 per cent. of the weight of metal treated.—W. E. F. P.

Copper ingots ; Furnace for heating ——, and for other like uses. G. B. A. Gibbons, Lower Gornal, Staffs, and R. Masters, Dudley, Worcester. Eng. Pat. 7203, Mar. 25, 1912.

A regenerative gas-furnace consisting essentially of a circular, dome-topped heating-chamber having in its floor one or more gas up-cast shafts, and beneath the floor a regenerator of annular shape. The furnace is provided with secondary air-inlets leading to the regenerator, hot-air outlets communicating with the up-cast shafts, and with waste gas outlets disposed in the circular wall and communicating, by down-cast passages and through the regenerator, with a waste gas flue leading to the chimney stack. The arrangement is such that the gases in combustion with the secondary air are caused to rise from the up-cast shafts and spread over the charge upon the floor of the heating-chamber to the periphery of the latter, whence the gaseous products pass through the outlets and the adjacent passages to the air-heating passages of the regenerator. The floor of the heating-chamber may consist of a rotatory table.—W. E. F. P.

Furnace ; Mechanical ore-roasting ——. J. Harris, Sheffield. Eng. Pat. 7727, March 30, 1912.

The apparatus comprises a number of superimposed roasting chambers beneath the lowest of which a heating flue is arranged. The fireplace is closed and the air-supply thereto regulated by dampers so that unburnt combustible gases may pass direct to the heating flue as required. The latter is made more or less tortuous by the disposition of the walls supporting the hearth immediately above, which hearth is constructed of tiles or similar thin material to permit of the maximum amount of heat being imparted to the charge. A number of separate air-channels, provided with dampers, extend from the exterior of the furnace to different points along the heating flue, the arrangement being such as to permit uniform heating of the lower hearth to any required degree by the manipulation of the dampers controlling the air supplies to the fireplace and the heating flue respectively.—W. E. F. P.

Furnace and process for reduction of ores. G. F. Rendall, Assignor to R. W. Priest, New York. U.S. Pats. 1,053,435 and 1,053,436, Feb. 18, 1913.

(1) The discharge end of an inclined, cylindrical, rotatory, gas-fired preheating furnace communicates—through a combustion chamber—with a vertical reducing furnace adapted to be supplied with an adjustable current of a reducing gas. The gas outlet of the reducing furnace communicates with the combustion chamber, to which air is also supplied by means of a fan. An ejector conveyor is provided for facilitating the discharge of the ore from the bottom of the reducing furnace. (2) The preheated and oxidised ore issuing from the inclined, cylindrical, rotatory, gas-fired furnace is subjected to the action of a "hydrogenous gas" during its passage through the second rotatory cylinder or reducing furnace, from which it is discharged into a water-jacketed cooling device to prevent re-oxidation. When cool, the reduced material is crushed and the metal separated by mechanical means. —W. E. F. P.

Aluminium-solder. R. Seifert, Union Hill, N.J. U.S. Pat. 1,052,693, Feb. 11, 1913.

An alloy containing approximately 38 per cent. of pure tin, 32 of phosphor-tin, and 30 of pure zinc.—W. E. F. P.

Aluminium ; Process of extracting —— from its ores. A. Kissock, Golden, Colo. U.S. Pat. 1,052,727, Feb. 11, 1913.

The process consists in heating an intimate mixture of the ore with carbon and sulphur (or a suitable sulphur compound) until the charge becomes viscous, dissolving the aluminium sulphide thus produced in a molten bath of "alkaline-earth solvents," and separating metallic aluminium from the resulting solution by electrolysis. —W. E. F. P.

Ores ; Process of treating ——, preparatory to magnetic separation. J. B. Etherington, Winthrop, Mass., Assignor to Campbell Magnetic Separating Co. U.S. Pat. 1,053,486, Feb. 18, 1913.

Ores containing non-magnetic iron and zinc sulphides are heated in a non-oxidising atmosphere until the corresponding magnetic sulphides are formed, when the material is subjected to magnetic separation as usual.—W. E. F. P.

Metallic vapours ; Process for condensing ——. F. W. Gordon, Fort Washington, Pa. U.S. Pat. 1,053,592, Feb. 18, 1913.

In a process for recovering metals from gases containing at most their own weight of metallic vapour, the gaseous mixture, under pressure, is caused to pass down a vertical conduit in which the temperature of the material is gradually lowered at a rate sufficiently slow to permit of practically complete "coalescence of the metallic molecules before the gas and vapour reach a temperature of congelation." The gaseous residue is caused to pass over a pool of the liquid metal before leaving the conduit. —W. E. F. P.

Tin ; Process for purifying —— from impurities present in such small quantities that they lie within the eutectic limits. P. Bergöe. Ger. Pat. 255,748, Oct. 3, 1911.

The tin is purified by systematic fractional crystallisation, crystals of pure tin being skimmed off from the solidifying metal, whilst those metals which do not form solid solutions with tin remain behind.—A. S.

Zinc or other metals volatile at the reduction temperature Distillation furnace with vertical muffles or other reduction chambers for obtaining ——. Rheinisch-Nassauische Bergwerks- und Hütten-A.-G. Ger. Pat. 255,918, Feb. 11, 1912. Addition to Ger. Pat. 236,759, Dec. 16, 1909.

According to the present patent, the permeable cores specified in the chief patent (see Eng. Pat. 27,467 of 1910, this J., 1911, 630; also Ger. Pat. 250,775, this J., 1912, 1187) are made of wood or other material which will be converted into charcoal during the reduction of the ore.—A. S.

Zinc, lead, etc.; Process for obtaining metals such as —— from their compounds with oxygen or sulphur. R. v. Zelewski. Ger. Pat. 256,083, May 19, 1912.

Metals such as zinc, lead, etc., are obtained from their sulphides or oxides by heating with carbides, a chlorine compound of an alkali or alkaline-earth metal being added to facilitate the reaction.—A. S.

Nickel alloy resistant to the action of chemicals and capable of being easily worked. W. and R. Borchers. Ger. Pat. 255,919, June 21, 1912.

The alloy contains per cent. more than 25 (*e.g.* about 30) Cr and a small proportion (*e.g.* 1·5—2·5) Ag.—A. S.

Nickel alloy resistant to the action of chemicals and capable of being easily worked. Gebr. Borchers Chemische Fabriken. Ger. Pat. 256,123, June 21, 1912.

An alloy containing per cent. more than 50 Co and up to about 1 of Ag.—A. S.

Tungsten or other metal of the chromium group; Process for improving the mechanical properties of coherent bodies of ——. Allgemeine Elektricitäts-Ges. Ger. Pat. 256,122, May 7, 1912.

The article, or the mass from which it is to be prepared, is heated in presence of calcium carbide, or other carbide capable of decomposing water, to about the softening point of the carbide. A small quantity of the carbide may be added to the mass from which the article is to be prepared, or the article itself may be heated in a packing of carbide. —A. S.

Iron; Production of ductile —— by electrolytic means. H. Plauson and G. Tistschenko, St. Petersburg. Eng. Pat. 10,822, May 7, 1912.

See Ger. Pat. 252,875 of 1911; this J., 1913, 29.—T. F. B.

Iron alloys for dynamo-electric purposes; Process for the manufacture of ——. W. Rübel, Westend-Berlin, Germany. Eng. Pat. 15,532, July 3, 1912. Under Int. Conv., July 11, 1911. Addition to Eng. Pat. 12,483, May 23, 1911.

See Addition of July 10, 1912, to Fr. Pat. 429,758 of 1911; this J., 1913, 146.—T. F. B.

Tool steel and other high-grade steels; Process for the production of ——. Dellwik-Fleischer Wassergas Ges.m.b.H., Frankfort, Germany. Eng. Pat. 24,440, Oct. 25, 1912. Under Int. Conv., Oct. 31, 1911.

See Ger. Pat. 250,999 of 1911; this J., 1913, 29.—T. F. B.

Steel; Manufacture of ——. W. R. Walker, New York. Reissue No. 13,538, Feb. 25, 1913, of U.S. Pat. 1,014,425, Jan. 9, 1912.

See this J., 1912, 192.—T. F. B.

Iron and steel; Process of improving the quality of malleable ——. O. Thallner, Assignor to Elektrostahl G.m.b.H., Remscheid-Hasten, Germany. U.S. Pat. 1,053,454, Feb. 18, 1913.

See Ger. Pat. 248,698 of 1910; this J., 1912, 929.—T. F. B.

Furnaces for the reduction of zinc ores; Preliminary heater in connection with ——. C. Roitzheim, Cöln, Germany. Eng. Pat. 1338, Jan. 17, 1912.

See U.S. Pat. 1,038,205 of 1912; this J., 1912, 994.—T.F.B.

Copper coating upon articles of carbon; Process for forming a ——. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 3917, Feb. 16, 1912. Under Int. Conv., April 6, 1911.

See Fr. Pat. 440,597 of 1912; this J., 1912, 823.—T. F. B.

Foundry sand; Treatment of ——. A. Poulson, Farnworth. U.S. Pat. 1,052,514, Feb. 11, 1913.

See Fr. Pat. 429,355 of 1911; this J., 1911, 1220.—T. F. B.

Amphidizing [copper ores]; Method of ——. C. S. Bradley, New York, Assignor to Bradley Copper Process Co., Jersey City, N.J. U.S. Pat. 1,052,793, Feb. 11, 1913.

See Fr. Pat. 430,692 of 1911; this J., 1911, 1392.—T.F.B.

Ores, etc.; Process of treating ——. A. Günzel, Ziebigk, Germany. U.S. Pat. 1,053,381, Feb. 18, 1913.

See Addition of April 15, 1909, to Fr. Pat. 390,316 of 1908; this J., 1909, 1200.—T. F. B.

Stannic oxide; Process for the reduction of ——. Z. Metzl, Rouen, France. U.S. Pat. 1,053,624, Feb. 18, 1913.

See Fr. Pat. 429,739 of 1911; this J., 1911, 1221.—T. F. B.

Cupola-furnace. P. Anderson, Arvika, Sweden. U.S. Pat. 1,054,381, Feb. 25, 1913.

See Eng. Pat. 18,414 of 1911; this J., 1911, 1392.—T. F. B.

Process for separating lime from sulphite-cellulose waste lyes to be used for briquetting ores, metallurgical products, or fuels. Ger. Pat. 255,853. *See* V.

XI.—ELECTRO-CHEMISTRY.

Changes involved in nitric oxide formation in the high-pressure arc. Fischer and Hene. *See* VII.

Patents.

Electro-osmose; Apparatus for ——. Ges. für Elektro-Osmose m. b. H., and H. Illig, Frankfort-on-the-Maine, Germany. Eng. Pat. 29,826, Dec. 27, 1912. Addition to Eng. Pat. 725 of 1912, dated Oct. 2, 1911 (this J., 1912, 708).

The liquid to be treated, containing material in suspension, is supplied to and conveyed from the electrodes along different paths, thus preventing the untreated and treated liquids from mixing. The liquid first passes through two inner chambers, each of which is provided with a shaft and rotating vanes for driving the material towards the cathodes. From the latter the liquid passes to a middle chamber, also provided with a shaft and vanes for driving it towards the auxiliary chambers at the ends of the electrolytic vessel, and from these it is discharged. In an alternative form, the material is fed into the apparatus near the base, and then led away from the upper part by collecting gutters. The lower part of the apparatus is divided by a longitudinal partition, thus providing two separate channels for the flow of the liquid, each of which is provided with a shaft carrying vanes.—B. N.

Storage batteries; Process of treating wood separators for ——. J. M. Skinner, Assignor to Philadelphia Storage Battery Co., Philadelphia, Pa. U.S. Pat. 1,052,851, Feb. 11, 1913.

Wood separators for storage batteries are immersed in a solution of sodium sulphite, which is maintained at a temperature of 100°—175° C., after which the treated wood is washed and dried under pressure.—O. R.

Cell : Electrolytic ——. E. O. Barstow, Midland, Mich. U.S. Pat. 1,053,266, Feb. 18, 1913.

A bipolar electrode, for use in electrolytic cells or the like, consists of a plate of conducting material, such as carbon, and a number of independent carbon pins with conical ends, these being mounted in conical holes in each face of the plate so that they may be removed.—B. N.

Gas reactions in the electric arc ; Process and apparatus for carrying out ——. A. J. Boult, London. From Dynamit-A.-G. vorm. A. Nobel und Co., Hamburg, Germany. Eng. Pat. 3342, Feb. 9, 1912.

See Ger. Pat. 242,210 of 1911 ; this J., 1912, 344.—T. F. B.

Furnaces ; Electric —— for producing gas reactions. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 21,478, Sept. 20, 1912. Under Int. Conv., Oct. 24, 1911.

See U.S. Pat. 1,029,886 of 1912 ; this J., 1912, 691.—T. F. B.

Furnace : Electric ——. J. M. Bocuze, Lyon, France. U.S. Pat. 1,053,563, Feb. 18, 1913.

See Fr. Pat. 435,493 of 1911 ; this J., 1912, 395.—T. F. B.

Galvanic cell. A. Heil, Frankfort, Germany, Assignor to C. H. and S. Stern, New York. U.S. Pats. 1,053,390 and 1,053,505, Feb. 18, 1913.

See Fr. Pat. 419,770 of 1910 ; this J., 1911, 221.—T. F. B.

Electrolysis of salt solutions ; Apparatus for the ——. J. Billiter, Vienna. U.S. Pat. 1,054,497, Feb. 25, 1913.

See Fr. Pat. 447,785 of 1912 ; this J., 1913, 241.—T. F. B.

Silica-glass electric appliance. H. A. Kent, Bound's Green, and H. G. Lacell, Finchley, Assignor to Silica Synd., Ltd., London. U.S. Pat. 1,054,647, Feb. 25, 1913.

See Eng. Pat. 24,482 of 1911 ; this J., 1912, 924.—T. F. B.

Appartaus for bleaching and for preparing [electrolytic] bleaching, deodorising, and disinfecting solutions. Eng. Pat. 15,321. *See* VII.

Process for dehydrating fats, oils, hydrocarbons, and similar liquids. Ger. Pat. 254,025. *See* XII.

XII.—FATS ; OILS ; WAXES.

Copra ; Analysis of ——. L. Allen and M. Auerbach. Chem.-Zeit., 1913, 37, 250—251.

Results in close agreement with those given by the official method of the German Oil-Millers' Association (this J., 1911, 964) may be obtained much more rapidly by the use of the extraction apparatus devised by the authors for the determination of tannin (Chem.-Zeit., 1911, 576). Ten grms. of the finely divided copra are extracted overnight with cold petroleum spirit in a cartridge in this apparatus, and the extraction completed by heating the flask for 2 hours on a water-bath at 75° C. Finally the residue is rapidly dried, mixed with sand and once more extracted for an hour. For ordinary purposes this final extraction may be omitted, and an addition of 0·5 per cent. made to the result as a correction. Objection is taken to the method of Hoepfner and Burmeister (this J., 1912, 396) on the grounds that the ether will extract non-fatty substances, and that measurement of an aliquot portion of the ethereal extract may cause considerable error if a slight fluctuation of temperature occur.—C. A. M.

Oil-seeds of Ximenia americana, L. F. Schröder. Arbb. Kais. Gesundh.-Amt, 1912, **43**, 454—474. Chem. Zentr., 1913, **1**, 940—942.

The seeds contain : water, 2·99 ; fat, 66·07 ; protein, 15·25 ; "crude fibre," 3·04 ; mineral matter, 2·19 ; and non-nitrogenous extractives, 10·46 per cent. Ether, benzene, chloroform, or carbon bisulphide remove from the seed kernels, in addition to the oil, about 1 per cent. of a substance, insoluble in acetone and alcohol, which has physical properties similar to those of rubber. The substance is free from nitrogen and sulphur, but appears to contain 3·19 per cent. of oxygen in addition to carbon and hydrogen. The yellow oil becomes pasty at 8° C. and solid at about 4° C. Its characters vary somewhat according to the mode of extraction (by pressing or by extraction with ether or acetone):—sp. gr. at 15° C., 0·9187—0·9220 ; refractive index at 40° C., 1·4677—1·4687; m. pt. 18°—22° C. ; viscosity (Engler), 19—37 at 25°, 11·5—22·9 at 35°, 6·6—11·3 at 50° C. ; acid value, 10·5—12·0 ; saponif. value, 173—177 ; ester value, 161·4—165 ; iodine value, 80·3—85·05 ; Hehner value, 93·86—94·83 ; Reichert-Meissl value, 1·61—2·45 ; Polenske value, 0·12—0·21 ; unsaponifiable matter, 0·46—0·55 per cent. The fatty acids obtained according to Hehner's method contained about 75 per cent. of liquid acids, and arachidic acid appeared to be present : m. pt. 49·5°—50° C. ; solidif. pt., 44°—45° C. ; iodine value, 71·01 ; neutralisation number of total fatty acids, 180·2—184·4 ; mean molecular weight, 304·6—311·6. The press-residue left after separating the oil, assuming a fat content therein of (1) 10 or (2) 5 per cent., contained : water, 6·85, 7·23 ; protein, 39·27, 41·45 ; non-nitrogenous extractives, 29·67, 31·31 ; "crude fibre," 8·4, 8·86 ; and ash, 5·82, 6·13 per cent. —A. S.

Fats ; Fusion of natural ——. H. Le Chatelier and Mlle. Cavaignac. Comptes rend., 1913, **156**, 589—594.

From an investigation carried out with "végétaline" (a cocoanut oil preparation) and stearin the authors conclude that the change of state of fats at their melting point is strictly reversible, as in the case of chemical compounds generally, but is characterised by extreme slowness. It was found possible to determine the temperature of this reversible transformation (with a possible error of about 0·1° C.), by maintaining a number of glass tubes containing the partly melted material, at different temperatures very near to that of fusion, and noting at which temperatures further fusion and at which further solidification occurred. In some cases no change was observed for several days. The temperature thus determined was that of incipient fusion or complete solidification ; the temperature of complete fusion was, in the case of "végétaline," about 3° C. lower, for this substance is a mixture, and after repeated fusion and solidification it loses its homogeneous character and undergoes a kind of liquation. A sample, maintained for 8 days in a state of partial fusion, was pressed ; the point of fusion of the solid portion was only 1°—2° C. higher than that of the original material. Admixture of one fat with another, appears therefore to affect the melting point to only a relatively small extent. The melting point of fats, determined rapidly in the ordinary way, does not as a rule differ by more than 1° C. from the temperature of the reversible change of state (found as above), but the solidifying point may vary to a much greater extent according to the rate of cooling and the absence or presence of solid particles of the substance.—J. H. L.

Osmium dioxide as hydrogen carrier. [Hydrogenation of unsaturated oils, etc.] F. Lehmann. Arch. Pharm., 1913, 251, 152—153.

The author finds that hydrogenation of oils or unsaturated acids can be readily effected by passing a stream of hydrogen into the oil which has been previously mixed with a small quantity of osmium tetroxide, the mixture is either heated until white vapours appear (before passing hydrogen) or is gently heated during the passage of hydrogen. The osmium dioxide formed from the tetroxide frequently forms a colloidal solution and can be recovered by treatment with animal charcoal. In one experiment 10 grms. of olive oil with 0·05 grm. of osmium tetroxide yielded a fat of m.p. 39° C. after passing hydrogen through the heated oil for 1½ hours. As it is unnecessary to apply the hydrogen under pressure, the reaction is suitable for lecture demonstration of the hydrogenation of oils. —R. G. P.

Lubricating greases; Determination of soaps in ——. J. Marcusson. Chem. Rev. Fett Ind., 1913, **20**, 43—45.

The following gravimetric method is simpler and more generally applicable than the usual volumetric method in which the proportion of soap is calculated from the amounts of free and combined fatty acids. It is based upon the facts that the soaps found in lubricating greases are only very sparingly soluble in acetone, whilst they may be subsequently separated from inorganic substances by treatment with a mixture of benzene and alcohol (9 : 1). Ten grms. of the grease are digested for several hours with 100 c.c. of cold freshly-distilled acetone in an Erlenmeyer flask, the mixture being meanwhile frequently broken up with a glass rod until the insoluble constituents are in a fine state of division. The liquid is then filtered, and the insoluble residue of soaps and inorganic matter washed with acetone and boiled for a short time with the mixture of benzene and alcohol. The hot solution is filtered, the filtrate evaporated, and the residue of soaps dried at 105° C. until constant in weight. Some greases are prepared from very viscous fats which do not dissolve very readily in acetone; in such cases the last traces of fat may be removed by washing the insoluble residue with a mixture of acetone and petroleum spirit of b. pt. 50° C. (3 : 1). By heating the separated soaps with 50 per cent. alcohol, alkali soaps are dissolved, whilst calcium or aluminium soaps remain undissolved and may thus be quantitatively determined. When pitch-like distillation residues are present the method is not applicable, since they are only partially soluble in acetone, but like the soaps dissolve readily in benzene-alcohol. Such greases, however, are very inferior and not of common occurrence. In some cases the results of the acetone method are somewhat higher than those obtained by the volumetric method. This is probably due to the fact that the fatty oils used for these greases frequently contain considerable quantities of fatty acids soluble in water which escape determination in the volumetric method. As a rule the amount of soap dissolved by the acetone is insignificant and a correction unnecessary, but when calcium resinate is present its solubility must be taken into account. The amount dissolved by the acetone is then found by determining the ash and calculating the corresponding quantity of resin acids of mean molecular weight 300. The oily constituents dissolved by the acetone may include petroleum oil, rosin oil, tar oil, fatty oils and glycerin, the last of which usually separates as a viscous layer beneath the oils.—C. A. M.

Solubility of salicylic acid in fatty oils. Engfeldt. *See* XX.

Patents.

Fats, oils, hydrocarbons, and similar liquids; Process for dehydrating ——. K. Hering. Ger. Pat. 254,025, June 16, 1911.

The oil, etc., is dehydrated by circulating it through a coiled pipe heated by means of steam. The temperature is kept constant by varying the steam pressure and the speed of circulation of the oil, and the vapours evolved are led to a condenser, in order that the process may be controlled by measuring the condensed water. The process may be used for the removal of water from electrical coils, windings, transformers, etc., these being immersed in a hot oil bath, and the oil dehydrated as described.—A.S.

Saponin; Process for preparing stainless solutions containing ——. R. Mandelbaum, and A. Kauffmann und Co, Asperg, Germany. Eng. Pat. 8704, June 27, 1912.

See Fr. Pat. 442,294 of 1912; this J., 1912, 936.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

[*Turpentine, etc.*] *Naval stores; Possibilities of Western* (*U.S.A.*) *pines as a source of* ——. H. S. Betts. U.S. Dept. Agric., Forest Service, Bull. 116, Oct. 22, 1912.

The investigation was made to ascertain the yield and quality of the oleoresin obtainable from the pines of the Western States (U.S.A.) by the methods employed in the turpentine-producing districts of Florida. The tests were conducted within various experimental areas in Arizona, California and Colorado and the following results were obtained:—

Arizona. Western yellow pine (*P. ponderosa scopulorum*). 783 trees tapped. 1500 cups employed. Experimental period 24 weeks. The average yield of crude oleoresin ("dip") was 0·217 lb. per week per cup, or about four-fifths of that obtained in Florida (from *P. palustris* and *P. heterophylla*); on the basis of the whole season, however, the yield was only about two-thirds of that from the Florida pines, the season in the latter state extending over 30—35 weeks as against 24—26 weeks in Arizona. In composition the oleoresin was similar to the Florida product; from the pure "dip," free from water and chips, the average percentages of rosin and volatile oil (turpentine) obtained were 77·9 and 22·1, respectively. The volatile oil consisted of pinene with a small proportion of a higher boiling terpene not present in ordinary American turpentine.

California. Western yellow pine (*P. ponderosa scopulorum*). 410 trees tapped. 986 cups employed. Experimental period 16 weeks. The average yield of crude oleoresin was 0·281 lb. per week per cup, which, in the author's opinion, would have been lower had the experiments been commenced earlier in the season. (The average yield from the Florida pines was 0·263 lb. per week per cup.) From the pure "dip," free from water and chips, the percentages of rosin and volatile oil obtained were about 81—83 and 19—17, respectively. Although containing a constituent not present in ordinary American turpentine and considerably less pinene than the latter, it is considered probable that Californian turpentine will prove of commercial value. The Californian season (period of flow of the oleoresin) is probably longer than that of Arizona.

Colorado. (*a*) Piñon (*P. edulis*). 95 trees tapped. 123 cups employed. Experimental period 20 weeks. The average yield of crude oleoresin was 0·147 lb. per week per cup. From the pure "dip," free from water and chips, the average percentages of rosin and volatile oil obtained were 78·4 and 20·6, respectively. Although consisting mainly of pinene, the volatile oil contained another constituent having quite different physical properties; but it is considered probable that the turpentine could be used for industrial purposes. (*b*) Western yellow pine (*P. ponderosa scopulorum*). (i.) Montezuma area: 68 trees tapped. 125 cups employed. Experimental period 20 weeks. Average yield of crude oleoresin 0·188 lb. per week per cup. (ii.) San Juan area: 62 trees tapped. 125 cups employed. Experimental period 20 weeks. Average yield of crude oleoresin 0·127 lb. per week per cup.

In conclusion the problems confronting commercial development are briefly outlined and discussed, the author being of opinion that, in time, the pines of the Western States will be utilised for the production of turpentine.—W. E. F. P.

Patents.

Antimony cinnabar; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,355, June 19, 1912

A good yield of antimony cinnabar (Sb_2S_3) is obtained by treating antimony solutions with thiosulphates in the presence of "acid-binding agents," such as hydroxides or carbonates of alkali and alkaline-earth metals; thus 1500 parts of antimony trichloride solution (sp. gr. 1·36) and 815 parts of caustic soda solution (sp. gr. 1·236) are stirred into a solution of 800 parts of crystallised sodium thiosulphate dissolved in 2600 parts of water, the stirring being continued for 2—3 hours at 50°—60° C., with the production of 90—95 per cent. of the theoretical yield of brilliant red antimony sesquisulphide.—O. R.

Sheet: Thin leaflike —— and method of making same. C. J. Healy, New York, Assignor to C. Brueckner, Brooklyn, N.Y., and J. Hamilton, East Orange, N.J. U.S. Pat. 1,051,953, Feb. 4, 1913.

The process consists in depriving a resinous substance of its soft, readily saponifiable part, adding an oil and colouring matter to the resinous residue, and forming the material into a thin, leaflike sheet.—H. H.

Varnish: Manufacture of ——. H. Schlueter and C. Zimmermann, jun., Assignors to New Process Varnish Co., New York. U.S. Pat. 1,053,652, Feb. 18, 1913.

The varnish comprises a resinous compound or a "nitro-sulpho-resinous compound," mixed with a concentrated "saccharic syrup" or "carbolised saccharine syrup," and diluted with a "nitro-sulpho-seed-oil solvent."
—E. W. L.

Product from which red lead can be burnt; Process for the manufacture of a ——. G Jansen, Dusseldorf, Germany. U.S. Pat. 1,052,924, Feb. 11, 1913.

See Fr. Pat. 439,287 of 1912; this J., 1912, 732.—T. F. B.

Varnishes and methods of making same. L. H. Baekeland, Yonkers, U.S.A. Eng. Pats. 6293 and 6294, March 13, 1912. Under Int. Conv., March 14, 1911.

See U.S. Pats. 1,037,719 and 1,018,385 of 1912; this J., 1912, 939. 347.—T. F. B

Plastic phenolic condensation product. J. W. Aylsworth, East Orange, N.J. Reissue No. 13,531, Feb. 11, 1913, of U.S. Pat. 1,046,137, Dec. 3, 1912.

See Fr. Pat. 429,292 of 1911; this J., 1911, 1267.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Cause of tackiness in ——. A. V. Rossem. Caoutchouc et Guttapercha, 1913, 10, 6961—6970.

Gorter has put forward a theory that rubber becomes tacky owing to infection (analogous to the so-called tin "pest") and that good rubber is the unstable modification. This was supported by an experiment in which a solution of rubber was mixed with a solution of rubber which had been exposed to light. On keeping the mixture under a red bell jar the viscosity fell. The author finds that on keeping solutions of rubber which have or have not been exposed to light (thus lowering the viscosity). or mixtures of exposed and unexposed solution, the viscosity does not fall in the dark, but that the viscosity does fall in subdued daylight. Thus Gorter's theory is not supported and his results are probably due to fall of viscosity through the light passing through the red bell jar and not to "infection."
H. E. P.

Rubber- and guttapercha resins. G. H. Hillen. Arch. Pharm., 1913 **251**, 94—121.

Jelutong or Pontianac rubber (*Dyera costulata.* Hook). (See also this J., 1908, 1123; 1912, 35). The resin was extracted by acetone containing a little benzene and was a yellowish white crystalline powder, which was found to consist of lupeol acetate, α- and β-amyrin acetate, and a resene (compare this J., 1910, 100). Tables are given showing the colour reactions of the different substances isolated when submitted to the Liebermann and Hesse-Salkowski tests. *Manihot Glaziovii* (*Leua*) *rubber*, from German East Africa, contained 7 per cent. of resins, which were found to consist of isocholesteryl acetate, a difficultly soluble green amorphous substance and a dark green balsam-like resinous substance. The resins yielded negative results when tested by the Liebermann and Hesse-Salkowski tests. *Guayule rubber.* The specimen of rubber examined had been specially prepared and only contained 16 per cent. of resins (24—30 per cent. is usually present). The resins were found to contain no phytosterols and to differ in character from all the other rubber resins: the authors were unable to ascertain the nature of the constituents but consider it possible that the resins consist principally of essential oil (compare this J., 1911, 1223) which had undergone resinification. *Determination of the resin-content of commercial rubbers and examination of the resins for phytosterol-like substances.* The resins were extracted by acetone, dried and weighed; the residue was then treated with ether-alcohol, the ether evaporated, the solution allowed to crystallise, and the crystals examined microscopically and by the Liebermann and Hesse-Salkowski tests. A table is given showing the percentage of resins in a number of commercial rubbers, their microscopic appearance and colour reactions in the above-mentioned tests. The resin contents of the rubbers examined were as follow: Fine Para rubber from the Amazon, 2·1; Mangabeira (*Hancornia speciosa*) rubber from Bahia, 7·04; Landolphia (*L. comorensis* var. *florida*) rubber from German Camerun, 14·28; vine (*Willoughbeia firma*) rubber from Malaya, 6·4; good Java rubber (*Ficus?*), 33·64; West Indian scrap (*Castilloa elastica*), 7·9; Kickxia (*K. elastica*) rubber from Ger. E. Africa, 8·8; Congo root rubber (*Carpodinus*), 5; Almeidina potato rubber (*Euphorbia ripsaloides*), 79·8 per cent. "*Malabuwai*" (*Alstonia grandiflora*) *guttapercha.* Derived from Pangalang (Metavi Islands). The material was almost entirely soluble in alcohol (10 per cent. of insoluble matter) and was found to contain α- and β-amyrin acetate, traces of a yellow resene, and an oily substance similar to that found by previous investigators in Chicle gum. *Guttapercha.* Derived probably from small plantations of *Palaquium Gutta* grown in German New Guinea. The resins were found to consist principally of lupeol cinnamate and an oily substance resembling that already found in Chicle gum (cf. this J., 1912, 140) together with a smaller amount of resene, and therefore differ in composition from other guttapercha resins.—R. G. P.

Airship envelope fabric. See V.

Patents.

Caoutchouc, gutta-percha, and balata; Process for the separation of —— from the milky juices containing them. H. Colloseus, Berlin. Eng. Pat. 22,255, Sept. 30, 1912.

The invention has for its object the precipitation of the albuminous substances (together with the rubber, etc.) in latices in a form in which they will not be subject to decomposition, but will keep permanently. This object is attained by first converting the albuminous substances into compounds soluble in water, by the addition of an alkali to the latex, subsequently precipitating them by the addition of salts of the alkaline earths, of the earths, or of the heavy metals. In order to promote a fine subdivision the latices may be mixed with an emulsifier (such as soap, albuminous substances, and the like) before, during, or after the addition of the alkali or the precipitants. A bleaching agent (such as zinc dust) may also be added at any stage of the process, and the precipitation of the rubber, guttapercha or balata may be effected (in conjunction with the precipitation of the albuminous substances) in presence of an antiseptic such as creosote, formalin, phenol, etc.—E. W. L.

Rubber; Process of treating —— and product of the same. H. O. Chute, Cleveland, Ohio. U.S. Pat. 1,051,987, Feb. 4, 1913.

Low-grade rubber, *e.g.* Pontianac rubber, from which the resin has been removed by treatment with a neutral volatile solvent, is macerated with crude pyroligneous acid in which are dissolved the oily products resulting from the destructive distillation of wood, such liquid being one in which the rubber itself is practically insoluble.—W. P. S.

Vulcanised rubber ; Process for the production of a substance to take the place of ordinary ——. F. C. Schneider, R. Reinecke, and E. Knoll, Meiningen, Germany. Eng. Pat. 3312, Feb. 9, 1912.

See Fr. Pat. 439,570 of 1912 ; this J., 1912, 735.—T. F. B.

Rubber or the like ; Process for treating worn or waste —— *for the utilisation thereof.* W. E. W. Richards, Assignor to The Bourne Rubber Co., Ltd., London. U.S. Pat. 1,053,439, Feb. 18, 1913.

See Eng. Pat. 28,489 of 1910 ; this J., 1912, 399.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Cellulose-extract. W. Eitner. Gerber, 1913, **39**, 43—45, 57—59.

Practical tests of cellulose-extract have established the fact that it is not an actual tanning material and has not the property of converting hide into a commercial leather. Hide treated with cellulose-extract cannot be reconverted to raw skin by simple washing : a colouration is produced completely through the skin and, when dried out, the skin is less transparent than is raw hide, but as hard and stiff as the latter. A rational analysis of cellulose-extract should consist in estimating its total solid matter and mineral matter. From the former an estimate of its value as a filling material can be made, and from the latter an idea of how far it has been purified from materials injurious to the leather. The cellulose-extracts formerly on the market contained 50 per cent. of solid matter and 5—8 per cent. of mineral matter, resembling in this respect sulphited quebracho extracts. The use of cellulose-extract as an adulterant of tanning extracts has reached large dimensions. Cellulose-extract is added to other extracts not only to lessen the cost but also because it confers a better appearance on an inferior extract and improves its solubility. Beside the aniline hydrochloride reaction for cellulose-extract (this J., 1909, 293), its presence may be detected by the proportion between "matter absorbed by hide" and "non-absorbed," which in the case of this material is about 1 : 0·82. For some other extracts the proportion is as follows :—Quebracho extract 1 : 10, oak-wood extract 1 : 2·3, chestnut-wood extract 1 : 3·0, and myrobalans, 1 : 2·5. The high ash-content of cellulose-extract (up to 9 per cent.) is also found in some strongly sulphited tannin extracts, so a high percentage of ash need not necessarily imply its presence. Yocum has shown that by admixture of cellulose-extract with tanning extracts a loss of tannin occurs which increases as the proportion of the former is increased. Liquid quebracho extract furnishes an exception to this statement, the tannin-content being slightly increased ; solid quebracho extract loses 4 per cent. of tannin, catechu 7 per cent., and chestnut extract 6 per cent. The author has shown that by treating the residue, obtained after allowing a solution of Argentine extract to settle, with sulphite liquor of 7° B. (sp. gr. 1·051) an increase of 3 per cent. of matter absorbed by hide in the extract is obtained. Grasser has shown that by treatment of already tanned leather with sulphite-cellulose, a dark colouration is produced in the liquor, caused by the removal of tannin or colouring matter from the leather, while the colour of the leather is improved. By treatment with sulphite-cellulose liquor, only the "difficultly soluble" and not the "insoluble" portions of quebracho extract are brought into solution. This solution cannot be ascribed to the sulphites in the cellulose liquor, as the purified extract has also the solvent action. The explanation probably lies in the fact that the difficultly soluble tannins dissolve more readily in a tannin solution than in water. As a filling and weighting material the cellulose-liquor is applied either like glucose to the tanned and struck-out leather or the dried or well-pressed leather is hung in a strong solution. The liquor penetrates and fills the leather more quickly in the latter way than does a tannin solution which is usually employed for that purpose, but for that reason it does not add much weight to the leather. Cellulose-extract may be incorporated with leather in much larger quantities than can a tanning extract, but a limit is reached at which the leather becomes brittle. The high solubility of cellulose-extract may cause stains to appear on the leather which has been treated with it, and of which the surface has been washed with water to improve the colour, the extract dissolving from the centre of the leather and not merely from the surface. The brittleness of leather heavily loaded with cellulose-extract may be lessened by incorporating the latter with a fatty material in a fine state of division, the acid oleates being the most suitable fats. The fat may cause a darkening of the colour of the leather, and must be removed from the surface by treatment with soda and acids. The use of cellulose-extract during the actual tanning process presents greater difficulties. The author has shown that the addition of the extract to the liquors, making the density greater, considerably hastens their tanning action. The rate of diffusion is increased by the increase in their density, and the penetration of tannin to the interior of the hide is hastened without any objectionable consequences such as drawn grain. Attempts have been made to produce the same effect by adding neutral salts, such as sodium chloride and potassium sulphate, to the liquors, but these have the disadvantage that tannin is precipitated by them from the liquors. The addition of cellulose-extract to other extracts, where it would improve them, should be made in the hot condition, and 20 per cent. should be sufficient to produce the best results. By the addition of 20—30 per cent. of cellulose-extract 2—5 per cent. of otherwise wasted tannin is brought into use, and 20 per cent. of the time necessary for the tanning process is saved. It will be found that cellulose-extract must become much cheaper than at present, if it is to find a use in this connection.—D. J. L.

Patents.

Leather ; Method of and apparatus for treating tanned sole ——. T. H. Ramsden, Bramhope, Yorks. Eng. Pat. 8974, April 16, 1912.

Cleaned, dried, or partially dried butts, bends, or pieces of leather are impregnated with boiled linseed oil, or other like drying oil, by passing such leather between rotating rollers adapted to feed the liquor to the flesh side and simultaneously force it into the body of the leather ; the leather is passed between the rollers at intervals until the desired amount of impregnating liquor is incorporated. The apparatus employed consists of two superposed rollers, the lower of which is partially immersed in a trough containing the impregnating liquor.—E. W. L.

Gelatin, glue, or the like ; Treatment of shreds or cuttings of hides for the manufacture of ——. M. Fischel, Vienna. Eng. Pat. 12,165, May 22, 1912. Under Int. Conv., May 22, 1911.

The shreds and cuttings of hides, which have previously been treated with milk of lime for the purpose of removing hair, are treated in a bath of some suitable dilute acid, preferably hydrochloric acid, before the final treatment in milk of lime. By this means the calcium carbonate which has become deposited on the material subsequent to the first liming is removed and the pores of the skin are opened, so that the lime in the final treatment, before the conversion into gelatin, can penetrate efficiently.—D. J. L.

Vegetable extracts containing tanning substances ; Process of decolorising ——. W. Hildt, Warsaw, Russia. U.S. Pat. 1,053,034, Feb. 11, 1913.

See Eng. Pat. 18,436 of 1912 ; this J., 1912, 1193.—T. F. B.

Manufacture of paper, boards, imitation leather, or material for packing, insulating, etc. Eng. Pat. 4332. *See* V.

XVI.—SOILS; FERTILISERS.

Nitrogenous soil constituents and their bearing on plant fertility. O. Schreiner and J. J. Skinner. U.S. Dept. Agric., Bureau of Soils, Bull. No. 87, Dec. 17, 1912, pp. 84 (see also this J., 1911, 40, 1078 and 1912, 292).

The investigations of the Bureau of Soils (U.S.A.) laboratory have led to the isolation from soils of a number of organic nitrogen compounds. The effect of these compounds together with a number of others on wheat seedlings has been studied. The culture solutions contained a very great variety of combinations of the ordinary fertilisers (nitrate, phosphate and potash). In each case the solution was changed after three days and subjected to analytical investigation. Amongst the soil constituents nucleic acid, hypoxanthine, xanthine, guanine, creatinine, creatine, histidine, and arginine were distinctly beneficial, choline slightly beneficial, and picolinecarboxylic acid distinctly harmful. The data with regard to the other organic substances are contained in comprehensive tables. Of the above list of beneficial soil constituents, all the members cause a pronounced increase in growth with solution cultures containing only phosphate and potash. The effect is less marked in the presence of nitrates, but it can be shown that under these conditions less nitrate is used by the plant. These soil compounds can therefore replace nitrates although the chemical control showed no decomposition of the compounds to ammonia, nitrite or nitrate. On the contrary it is highly probable that the organic substances are absorbed by the plant as such, entering the cell and producing a beneficial or detrimental reaction with the protoplasm. The authors believe that the beneficial soil constituents, which are all protein degradation products or decomposition products of nucleic acid, are directly used in building up plant protein. Of substances which have not yet been recognised as soil constituents, guanidine is specially interesting. It has a harmful effect similar to that produced by some plant diseases. The leaves assume bleached spots, wilt and finally collapse. This effect is accentuated by the presence of nitrates. The authors emphasise the importance of considering the balance between harmful and injurious organic substances and its variation with tillage, etc., and not merely the effect of the mineral components, in the study of soil fertility.—W. H. P.

Soil catalysis; Studies in ——. M. X. Sullivan and F. R. Reid. U.S. Dept. Agric., Bureau of Soils, Bull. No. 86, Sept. 19, 1912, pp. 31.

The catalytic power of soils is measured by the rate of evolution of oxygen from neutral hydrogen peroxide. The power is greater in soil than in subsoils, and is on the whole greatest in strong vital soils. Good production is not an essential consequence of strong catalytic power, but the possession of the latter may be taken as *à priori* evidence of productivity. There seems to be a certain amount of association between oxidising and catalysing power, although the relationship is not very clear. The fertiliser treatment which gives best growth does not necessarily give the greatest catalytic effect to a soil. The catalytic power is checked to some extent by carbon bisulphide, mercuric chloride and especially by hydrocyanic acid. Heating to 105° C. for one hour produces little change, though heating in an autoclave to 10 atmospheres retards the catalytic effect. It does not appear that the action is due to the presence of catalase but rather that inorganic and organic soil components may be acting separately, conjointly, or in activating combination. —W. H. P.

Soil solutions; Colloids in ——. Formation of soda in soils. Alkali- and salt-soils. K. Gedroiz. Russ. J. Exp. Landwirts., 1912, 13, 421. Biedermann's Zentr., 1913, 42, 76—79.

By the dialysis of soil solutions from different soils the amount of colloids was found to vary from 0·0200 to 0·0018 grm. per 100 grms. of soil, with the exception of alkali soils, the solutions from which contained up to 0·0591 grm. The author considers that the coagulation of the minute quantities of colloids in other than alkali soils is insufficient to cause alteration of the physical state of the soil, but that the larger amount of colloids in alkali soils may do so. The residue of the dialysed soil solutions from alkali soils consisted of silicic acid, and aluminium and iron oxides.

From experiments on water extracts of different soils the author finds that (1) in alkali soils (almost free from chlorides or sulphates) the soda is more slowly extracted than it would be if it originally existed as such in the soil; (2) in alkali soils rich in sodium sulphate, the soda decreases in proportion to the washing out of the sodium sulphate; (3) in salt soils (almost free from sodium sulphate), alkalinity first appears after washing out part of the salt and increases in proportion to its removal. From these results and from other experiments it is stated that the formation of soda is not directly due to sodium chloride or sulphate but to humates and to silicates of sodium of the zeolite type, and further that sodium chloride and sulphate not only yield no soda in soils but even prevent its formation from organic and zeolite-like substances. The improvement of salt and alkali soils can be effected by irrigation and by Hilgard's method of application of gypsum.—R. G. P.

Nitrogenous fertilisers; Researches on the action of different ——. W. Schneidewind. Arbeiten der Deuts. Landwirtschaftsges., Heft 217. Biedermann's Zentr., 1913, 42, 101—110

Results of numerous trials (cf. this J., 1910, 1070) with sodium nitrate, calcium nitrate (Norwegian saltpetre), "Schlösingsaltpetre," calcium nitrite "*Ammoniaksalz*" (ammoniacal superphosphate), nitrolim (crude calcium cyanamide), urine and flesh meal upon different soils are given. The experiments were made with rye, wheat, oats, potatoes, and fodder and sugar beets, and include data as to the increase in crop caused by each fertiliser, its influence when used as an autumn or spring manure, the absorption and loss of nitrogen, etc. The different nitrate fertilisers were found to be approximately equal to Chili saltpetre, and taking 100 to represent the increase in crop caused by Chili saltpetre the following approximate figures were found in field trials: nitrolim 68, ammoniacal superphosphate 88, fleshmeal 86. Calcium nitrite in some cases gave good results and in others bad results.—R. G. P.

Calcium carbonate recovered from causticising plant; Agricultural value of ——. J. Hendrick. Brit. Assoc., Dundee, 1912. Sect. M.

Comparative trials have been made with the waste calcium carbonate from causticising plants and with burnt lime and ground limestone on land deficient in lime, and on which turnips were very subject to finger and toe disease. The waste calcium carbonate proved to be as efficacious, in regard to both increase of crop and diminution of finger and toe disease, as any other form of lime, and on the whole was superior to ground limestone.—A. S.

Patent.

Fertilisers. [Basic superphosphate.] A. T. Burbery, London. Eng. Pat. 3327, Feb. 9, 1912.

Superphosphate is heated above 825° C. at which temperature the calcium sulphate is decomposed, the sulphuric acid being driven off and free lime formed, so that the product is alkaline. Water is driven off also by the heating, so that the product is more concentrated than the original. Thus there is produced a basic superphosphate containing no free acid, a trace only of calcium sulphate, and about 40 per cent. of free lime.—J. H. J.

XVII.—SUGARS; STARCHES; GUMS.

Juice extraction; Question of the undetermined losses in [beet] ——. O. Claassen. Centralbl. f. Zuckerind., 1912, 21, 411—412.

In determining the sucrose content of the raw juice, after determining the specific gravity (Brix) it is usual to take 100 c.c. of the raw juice, make up to 110 c.c. with basic lead acetate, filter, and polarise; then the degree Brix being known, the percentage of sucrose is directly read from Schmitz' table. Several series of experiments carried out by three different workers have, however, shown that this so-called "volumetric" method does not give results agreeing with those found by the procedure adopted for the other products of the factory, namely, by transferring the normal sugar weight, or a multiple of it, to a 100 c.c. flask, defecating, making up to the mark, filtering, and polarising. Using raw and purified juices, originating from the ordinary diffusion process, and from the scalding modification, it was found that the difference may vary between 0·08 and 0·13 per cent. on the juice, which difference may be an important one in ascertaining the undetermined losses of manufacture. Until corrected tables for use in the "volumetric method" are available, the "gravimetric" method therefore should always be used in an accurate computation of the losses of manufacture.—J. P. O.

Gas development; A case of —— during [beetroot] diffusion. J. Mintz. Westnik Saccharnoi Promyschlenosti, 1912, Nos. 31—33; Z. Zuckerind. Böhm., 1913, **37**, 260—274.

In a Russian factory during the 1911—12 campaign a considerable formation of gas took place during diffusion, and this was so marked at times that the circulation of the juice through the cells of the battery was retarded, although working in the subsequent stages of manufacture remained uninfluenced. Bacteriological examination of the juices showed that in abnormal diffusion, bacteria and yeasts were unusually numerous and varied, and finally the origin of these was traced to the roots sliced and the water used, the former being infected with dry rot and insufficiently washed, and the latter being very impure and alkaline. From the cultures made it was impossible to isolate any single micro-organism capable of causing the phenomenon of gas formation under the conditions obtaining in the factory, and it is suggested that "the fermentation process taking place may be regarded as the result of a complicated symbiosis." Claassen (Deut. Zuckerind., 1912, Nos. 1 and 2) has stated that whether returning the waste waters is practised or not, there is no appreciable amount of sucrose decomposed during diffusion, and this statement is confirmed by the experiments of the author, since even with the very abnormal conditions under which diffusion was conducted, the undetermined losses of sucrose amounted only to a few hundredths of 1 per cent., calculated on the weight of roots sliced.—J.P.O.

Invert sugar; Volumetric use of titanous chloride for the determination of ——. L. Radlberger and W. Siegmund. Oesterr.-Ungar. Zeits. Zuckerind. u. Landw., 1913, **42**, 34—44. (Compare also this J., 1912, 351.)

Instead of weighing the cuprous oxide precipitated from Fehling's solution, as is usually done, the copper in the filtrate is determined volumetrically by means of titanous chloride solution. The titration is carried out in the presence of potassium thiocyanate, and a definite small amount of a ferric salt, the titanous chloride acting selectively, so that all the copper in solution is precipitated as cuprous thiocyanate before the ferric salt is reduced and the red colouration produced by it is discharged. For the preparation of the titanous chloride solution, 100 c.c. of the commercial liquid are boiled with an equal volume of concentrated sulphuric acid, cooled, and made up to 2000 c.c. To the copper solution under examination are added 4 c.c. of dilute sulphuric acid (sp. gr. 1·16), 20 c.c. of potassium thiocyanate solution (10 per cent.), and 0·5 c.c. of ferric chloride solution (1 c.c. corresponding to 0·2 c.c. of the titanous chloride solution); the titration is carried out in an atmosphere of carbon dioxide, and from the number of c.c. required to decolourise the solution is deducted 0·1 c.c., this being the correction due to the presence of the ferric chloride solution used as indicator. For the standardisation of the titanous chloride solution, 50 c.c. of Fehling's solution, the copper content of which has previously been established electrolytically, are diluted to 500 c.c., and 50 c.c. of this liquid used. In making a determination, Herzfeld's method is followed as far as separating the cuprous oxide, when the filtrate is caught in a 500 c.c. flask, cooled, made up to the mark, and 50 c.c. used for the copper determination. It is claimed that results are obtained more rapidly than by reducing the cuprous oxide and weighing, that the degree of accuracy is about the same as that of the gravimetric method; and that the method is particularly suitable for products containing fairly large amounts of invert sugar, such as fruit juices, jams, and cane sugars.—J. P. O.

Sugar-house work; Use of the refractometer in ——. Determination of dry substance. W. E. Cross. Louisiana Bull. No. 135, Dec., 1912, 5—16.

The refractometric method for determining the dry substance of all sugar-house products, juices, syrups, molasses, massecuites, and sugars, is reliable, and ensures higher accuracy as well as a greater simplicity of working than the older methods. For syrups and molasses the Abbé instrument is very satisfactory. Except with very dark low-grade samples, diluting is not necessary. If the molasses is too dark to read, and the use of a grain of "Blankit" (hydrosulphite) does not help matters, the sample should be dissolved in its own weight of fairly concentrated sugar solution (Tischtschenko's method). This is theoretically sounder than simple dilution, and the results obtained approximate more nearly to those in the undiluted sample. The Abbé instrument is reasonably accurate in determining the moisture in sugars (20 grms. of sugar dissolved in 20 grms. of water), but the immersion refractometer is more suitable. Stolle's method is to take the reading of a solution made by dissolving 20 grms. of sugar in water in a 100 c.c. flask, and making up to the mark. Tables are then referred to to find the moisture.—L. J. de W.

Sucrose in molasses; Modification of the Clerget method of determining ——. W. E. Cross and W. G. Taggart. Louisiana Bull. No. 135, Dec. 1912, 25—38.

In the methods of analysis of molasses in general use, no excess or at most a slight excess of lead is used for clarification and in this way frequently very imperfect clarification is obtained. Often an excess is employed of necessity, without means being taken to eliminate the error introduced. When, following Tervooren, a sufficiently large excess is used to give a maximum of clarification, the volume occupied by the lead precipitate is probably considerable. The authors eliminate the influence of the lead precipitate by adding an excess of dry lead subacetate to the half-normal molasses solution and, after filtering, removing the excess of lead by adding approximately the right amount of finely powdered oxalic acid. After filtration the well decolourised liquid, free from lead, is polarised, single and Clerget. It was found that too great an excess of lead should be avoided, as the Clerget result falls slightly after a certain excess has been reached. The use of small quantities of zinc dust in decolourising dark inverted solutions is recommended. In conjunction with the method advanced above, the factor for Clerget determination should be modified for varying concentrations of sucrose according to the tables given, and the single and invert readings should be taken at the same temperature.
—L. J. de W.

Glutamic acid and betaine hydrochloride from waste molasses; Preparation of ——. H. Stoltzenberg. Ber., 1913, **46**, 557—566. (See also this J., 1912, 788.)

Five kilos. of waste molasses (sp. gr. 1·42) were mixed with 3700 c.c. of concentrated hydrochloric acid, and saturated with hydrochloric acid gas. The salt mixture thrown down was pressed, ground in a mortar, mixed with 2 litres of absolute alcohol, and charged with hydrochloric acid gas to convert glutamic acid hydrochloride into the readily soluble ester hydrochloride. The liquid was next boiled for 2 hours under a reflux condenser, with frequent agitation, and afterwards cooled and filtered.

The residue was washed twice with alcohol, and the filtrate was heated to boiling with 2·5 litres of alcohol, filtered, decolourised completely with 120 grms. of charcoal, and evaporated *in vacuo* below 60° C. As soon as crystallisation started, the liquid was saturated with hydrochloric acid gas, and after several days the crystals were collected and dried in a vacuum desiccator over solid potassium hydroxide and soda-lime. A white product was obtained, which after solution in rather less than its own weight of hot water, and re-precipitation with hydrochloric acid gas, yielded more than 450 grms. of pure glutamic acid hydrochloride. The product appeared to have been partially racemised, for in 10 per cent. hydrochloric acid solution it showed $[\alpha]_D^{5} = +26{\cdot}1°$, whereas Siegfried and Schutt have obtained values as high as +34·89°. The dark brown filtrate from the first precipitation of glutamic acid was concentrated *in vacuo*, until crystallisation had set in, and was then well mixed with alcohol and left. On the following day 176·8 grms. of pure white betaine hydrochloride were obtained, and a further quantity of 8 grms. was isolated from the alcoholic filtrate. The author considers that Ehrlich's method of extracting betaine hydrochloride (see this J., 1912, 1001), is more troublesome to carry out than his own, and gives lower yields.—J. H. L.

Sugars; Synthesis of —— by radio-active emanations. J. Stoklasa, J. Sebor and V. Zdobnicky. Comptes rend., 1913, **156**, 646—648.

It has previously been shown (see this J., 1911, 300; 1912, 653) that under the influence of ultraviolet rays, sugars are formed by the interaction of nascent hydrogen and carbon dioxide in presence of potassium hydroxide. The authors have now found that a similar reaction occurs under the influence of radium. They succeeded in isolating 0·686 grm. (calculated as dextrose, from the cupric-reducing power) of a product which contained hexoses and pentoses and which yielded two osazones melting respectively at 198°—199° and 178° C. They state moreover that the product was dextrorotatory.—J. H. L.

The action of animal charcoal on cane sugar solutions. W. B. Clark. *See* Scottish Section, p. 262.

ERRATA.

Page 247, col. 1, line 2 from bottom, *for* " Fredo " *read* " Redo."

Page 247, col. 2, line 18 from top, *for* " Monoseal " *read* " Monoscal."

PATENTS.

[*Sugar*] *Defecation; Apparatus for* ——. A. Wedderburn, Vienna, Va., Assignor to Deming Apparatus Co., New York. U.S. Pat. 1,052,195, Feb. 4, 1913.

The defecating apparatus comprises a juice heater, a juice preheater, a vacuum chamber and a settling chamber, all connected by pipes, means to supply juice thereto and a valved by-pass between the heater and preheater, whereby a predetermined quantity of the juice may be passed through the preheater before entering the juice heater, and means for heating the preheater by vapours from the vacuum chamber. Also in apparatus for treating liquids having solids in suspension, a gas-eliminator is arranged comprising a closed tank with inlet and outlet for liquid and an outlet for fixed gases, means for maintaining a constant liquid level within the tank and a surface condenser located outside of and in operative connection with the tank.—J. F. B.

Syrup; Concentrating ——. J. H. Campbell, New York, and C. H. Campbell, Philadelphia, Pa. U.S. Pat. 1,053,784, Feb. 18, 1913.

The process for concentrating syrup consists in applying heat to the syrup and simultaneously passing air through it to effect a rapid concentration at a low temperature, the air being introduced in large streams under pressure, to avoid the formation of minute bubbles, and in a direction to give the mass a rolling motion to liberate the bubbles formed. The application of heat and the temperature of the air are so proportioned as to maintain the mass at a temperature below 160° F. (71° C.). The syrup is concentrated until it is reduced to about one-fourth of its original volume or until the mass is so thick as to render the action of the air inefficient; the thick mass is then drawn out into a film which is exposed to the action of currents of heated air until practically all the remaining moisture has been extracted.—J. F. B.

Concentration of solutions, particularly of sugar solutions, by freezing, displacement and evaporation; Process and apparatus for the ——. E. Monti. Fr. Pat. 447,379, Aug. 19, 1912. Under Int. Conv., Aug. 21, 1911.

The sugar solution coming direct from the diffusion battery is passed through a series of refrigerators after receiving a preliminary cooling in a heat-interchanging apparatus. The refrigerators consist of vessels in which corrugated drums, partially immersed and through which the brine or other cooling medium is circulated, are rotated. The ice crystals adhere to the surface of the drums and are removed. The separated and concentrated sugar solution is then treated with lime, carbonated and defecated and finally concentrated in special evaporators at a low temperature. The evaporators are heated by the hot water coming from the condensers of the refrigerating machine, which is passed through the jacket of the gas or oil motor or through the condenser of the steam engine before entering the concentrators.—W. H. C.

Adhesive [*starch*] *and method of making same.* A. A. Dunham, Bainbridge, N.Y., and H. V. Dunham, Velasco, Tex., Assignors to Casein Co. of America, New York. U.S. Pat. 1,053,719, Feb. 18, 1913.

An adhesive suitable for use in the coating of paper is produced by subjecting starch to the action of oxalic acid in solution, evaporating the solvent and neutralising the action of the oxalic acid by the addition of ammonia when the starch has been so far modified that it has, in admixture with water and a large proportion of mineral pigment, strong adhesive properties which make it suitable for application as a surface coating for paper. The modified starch, when mixed with 9 times its weight of water, neutralised with ammonia and heated to a temperature sufficient to break up its granules, should give a solution which at 100° F. (38° C.) will pass at the rate of 40—45 c.c. per half-minute through an orifice which will deliver 58 c.c. of water in the same time.—J. F. B.

Insoluble gums; Process for producing solutions of ——. E. Siefert-Schwab, Neunkirchen, Austria. Eng. Pat. 23,629, Oct. 16, 1912. Under Int. Conv., Nov. 23, 1911.

Certain insoluble gums, notably Indian gum tragacanth can only be dissolved in water by long boiling, whereby a deterioration takes place resulting in an undue thinning of the solution. According to this specification such gums, which possess an acid reaction, are dissolved by boiling in water to which has been added a non-oxidising body having an alkaline reaction. Example: 1 kilo. of caustic soda is dissolved in 100 litres of water in which 10 kilos. of comminuted Indian gum tragacanth is allowed to swell and the mixture is boiled until a solution is formed. Alternatively 1 kilo. of chalk may be used instead of the caustic soda.—J. F. B.

Sugar and by-products from sugar-cane; Process of making ——. G. W. and G. B. McMullen, Picton, Ont., Assignors to Simmons Sugar, Ltd. Reissue No. 13,527, Feb. 11, 1913, of U.S. Pat. 1,040,560, Oct. 8, 1912.

See Fr. Pat. 417,317 of 1910; this J., 1911, 43.—T. F. B.

[*Fermentation*] *saccharometers.* Eng. Pat. 26,696. *See* XXIII.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Action of free ammonia on ——. Comparison with other bases. Bokorny. Allgem. Brauer- u. Hopfen Zeit., 1912, No. 272. Z. Spiritusind., 1913, **36**, 117. (See also this J., 1913, 102.)

Free ammonia in aqueous solutions of more than 0·01 per cent. concentration prevents the germination of most seeds; at a concentration of 0·005 per cent. it kills algæ, and at a concentration of 0·05 per cent. it retards the growth of yeast in nutrient liquids. Yeast possesses the power of fixing chemically considerable quantities of ammonia (1/10 of the weight of yeast-substance), and it is quite possible for the fermentative power of pressed yeast to be impaired by storage in an atmosphere containing ammonia. Ammonium salts are less toxic than free ammonia. Phenylhydrazine is one of the strongest yeast poisons known, and hydrazine retards development at a concentration of 1 in 50,000. Potassium hydroxide in 0·05 per cent. solutions has no inhibitive action on the growth of yeast, and the concentration of this base necessary to prevent the germination of seeds is ten times as great as in the case of ammonia.—J. H. L.

Fermentation; Catalytic action of dead yeast cells on ——. E. Moufang. Woch. Brau., 1913, **30**, 113—116.

If yeast water, prepared by heating an aqueous suspension of yeast and then filtering, is added to fermenting wort, fermentation is not appreciably affected (see A. J. Brown, this J., 1890, 531), but if the yeast water contains a considerable quantity of dead cells, or if the latter are added alone, the course of fermentation is modified to a remarkable extent. (1) The velocity of fermentation is increased often to the extent of 50 per cent. or more, although the degree of final attenuation remains about the same as when dead cells are absent. (2) The quantity of assimilable nitrogen in the wort is increased, probably owing to stimulation of the proteolytic activity of the living cells. (3) The wort becomes paler, and in some cases 30—50 per cent. of the colour is discharged. Worts and certain other liquids, such as oils, may be partially decolourised by simply shaking them with dead yeast cells. (4) The "break" of the wort is better, and the beer is more brilliant and less liable to become cloudy when chilled. The author's experiments were carried out with bottom fermentation yeast, but top yeast behaves similarly. The effects are more marked the greater the quantity of dead yeast added (the author used amounts corresponding to 0·1—1 grm. of dried substance per 100 c.c. of fermenting liquid), the higher the temperature of fermentation, and the higher the temperature to which the dead yeast has previously been heated. The stimulating influence of dead cells on the fermentative activity of living yeast may be exercised over a number of successive fermentations, and as this influence is exerted by samples which have been repeatedly extracted with hot water, the author considers that it cannot be due to substances which diffuse out of the dead cells, but must be ascribed to a catalytic action, possibly to a kind of emanation from the dead cells which is enhanced by rise of temperature owing to increased "dissociation" of the active substance.—J. H. L.

Lactic acid; Production of commercial fermentation —— from potato starch. W. Hoffmann. Z. Spiritusind., 1913, **36**, 71—72, 95. (See also Claflin, this J., 1897, 516; McLauchlan, this J., 1909, 734.)

The following is an outline of the process described:—The saccharification of the starch may be carried out in the fermentation vats or in special iron vessels provided with stirring gear and heating and cooling coils. The charge for a vessel of the latter kind, of 10,000 litres capacity, is 1200 kilos. of starch (80 per cent.) and 120 kilos. of malt. One-sixth of the malt is first mashed in, with the vessel half filled with water at 45° C. The whole of the starch is next added, with constant stirring, and the mash is heated to 70° C. in 30 mins. and maintained at this temperature until the starch is liquefied (15 mins.). After cooling to 56° C., the rest of the malt grist or crushed green malt is added and the mash kept stirred for 4 hours at 55°—56° C. until saccharification is complete. It is then heated to 80° C. and run, in two portions of 3000 litres, into two fermentation vats provided with stirring mechanism, and heating and cooling coils. The hot mash in each vat is treated with 225 kilos. of fine chalk, and after a time diluted with cold water until its maltose-content is 10 per cent. It is then brought to 50° C. and inoculated with a pure culture of the lactic acid bacillus (*e.g. Bac. Delbrücki*) which has been grown for 4 days in a similar mash in a pure culture apparatus. Recently the bacillus of Yoghourt (see Henneberg, this J., 1912, 454) has been suggested for the manufacture of lactic acid. During fermentation the liquid is kept at 47°—50° C. and roused for 15 mins. every 2 hours. It is necessary to ascertain that an excess of chalk is present throughout the fermentation, and the liquid should be examined microscopically from time to time. After 6—8 days, fermentation should be complete, and the liquid should not contain more than 2 grms. of maltose per litre. Determinations are made of the maltose-, lactic acid-, and volatile acid-contents of the liquid. If these tests have shown that fermentation is complete, the whole charge is rendered slightly alkaline with slaked lime, and the precipitate formed, which carries down various impurities, is allowed to subside. The clear liquid is drawn off, and together with that from the filtration of the sludge, is treated with sufficient pure sulphuric acid to decompose all the calcium lactate. The precipitated calcium sulphate is next removed by a filter-press, preferably made of wood. From this stage onwards the liquid should not come in contact with iron, and all pipes, etc., should be of copper or lead. The acid is mixed with charcoal before passing to the vacuum pan. It is concentrated at about 55° C. in a vacuum of 680 mm. to a density of 18°—19° Bé. or sp. gr. 1·142—1·152 (for acid of 50 per cent. by weight) or 25°—26° Bé. or sp. gr. 1·210—1·220 (for 80 per cent. acid). The duration of heating should be as short as possible to minimise the formation of lactic acid anhydride. From the vacuum pan the acid is run at once to a wooden vat provided with stirring mechanism and heating and cooling coils. Finely powdered potassium ferrocyanide is added until all the iron is precipitated, and any excess of the former is precipitated by addition of zinc sulphate. The cold liquid is stirred continuously for several days to allow separation of calcium sulphate and dextrin, and then warmed slightly, and filtered from the suspended charcoal, Prussian blue, and other impurities. Lactic acid of 50 per cent. by weight obtained by this process is a mobile liquid almost water-clear, and should not contain more than 1·5—1·8 per cent. of anhydride. Eighty per cent. acid is usually darker and more viscous, and may contain 3—4 per cent. of anhydride. This anhydride is a mono-basic acid ($CH_3·CHOH·COO·CH(CH_3)·COOH$) and neutralises only half as much alkali as the lactic acid from which it is formed. In strong solutions of lactic acid it is formed slowly even in the cold, but at great dilution, such as that of the lactic acid used for de-liming in tanning, it is reconverted into the free acid. Fermentation lactic acid possesses usually a characteristic odour, and contains small quantities of mineral matters, *e.g.* lead from pipes, or arsenic from impure sulphuric acid. For use in tanning and dyeing it must be free from iron and sulphuric acid. Various methods are in use for producing chemically pure lactic acid, *e.g.* by repeated crystallisation of calcium lactate and its subsequent decomposition by sulphuric acid, by conversion of calcium lactate into the zinc salt which is then decomposed by hydrogen sulphide, or by shaking the free acid for 24 hours with 3 vols. of ether and distillation of the filtered ethereal extract whereby a residue of the pure acid is obtained. The chemically pure acid of the (German) Pharmacopœia is produced by repeated extraction with ether and decolourisation with charcoal.—J. H. L.

Ethyl alcohol and its mixtures with water; Specific gravity and thermal expansion of ——. N. S. Osborne, E. C. McKelvy, and H. W. Bearce. Bull. Bureau of Standards, Vol. 9, Scient. Paper No. 197. J. Franklin Inst., 1913, **175**, 165—167.

Ethyl alcohol was prepared and purified by different methods until a product was obtained which could not be separated into fractions of different specific gravities. Alcohol dehydrated with metallic calcium had a somewhat higher specific gravity than that dehydrated with lime or aluminium amalgam. The mean specific gravity of fifteen of the purest specimens prepared was 0·78506 at 25° C. The specific gravities of twelve mixtures of alcohol and water were determined at 10°, 15°, 20°, 25°, 30°, 35°, and 40° C., respectively, by the method of hydrostatic weighing, and from the results the values of the coefficients for the following equation for computing the specific gravity at any temperature (t), between 10° and 40° C., from the specific gravity at 25° C.,

$$D_t = D_{25} + \alpha(t-25) + \beta(t-25)^2 + \gamma(t-25)^3,$$

were calculated.

These values are given in the following table :—

Per cent. of alcohol by weight.	Specific gravity at 25° C. grms./c.c.	$\alpha \times 10^7$.	$\beta \times 10^8$.	$\gamma \times 10^{10}$.
0·000*	0·997077	—2565	—484	+319
4·907	0·988317	—2684	—502	+311
9·984	0·980461	—3119	—484	+258
19·122	0·967648	—4526	—393	+180
22·918	0·962133	—5224	—331	+100
30·086	0·950529	—6431	—226	+ 47
39·988	0·931507	—7488	—145	— 4
49·961	0·909937	—8033	—128	— 24
59·976	0·887051	—8358	—121	— 24
70·012	0·863380	—8581	—117	— 9
80·036	0·839031	—8714	—108	— 69
90·037	0·813516	—8746	— 93	— 51
99·913	0·785337	—8593	— 57	— 62

* Water according to Chappuis.

By the aid of this table and the following one (based on determinations of the specific gravities of 25 different mixtures, partly by the method of hydrostatic weighing and partly by the use of special pycnometers) the specific gravity of any mixture of ethyl alcohol and water, at any temperature between 10° and 40° C., can be calculated.

Per cent. of alcohol by weight.	Sp. gr.* at 25° C. grms./c.c.	Per cent. of alcohol by weight.	Sp. gr. at 25° C.
0	0·997077	55	0·898502
2	0·993359	60	0·886990
5	0·988166	65	0·875269
6	0·986563	70	0·863399
10	0·980434	75	0·851336
15	0·973345	80	0·839114
20	0·966392	85	0·826596
25	0·958946	90	0·813622
30	0·950672	95	0·799912
35	0·941459	98	0·791170
40	0·931483	99	0·788135
45	0·920850	100	0·785058
50	0·909852	—	—

* These values are for mixtures saturated with air.

—A. S.

Alcohol ; Accurate determination of —— by means of permanganate, in very dilute solutions. H. P. Barendrecht. Z. anal. Chem., 1913, **52**, 167—172.

The proportion of alcohol in a few c.c. of a very dilute solution may be rapidly determined by its complete oxidation to carbon dioxide and water by means of alkaline permanganate. 100 c.c. of permanganate solution (39 grms. in 4 litres of water) are introduced into a Jena flask of about 700 c.c. capacity, 40 c.c. of sodium hydroxide solution (150 grms. in 1 litre of water) are added, and the mixture is heated to boiling ; 5 c.c. of the alcoholic liquor (without previous distillation, and diluted so as to contain about 0·2 per cent. of alcohol) are then rapidly introduced into the boiling liquid. After boiling for a minute, the flame is removed and 100 c.c. of oxalic acid solution (80 grms. in 4 litres of water) and then 40 c.c. of sulphuric acid (2 vols., sp. gr. 1·84, with 5 vols. of water) are added, and the solution is shaken, after which the excess of oxalic acid is at once titrated with permanganate (3·182 grms. of pure permanganate in 1 litre). Another 5 c.c. of the dilute alcohol are evaporated in a Jena glass dish on the water-bath, 5 c c of sucrose solution (1 grm in 250 c.c. of water) are added to the residue, and the above operations are repeated with the solution. 20 mgrms. of sucrose correspond to 28·05 c.c. of the permanganate solution used, and the weight (in mgrms.) of alcohol is obtained by multiplying A – (B – 28·05) by the factor 0·384, A and B being the number of c.c. of permanganate used in the respective titrations. The corresponding number of cb. mm. is calculated by using the alternative factor 0·483. Where the content in alcohol is very low, as compared with that of other organic substances present, the liquid may be distilled and the determination carried out on the distillate.—F. Sodn.

XIXa.—FOODS.

Flours ; The soluble nitrogenous matter as a factor in the valuation of ——. E. Rousseaux and M. Sirot. Comptes rend., 1913, **156**, 723—725.

It frequently happens that flours which appear quite normal when judged by the ordinary methods of analysis prove unsatisfactory in the bakery. The authors recommend that in addition to the usual determinations, the ratio of the total to the soluble nitrogenous matter should be determined. In 20 flours of good quality this ratio was almost constant at 5·72 ± 0·3, whilst in defective flours it was much smaller, falling in some cases to 1·15. A flour of good quality when stored under proper conditions gave practically the same results before and after storage, but when the conditions of storage were faulty, the value of the ratio fell from 6·02 to 4·00 in 3 months. Flours which gave normal results by the ordinary methods of analysis, but proved unsatisfactory in the bakery, also gave low results for the ratio of total to soluble nitrogenous matter, viz., 5·00, 2·76, 4·05, 4·32 in different cases. It is stated that in all cases where the ratio was below 5·20, the flour proved unsatisfactory in the bakery. The total nitrogen was determined in the ordinary way by the Kjeldahl method, using 2 grms. of flour. The soluble nitrogen was determined by shaking 10 grms. of the flour with about 150 c.c. of water, heating on the water-bath for 2—5 minutes, with frequent agitation, cooling, making up to 200 c.c., filtering, and applying the Kjeldahl process to 50 c.c. of the filtrate (= 2·5 grms. of flour).—A. S.

Bread ; The staling of —— from the physico-chemical standpoint. J. R. Katz. Z. Elektrochem., 1913, **19**, 202—206.

The author advances the view that the change from fresh to stale bread is a reversible transformation, stale bread being the form stable at low temperatures (0°—25° C.) and fresh bread the stable form at higher temperatures (50°—100° C.). An exact transition point cannot be determined, but the change shows otherwise all the properties of such a transformation. Fresh bread can be preserved in liquid air on account of the very small velocity of transformation at low temperatures. The distinction between fresh and stale bread is easily made qualitatively, or by grinding up 10 grms. of the bread in water, bringing into a 250 c.c. flask and measuring the volume of the liquid when sedimentation is complete. Fresh bread has a much greater swelling power, and by this method a quantitative distinction may be made. On the basis of his experiments the author suggests that bread may be kept fresh, and night work in bakeries avoided, by storage either at 60°—100° C., or in a refrigerating chamber.

—W. H. P.

Lactose [milk sugar] ; Influence of ammonium sulphate in the polarimetric determination of ——. G. Jahnson-Blohm. Z. physiol. Chem., 1913, **83**, 441—443.

Salkowski (this J., 1912, 507) has proposed a method for the determination of milk sugar in which the milk is saturated with ammonium sulphate, diluted with a saturated solution of ammonium sulphate, filtered, and the filtrate examined in the polarimeter. Experiments of the author's have shown that under the prescribed conditions the rotatory power of lactose is slightly diminished in presence of ammonium sulphate, and in order to obtain exact results, a correction of 0·1 per cent. should be added to the percentage of lactose found by Salkowski's method. —A. S.

Peanut butter. W. R. Beattie. U.S. Dept. Agric., Bureau of Plant Ind., Circular No. 98, Oct. 14, 1912.

A brief account of the manufacture of peanut (earth nut) butter, a food product consisting of fresh-roasted peanuts, ground finely and flavoured by addition of salt. It is estimated that in 1911, approximately 1,000,000 bushels of the shelled nuts were used for the manufacture of peanut butter in the United States.—A. S.

Determination of lecithin in lecithin preparations, etc. Cohn. *See* XX.

Determination of malic and tartaric acids in the same solution. Dunbar. *See* XXIII.

Patents.

Food ; Process for preparing a Baby ——. M. Gawenda, née Bonk, Oppeln, Germany. Eng. Pat. 23,262, Oct. 11, 1912.

Rye flour is roasted in a suitable vessel with continuous stirring until it becomes light brown in colour ; the flour is then ground to a fine powder, passed through a sieve, cooled, and packed.—W. P. S.

Butter ; Method of determining the content of butter-fat in ——. R. H. Shaw, Washington, D.C. U.S. Pat. 1,052,098, Feb. 4, 1913. (Dedicated to the public.)

The butter is placed together with hot water in a vessel (similar in shape to a separating funnel), submitted to centrifugal action, and the aqueous portion is removed ; a hot mixture, consisting of equal parts of sulphuric acid and water, is now added to the contents of the vessel, and, after the acid liquid has been separated by centrifugal action and removed, the fat remaining in the vessel is weighed.—W. P. S.

Oils ; Manufacture of edible ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,052,469, Feb. 11, 1913.

An unsaturated oil is allowed to flow slowly through a rotating cylinder, inclined slightly from the horizontal, and containing a porous non-rigid bed of catalytic material, moving in a direction transverse to that of the stream of oil. A stream of hydrogen is passed at the same time in a counter direction through the catalytic material.—J. H. J.

Dried food products ; Process of and apparatus for manufacturing ——. M. Vouga. Neuchâtel, Switzerland. U.S. Pat. 1,054,650, Feb. 25, 1913.

See Fr. Pat. 441,490 of 1912 ; this J., 1912, 836.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

The Eighth Report of the Royal Commission on Sewage Disposal. H. T. Calvert. *See* Yorkshire Section, p. 265.

Patents.

Water softening apparatus. H. J. Fox, Forest Gate, Essex. Eng. Pat. 16,861, July 19, 1912.

The water is treated with definite quantities of lime and soda, solutions of these being contained in separate tanks provided with stirrers. The lime solution is conveyed to the tank containing the hard water by grooved plates or trays on a travelling band operated by connection with a water-wheel which is rotated by the inflowing current of hard water. The soda solution is delivered by means of a pipe and plunger, also operated by the water-wheel, and devices are provided for cleansing and flushing the plates or trays, and the pipe and plunger arrangement.—W. P. S.

Sewage purification. C. Imhoff, Essen-on-the-Ruhr, Germany. U.S. Pat. 1,053,396, Feb. 18, 1913.

The main portion of the sewage is treated first in a grit-separating and then in a sludge-separating chamber. Any excess of sewage is diverted to the storm-water chamber, where a portion of the water is removed and the concentrated sewage remaining is then treated in the grit- and sludge-separating chambers.—W. H. C.

Disinfectants ; Processes for the production of ——. P. Flemming, Hamburg, Germany. Eng. Pat. 4838, Feb. 27, 1912.

The sodium and potassium salts of cresols and of *p*-chloro-*m*-cresol described in Eng. Pats. 9953 of 1904 and 21,203 of 1911 (this J., 1905, 345 ; 1912, 379) are mixed with fats or oils, water or alcohol being also added, and the mixtures are allowed to stand at the ordinary temperature to yield a homogeneous liquid which is soluble in water.—W. P. S.

Filtration of water or other fluids. R. N. Lennox, Chiswick. Eng. Pat. 28,809 of 1911, date of Appl., June 21, 1912.

See Fr. Pat. 445,368 of 1912 ; this J., 1912, 1198.—T. F. B.

Water ; Process for the purification or filtration of —— by the use of non-crystalline or amorphous substances, and method of obtaining such substances from volcanic rock. Deutsche Filtercompagnie G. m. b. H., and V. Kobelt, Berlin. Eng. Pat. 3057, Feb. 6, 1912.

See Fr. Pat. 440,351 of 1912 ; this J., 1912, 948.—T. F. B.

Sewage waters ; Process for the purification of ——. C. Gunkel, Halle on Saale, Germany. Eng. Pat. 15,243, June 29, 1912.

See Ger. Pat. 248,980 of 1911 ; this J., 1912, 837.—T. F. B.

Waste water ; Plant for the mechanical cleansing of —— by the putrefaction and separation process. O. Stock, Stuttgart, Germany. Eng. Pat. 18,433, Aug. 10, 1912.

See Fr. Pat. 447,516 of 1912 ; this J., 1913, 250.—T. F. B.

Oxidising a viscous liquid by means of ozone ; Process for ——. E. Gevers-Orban, Montegnee-lez-Liège, and C. Cavadino, Liège, Belgium. Eng. Pat. 11,960, May 20, 1912.

See Fr. Pat. 443,407 of 1912 ; this J., 1912, 996.—T. F. B.

Sterilising liquids by means of ultra-violet rays ; Apparatus for ——. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. U.S. Pat. 1,052,818, Feb. 11, 1913.

See Fr. Pat. 403,945 of 1909 ; this J., 1910, 107.—T. F. B.

Apparatus for bleaching and for preparing [electrolytic] bleaching, deodourising, and disinfecting solutions. Eng. Pat. 15,321. *See* VII.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Alkaloids in cinchona bark and its preparations ; Determination of ——. R. Gaze. Apoth.-Zeit., 1913. 28, 144—147.

In the case of cinchona barks with a high alkaloidal content, the amount of macerating fluid prescribed by the German Pharmacopœia, 5th Edn., is insufficient. The temperature of the extraction plays an important part, the amount of alkaloid extracted at 30° C. being higher than when the extraction is carried out at 15° C. The prescribed amount of sodium hydroxide solution is too small when the amount of alkaloid is high. A macerating mixture of 5 grms. of absolute alcohol and 25 grms. of chloroform is sufficient for 6 grms. of bark, or 25 grms. of tincture; 5 grms. of sodium hydroxide solution are used with these quantities, and 40 grms. of the extract are filtered off. Haematoxylin appears to be a satisfactory indicator.—F. Shdn.

Pareira root; Alkaloids of ——. M. Scholtz. Arch. Pharm., 1913, **251**, 136—151. (See also this J., 1912, 1199.)

The author produces further evidence that the formula of bebirine is $C_{18}H_{21}NO_3$ and not $C_{21}H_{23}NO_4$ as contended by Faltis (this J., 1912, 838). From analyses of *iso*bebirine and β-bebirine and of several of their derivatives it is shown that these alkaloids are also represented by the same formula. Both *d*- and *l*-bebirine and β-bebirine yield the same optically inactive triacetyloxy-compound, while isobebirine yields a mixture of α-triacetyloxyisobebirine ($[\alpha]^{20}_{D}=+68{\cdot}1$) and β-triacetyloxyisobebirine, the proportion of the α- to the β-modification varying according to the conditions under which acetylation is carried out; the β-compound is optically inactive and is probably a racemic modification.—R. G. P.

Anhydrocotarnineacetophenone, etc.; Constitution of ——, *together with an account of some new condensation products of cotarnine. Synthetical experiments in the group of the isoquinoline alkaloids. Part III.* E. Hope and R. Robinson. Chem. Soc. Proc., 1913, **29**, 63.

The authors have submitted to a careful examination the condensation products of cotarnine with acetophenone and ethyl phenylacetate, which were first described by Liebermann and his co-workers (this J., 1909, 202, 802), and regarded by them as derivatives of N-methylaminoethylbenzaldehyde. It is now found that these substances are in reality derivatives of tetrahydro*iso*quinoline, and are therefore constituted analogously to narcotine and hydrastine. New condensation products of a similar nature have been prepared by the condensation of cotarnine with phenylacetonitrile, 1-hydrindone, 1 : 3-diketohydrindene, indene, isatin, fluorene, and 1-methylindole.

Ipuranol and some allied compounds as phytosterol glucosides; The identification of ——. F. B. Power and A. H. Salway. Chem. Soc. Proc., 1913, **29**, 63—64.

It has previously been recorded in connection with the description of ipuranol and some allied compounds to which distinctive names and formulæ had been assigned, such as citrullol, trifolianol, ipurganol, bryonol, cluytianol, etc., that they yield colour reactions very similar to those given by the phytosterols. The observation has now been made that several of these compounds, when heated under suitable conditions with aqueous hydrogen chloride, undergo hydrolysis, with the formation of a phytosterol and dextrose. The formula originally assigned to ipuranol, namely, $C_{23}H_{40}O_4$, requires C=72·6; H=10·5, whereas a sitosterol glucoside, $C_{33}H_{56}O_6$, requires C=72·3; H=10·2 per cent., and the latter figures are likewise in excellent agreement with the analytical results recorded for ipuranol and some allied compounds. The hydrolysis of ipuranol may therefore be represented by the following equation: $C_{33}H_{56}O_6+H_2O=C_{27}H_{46}O+C_6H_{12}O_6$. It is concluded that all the compounds of the type of ipuranol are glucosidic in character, although the phytosterols obtained by their hydrolysis are not in all cases identical. In place of the distinctive names which have previously been assigned to a number of these substances, it is proposed to designate them collectively as *phytosterolins*.

Cummin; Persian ——. J. C. Umney and E. M. Holmes. Perfum. and Essent. Oil Rec., 1913, **4**, 43—47.

A shipment of Persian cummin, which recently arrived in England, was distilled, when a yield of 2 per cent. of oil was obtained. The characters were: sp. gr., 0·911; optical rotation, +7°; refractive index, 1·4980; aldehydes by absorption with sodium bisulphite, 18 per cent. Practically all the oil distilled below 240° C. The oil is distinctly sweeter than the normal cummin oil, and a little more reminiscent of caraway. The fruits have been identified as derived from *Carum gracile*.—F. Shdn.

Essential oils; Constituents of ——. *Decomposition of the diketone, $C_{13}H_{20}O_2$, from selinene.* F. W. Semmler and F. Risse. Ber., 1913, **46**, 599—603. (See this J., 1913, 107.)

When oxidised with an alkaline solution of bromine the diketone, $C_{13}H_{20}O_2$, obtained from selinene gives a tricarboxylic acid, $C_{12}H_{18}O_6$. This melts at 188° C., and forms a methyl ester boiling at 200°—205° C. at 8 mm., sp. gr. 1·140 at 20° C., $n_D=1{\cdot}47948$, $\alpha_D=-27°\ 48'$. The same acid is produced when the diketomonocarboxylic acid, $C_{14}H_{22}O_2$, is oxidised as above. From these observations the constitution of pseudo-(β)-selinene and ortho-(α)-selinene is deduced.—F. Shdn.

Lemon oil; Terpeneless. E. Sachsse and Co. Perfum. and Essent. Oil Rec., 1913, **4**, 47—48.

The characters of terpeneless lemon oil are: sp. gr. 0·890 to 0·930; optical rotation, —6° to —9°; citral content, 42 to 50 per cent.; solubility in 22° overproof alcohol (sp. gr. 0·89), 1 : 40 to 80 (sometimes cloudy); in 5° overproof alcohol (sp. gr. 0·9137), 1 : 150 to 300 (often cloudy); in 12½° underproof alcohol (sp. gr. 0·9347), 1 : 500 to 1000 (mostly cloudy). Lemon oil which is terpeneless and sesquiterpeneless has the following characters: sp. gr., 0·895 to 0·905; optical rotation, —1° to —4°; citral content, 64 to 74 per cent.; solubility in 22° overproof alcohol (sp. gr. 0·89), 1 : 16 to 20; in 5° overproof alcohol (sp. gr. 0·9137), 1 : 6 to 10; in 12½° underproof alcohol (sp. gr. 0·9347), 1 : 75 to 125, all the solutions remaining perfectly clear.—F. Shdn.

Lemongrass oil. E. J. Parry. Perfum. and Essent. Oil Rec., 1913, **4**, 40.

Samples of lemongrass oil tested in the West Indies were always clearly soluble in three volumes of 70 per cent. alcohol, but on arrival in London, they were found to be insoluble in alcohol when tested in the same way. This change is probably due to the oxidation of an olefinic terpene. After several years' storage the citral value had dropped by 4 to 5 per cent. from what it had been on arrival in England. Cochin lemongrass oil behaves in a similar way on transport and storage.—F. Shdn.

Peppermint oils; Japanese ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1913, **4**, 32—33.

A number of recent samples of partially dementholised Japanese peppermint oils had a free menthol content of 43·0 to 50·8 per cent., and a menthol ester content of 8·4 to 14·4 per cent. The high percentage of ester is unusual. This may possibly be due to the distillation of the oil from a different species to that formerly utilised. Adulterated American oils give reactions with glacial acetic acid and nitric acid as well as with formaldehyde and citric acid (see this J., 1912, 45). Pure oils of English, French, Italian and American origin give an intense colouration, whilst Japanese oils only give a faint colouration.
—F. Shdn.

Lecithin; Determination of —— *in lecithin preparations, etc.* R. Cohn. Z. öffentl. Chem., 1913, **19**, 54—62.

The determination of lecithin may be divided into three parts, namely, the extraction of the lecithin from the material, its purification, and the determination of the phosphoric acid in the product thus obtained, the lecithin being calculated from the amount of phosphoric acid found. In the majority of cases the following method of extraction will give trustworthy results. From 1 to 2 grms. of the lecithin preparation, or from 5 to 20 grms. of a food containing lecithin, are mixed with 100 c.c. of 96 per cent. alcohol and shaken repeatedly for a few hours; the alcohol is then separated and the residue is boiled for some hours with a further quantity of alcohol under a reflux condenser. The residue from this extraction is then ground up with sand, and the hot extraction is once more repeated. The insoluble portion is, finally, extracted for 2 hours with boiling chloroform. Lecithin preparations which have been kept for a long time, or which have been overheated, require to be extracted with hot alcohol for some

20 to 30 hours before they cease to yield alcohol-soluble phosphorus compounds. The united alcoholic extracts are evaporated, the chloroform extract is added and also evaporated, and the residue is digested for 2 hours with about 100 c.c. of chloroform in order to separate the lecithin from free phosphoric acid, glyceryl-phosphoric acid, etc.; the chloroform solution is then filtered and evaporated. For the determination of the phosphoric acid in this residue, the latter is either incinerated with the addition of sodium carbonate and potassium nitrate, or of magnesia, or oxidised by heating with sulphuric and nitric acids; the resulting phosphoric acid is precipitated with magnesia mixture and weighed as magnesium pyrophosphate. If desired, an intermediate precipitation with molybdic acid may be made. These methods all yield accurate results, but the method in which the residue is ignited with magnesia is recommended. The quantity of phosphoric acid (P_2O_5) found is multiplied by the factor 11·36 to give lecithin. The author has examined many lecithin preparations and finds that whilst products manufactured by reputable firms contain from 95 to 98 per cent. of lecithin, others guaranteed to contain upwards of 90 per cent. yield far less than this quantity. Foods stated to contain a certain percentage quantity of lecithin should yield within 9 per cent. of the guaranteed quantity. Products sold as soluble lecithin and prepared by the saponification of lecithin consist of a mixture of glycerylphosphoric acid, choline, glycerol, and sodium chloride, and are not true lecithin preparations.—W. P. S.

Arsenic compounds; Aromatic ——. IV. Preparation of 3-nitro-4-dimethylaminophenylarsinic acid and 3-nitro-4-hydroxyphenylarsinic acid. P. Karrer. Ber., 1913, **46**, 515—517.

p-Dimethylaminophenylarsinic acid (Ger. Pat. 200,065; this J., 1908, 999) can be readily nitrated by a mixture of glacial acetic and nitric acids, and the 3-nitro-derivative thus obtained, when dissolved in sodium hydroxide solution and heated, is converted, in good yield, into 3-nitro-4-hydroxyphenylarsinic acid, which serves as raw material for the preparation of salvarsan IV (the hydrochloride of diaminodihydroxyarsenobenzene).—A. S.

Anilipyrine; Constitution of ——. E. Comanducci. Boll. Chim. Farm., 1912, **51**, 741—743. Chem. Zentr., 1913, **1**, 837.

The author has found that α-anilipyrine (m. pt. 75° C.) and β-anilipyrine (m. pt. 105° C.) are not chemical compounds or solid solutions, but merely crystalline mixtures of antipyrine and acetanilide, from which antipyrine may be dissolved by a small quantity of water or acetanilide by means of ether. The eutectic mixture of the two substances melts at 45° C. and contains 45 mols. of antipyrine and 55 mols. of acetanilide per cent.—A. S.

Salicylic acid; Solubility of —— in fatty oils. N. O. Engfeldt. Apoth.-Zeit., 1913, **28**, 182.

According to the author's experiments, the percentage solubility of salicylic acid in different fatty oils is as follows:—Seal oil, 1·70; cod-liver oil, 1·86; arachis oil, 1·88; almond oil, 2·08; olive oil, 2·14; rape oil, 2·17; poppy-seed oil, 2·22; sesamé oil, 2·61; hemp-seed oil, 3·00; linseed oil, 3·04; walnut oil, 3·15; cottonseed oil, 3·23; castor oil, 12·98.—A. S.

Acetaldehyde in paraldehyde; Detection of ——. G. Heyl. Apoth.-Zeit., 1913, **28**, 165—166.

For the purpose of detecting acetaldehyde in paraldehyde, 1 grm. of the latter is dissolved in 100 c.c. of water. 10 c.c. of the solution are diluted to 50 c.c. and 10 c.c. of this shaken with 20 drops of freshly prepared 1 per cent. sodium nitroprusside solution and 3 drops of piperidine. If a distinct blue colouration is produced at this dilution, the paraldehyde contains more than the 4 per cent. of acetaldehyde allowed by the German Pharmacopœia. Metaldehyde gives no reaction (see also this J., 1912, 458).—F. Shdn.

Determination of malic and tartaric acids in the same solution. Dunbar. *See* XXIII.

Patents.

Powders for medical, toilet and like purposes. R. Marcus, Frankfort on the Maine, Germany. Eng. Pat. 25,220, Feb. 5, 1912.

Powders for medical, toilet and similar purposes are mixed with an artificial chemically pure silicic acid prepared by the osmotic process.—F. Shdn.

Tar colloid with curative properties; Process for the production of a light-coloured ——. I. Bugarsky, Buda-Pest, Hungary. Eng. Pat. 28,168, Dec. 6, 1912. Under Int. Conv., Jan. 3, 1912.

A light-coloured tar colloid (b. pt. 220°—300° C. at 20 mm.) with curative properties is prepared from oil of cade by fractional distillation under reduced pressure.—F. Shdn.

Hydrogen peroxide [urea and acetanilide]; Solidified ——, and process of forming the same. F. E. Stockelbach, Assignor to F. Stearns and Co., Detroit, Mich. U.S. Pat. 1,051,926, Feb. 4, 1913.

Acetanilide (say 2 grms.) is dissolved in hydrogen peroxide of 23—25 per cent. (say 1000 grms.), urea (say 600 grms.) is added, and the whole is evaporated to dryness.—J. T. D.

Pharmaceutical product [compound of urea and hydrogen peroxide]; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F Bayer und Co., Elberfeld, Germany. Eng. Pat. 7767, March 30, 1912. Addition to Eng. Pat. 1555, Jan. 20, 1911.

See Addition of June 17, 1912, to Fr. Pat. 436,095 of 1911; this J., 1912, 1200.—T. F. B.

Pharmaceutical product [compound of urea and hydrogen peroxide]. M. Stern, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,052,762, Feb. 11, 1913.

See Fr. Pat. 436,095 of 1911; this J., 1912, 409.—T. F. B.

Pharmaceutical compounds [dihydroxyphenyl-α-propanolamine]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8957, April 16, 1912.

See U.S. Pat. 1,044,778 of 1912; this J., 1913, 161.—T.F.B.

1-*Dimethylaminobutene*-3 *and* 1-*dimethylamino*-2-*methylbutene*-3; *Manufacture of ——.* P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,620, May 28, 1912.

See Ger. Pat. 254,529 of 1912; this J., 1913, 212.—T. F. B.

Pyrazolone derivative. F. Stolz, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,035,240, Feb. 18, 1913.

See Eng. Pat. 10,538 of 1912; this J., 1912, 702.—T. F. B.

Diaminodi[hydr]oxyarsenobenzene; Derivatives of —— and process of making same. G. Korndörfer and B. Reuter, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,053,300, Feb. 18, 1913.

See Ger. Pat. 245,756 of 1911; this J., 1912, 604.—T. F. B.

Iminopyrimidines; Manufacture of acetyl derivatives of the alkylated ——. E. Witte, Gross-Lichterfelde, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,053,690, Feb. 18, 1913.

See Fr. Pat. 409,223 of 1909; this J., 1910, 719.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; Action of low temperatures on ——. A. Kling and D. Florentin. Comptes rend., 1913, **156**, 694—696.

Comparative experiments at the ordinary temperature and at —190° C. (liquid nitrogen) showed that the sensitiveness of explosives to detonation is considerably diminished at low temperatures, and this is the case whether the explosive itself, the detonator, or both be cooled. Provided the detonation be sufficient to explode the whole of the explosive contained in the cartridge, the explosive force (as measured by the Trauzl lead block) and the speed of propagation of the explosion wave are not appreciably affected by cooling.—A. S.

Patent.

Explosive charges ; Method of casting ——. *Cast explosive charge.* E. Sokolowski, Hamburg, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 1,054,049 and 1,054,147, Feb. 25, 1913.

See Ger. Pat. 255,026 of 1911 ; this J., 1913, 214.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Silver, chlorine, sulphuric acid, etc. ; Flask for volumetric determination of ——. W. N. Iwanow. J. Russ. Phys.-Chem. Soc., 1913, **45**, 66—69.

Volhard's method gives results which are about 0·4 per cent. too high (or too low), when used for the estimation of silver (or chlorine). This inaccuracy, which is due to adsorption of ammonium thiocyanate by the silver thiocyanate, may be avoided by using for the titration a beaker with vertical or slightly tapering sides and a concave base. The central part of the base is blown into the form of a spherical bulb, which juts up into the body of the beaker and leaves a distance of not more than 0·5 cm. between itself and the main wall of the beaker. The precipitate formed falls through this narrow space to the bottom of the beaker, where it remains even after rotation of the vessel. When the end-point is approached, the contents of the beaker are thoroughly mixed by vigorous shaking, the precipitate being allowed to settle again before the titration is continued.The final red colouration is found to persist for some hours, whereas that obtained in the ordinary way disappears in the course of a few minutes. The above procedure yields results identical with those given by Mohr's volumetric method or by the gravimetric method.—T. H. P.

Dialysis ; New apparatus for quantitative ——. A. Golodetz. Chem.-Zeit., 1913, **37**, 259—260.

In the usual methods of carrying out separations by dialysis, it is almost impossible to recover the crystalloid constituents on account of the very large volume of water that has to be used. In order to get over this difficulty the author uses an apparatus based on the same principle as the Soxhlet extractor. The cylindrical dialyser is so bent within itself as to form a tall narrow annular chamber in which the substance under examination is placed. The dialyser is supported in a wide glass tube connected below with a distilling flask and above with a condenser, the latter communicating also by a separate tube with the distilling flask. Water is distilled from the flask, the steam passes to the condenser, and the condensed water drops into the space surrounding the dialyser.—A. S.

Arsenic ; Determination of ——. C. R. Smith. U.S. Dept. Agric., Bureau of Chem., Circular No. 102, Oct. 19, 1912.

Modifications of the Gutzeit method as described by Sanger and Black (this J., 1907, 1115) are proposed together with new means of determining comparatively large quantities of arsenic and its separation and concentration from organic and inorganic substances. A modified Gutzeit apparatus is described and stannous chloride is recommended for use in sensitising the zinc employed ; stannous chloride in conjunction with potassium iodide affords a convenient means of reducing arsenates to arsenites before treatment in the apparatus. Quantities of arsenic exceeding 10 mgrms. may be determined by passing the gases evolved from the apparatus into mercuric chloride solution, and determining the arsenic either by titration with iodine solution or by weighing the calomel formed on heating the solution. The arsenic present in a substance may be concentrated and separated from such metals as copper, antimony, etc., by the addition of sodium phosphate and precipitation with magnesium salts, the arsenic being carried down with the ammonium magnesium phosphate precipitate.—W. P. S.

Malic and tartaric acids in the same solution ; Determination of ——. P. B. Dunbar. U.S. Dept. Agric., Bureau of Chem., Circular No. 105, Oct. 4, 1912.

Solutions of both malic and tartaric acids when treated with uranyl acetate show an increased rotation, which, within certain limits, is proportional to the concentration (see this J., 1911, 1177, 1407) ; both acids reduce definite quantities of potassium permanganate in alkaline solution and form oxalic acid quantitatively. Hence it is possible to calculate the amounts of malic and tartaric acids in a solution, knowing the total change in the rotation of the solution on treatment with uranyl acetate, and also either the amount of potassium permanganate reduced or the amount of oxalic acid formed. The details of the method are as follows :—85 c.c. of the solution are rendered slightly alkaline with sodium hydroxide, and 5 grms. of sodium acetate are dissolved in the mixture, which is then rendered acid with citric acid and diluted to 100 c.c. About 30 c.c. of this solution are shaken for 3 hours with from 2 to 3 grms. of uranyl acetate ; if all the latter dissolves more must be added. After filtration, the solution is polarised in a 200 mm. tube, and the reading in degrees Ventzke observed calculated to the basis of the original solution. If optically-active substances other than malic and tartaric acids are present, 50 c.c. of the original solution must be treated with an excess of dry powdered lead acetate, filtered, the excess of lead removed from the filtrate by means of anhydrous sodium sulphate, and the solution polarised. The difference between the two readings will give the rotation due to the uranium complexes of the two acids. The quantity of permanganate reduced by the mixed acids is determined by rendering a portion of the solution alkaline with sodium hydroxide, adding an excess of about 3 grms. of the latter, and heating the mixture with 50 c.c. of a 1·5 per cent. permanganate solution on the water-bath for 1 hour. The mixture is then acidified with sulphuric acid and the excess of permanganate titrated with oxalic acid solution. In the presence of other substances which reduce permanganate but do not form oxalic acid, the amount of the latter may be determined in the usual way by titration with permanganate ; 1 c.c. of 1·5 per cent. potassium permanganate solution is equivalent to 0·0299 grm. of crystallised oxalic acid. Let x be the grms. of malic acid, and y the grms. of tartaric acid, per 100 c.c. of solution, a the polarisation in degrees Ventzke in a 200 mm. tube after treatment with uranyl acetate, and b grms. of potassium permanganate required to oxidise 100 c.c. of the solution, then $x=-0{\cdot}0185a+0{\cdot}1720b$, and $y=0{\cdot}0248a+0{\cdot}2436b$. If c equals grms. of oxalic acid yielded by 100 c.c. of the solution, then $x=-0{\cdot}020a+0{\cdot}233c$, and $y=0{\cdot}023a+0{\cdot}331c$. The data taken into account in these equations are : One grm. of malic acid in 100 c.c. will show a rotation of —27·77° V. after treatment with uranyl acetate, and 1 grm. of tartaric acid per 100 c.c. a rotation of 19·61° V. ; 1 grm. of malic acid reduces 2·8297 grms. of potassium permanganate, and 1 grm. of tartaric acid reduces 2·1062 grms. of permanganate. In the case of fruit juices and solutions containing sugars, 50 c.c. of the solution are mixed with about 150 c.c. of 95 per cent. alcohol, and the mixed acids are precipitated with lead acetate ; the precipitate is collected on a filter, washed with 80 per cent. alcohol until free from sugars, then decomposed with dilute sulphuric acid, the lead sulphate is removed by filtration and the alcohol by evaporation, and the resulting solution of the acids is treated as described.—W. P. S.

Tryptic protein hydrolysis; Measurement of —— by determination of the tyrosine liberated. S. J. M. Auld and T. D. Mosscrop. Chem. Soc. Trans., 1913, **103**, 281—284.

The estimation of tyrosine formed during tryptic digestion is best effected (see Brown and Millar, Chem. Soc. Trans., 1906, **89**, 145) by absorption of bromine. The test liquid is acidified with hydrochloric acid to which sodium bromide is added and titrated with standard sodium bromate solution. The end point of the reaction is not at all sharp, but it may be made so by the use of methyl violet or gentian-violet as an outside indicator. The colour is olive-green in acid solution, changing to a deep bluish-violet in presence of traces of free bromine. The indicator is made of 1 per cent. strength in 70 per cent. alcohol, and 10 drops are added to 10 c.c. of 5 per cent. hydrochloric acid. This liquid is dotted over a white tile and tested with the experimental liquid. The hydrochloric acid in the tyrosine solution should be between 2 and 5 per cent. The addition of the sodium bromate is carried out in a stoppered bottle which is shaken for 30 seconds between successive additions.—E. F. A.

Determination of ethylenic and acetylenic hydrocarbons in gaseous mixtures. Lebeau and Damiens. *See* IIA.

New Prussian regulations for official tests of inks. Hinrichsen. *See* IV.

Testing of parchment papers. Fortini and Cecchcrelli. *See* V.

Detection of gelatin in finishing materials. Schmidt. *See* VI.

Determination of sulphur trioxide in sulphur-furnace gases. Richter. *See* VII.

Iodometric determination of persulphuric acid. Müller and v. Ferber. *See* VII.

Determination of alkalis in rocks. Krishnayya. *See* VII.

Determination of free acid or base in aluminium sulphate. Iwanow. *See* VII.

Analysis of copra. Allen and Auerbach. *See* XII.

Determination of soaps in lubricating greases. Marcusson. *See* XII.

Volumetric use of titanous chloride for the determination of invert sugar. Radlberger and Siegmund. *See* XVII.

Use of the refractometer in sugar-house work. Determination of dry substance. Cross. *See* XVII.

Modification of the Clerget method of determining sucrose in molasses. Cross and Taggart. *See* XVII.

Accurate determination of alcohol by means of permanganate, even in very dilute solutions. Barendrecht. *See* XVIII.

Influence of ammonium sulphate in the polarimetric determination of lactose. Jahnson-Blohm. *See* XIXA.

Determination of alkaloids in cinchona bark. Gaze. *See* XX.

Determination of lecithin in lecithin preparations, etc. Cohn. *See* XX.

Detection of acetaldehyde in paraldehyde. Heyl. *See* XX.

Erratum.

Page 215, col. 1, line 3 from bottom; also col. 2, line 2 from top, *for* "bisulphate" *read* "sulphate."

Patents.

Analysis of gases; Apparatus for use in ——. J. Harger, Liverpool. Eng. Pat. 9623, Apr. 23, 1912.

The apparatus is of the type in which the gas is treated with reagents in a chamber of constant volume, and the amount of gas absorbed by each reagent is determined by observing the reduction in pressure. The apparatus comprises a cylindrical chamber or gas-holder, of which the cover forms the diaphragm of an aneroid barometer. The movements of the diaphragm are transmitted to a pointer which can be adjusted to zero irrespective of the atmospheric pressure. In one form, the reagents are placed in vertical tubes connected at each end with the gas-holder through stopcocks. By opening both cocks, the reagent is allowed to flow into the holder, and the tube is filled with gas. After absorption, the reagent is caused to flow back by tilting the apparatus. A separate tube may be provided for each reagent. In another form, the reagents are placed in the gas-holder in capsules which are broken in turn. For this purpose, the cover of the gas-holder is formed by a ground-glass plate which carries the aneroid and also carries the capsules suspended beneath. The capsules may be broken by sliding the cover so as to crush them against the wall of the holder, or so as to drop them to the bottom of the holder. The aneroid may be filled with a liquid which extends into a graduated capillary tube.—A. T. L.

Flue and furnace gases, Testing instrument for ——. A. Schmid, Zürich, Switzerland. Eng. Pat. 25,046, Nov. 1, 1912. Under Int. Conv., Nov. 11, 1911.

In a glass instrument, adapted for collecting and analysing gases, a reservoir, containing the absorption liquid, communicates by means of a three-way tap with a graduated measuring vessel. The three-way tap is so bored that in one position it seals the reservoir, but affords communication between the measuring vessel and the atmosphere, in which position the instrument is filled with the gas to be examined. The second position of the tap seals the measuring vessel from the atmosphere, but affords communication between it and the absorption reservoir, in which position the gas under examination is treated with the absorbing liquid. The third position of the tap seals the measuring vessel from both the reservoir and the atmosphere, and in this position the unabsorbed gas is brought to atmospheric pressure and its volume is measured.—O. R.

Gas mixtures; Method and apparatus for testing ——. T. M. Eynon, Philadelphia, Pa. U.S. Pat. 1,052,412, Feb. 4, 1913.

Air and the mixture of gases are respectively forced by a suitable pump or other device into the alternate limbs of a U-shaped gas-density measurer. Each limb of the U-tube has a pressure gauge, the gauges having co-axial needles. Registering devices are superposed above the gauges.—W. H. C.

Gas analysis; Apparatus for ——. P. Eyer. Ger. Pat. 256,218, Sept. 27, 1911.

The apparatus consists essentially of a U-shaped tube, one limb of which is provided with a graduated scale, below which is a stopcock of such construction that this limb can be either closed or put in communication with the atmosphere or with the other limb. There is also a two-way stopcock in the bend of the U-tube. A suitable absorption-reagent is poured into the ungraduated limb of the U-tube until it reaches to the stopcock below the graduated scale, and this stopcock, after the one in the bend of the U-tube has been closed, is turned to communicate with the atmosphere. The gas to be tested is drawn through the graduated limb to displace the air, and then a definite volume of it is collected by closing the stopcock. The latter is then turned to bring the gas and absorption-reagent into contact, and the apparatus is shaken for some time. On now opening the stopcock in the bend of the U-tube, the absorption-reagent rises in the graduated limb to an extent corresponding to the volume of gas absorbed.—A. S.

Saccharometers [, *Fermentation* ——]. A. Eppens, Berlin. Eng. Pat. 26,696, Nov. 20, 1912.

In a fermentation saccharometer in which the pressure of the carbon dioxide generated by the fermentation of the sugar is measured by means of a manometer containing mercury or other liquid, the fermentation chambers are separated from the measuring chamber by diaphragms (clay or the like) which are permeable to gases but not to the mercury or other liquid used in the manometer, so that the liquid cannot run out during transport. The manometer is connected on the one hand with a fermentation chamber containing the liquid to be tested and on the other hand with a similar fermentation chamber containing the same quantity of yeast together with a neutral liquid, so that the error caused by the glycogen in the yeast is compensated by the counter-pressure produced in the second fermentation chamber. Both fermentation chambers are closed to the outside air by adjustable flexible diaphragms by which the manometer may be set to zero.—J. F. B.

Toxic or inflammable gases in the atmosphere ; Apparatus for indicating the presence and quantity of ——. A. Guasco, Paris. Eng. Pat. 3628, Feb. 13, 1912.

See Fr. Pat. 429,862 of 1911 ; this J., 1911, 1337.—T. F. B.

Paper testing apparatus. Fr. Pat. 447,562. *See* V.

Method of determining the content of butter-fat in butter. U.S. Pat. 1,052,098. *See* XIXa.

Books Received.

Introduction to the Physics and Chemistry of Colloids. By E. Hatschek. J. and A. Churchill, London. 1913. Price 2s. 6d. net.

This volume, 7⅝ by 5⅛ ins., is an enlarged reprint of articles published in the "Chemical World," based on a course of lectures delivered at the Sir John Cass Technical Institute, London. It contains 87 pages of subject matter, 14 illustrations, and alphabetical indexes of subjects and authors' names, and includes sections on the properties and classification of colloids (suspensoids and emulsoids), the ultramicroscope, viscosity, Brownian movement, emulsions, gels (structure, properties, etc.), surface tension and energy, adsorption, and applications of the science of colloids.

The Manufacture of Sulphuric Acid and Alkali, with the Collateral Branches. A Theoretical and Practical Treatise. By George Lunge, Ph.D. Professor Emeritus in the Federal Technical High School, Zürich, etc. Fourth Edition. Volume I., Sulphuric Acid, Parts I., II. and III. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1913. Price £3 3s. net.

This volume I., devoted to sulphuric acid, is actually a work in three volumes (Parts I., II. and III.), each measuring 9 × 6¼ ins. Part I. contains 582 pages of subject matter with 157 illustrations, Part II., 496 pages, with 212 illustrations, and Part III., 499 pages with 174 illustrations, followed by alphabetical indexes of names and subjects for the whole work (Vol. I.). The subject matter is classified and arranged as follows : Part I. (i.) Historical and general notes on the manufacture of sulphuric acid. (ii.) Raw materials of the sulphuric acid manufacture, including nitric acid. (iii.) Properties and analysis of the technically employed oxides and acids of sulphur. (iv.) Production of sulphur dioxide. Part II. (v.) Construction of the lead chambers. (vi.) Recovery of the nitrogen compounds. (vii.) The chamber process. (viii.) Purification of sulphuric acid. Part III. (ix.) Concentration of sulphuric acid. (x.) Arrangement of a sulphuric acid works on the chamber process ; yields and costs. (xi.) Manufacture of Nordhausen or fuming oil of vitriol, and of sulphuric anhydride. (xii.) Other processes for manufacturing sulphuric acid. (xiii.) By-products of the manufacture of sulphuric acid. (xiv.) Applications of sulphuric acid, and statistics. (xv.) Addenda (pages 1543—1577).

Food Inspection and Analysis. For the use of Public Analysts, Health Officers, Sanitary Chemists, and Food Economists. By Albert E. Leach, S.B. Late Chief Analyst of the Massachusetts State Board of Health, etc. Revised and enlarged by Andrew L. Winton, Ph.D., Chief of the Chicago Food and Drug Inspection Laboratory, Bureau of Chemistry., U.S. Dept. of Agriculture. Third Edition. John Wiley & Sons, New York. Chapman and Hall, Ltd., London. 1913. Price $7.50, or 31s. 6d.

Volume measuring 9⅞ ins. by 7 ins., and containing 974 pages of subject matter, with 278 illustrations, and an alphabetical index. The illustrations include 40 microphotographic plates of pure and adulterated foods, and of adulterants. The subject matter is classified as follows :—I. Food analysis and official control. II. The laboratory and its equipment. III. Food, its functions, proximate components, and nutritive value. IV. General analytical methods. V. Microscope in food analysis. VI. The refractometer. VII. Milk and milk products. VIII. Flesh foods. IX. Eggs. X. Cereals and their products, legumes, vegetables, and fruits. XI. Tea, coffee and cocoa. XII. Spices. XIII. Edible oils and fats. XIV. Sugar and saccharine products. XV. Alcoholic beverages. XVI. Vinegar. XVII. Artificial food colours. XVIII. Food preservatives. XIX. Artificial sweeteners. XX. Flavouring extracts and their substitutes. XXI. Vegetable and fruit products.

A Foundation Course in Chemistry for Students of Agriculture and Technology. By J. W. Dodgson and J. Alan Murray. Longmans, Green & Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1913. Price 3s. 6d. net.

Volume measuring 7½ ins. by 5 ins., and containing 234 pages of subject matter, with 17 illustrations, an appendix with weights, measures, and questions, and an alphabetical index. The subject matter is classified as follows :—I. Matter and energy. II. Air. III. Chief gases of the atmosphere. IV. Water. V. Hydrogen. VI. General principles. VII. Oxides, acids, bases, and salts. VIII. Limestone. IX. Common salt. X. Sulphur. XI. Ashes. XII. Sand, clay, etc. XIII. Organic matter. XIV. Paraffins and their derivatives. XV. Coal tar. XVI. Some common metals.

Die Anwendung hoher Drucke bei chemischen Vorgängen und eine Nachbildung des Entstehungsprozesses der Steinkohle. Von Dr. Friedrich Bergius. Wilhelm Knapp's Verlag. Halle (Saale). 1913. Price M. 2.80.

Volume measuring 9¾ by 6¾ ins., and containing 58 pages of subject matter. Dedicated to the memory of Richard Abegg. In the text are four illustrations, and the following classification is observed :—I. Systematic consideration of the part played by pressure in chemical reactions. II. Investigations on work with high pressures. III. Dissociation and formation of calcium peroxide. IV. Reactions with superheated water. Combustion of carbon with liquid water. V. The demonstration of the process of formation of coal in the laboratory. (See also this J., 1912, 665.)

Einführung in die chemische Laboratoriumspraxis. Hilfsbuch für Techniker und Laboranten. Von Dr. E. Kedesdy. Wilhelm Knapp's Verlag. Halle a. S. 1913. Price M. 6.80.

Volume measuring 9¾ by 6¾ ins., and containing 177 pages of subject matter, with 67 illustrations, followed by an alphabetical index of subjects. The subject matter is arranged under the following heads :—I. Special laboratory operations, apparatus, etc. II. Weighing. III. Measuring. IV. Heating, heat and heat-measurement. V. Cooling. VI. Specific gravity. VII. Distilling. VIII. Sampling and calculation of analyses. IX. Essential principles of chemistry. (i.) General. (ii.) Non-metals. (iii.) Metals. (iv.) Organic chemistry.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, February 6th, 1913.

MR. E. C. ROSSITER IN THE CHAIR.

THE REACTION OF METALS AND ALLOYS WITH NITRIC ACID.

BY J. H. STANSBIE, B.SC. (LOND.), F.I.C.

The investigations described in this paper are a continuation of those already published (this J., 1906, 45, 1071: 1908, 365: 1909, 268). They deal with the metals and alloys of copper, arsenic, zinc, silver, and bismuth. The apparatus has been modified and extended, and the work developed on somewhat new lines, while special efforts have been made to obtain pure materials for the experiments.

The acid was redistilled from a Wurtz flask with the addition of 2 c.c. of a strong solution of silver and barium nitrates. The first portion of the distillate was rejected, and the distillation stopped before all the acid had passed over. The distillate was then bleached by drawing a current of pure dry air through the liquid heated to 60° C. in a water bath. When colourless an ozone tube was interposed between the air purifier and the bleaching apparatus, and ozonised air aspirated for an hour, and continued until the acid had cooled nearly to the room temperature.

This acid had a specific gravity of 1·394, and contained 2·2 mgrs. of nitrous acid per litre. From the care taken in the preparation of the acid, and the removal of lower oxides of nitrogen it seems most probable that nitric acid quite free from nitrous acid is practically unobtainable by distillation and bleaching.

The metals were carefully selected, and in some cases further purified in the laboratory before use. The melting and alloying was done in carbon crucibles, and the metals and alloys were allowed to cool in the crucible under a layer of charcoal so as to prevent absorption of gases from the air.

Section I.

Alloys of Copper and Arsenic.

In the investigations described in previous papers the results of experiments with alloys of copper and arsenic are given, and as they are of considerable importance it was decided to carry out another series of experiments with similar alloys and entirely new apparatus in which the liability to error is reduced as far as possible.

This apparatus is shown in Fig. 1. The reaction vessel, A, is specially designed to exclude rubber from contact with the acid solution and the gases arising therefrom. It consists of a cylindrical vessel of thin glass, into the top of which is fused a syphon tube extending nearly to the bottom, a delivery tube for the introduction of the acid also reaching nearly to the bottom, a tubulure into which a thermometer is ground, and an exit tube for the escape of gas. The top of the vessel slopes upwards from all parts to the delivery tube so that when liquid is run into the vessel every trace of gas can be displaced. A burette, B, to contain the measured volume of acid solution which is run into it from a pipette, is attached to the acid delivery tube. The long limb of the syphon is fixed on when the vessel is in position. The thermometer is accurately ground to fit the tubulure, and with a thin film of vaseline on the upper part is perfectly gas tight. The vessel is arranged so that it can be partially immersed in the water bath, C. The gas delivery tube is connected with the two-way tap, D, to the second tube of which a wash bottle, E, is attached; the third tube being connected with the absorption apparatus, F, which is connected to the gas burette, G.

The method of conducting an experiment is as follows:— The metal or alloy is reduced to filings which are first magneted and then sifted through fine gauze to separate dust and through a sieve with 60 meshes to the inch to remove coarser particles. The weighed quantity of the metal, 0·8 grm., is introduced into the dry reaction vessel, A, which is then fixed in position. The air in the tube between the wash bottle, E, and the tap, D, is displaced by water from the bottle, and the connections made. The absorption apparatus, F, containing 25 c.c. of sodium hydroxide solution in the larger tube and 10 c.c. in the smaller one, is connected to the two-way tap. The acid solution is measured into the burette and allowed to displace the air from the connecting tube, but not to run into the vessel. The syphon tube is fixed on, and the open end connected with the hydrogen holder from which a steady stream of hydrogen is passed through the apparatus to displace the contained air. About a litre of hydrogen, collected over a dilute solution of pyrogallol, is used for each experiment. The absorption apparatus is then connected with the gas burette which is filled with a weak solution, 1 per cent., of sodium hydroxide. The end of the syphon tube is closed and the water bath containing water at 75° C. is placed in position. When the thermometer in the reaction vessel becomes stationary the acid solution is allowed to enter in a slow stream. The reaction commences at once, and the gas liberated passes through the apparatus and collects in the burette. The nitric peroxide, which can be seen in the reaction vessel during the whole time of dissolution, is completely removed by the sodium hydroxide in the absorption tubes.

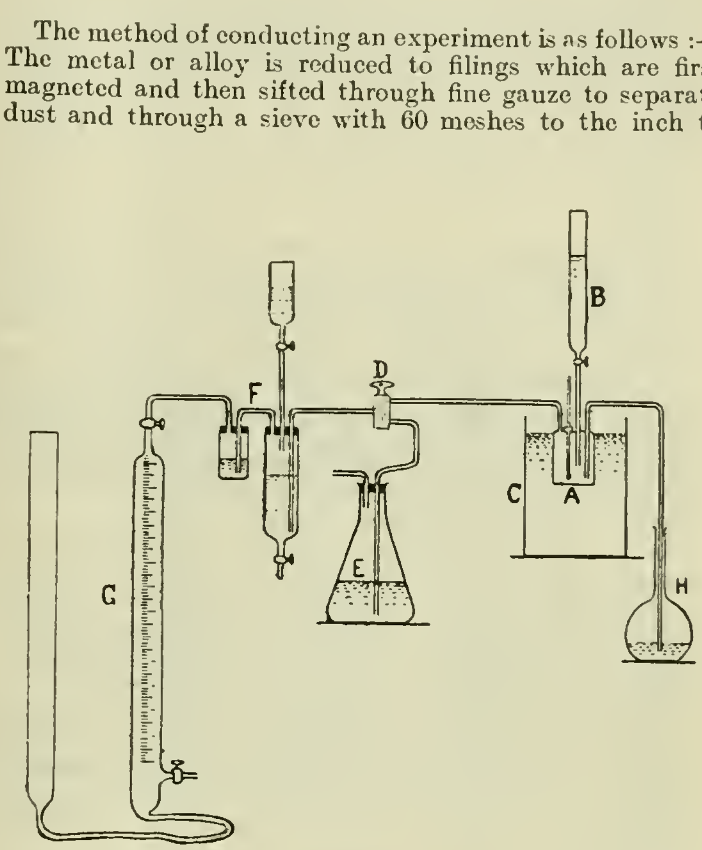

Fig. 1.

When the metal is dissolved, water is allowed to enter the vessel from the burette, B, until the gas is displaced to the tap, D. The solution in the absorption tubes is run through the tap into a 250 c.c. flask. This is readily done by increasing the pressure of the gas in the burette, G. The tubes are then filled with water and emptied twice through the tap funnel, and the gas in the connecting tube between D and F is displaced by water from E. Finally the whole of the gas is displaced into the gas burette which is then disconnected and allowed to stand for a few minutes before determining the temperature, pressure and volume of the gas.

The solution in the reaction vessel is syphoned into a 500 c.c. flask, containing excess of sodium hydroxide solution of known strength, by running in water from the burette. When the apparatus has been well washed the solution in the flask is made up to the mark, well shaken and allowed to stand for the hydroxide precipitate to settle.

The gas in the burette is analysed to determine the nitric oxide, hydrogen, and nitrogen present. A known volume of oxygen, in excess, is passed through the lower tap of the burette in a rapid stream. This unites with the nitric oxide, and the nitric peroxide so formed is rapidly absorbed by the sodium hydroxide solution. When the volume of the residual gas, which now contains hydrogen, nitrogen and the excess oxygen, is constant, its volume is noted.

The neutralisation of the nitrous acid by the sodium hydroxide solution in the burette, prevents the absorption of any of the excess oxygen during the interval between the removal of the nitric oxide and the analysis of the residual gas. To test this, a measured volume of oxygen was passed into the gas burette through the solution into which the nitric oxide from an experiment had already been absorbed. This test was repeated three times with the same volume of gas, and proved conclusively that no absorption takes place in the mass of the solution, and is therefore even less likely to take place through its surface.

Part of the residue is drawn off into a measuring burette, measured, mixed with more hydrogen and exploded in an explosion bulb to determine the residual oxygen. The hydrogen is then determined in another portion of the residue by mixing with purified air and exploding as before. The volume of nitrogen is obtained by difference.

The volumes of nitric oxide and nitrogen are corrected for temperature, pressure, and water vapour, and their volumes at N. T. P. found. The weights of the gases can then be calculated from their volumes, and also the weights of nitric acid corresponding with the weights of nitrogen they contain.

The clear solution is syphoned off from the precipitated copper hydroxide for the determination of the nitrous acid and free alkali present; and the hydroxide solution from the absorption tubes is also examined for nitrous acid and free alkali.

The volume of oxygen in the residual gas, determined as described above, does not agree with that found by calculation based upon the assumption that the volume of oxygen which disappears is equal to one-third the decrease in the total volume taking place when oxygen and the original gas are mixed together, which would be true if nitric peroxide only were formed and dissolved. On this account the volume of nitric oxide present in the collected gas is obtained by difference after the volumes of nitrogen and hydrogen have been determined in the residue.

It has been shown that this disappearance of oxygen is not due to absorption through the surface of the liquid in the burette after the nitric peroxide has once been completely absorbed.

According to Lunge there is a tendency to the formation of nitric acid in the presence of water vapour when oxygen is in excess. In that case more oxygen would disappear than is required for the conversion of the oxide into the peroxide, and the shortage would be explained.

Another explanation is that some of the nitrous acid is decomposed at the surface of the liquid in the burette as follows: $3HNO_2 = HNO_3 + 2NO + H_2O$, and that part of the excess oxygen is used up in reoxidising the liberated nitric oxide; but it is difficult to understand how this could happen in the presence of sodium hydroxide, even though it is in dilute solution.

In working through a complete experiment the following quantities are obtained:—

(1) volume of nitric oxide in the collected gas.
(2) volume of nitrogen in the collected gas.
(3) weight of nitrous acid in the main solution.
(4) weight of excess of alkali in the main solution.
(5) weight of nitrous acid in the absorption tubes.
(6) weight of alkali neutralised in the absorption tubes.
(7) weight of ammonia in the main solution.

The weight of nitric acid in the measured volume of solution, and the weight of sodium hydroxide in the solution used to neutralise the excess acid and precipitate the copper from its salts, are known. Therefore it is possible to calculate the weight of acid which has been transformed in the dissolution of the metal or alloy, and to compare this with the sum of the weights of the products calculated back to nitric acid for comparison. In this way the results may be checked, and a general view of the reactions obtained. The ratios given by $\frac{HNO_3}{NO}$; $\frac{HNO_3}{N}$; $\frac{HNO_3}{HNO_2}$ and $\frac{HNO_3}{NH_3}$ are employed for this purpose. In the following example the details of an experiment are given, and the results for the series of copper arsenic alloys are collected in table I. All weights are given in milligrams, and volumes in cubic centimetres.

EXAMPLE.

Weight of alloy containing 0·25 per cent. of arsenic ...	=	800
,, ,, nitric acid in 20 c.c. of 1·14 sp. gr.	=	5198
Volume of gas collected in gas burette	=	185·4
,, ,, oxygen added	=	92·8
,, ,, residual gas after removal of nitric oxide ..	=	128·5
,, ,, hydrogen in the residue	=	72·1
,, ,, oxygen in the residue	=	38·5
,, ,, nitrogen introduced with oxygen	=	2·1
		112·7
Then 128·5—112·7=volume of nitrogen in the gas ..	=	15·8
and 185·4—(72·1 + 15·8)=vol. of nitric oxide in the gas	=	97·5
Temperature and pressure=750 m.m. and 17° C.		
Volume of dry nitric oxide at N.T.P.	=	89
,, ,, ,, nitrogen at N.T.P.	=	14·4
Weight of nitric acid equivalent to the nitric oxide	=	256·0
,, ,, ,, ,, ,, ,, nitrogen	=	83·0
Weight of nitrous acid in the main solution	=	115·1
,, ,, nitric acid equivalent	=	154·2
,, ,, nitrous acid in absorption tubes	=	7·2
,, ,, nitric acid equivalent	=	9·7
,, ,, ,, ,, ,, to alkali neutralised	=	14·8
,, ,, nitric peroxide	=	3·3
,, ,, sodium hydroxide in main solution	=	3955
,, ,, ,, ,, after neutralisation	=	886
,, ,, ,, ,, used for neutralisation ..	=	3069
,, ,, nitric acid equivalent	=	4833
Then 5198—4833=365; and 256 + 83 + 14·8	=	353·8
and 4833 + 353·8=5186·8 compared with 5198 in the volume of acid used.		

An examination of the table will make it clear that while the qualitative reactions for copper and its alloys with arsenic are the same, the quantitative results vary in the manner already described. That is, the volume of nitric oxide and weight of nitrous acid decrease and increase as the content of arsenic in the alloys increases. Also it is seen from cols. 2 and 5 that there is an intimate relation between the nitric oxide and the nitrous acid, for when the volume of the one is smaller than would be expected the weight of the other is greater; which is evidence that the liberation of nitric oxide is dependent upon the formation of nitrous acid. The formation of nitric peroxide is shown, and the variations are probably due to small changes in the temperature of the parent solution. The same applies to the nitric oxide. It is also clear from col. 3 that the volume of nitrogen liberated increases and decreases with the increase in the content of arsenic.

In cols. 6 and 7 the weights of nitrous acid in the absorption tubes and the weights of alkali neutralised, calculated to nitrous acid, are given for comparison; and it is seen that in most cases there is such a close approximation as to indicate that nitrate only is formed as shown by the equation: $NO_2 + NO + 2NaHO = 2NaNO_2 + H_2O$. The excess of alkali neutralised over nitrous acid formed is no doubt due to small quantities of acid being carried over from the reaction vessel by the escaping gases.

Col. 8 shows the weights of acid transformed in the reactions by which nitric oxide, nitrogen, nitric peroxide, and nitrous acid are formed; and it is noticed that there is a minimum transformation for the alloys containing about 0·25 per cent. arsenic.

Reference to cols. 9 and 10 will indicate the degree of accuracy which may be expected from the method and apparatus, which is such that only reactions that take place to a very limited extent could be missed.

The cause of the variations in the general results is most probably the increase in the reactions by which nitrogen is set free, and although the ammonia in the main solution was not determined in every case there is abundant evidence of its formation. Thus an increased formation of ammonia in the presence of nitrous acid is sufficient to account for an increase in the nitrogen set free, if it is assumed that the reaction expressed by the equation takes place, $NH_3 + HNO_2 = N_2 + 2H_2O$.

heating of the solution as long as gas was expelled from it. On the other hand, Gladstone examined the solution obtained by dissolving the alloys at room temperatures under conditions in which as little gas as possible was evolved. He found that nitrous acid decreases and ammonia increases in the solution as the content of zinc in the alloys increases.

TABLE I.

Copper and Copper-Arsenic Alloys.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Percentage of arsenic as determined.	Nitric oxide liberated volume.	Nitrogen liberated volume.	Nitric peroxide liberated weight.	Nitrous acid in the main solution.	Nitrous acid in the absorption tubes.	Alkali neutralised in the absorption tubes calculated to nitrous acid.	NO, N_2 and total HNO_2 calculated to HNO_3 for comparison.	HNO_3 calculated from data obtained to compare with 5198 in solution used.	Excess or deficiency of HNO_3.
0·00	113·8	6·8	4·1	154·9	8·4	13·1	573	5205	+7
0·01	108·0	11·0	3·5	117·2	7·2	9·7	528	5199	+ 1
0·05	101·8	9·5	5·4	141·5	11·1	13·9	538	5183	—15
0·10	101·2	11·1	3·9	122·2	8·0	9·7	517	5198	0
0·13	94·6	11·5	3·5	124·6	7·1	11·0	504	5170	—28
0·25	90·7	14·4	3·5	115·0	7·2	11·0	503	5187	—11
0·50	95·8	14·2	3·1	122·4	6·3	6·6	519	5186	—12
0·78	101·9	12·4	4·3	121·2	8·8	10·2	528	5188	—10
0·92	94·2	11·7	3·6	136·7	7·4	10·6	520	5192	— 6
1·45	98·3	12·1	4·2	129·6	8·5	10·2	525	5220	+22
1·92	97·3	11·5	5·3	148·2	7·2	8·0	543	5185	—13
2·43	97·5	13·8	3·3	161·9	6·7	11·0	572	5227	+29
2·98	103·3	11·6	3·3	146·4	6·7	8·8	558	5227	+29

There seems to be no reason to alter the opinion already expressed that the primary cause of the variations in the reactions of these alloys with nitric acid is the formation of a solid solution of copper arsenide in copper which sets up a reaction by which ammonia is formed, and that the effect increases with the concentration of this solution up to about 0·25 per cent. arsenic, beyond which it diminishes.

It is well known that the arsenide soon begins to separate from the solution in alloys containing more than 0·25 per cent. of the metal. Similar remarks apply to the alloys of copper with antimony and phosphorus.

Copper-Zinc Alloys.

The reactions of copper-zinc alloys have been studied by Acworth and Armstrong, who found that with alloys rich in copper the reactions were similar to those of copper itself. They, however, only dealt with the gases set free during the dissolution of the metal and by the subsequent heating of the solution as long as gas was expelled from it.

It was thought that the method and apparatus used for the copper-arsenic alloys might be employed for the examination of a series of copper-zinc alloys of known composition. These alloys were prepared from pure metals, so that the effects of impurities upon the results obtained need no consideration.

It is well known that the two metals when dissolved separately give quite distinct sets of reactions, which will serve to show the general effects of alloying in their case.

In the experiments, the results of which are given in Table II., 800 mgrs. of the alloy in the form of sifted filings and 20 c.c. of dilute nitric acid (sp. gr. 1·149) containing 5427 mgrs. of the acid were used. The temperature was kept as near 65° C. as possible, but was more difficult to control than with the copper-arsenic alloys, as the rate of action increases with the content of zinc. The difficulty, however, was overcome by reducing the temperature of the water bath as the zinc increasesd in the alloys. Otherwise the experiments were carried out exactly as described at the beginning of this section.

TABLE II.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	Percentage of zinc.	Nitric oxide liberated. volume.	Nitrogen liberated volume.	Nitric peroxide liberated. weight.	Nitrous acid in the main solution.	Nitrous acid in the absorption. tubes.	Alkali neutralised in the absorption tubes calculated to nitrous acid.	NO, N_2, total HNO_2 and NH_3 calculated to HNO_3 for comparison.	HNO_3 calculated from the data obtained to compare with 5427 in the solution used.	Excess or deficiency of HNO_3.	Ammonia in the main solution.
1	0·0	113·8	6·8	4·1	154·9	8·4	13·1	573	5025	+ 7	
2	20·9	115·2	4·7	4·8	188·7	9·6	9·3	614	5391	—36	0·2
3	30·2	117·5	6·0	4·4	170·5	9·0	11·7	608	5443	+16	0·6
4	42·8	114·8	6·7	6·0	133·7	12·2	16·2	562	5444	+17	1·0
5	52·9	129·8	8·2	4·2	78·5	8·6	13·5	539	5425	— 2	2·4
6	68·1	116·2	7·4	5·3	90·5	10·8	28·8	509	5411	—16	3·0
7	82·8	114·5	7·8	4·8	63·4	9·6	18·0	479	5440	+13	6·5
8	100·0	24·2	11·6	2·2	19·2	4·6	9·9	290	5332	—95	18·0

The gas collected from the dissolution of zinc contained 5·9 c.c. of nitrous oxide, which is not given directly in the table, but is included in cols. 8 and 9. As the gas was passed through the absorption tubes it is probable that some nitrous oxide was dissolved, and this would account for some of the 95 mgrms. of acid given in col. 10 as not traced.

The results for the alloys given in the table bring out in a clear manner the general characteristics of the reactions of the copper-zinc series with nitric acid; while those for pure copper and pure zinc, which are given for comparison, show the great difference in the reactions of the individual metals.

The influence of the copper in the alloys is seen in the steady liberation of nitric oxide, as shown by the results collected in col. 2; and that of the zinc by the uniform decrease in the weight of nitrous acid left in the solution, col. 5, and the increase in the ammonia, col. 11. The relation between the volume of nitric oxide and the weight of nitrous acid given in cols. 2 and 5, line 5, gives support to the statement already made that the oxide is the product of the decomposition of the acid, for an increase in the one is accompanied by a decrease in the other. The cause of the variation with this particular alloy is probably due to a somewhat higher average temperature during the reaction.

The results given in cols. 6 and 7, although irregular, serve to show that nitrous acid only is formed from the nitric peroxide and nitric oxide passing into the absorption tubes. The irregularities are no doubt due to acid carried over from the reaction vessel by the escaping gases.

The gradual decrease in the weight of acid transformed in the reactions, as shown in col. 8, is perhaps the most instructive feature of the table, since it shows the increasing influence of the zinc through the series, for while there is a general resemblance of the reactions to those of copper itself, it decreases as the content of zinc increases. The regular variations in the reactions are no doubt due to the alloys consisting of one or more solutions, and is another example of marked influence which solid solutions exert upon the properties of alloys containing them.

The accurate determination of nitrous oxide in the presence of nitric oxide is a difficult problem in gas analysis, and considerable attention has been given to it in connection with the work on the copper-zinc alloys, as it was necessary to prove the presence or absence of the gas in the gaseous products of the reactions. To this end a number of experiments were made with the gases obtained by the dissolution of zinc and lead in nitric acid; and with mixtures of gases of known composition.

If the nitric oxide is first removed by mixing with the gas a known volume of oxygen the exact volume of oxygen left in the residue is not known, for reasons already stated. Therefore, nitrous oxide present in the original gas cannot be determined exactly by exploding the residue with excess of hydrogen.

The determination of nitric oxide in a mixture of gases, by absorbing the gas into an alkaline solution of potassium sulphite as recommended by Divers* is accurate in the absence of soluble gas, but when nitrous oxide is present that gas is dissolved to an extent that renders the method useless except for qualitative work. Alcohol is also useless for the purpose, for although it dissolves nitrous oxide readily, it also dissolves nitric oxide, so that the gases cannot be separated by its agency.

It is well known that nitrous oxide forms an explosive mixture with hydrogen, but the latter gas must be present in very moderate excess or the mixture will not explode. Sometimes a mixture which is not sufficiently concentrated to explode under normal conditions may be exploded if the pressure of the gas in the explosion bulb is increased before sparking it, but this does not raise the limit very much. If, however, there is free oxygen in the mixture any nitrous oxide is reduced and its volume can be calculated provided that the volume of oxygen present is known. But if nitric oxide has been removed by oxygen the volume of the latter gas left in the mixture is not known accurately, especially when the volume of nitric oxide to be removed is relatively large. This has been already referred to, and prevents the accurate determination of nitrous oxide. When, however, the volume of nitric oxide is relatively small the excess of oxygen actually present approximates closely to the volume calculated from the decrease in volume due to the absorption of nitric peroxide.

When much nitric oxide is present the following procedure has been found to give good results:

(1) The nitric oxide is removed from the mixed gases by the addition of a measured volume of oxygen.
(2) A measured volume of the residual gas is exploded with excess of hydrogen.
(3) The nitrous oxide is absorbed from another portion of the residual gas by placing it over alcohol.
(4) The residue from (3) is washed to free it from alcohol vapour and the oxygen determined by placing it over alkaline pyrogallate solution.

By comparing the contraction in volume taking place in (2) with that calculated from the volume of oxygen found in (4) the presence or absence of nitrous oxide in the original gas is indicated.

This method was applied to the examination of the gas obtained from an experiment with the copper-zinc alloy, containing 82·8 per cent. of zinc, in which the absorption tubes were omitted, so that the only possible absorption of nitrous oxide should be through the surface of the solution in the gas burette, and this is known to be very slow when the percentage of the gas is low.

The results prove that if nitrous oxide is one of the gaseous products of the reactions when copper-zinc alloys are dissolved the quantity is too small to be detected.

Bismuth and Copper.

The similarity of the reactions of copper and bismuth is dealt with in this J., 1908, 365, and it is stated that nitrous acid must be present in the nitric acid, and that the dissolution of the metal depends upon the formation of their nitrites. It was thought however that a further test with the apparatus shown in Fig. 1, would be useful, and a sample of pure bismuth was prepared for the experiment, which was carried out exactly as described above. Equal weights of the two metals require different weights of acid for their dissolution so for better comparison a weight of bismuth equivalent to 800 mgrs. of copper, and found from the relation $\frac{208 \times 800 \times 2}{63{\cdot}57 \times 3} = 1745$, was taken, so that the same weight of acid would be concerned in both reactions.

Table III.

	1.	2.	3.	4.	5.	6.
	Weight of metal dissolved.	Volume of nitric oxide liberated.	Volume of nitrogen liberated.	Nitrous acid in the main solution.	Nitrous acid in the absorption tubes.	Nitric acid transformed.
Bi	1745	105·1	7·0	169·7	6·9	569
Cu	800	113·8	6·8	154·9	8·4	573

20 c.c. of 1·14 acid were used and the results together with those for copper taken from Table I. are given in Table III.

The similarity of the reactions of the two metals is quite clear, but that the presence of nitrous acid is necessary is not demonstrated. Veley has shown that the lower acid must be present in the case of copper and couples bismuth with it, but as far as the author is aware he has not given any statements of results for the latter metal.

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* Trans. Chem. Soc., 1899, p. 82.

A number of experiments were then made in which 20 c.c. of 1·14 nitric acid, containing 0·04 mgr. of nitrous acid, were used. The temperature of the acid was raised to 35° C. in a water bath, and then allowed to cool slowly to 25° C., during aspiration.

(1) Pure air was aspirated through the acid for one hour. A button of bismuth weighing 6·2 grms. was then introduced and the aspiration continued for one hour, when 4 mgrs. of metal dissolved.

(2) The button was immersed for one hour in a fresh portion of acid without aspiration either before or after immersion, when 280 mgrs. of the metal dissolved.

(3) The button was immersed for one hour in a fresh portion of the acid containing 50 mgrs. of urea in solution, when 48·3 mgrs. of the metal dissolved.

(4) The button was put into a fresh portion of the acid which had been aspirated for an hour and then had 50 mgrs. of urea added to it, when 40·8 mgrs. of the metal dissolved.

Experiments (1), (2) and (4) were repeated with copper in the place of bismuth, and the weights of copper dissolved were 1·9, 789·2, and 177 mgrs. respectively.

It would appear from these experiments that a great similarity does exist between copper and bismuth in their reactions with nitric acid; but there are points of difference which should be noted. The dissolution of bismuth under the same conditions is slower than that of copper. Yet when the action of nitrous acid is reduced as much as possible more of the former than of the latter metal is dissolved, but when the nitrous acid is allowed to exert its action the opposite is the case. Further, a black film, which increases with the length of exposure to the acid, is formed on the surface of the bismuth in all cases, and this is most probably an oxidation product which is insoluble in dilute nitric acid. No such action is noticed in the case of copper.

SECTION II.

Reactions of Silver and Copper.

In the work described in the preceding section the reactions were caused to take place rapidly by using the metals in a finely divided state, and by raising the temperature of the acid. In this section the experiments have been made with the metals in the form of plates and the acid at room temperatures, so as to increase the time required for the reactions.

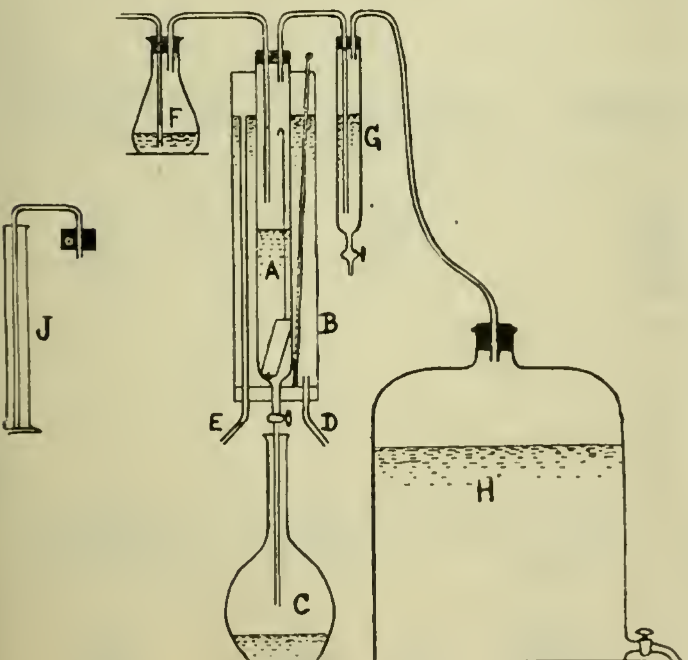

FIG. 2.

The form of the apparatus employed for this purpose is shown in Fig. 2. It consists of a burette, A, surrounded by a water jacket, B, in which a thermometer is suspended. The jacket is fitted with inlet and outlet tubes, D and E, by which the water in it can be easily renewed. The burette is emptied through a long tube into the measuring flask, C. The top of the burette may be closed either by the bung attached to the pressure tube, J, or by the one connected with the wash bottle, F, and the absorption tube, G, as required.

Silver.

The metal was prepared by dissolving fine silver in nitric acid, precipitating the metal as chloride by hydrochloric acid, and then reducing the chloride by fusion with sodium carbonate.

An experiment is conducted as follows: a measured volume of the acid solution is run from a pipette into the burette and allowed to come to the temperature of the water in the jacket. The metal or alloy in the form of a rectangular plate, which has been cleaned by scouring with sodium hydroxide solution and then with fine pumice powder, is washed, dried and weighed. It is then swilled, placed on the expanded end of a thin glass rod, and lowered into the acid solution, being well moved about to detach any bubbles of air clinging to the surface. The rod, which is left in the burette till the end of the experiment, has a hook at the end by which it can be withdrawn. The top of the burette is closed with a rubber bung coated with paraffin wax and fitted with an angle tube, the long limb of which dips into water in the cylinder, J. The time and temperature at the beginning of the experiment are noted. When the action has proceeded to the assigned limit the bung is removed, and the acid solution run into a measured volume of sodium hydroxide solution of known strength contained in the flask, C. The burette is filled up and emptied three times to ensure thorough washing of the tube and the remaining metal. The metal plate is then taken out, dried and weighed. The solution in the flask is made up to the mark, well mixed, allowed to stand for the precipitate to settle, and the clear solution syphoned off. It is then titrated for nitrous acid in solution, with standard permanganate, and for excess of sodium hydroxide, with standard acid, using methyl orange as indicator.

As the temperature is practically constant any change in pressure in the burette is due to the evolution of gas from the solution. Nearly the whole of the gas liberated by the dissolution of silver in dilute nitric acid is nitric oxide. Any of this gas escaping from the solution forms nitric peroxide by union with the oxygen of the enclosed air, and a gradual diminution in the pressure takes place, due to the absorption of the higher oxide, until the whole of the oxygen has been used up. Then the pressure gradually increases due to the replacement of the oxygen by nitric oxide. It is only in experiments of long duration that any escape of gas from the apparatus is observed.

In the first experiment made as described above a weighed strip of sheet silver was immersed in 15 c.c. of nitric acid, sp. gr. 1·2, and allowed to remain there for 50 minutes. Bubbles of gas commenced to escape from the surface of the metal almost immediately, and the pressure increased slightly. $T=17^\circ$ C. The weight of silver dissolved was 1642 mgrms., and that of nitrous acid formed, 320 mgrms.

It was considered that the action of the 1·2 acid was too rapid for the purpose, and a number of experiments were made with more dilute acid. The action was allowed to proceed until the whole of the metal had disappeared.

The dissolution as indicated by the appearance of small bubbles of gas on the surface of the metal did not commence at once. The time between the immersion of the metal and the appearance of bubbles increased with the dilution of the acid. The action was allowed to proceed through the night so that the exact time required for the dissolution was not determined. The weight of acid $=4·953$ grms. HNO_3, was kept constant, but the volume of solution varied with the concentration.

Now the metal is converted into nitrate and nitrite, and the weight of acid required for a given weight of the metal can be calculated by using the ratios $HNO_3 : Ag = 63 : 107{\cdot}9$. If then the nitrous acid found in solution is calculated to nitric acid a direct comparison can be made with the total quantity of acid required. The results are given in Table IV. Weights in this and the following tables are expressed in milligrammes.

On reference to the table it is seen that the rate of dissolution is considerably reduced by the dilution of the acid, and it was noticed in the experiments themselves that the surface of the metal showed no signs of reaction for a length of time which increased with the dilution of the acid. This is clearly brought out by experiment 6 in which no difference could be detected in the weight of the metal before and after immersion, and the solution was quite free from silver. The observations generally point to the conclusion that the metal is not dissolved unless the temperature and concentration of the solution are such that nitrate or nitrous acid is decomposed with evolution of gas. The figures of column 8 show that about 45 per cent. of the acid is converted into nitrite.

In the next series of experiments the conditions were kept as nearly as possible the same. The silver was in the form of rolled sheet 26 × 12 m.m., and the time of immersion was three hours. 25 c.c. of 1·104 acid were used. The results are given in Table V.

From the weights given in column 1 it is evident that even slight variations in the conditions during an experiment have a considerable influence upon the rate at which the metal passes into solution: but this does not affect very much the percentage of acid transformed into nitrite.

In the next series the time of immersion was varied, but the other conditions were kept the same as above. The results are given in Table VI., and it is interesting to note the increase in the rate of dissolution as the products of the reaction collect in the neighbourhood of the dissolving metal. It is generally assumed that the rate increases as the quantity of nitrite, not nitrate, increases.

The influence of nitrous acid. Experiments were then made to test the effect of increasing the quantity of nitrous acid usually present in the acid solution upon the rate of dissolution of the metal. For this purpose four silver plates were cut from the same sheet of metal, filed together to a uniform size, cleaned, dried, and weighed. Four test tubes, in each of which was placed 25 c.c. of the acid solution containing 4·46 grms. of nitric acid, but different weights of nitrous acid, were used. The test tubes were fitted with syphon tubes, and supported side by side in a water bath at room temperature. The pieces of metal were dropped in at intervals of ten minutes so as to allow of the same time of immersion for each piece.

The solutions were syphoned into excess of sodium hydroxide, also at intervals of ten minutes, and the clear solutions examined as before. The results are embodied in Table VII.

It is quite clear from the results that the presence of nitrous acid accelerates the action of the acid on the metal; also the appearance of the tubes indicated in which the action was most vigorous. The dissolution, as indicated by the escape of gas bubbles from the surface of the plates, commenced first in No. 4 and last in No. 1.

It appears from the general results that approximately half the quantity of acid required to convert silver into its nitrate is converted into nitrous acid, but whether

TABLE IV.

Experiment.	1.	2.	3.	4.	5.	6.	7.	8.
	Silver dissolved.	Sp. gr. of acid.	Volume of acid.	Duration of experiment in hours.	Nitric acid required.	Nitrous acid found.	Nitric acid equivalent to nitrous acid.	Percentage of HNO_3 converted into HNO_2.
1	938	1·104	25	17	547	194	260	47·5
2	953	1·104	25	22	573	178	238	41·6
3	898	1·076	35	41	523	177	237	45·2
4	1244	1·076	35	24	726	246	330	45·5
5	1047	1·060	45	76	611	199	267	45·8
6	—	1·060	45	24	—	—	—	—

TABLE V.

Experiment.	1.	2.	3.	4.	5.
	Silver dissolved.	Nitric acid required.	Nitrous acid found.	Nitric acid equivalent to nitrous acid.	Percentage of nitric acid transformed into nitrite.
1	353·5	206·2	76·9	103·0	50·0
2	333·8	194·6	72·9	97·7	50·2
3	266·4	155·4	58·0	81·0	52·1
4	366·5	213·8	79·8	109·6	51·3
5	478·0	278·8	104·0	141·1	50·6

TABLE VI.

Experiment.	1.	2.	3.	4.	5.	6.
	Silver dissolved.	Duration of experiment.	Nitric acid required.	Nitrous acid found.	Nitric acid equivalent to nitrous acid.	Percentage of nitric acid transformed into nitrite.
1	41·8	1 hour	24·4	9·9	13·3	54·4
2	243·7	2 hours	142·2	53·4	71·7	50·3
3	453·2	3 ,,	264·6	97·2	130·3	49·2
4	826·4	4 ,,	482·5	181·1	242·8	50·3

it is present as silver nitrite is not shown by the experiments. If it is, as is most probably the case, the change may be expressed by the equation given by Dr. Divers :

$$2Ag+2HNO_3=AgNO_3+AgNO_2+H_2O$$

This is further supported by the fact that the burette as used is practically a closed vessel, and that very little gas escapes from the solution as the change proceeds.

Also that the increase in the rate of dissolution depends upon the accumulation of nitrite near the surface of the dissolving metal. This will be confirmed later.

Copper.

There is a great similarity between the reactions of copper with nitric acid and those of silver; and it would seem that the equation :

$$2Cu+4HNO_3=Cu(NO_3)_2+Cu(NO_2)_2+2H_2O,$$

might well express the primary reaction. With the object of examining this statement a number of experiments were made on the same lines as those already described for silver.

As a preliminary experiment a strip of copper was immersed in 44 c.c. of 1·106 nitric acid, and left for twenty four hours at room temperature. 1904 mgrs. of the metal were dissolved, but the solution contained only 177·6 mgrs. of nitrous acid, and 152·3 mgrs. of nitric acid were unaccounted for. As the liberation of gas from the surface of the metal was more vigorous than in the case of silver it was evident that if copper nitrite was being formed it was undergoing more rapid decomposition than silver nitrite would.

A series of experiments was then made with a rectangular strip of copper immersed in 25 c.c. of 1·104 nitric acid, and the time of exposure limited to three hours. The apparatus fitted with the pressure tube J., shown in Fig. 2, was used, and the temperature was kept nearly constant by means of the water jacket. The solution was run into excess of sodium hydroxide solution of known strength, so that both the nitrous acid and the excess of alkali could be determined. The action as indicated by the appearance of bubbles on the surface of the metal, commenced almost immediately, and the pressure in the tube increased, but there was no escape of gas.

The results are given in Table VIII.

The weights of nitric acid given in column 2 are found from the proportion : $2HNO_3 : Cu=126 : 63·57$.

It will be noticed that the weight of metal dissolved varies considerably in the three experiments. The metal was rolled into sheet without annealing, and the difference may be due to the character of the surface presented to the acid. As the same piece of metal was used for the three experiments deeper layers would be presented to the acid in the second and third immersions. But the movement of the gas escaping from the surface of the metal may have caused variations in the concentration of the solution in contact with the surface, which would account to some extent for the difference. This, however, requires investigation.

Column 5 shows that nearly half the acid required for the conversion of the copper into nitrate is transformed into either nitrous acid or nitrate.

It was evident from the appearance of the dissolving metal that more gas escaped than in the case of silver, which is probably due to the less stable character of copper nitrite enabling secondary changes to take place more readily, and this is no doubt the cause of the loss of acid indicated in column 6.

The apparatus was then modified by the introduction of an absorption tube to intercept any nitric oxide liberated from the solution. The modified apparatus (fitted with

TABLE VII.

Experiment.	1.	2.	3.	4.	5.	6.
	Silver dissolved.	Nitrous acid in the original solution.	Nitric acid required.	Nitrous acid found.	Nitric acid equivalent to nitrous acid.	Percentage of nitric acid transformed into nitrite.
1	63·9	0·7	37·3	11·5	15·4	41·3
2	187·2	0·8	109·2	33·2	44·5	40·7
3	240·2	1·5	140·2	47·3	63·4	45·2
4	273·3	3·9	159·6	55·1	77·3	46·3

TABLE VIII.

Experiment.	1.	2.	3.	4.	5.	6.
	Copper dissolved.	Nitric acid required.	Nitrous acid found.	Nitric acid equivalent to nitrous acid.	Percentage of nitric acid transformed into nitrite.	Weight of nitric acid not accounted for.
1	421·0	834·7	260·8	349·1	41·9	40·7
2	241·2	478·2	160·5	215·1	44·0	17·0
3	144·2	285·9	95·0	127·4	44·5	12·5

TABLE IX.

Experiment.	1.	2.	3.	4.	5.	6.	7.	8.	9.
	Copper dissolved.	Duration of experiment in hours.	Nitric acid required.	Nitrous acid in the main solution.	Nitrous acid in the absorption tube.	Alkali neutralised in the absorption tube calculated to nitrous acid.	Percentage of nitric acid transformed into nitrite.	Nitric acid not accounted for.	Ammonia in the main solution.
1	43·5	2	86·7	28·9	1·7		48·9	4·2	0·05
2	124·5	3	246·8	78·0	2·0	1·8	44·0	6·3	0·10
3	314·5	4	623·4	167·6	11·3	13·3	39·8	38·4	0·15
4	406·7	5	806·3	232·6	7·8	7·2	40·6	14·0	0·15

the absorption tube) is shown in Fig. 2. In this arrangement air is drawn through the wash bottle F, the burette, A, and the absorption tube, G, by the aspirator, H. The wash bottle contains a strong solution of sodium hydroxide to remove carbon dioxide from the air passing through it, and the absorption tube contains a measured volume of sodium hydroxide of known strength to absorb nitric peroxide carried over from the burette. A steady stream of air is maintained throughout the experiment, so that the whole of the nitric oxide escaping from the acid solution in the burette should be oxidised and then absorbed by the alkali in the absorption tube. Thus the nitrous acid formed and the alkali neutralised can be determined. The nitrous acid, and loss of acid in the main solution can also be determined.

In the experiments, the results of which are given in Table IX, the time of immersion of the metal in the acid was varied, but the other conditions were kept the same. 25 c.c. of the 1·104 acid were used in each case.

Reference to the table shows that the rate of dissolution increases more rapidly than the time of exposure, and this depends no doubt upon the accumulation of the products of the reaction in the neighbourhood of the dissolving metal. Comparison of columns 5 and 6 shows that the alkali neutralised in the absorption tube is practically all converted to the form of nitrite, which does not agree with the reaction expressed by the equation :

$$N_2O_4+2NaHO=NaNO_3+NaNO_2+H_2O,$$

but rather with that taking place when a mixture of nitric peroxide and nitric oxide is passed into the alkali solution. But it seems very improbable that nitric oxide would remain unchanged in the current of air passing through the apparatus. If, however, it is assumed that the nitric oxide is oxidised to nitrous acid in the presence of air and moisture an explanation of the results is obtained. To test this assumption experiments were made in which oxygen was passed through the apparatus in place of air and a stronger acid solution (1·14) was used in order to accelerate the action. The results of three experiments are given below, 1, 2 and 3.

TABLE X.

1.		2.		3.		4.	
32·4	62·7	38·5	75·9	28·3	59·1	135·6	208·4

For direct comparison the nitrous acid found and the alkali neutralised are calculated to their equivalents in nitric acid, and it is seen at once that the ratio 1 : 2 is practically obtained in each case. A fourth experiment was made with air instead of oxygen, the results of which are given in 4, and it is seen that the same ratio does not hold.

It is evident th n that the equation given above represents the reaction in the absorption tube when oxygen is used ; but with air it approximates to that given by : $N_2O_3+2NaHO=2NaNO_2+H_2O$, and this is borne out by later experiments.

It may be assumed that the nitric oxide set free is a product of the decomposition of nitrous acid (or nitrite) in the solution, and that the reaction is represented by the equation : $3HNO_2=HNO_3+2NO+H_2O$.

In this case it is seen that when oxygen is used, the nitrous acid formed represents only one-third of that decomposed in the solution ; while when air is used it approximates more nearly to two-thirds of the amount. This assumption is used in computing the weight of nitrite in order to obtain the percentages given in column 7, Table IX. If then it is borne in mind that nitrogen is also a product of the decomposition of the nitrite the evidence is strongly in favour of the primary reaction given by the equation on p. 317.

With respect to the formation of ammonia during the dissolution of copper in dilute nitric acid it may be mentioned that in an experiment extending over 24 hours 4645 mgrms. of copper were dissolved and 1·9 mgrs. of ammonia formed. This ammonia was not present as an impurity in the reagents used ; but a careful examination showed that the copper contained a trace of iron which may be responsible for the presence of ammonia in the solution.

SUMMARY.

The reaction of nitric acid with metals is known to be very complex in character, and its mechanism has by no means been thoroughly worked out. It is usually stated that a chemically pure and physically homogeneous metal is not attacked by the pure anhydrous acid, which is regarded as consisting of molecules represented by the formula HNO_3, or a simple multiple of it. When, however, water is added to the acid, some dissociation takes place, and part of the molecules are ionised. The dilute acid is then a solution containing both dissociated and undissociated molecules in which the ratio of the former to the latter increases as the concentration of the acid decreases. Such a solution will therefore contain $H^{\cdot}NO_3'$ and HNO_3, and its attitude towards any metal presented to it will depend, in part at least, upon the ratio of the dissociated to the undissociated molecules.

The tendency of a metal to dissolve into an acid solution by the separation of metalions from its surface is now generally admitted, and this is ascribed to a definite solution pressure which varies with the nature of the metal and that of the solution with which it is in contact. Equilibrium may however be rapidly brought about by the electro-static condition in which the metal is left by the separation of ions from it. As the metal is electronegative it exerts an action upon the ions which are electro-positive, and this attraction is supplemented by the osmotic pressure of the ions themselves, which tends to restore them to the molecular state on the surface of the metal. This state of things at the metal surface is expressed thus :

Solution pressure = electrostatic tension + osmotic pressure.

And in cases where the metal does not appreciably dissolve the number of ions passing into solution is said to be so small as to be outside the region of chemical analysis. But the equilibrium is disturbed by the presence of segregated impurities in the metal, which, forming couples with the metal itself, set up local currents at the surface, which results in continued dissolution of the metal. It is also suggested that when the metal is pure and homogeneous, that such local actions may be set up by impurities present in the acid solution.

Now, if the pressure of the hydrogen ions equivalent to the few metal ions which pass into solution is sufficient to keep the metal from continued passage into the ionic condition no sensible dissolution can take place : but if that pressure is diminished in any way then metal ions will continue to pass into the solution. It would appear then that the function of part of the nitric acid is to oxidise hydrions to water, and by continued reduction of the pressure to allow of continued dissolution of the metal. This is equivalent to saying that hydrions are oxidised to make room for metal ions. It seems very probable that this function of the acid is carried on by the undissociated molecules in the solution and that they thus furnish the various reduction products resulting from the dissolution of the metal. In this case it does not appear that electrolytic action is necessary to bring about the change, but that it is due to the relation of the metal to the other components of the system, metal + acid solution, when the electrical double layer is set up at the surface of the metal. This appears to be in accordance with Ostwald's view that the formation of secondary products is due to the reducing action of hydrogen dependent upon its concentration as liberated by the metal. If this is the case the metals generally may be arranged into groups in which their relation is similar in character for the metals constituting a similar group. A group that has received much attention is the one containing silver, copper, mercury and bismuth the reactions of which with nitric acid have been investigated by Acworth & Armstrong, Divers, Gladstone, Räy, Veley and others.

According to Veley equilibrium is set up immediately when any one of these metals in the pure state is placed in contact with dilute nitric acid free from nitrous acid: but that the presence of even a trace of the lower acid is sufficient to commence the reaction, which gradually increases with the accumulation of nitrous acid in the solution. The nitrous acid originally present is said to exert a catalytic action only.

The member of the group which has received most attention is copper. and an account of its reactions with nitric acid is set forth in every work on chemistry. The reactions most favoured are expressed by the equations:

(1) $3Cu+6HNO_3=3Cu(NO_3)_2+3H_2$.

(2) $3H_2+2HNO_3=4H_2O+2NO$.

But a survival of the old theory of oxidation is still to be found in well known works, and may be expressed thus:

(3) $3Cu+2HNO_3=3CuO+H_2O+2NO$.

(4) $3CuO+6HNO_3=3Cu(NO_3)_2+3H_2O$.

Now the equations which most nearly agree with the experimental results obtained by the author for copper were suggested to him by the late Dr. Divers, and are as follows:

(5) $3Cu+6HNO_3=3Cu\left\{\begin{matrix}NO_3\\NO_2\end{matrix}\right.+3H_2O$.

(6) $3Cu\left\{\begin{matrix}NO_3\\NO_2\end{matrix}\right.+2HNO_3=3Cu(NO_3)_2+H_2O+2NO$.

In equations 1 and 2 it is inferred that the reduction of free acid by nascent hydrogen furnishes the nitric oxide which forms nearly the whole of the gaseous products of the reaction: but it is difficult to understand how this can hold, for the metal may be completely dissolved with very little evolution of gas, and the reaction is not complete until the solution has been boiled. This objection applies with even greater force to reactions 3 and 4 in which it is assumed that the nitric oxide is liberated before the complete dissolution of the metal. On the other hand the formation of nitrite and its conversion into nitrate by the free acid is quite consistent with the behaviour of the solution on heating after complete dissolution of the copper. This is equally true for silver, bismuth and mercury. The influence of the initial nitrous acid is well defined in the case of these metals and varies in direct proportion to the quantity present. But it is evident that the action does not take place to a measurable extent until the conditions are such that nitrous acid or nitric is in part decomposed with evolution of nitric oxide. The weaker the concentration of the nitrous acid the stronger must be that of the nitric acid to promote the reaction with a given metal at a given temperature.

The influence of the solid solution in the dissolution of alloys is clearly shown with the copper-arsenic and copper-zinc series. Thus the association of arsenic with copper sets up a secondary reaction by which ammonia is formed, while the same reaction is checked by the introduction of copper into zinc.

One of the effects of the mechanical treatment of metals is to alter its relation to the solvent liquid. and generally to increase the rate of action. In this relation it may be noted that Berthelot regarded hammered and annealed silver as distinct allotropic forms of the metal. He found a marked difference in the heat of solution of the two forms when dissolved separately in mercury. the hammered variety liberating more heat than the annealed form. Dr. Beilby* also states that a metal which has been cold rolled or drawn into wire is partly converted into a vitreous amorphous form quite distinct from the crystalline variety of the metal which is formed when it solidifies from the molten state. He also states that this energised form of the metal is more soluble in the ordinary solvents, which is borne out by the author's experiments with copper. The increased action is probably due to the fact that the surface layers of a cold rolled metal plate consists of crystalline particles set in a matrix of vitreous amorphous metal. The proportion of the vitreous form will evidently depend upon the amount of work put into the metal, and will decrease from the surface to the interior of the plate. The contact of physically dissimilar particles is most probably the cause of the increase in the rate of action.

It is clear from what has gone before that the following conditions must be taken into account in discussing the reactions of metals and alloys with nitric acid.

(1) The purity, physical and mechanical condition of the metallic body.

(2) The purity, concentration and mass of the acid solution.

(3) The temperature at which the reactions take place.

(4) The accumulation of the products of the reactions in the solutions.

Meeting held at Birmingham University on Thursday, March 6th, 1913.

MR. N. PARR BOOTH IN THE CHAIR.

THE DETERMINATION OF BENZOIC ACID IN MILK.

BY J. F. LIVERSEEGE, F.I.C., AND NORMAN EVERS, B.SC., F.I.C.

(Abstract.)

The authors drew attention to a milk preservative which is now on the market consisting of 6 parts of sodium benzoate and one part of anhydrous sodium carbonate (see Monier-Williams; this J., 1912, 249). Milk preserved with this substance, according to the direction of the vendors, would contain about 65 grains of sodium benzoate and about 10 grains of sodium carbonate per gallon.

The fact that this preparation was being offered to milk dealers induced the authors to investigate methods which might be used for the detection and estimation of benzoic acid in milk. They found that when a solution of sodium benzoate is acidified with varying amounts of sulphuric acid and distilled with steam, the distillate acidified and extracted with ether, under no conditions could the whole of the benzoic acid be recovered. On the other hand they found that in the case of milk containing no benzoic acid, the distillate, when acidified and extracted with ether, yielded a certain residue. As a result of their investigations they recommend the following empirical method by means of which they state that about 45 per cent. of the benzoic acid is obtained. They point out, however, that it is advisable for each analyst to make test analyses with his own apparatus in order to ascertain the exact proportion he can obtain. The method described is as follows:—

One hundred c.c. of milk are mixed with ten c.c. of strong sulphuric acid and distilled in a current of steam until 600 c.c. have passed over. To the distillate 5 c.c. of concentrated hydrochloric acid are added, after which it is shaken successively with 100, 35, and 35 c.c. of ether. The ethereal extract is allowed to evaporate spontaneously in a tared glass dish, and after the latter has remained in a desiccator for a day the dish and residue are weighed. From the weight of the residue 5 mg. is subtracted to correct for the blank obtained with milk free from the preservative in question.

In order to prove that the residue is actually benzoic acid, the authors recommend a modification of Halphen's test (this J., 1908, 27, 954), which they have found to give fair quantitative results. The procedure is as follows:—

To the residue in an evaporating dish is added 1 c.c. of strong sulphuric acid and 0·2 c.c. of strong nitric acid.

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* Proceedings of The Institute of Metals, 1911.

The dish is gently heated over a low flame so that the liquid fumes moderately for three minutes. If a deep yellow colour is formed before the end of the time the heating is at once stopped. When cool about 5 c.c. of water are added and the liquid is poured into a 50 c.c. Nessler cylinder, the dish being further washed with about 3 c.c. of water. 1 c.c. of a saturated solution of sodium sulphite is mixed with the liquid and then 10 c.c. of about 6 N ammonia are added while cooling. A brown colour indicates the presence of benzoic acid. Finally 2 c.c. of ammonium sulphide are added, when a deep red colour is produced. The liquid is then diluted with water to 50 c.c. and compared with standards prepared in the same manner. In a particular experiment standards of 3, 5, and 7 mg. of benzoic acid were made. A milk residue to which 5 mg. of benzoic acid had been added indicated about 4·5 mg. on comparison with them.

Discussion.

Mr. F. H. Alcock said that, whilst examining a bottle of medicine which was found to contain both sodium benzoate and ammonium chloride, during the process of evaporation the benzoate was dissipated and only sodium chloride with the excess of ammonium chloride remained. This suggested a method for determining the sodium benzoate in milk—the addition of ammonium chloride and submission to steam distillation. The dissociation would take place more readily than ever in acid solution, the whole of the benzoic acid being found in the distillate and in less quantity than 600 c.c. of it. In the authors' process the latter might be concentrated by adding sodium carbonate to fix the benzoic acid before the acid and ether treatment, which would economise the amount of ether. He did not regard as desirable the use of sulphuric acid with sodium benzoate, for fear of the formation of a sulpho derivative which would not be volatilised so readily. He favoured the less destructive phosphoric acid rather than hydrochloric or sulphuric acid.

Mr. Liverseege, in reply to questions, said the preservative was intended to prevent the milk going sour, and there was wisdom in including the sodium carbonate. The alternative method suggested by Mr. Alcock was certainly interesting.

London Section.

Meeting held at Burlington House, on Monday, February 3rd, 1913.

PROF W. R. E. HODGKINSON IN THE CHAIR.

THE BEHAVIOUR OF PAINTS UNDER THE CONDITIONS OF PRACTICE, WITH SPECIAL REFERENCE TO THE ASPERSIONS CAST UPON LEAD PAINTS.

BY HENRY E. ARMSTRONG AND C. A. KLEIN.

A communication was made to the Liverpool Section of this Society on May 3rd, 1911, by Prof. E. C. C. Baly, on "The Toxicity of White Lead," which became widely known, though not published in the Journal of the Society, through the appearance of accounts of the meeting in various trade journals—notably "The Oil and Colour Trades Journal" of May 6th, 1911, p. 1518 and the Chemical Trade Journal, May 13th, 1911. The final conclusion arrived at in this communication was: "That a definite volatile lead compound is given off in the drying of white lead paint. It appeared to be peculiar to basic carbonate of lead and to explain the prevalence of lead poisoning among painters." We believe that before being presented to this Society, this conclusion had been brought under the notice of the Departmental Committees of the Home Office appointed February, 1911, to consider the danger attendant on the use of lead compounds in the painting of buildings, the painting of coaches, etc., and that a serious impression had been produced upon the Committees by Prof. Baly's representations.

When requested, at the time of the appearance of the account of Prof. Baly's work, by a Committee of the London Chamber of Commerce, to consider these statements, one of us forthwith formed the opinion that his conclusion was illogical, unwarranted by the facts and without justification; our experiments show this to be the case.

The opening sentence of the Chemical Trades Journal report:—"Prof. Baly said the experiments which he made were with a view to ascertaining whether it was possible to obtain conclusive evidence as to the toxicity of white paint used by painters"—affords clear indication that Prof. Baly was inclined to assume toxicity, whatever that expression may include. The following sentences show this to be the case:—"Everyone is familiar with the characteristic smell of white lead paint when drying upon a newly painted surface, which was described by painters as the smell of lead. Painters have long ascribed this characteristic smell to lead and it is noticeable that there is no such smell from zinc-white paint. It is well known, too, that while painters do suffer from lead poisoning, only in rare instances is poisoning known among workers in the manufacture and mixture of white lead. It was therefore decided to investigate and to obtain some definite pronouncement with regard to this so-called leady smell."

The argument on which the experiments made by Prof. Baly were based is stated as follows:—"If, as painters insisted, some lead compound was given off in drying white lead, then there would be absorption of light when light passed through the vapour into the spectroscope and so, on these lines, experiments were made."

The question arises, first—have painters long ascribed the smell illogically to lead or logically to lead paint? Then, is it true that they have insisted that "some lead compound" is given off as white lead dries? Was not this last statement a product of the speaker's imagination?

The one serious suggestion which we have been able to find that a volatile compound of lead is given off from paint in drying is made in the Report presented in 1907 by M. Breton to the French Chamber of Deputies. We shall deal with this Report later on.

The reason why Prof. Baly used a complicated photographic method, in the first place, is not far to seek. During the greater part of his career, he has been engaged not in chemical work but in taking photographs of the absorption spectra of substances in solution. He used the method both naturally and because, probably, he wished to show that the very elaborate, costly apparatus at his disposal could be put to practical use.

In the first experiment, a tube was coated inside with "stiff white lead paste containing 7 to 8 per cent. of linseed oil." In the second, "zinc white paint" paste was used; in the third "Purex lead paint." Some light was absorbed in the case of the white lead paint alone.

The experiments were then repeated with the three materials in tubes heated at temperatures varying from 60° to 150° C., photographs being taken at 5° intervals throughout this range; we are told that:—"With zinc white there was no absorption of light up to 100° C., after which there was a small increasing absorption probably due to the linseed oil beginning to vaporise at this point. In the case of white lead, absorption was apparent at 75° C., while purex behaved exactly the same as zinc white."

But as it might be asked, "Why heat the paint?" in the next experiment, "a tube of glass was coated with white lead and placed in a copper tube overnight at 40° C. Upon passing a beam of light through it as before, absorption took place. Another tube smeared with purex treated in the same way showed no absorption."

We are left in doubt what is meant by "white lead" here and when it was that the beam of light was passed through the tube which had been placed in the copper tube overnight. But we are only dealing with a report.

Finally, to test whether a room painted with white lead paint would show the same result (as the tubes) under the spectroscope "two wooden boxes were made 7 ft. long and 2 in. square fitted at each end with quartz windows. They were painted inside with white lead and purex paint respectively. In this case the paint was let down to the ordinary consistency in painting. These boxes were allowed to dry in a warm room and then each was photographed with the beam of light passing through. The result was definite absorption with white lead, none with purex."

No definition of " paint" is given. Apparently actual paint was never used but merely mixtures of the solid material and linseed oil, without turpentine.

The conclusion arrived at up to this point by Prof. Baly was that the painter using white lead paint is exposing himself to volatile compounds ; this (apart from the fact that painter's paint is something different from Prof. Baly's mixture) is the only logical deduction that he was entitled to make, though by implication his hearers were probably led all through to regard the white lead as an incriminated article, capable of emitting vapour containing lead and presumably poisonous ; indeed the implied charge at once follows :—" Having arrived at these conclusions, the point to determine was, what these volatile compounds are. Though this point has not been settled conclusively, enough evidence has been obtained to prove that a definite volatile compound of lead does exist in white lead paint."

Various distillation experiments are then referred to in which distillates were obtained containing lead when white lead had been used but free from lead when purex was substituted for the white lead. No word is said which indicates that any special precautions were taken to prevent the lead from being carried over mechanically or, indeed, that Prof. Baly was in the least alive to the need of taking any precautions to prevent priming.

Finally, the rapid action of litharge on linseed oil is referred to and the opinion expressed that action takes place in a similar manner between white lead and oil, though more slowly, the implication being that the primary volatile lead compound is produced because " while grinders and mixers rarely suffered from lead poisoning, painters frequently did, owing to the fact that the white lead paint was kept eight to nine months, during which time the reaction took place."

In opening the discussion, Mr. Carey, the Chairman, said " that Prof. Baly had made a speciality of spectroscopic work and his contribution that evening had shown them one of the uses to which the spectroscope could be put." We should prefer to say *misuses* rather than *uses*.

The following remarks made by two medical men present at the meeting, showing the impression produced, are of interest in more than one particular :

" Dr. Collis[*] said that doctors always argued that the poisoning of painters must be due to dust, while the pointers themselves always insisted that it was due to the leady smell, as they called it, from white lead paint. Professor Baly had shown that the painter was right after all. He always thought that chemists could help doctors more than had been the case up to the present. His own personal opinion was that rather too much was made in these days of microbes. It was true that microbes did a great deal of damage, but he thought that in many cases it was due to the vitality of the human system having been previously lowered by other means before the microbes got to work."

" Dr. Buchanan,[†] a toxicologist, said that one of the surest indications of lead poisoning was the alteration in the corpuscles of blood which took place half an hour after inhaling. He mentioned that he had drawn the attention of one of the district medical officers to this fact and he had let his daughter examine the blood of patients who came under his notice. After a time his daughter, who was quite healthy, showed signs of lead poisoning by (on examination of her) red blood corpuscles. The medical officer was at a loss to understand this, until it transpired that some painting had been done at her home."

It is evident that Prof. Baly paid no attention to existing knowledge of the behaviour of drying oils—to the well-known fact that the drying process involves more or less oxidation of the oil and that volatile products are formed ; also that he in no way took into account the use of turpentine or other volatile liquids in thinning paints and that the vapour of these is at once given off rapidly from the painted surface : even Drs. Collis and Buchanan, the medical men present, seemed to be unaware of this latter circumstance.

Three questions were before us when we commenced our experiments :—

1. The possible effect of the various constituents of paints taken singly ; in other words, whether the symptoms supposed to be characteristic of lead poisoning were in reality due to lead.

2. The extent to which volatile substances were produced at any stage either during the preparation of lead paints or during their use by painters.

3. Whether volatile lead compounds were producible or produced in the manner Prof. Baly had indicated.

1. It is well known to the chemist that the compounds of lead generally and also the fatty oils used by painters are not volatile in any ordinary sense of the term. The few volatile compounds of lead, such as the tetraethide ($PbEt_4$), that are known are altogether peculiar substances and there is no probability that such are formed from white lead and oil. But turpentine is well known to be a very volatile substance and a powerful irritant of the skin ; those who have worked with it much are well aware that it produces headache and that it also affects the stomach ; different persons, however, are sensitive to its action in very different degrees and painters, as a rule, seem to become accustomed to it early in their career. Russian turpentine is far more active than either French or American turpentine—probably owing to the presence of easily volatile products of destructive distillation.

We were led at the outset of the inquiry to make the suggestion that some at least of the symptoms ascribed to lead poisoning were to be attributed to the turpentine in the paint—especially the effect on blood corpuscles commonly regarded as symptomatic of lead poisoning.

It is somewhat remarkable that, apparently, this point has escaped the notice of the medical experts. Dr. K. R. Goadby, one of the authorities on lead poisoning, has made special experiments to test the validity of our contention which have led him to conclusions in entire agreement with our suggestion.

Dr. Kenneth Goadby[*] has found that animals subjected to the vapours given off from white lead paste at an elevated temperature, viz., 50° C., were quite unaffected after over 300 hours' exposure, whilst those exposed to the vapours produced at ordinary room temperature from a surface painted with any paint containing turpentine suffered from the outset. Whilst he was unable to distinguish between the physiological effects produced by paints containing white lead, basic sulphate of lead, zinc oxide or lithopone, it was obvious that the animals suffered through the agency of a common cause ; further experiments showed that the ill-effects observed were due to turpentine vapours and could be reproduced in other animals by subjecting them to turpentine vapour alone.

In determining whether and to what extent volatile products are formed from linseed or other oils and the ordinary materials used in making paints, we have substituted for the very complicated and expensive apparatus used by Prof. Baly a very simple and inexpensive test which it is open to every one to use. This has the advantage of being a physiological test comparable with that afforded by the human subject, comparable even with the blood corpuscle, a test, moreover, the result of which cannot well be misinterpreted—the leaf of the common shrub the *Aucuba Japonica* or spotted Japanese laurel. When the leaf is exposed in an atmosphere of any volatile substance, it blackens more or less rapidly, as the vapour which enters through the stomatal openings of the under surface rapidly induces the interaction of a glucoside (*aucubin*) present in the leaf and a corresponding enzyme, the immediate product of change being a substance which undergoes alteration in a manner not yet understood into an almost black substance.

We believe the test is likely to prove of special value in examining oils to be used in making paints. All that is necessary is to shut up the leaf along with, though not in contact with, the material to be tested, in a large test tube, bottle or jar; in order to hasten the action, the charged vessel is best placed in an incubator at about blood temperature (35—37° C.).

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[*] A Medical Inspector of the Home Office and a member of both the Departmental Committees referred to.

[†] Professor of Toxicology, University of Liverpool.

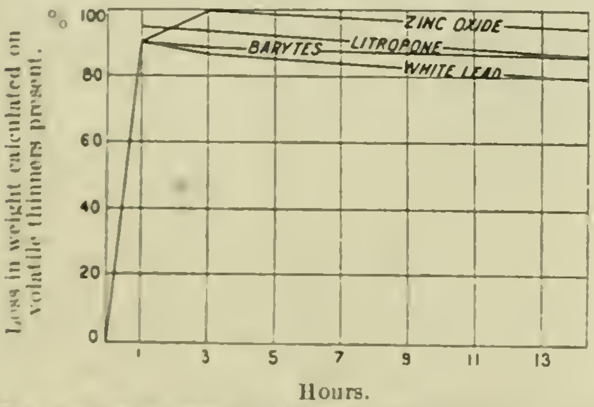
[*] Lead poisoning and lead absorption, Legge and Goadby, p. 108, Arnold, London, 1912.

Nothing happens when the *Aucuba* leaf is exposed during 24 hours in presence of either dry white lead or of any of the solid materials used in paint making or of any of the oils used in making paint; but the leaf blackens rapidly in the presence of turpentine, the effect being visible often after a few minutes and the blackening complete usually within an hour. The leaf varies in sensitiveness, being most sensitive during the growing period. We are confident that all the liquids which can be used in thinning paint would act similarly. Recently we examined several samples of turpentine substitute thinners now on the market and found all to be extremely active.

The fact that turpentine and similar liquids produce the effect so rapidly is of special significance in connexion with the effects sometimes observed in newly painted apartments. We believe that the vast majority of complaints that are made against paints as having caused inconvenience or serious effects are simply and solely due to this cause alone. It also follows that the one necessary precaution to take is not to risk exposure to the vapour; as the turpentine evaporates rapidly from a painted surface it is not difficult to avoid being subjected to its influence. Those painters who are specially sensitive should not be allowed to undertake work (flatting) in which much turpentine is used.

To test the behaviour of paints in drying, a series of paints were made up so that each contained the same quantity of turpentine. These were then applied to glass and the weight determined at intervals. That an immediate decrease in weight takes place owing to the rapid evaporation of turpentine is obvious; and the induced drying effect is clearly shown in the following curves:—

Curve I.

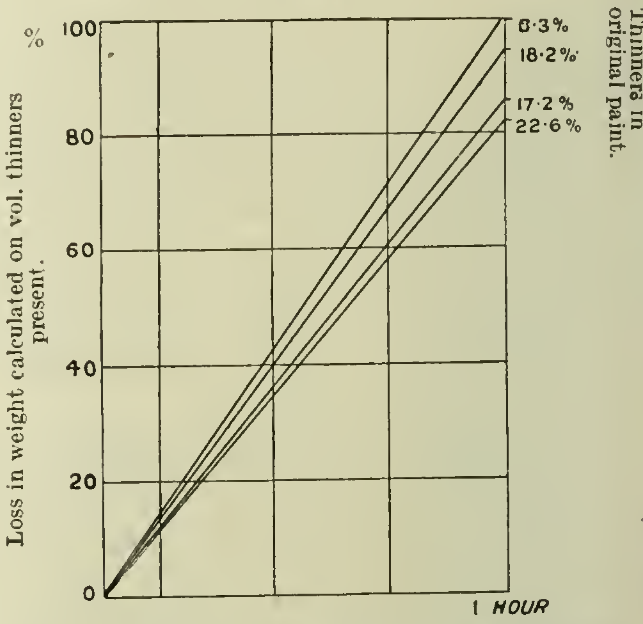


Showing loss in weight of films of paint of ordinary thickness—paint applied on glass. The drying effect is seen. Paint contained 20% vol. thinners.

It appears that practically the whole of the turpentine is removed after a period of one hour and that there is little difference in the behaviour of different paints, whatever the base; obviously the effect of the turpentine is the same, whatever base be used. It is to be noted that most of the substances introduced as substitutes for white lead require a larger proportion of thinners. We have examined eight of the most advertised substitutes on the market. These are sold either in paint or paste form and vary in volatile thinners from 5—22 per cent. All these thinners are toxic to leaves.

2. When an *Aucuba* leaf is exposed over a mixture of white lead and linseed oil, it sooner or later shows signs of being affected, black spots appearing here and there; after 2 or 3 days black patches are usually visible or it may be nearly black all over. When boiled linseed oil is used, this effect is produced more rapidly. Of course, the leaf is not so immediate a test of the presence of vapour as the spectroscopic test used by Prof. Baly; it is, however, sufficiently rapid and not only has the advantage of being both simple and practical but is of special value, as it is a cumulative test which affords ocular demonstration of the rate at which and the extent to which volatile products are being given off from the substance or mixture to which it is exposed. The behaviour of the *Aucuba* leaf and also of the ordinary laurel leaf when exposed to vapours has been fully discussed by one of us in conjunction with E. F. Armstrong.*

Curve II.



Loss in weight of paint films due to volatilization of thinners. After one hour paints began to dry so that volatilization loss is balanced by drying. The above are four well-known white lead substitutes.

We may here state that all the materials used in our experiments were of good commercial quality as determined by analyses before use. The white lead used was of English manufacture—both stack and other process products; the oxysulphate used was in part of French and in part of English manufacture and consisted entirely of basic sulphate of lead unadulterated with barium sulphate in the manner now practised in England.

We have exposed leaves, at blood heat, in presence of a great variety of mixtures of solid materials with linseed oil. In all cases some effect has been visible sooner or later, whilst leaves exposed simply over water have undergone no visible change during the same period. In the case of mixtures containing either white lead or sublimed oxysulphate of English or French manufacture, blackening has sometimes been complete after 3 or 4 days; but leaves exposed over mixtures made from either lithopone or natural barytes or zinc oxide free from lead became more or less spotted in the same time; even lime and baryta have been found to hasten the production of the vapours. Eventually the leaves exposed over oil alone have shown signs of blackening, proving that the oil is slowly undergoing oxidation; leaves exposed over boiled oil blacken much more readily than those exposed over raw oil and when boiled is substituted for the unboiled oil in any of the mixtures the blackening takes place more rapidly.†

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* The function of hormones in stimulating enzymic change in relation to narcosis and the phenomena of degenerative and regenerative change in living structures. Roy. Soc. Proc., 1910, **82**, 588. The function of hormones in regulating metabolism, Annals of Botany, 1911, **25**, 507.

† *Nature of the volatile products produced from linseed oil.* It has long been known that considerable amounts of volatile products are formed in the process of drying linseed or any other drying oil. Genthe (Zeits. f. ang. Chem., 1906, **19**, 208) states that the loss amounts to 15 per cent. in the case of linseed oil drying at ordinary temperatures. Reid (Journ. Soc. Chem. Ind., 1898, **17**, 75) records that in the manufacture of linoleum (where large quantities of linseed oil are oxidised) a gain of only 10 per cent. is observed and ascribes the difference between this gain and the theoretical gain to loss of volatile products. We have examined solidified oil obtained from the volatile products given off on boiling oil together with litharge, the samples being collected from areas where mechanical spraying was impossible; we were unable to find lead in these. Oil boiling is carried on at elevated temperatures and therefore the conditions are such as would be favourable to the formation of volatile organic lead compounds if such were possible.

It is to be noted that Baly has also examined such products and has failed to find lead present.

The behaviour of zinc oxide is variable; sometimes the leaves blacken rapidly over mixtures of this substance with linseed oil. The differences observed may be ascribed to the presence of lead or perhaps of manganese in varying amounts. It is well known, that, excepting the New Jersey brand, zinc oxide made from the ore generally contains from 1 to 5 per cent. of lead (as oxysulphate); that made from spelter is usually free from lead. It may be noted that certain standard English specifications specify that zinc white shall not be blackened by sulphuretted hydrogen.

Mixtures of linseed oil with the various commercial driers all affect the leaves more or less rapidly: we therefore think that the "Aucuba" test is one that may prove to be of value in testing the efficiency of driers.

Nor is linseed oil peculiar in this respect: cornflower oil, crude and refined soya bean oil, menhaden oil and even olive oil give off vapours moderately rapidly, when mixed with either white lead or driers or both, on exposure to air; castor and China-wood oils are more slowly affected. There is no doubt that any oil that will dry and can be used in paint will yield volatile products during the process of drying.

3. Taking into account what is known of the compounds of lead, it was inconceivable that the vapours given off during the drying of lead paints should contain lead. From the experience gained from a large number of experiments we have made to test whether lead is volatilised as Prof. Baly has asserted it is, we are able to state positively that lead cannot be found in the distillate from the distillation either of white lead or of basic sulphate of lead *when effective precautions are taken to prevent the contents of the distillation flask from being carried over mechanically into the distillate.* It is astonishing, however, how easily priming takes place when a mixture of oil and white lead is heated and how difficult it is to prevent particles of solid from being carried over when a mixture of oil with any solid substance—not white lead alone—is subjected to distillation in a current of steam. Oxysulphate (Purex), in our experience, is just as "volatile" as white lead.

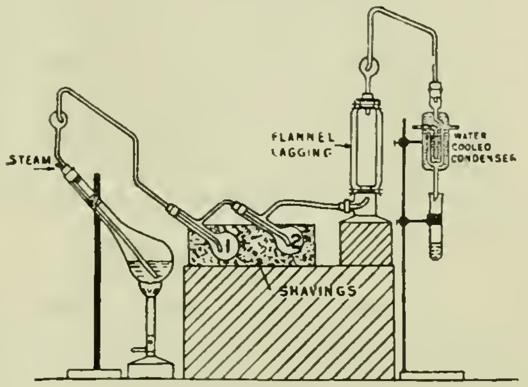
We have tried in many ways to prevent this priming effect and have found the most effective preventative to be the use of a length of half-inch block tin tubing, bent at an acute angle about one foot above the distilling flask, as connecter and condenser, in the manner advocated by Dr. Bernard Dyer for the determination of nitrogen by the Kjeldahl method.

When a mixture of white lead with oil is heated, the basic carbonate is decomposed and both steam and carbon dioxide are given off: solid particles are easily carried forward in the spray that is formed by the bursting of the bubbles as the gas escapes.

When the distillation is effected under reduced pressure, this effect is even exaggerated. When basic sulphate of lead is heated, no gas is produced and but little water is given off, so that there is far less priming.

It is necessary here to point out that no such spraying effect or mechanical separation of particles as is observed in distillations can occur during the drying of paint under the conditions of ordinary practice and therefore these experiments have been carried out under conditions much more rigorous than obtain in practice.

A proof of the inefficiency of glass traps in preventing priming is afforded by experiments made with the apparatus shown in Fig. I. A mixture of oil and the lead salt to be distilled in a current of steam having been put into a flask about 800 c.c. in capacity, steam was passed into the mixture and afterwards through flasks 1 and 2 into the upright tower and thence through a condenser.



DISTILLATION EXPERIMENTS

FIG. 1.

Experiments were made using (1) white lead and (2) litharge, linseed oil and lead acetate being added in each experiment. No lead was found in the final distillate but the contents of the first receiving flask contained lead, whilst the second receiving flask and the tower were free from lead.

The presence of lead in the first receiver flask could be due to one or both of two causes—(1) to a volatile lead compound soluble in water and volatile in steam but not volatile at the temperature of No. 1 flask; and (2), to the spraying over of the lead compound.

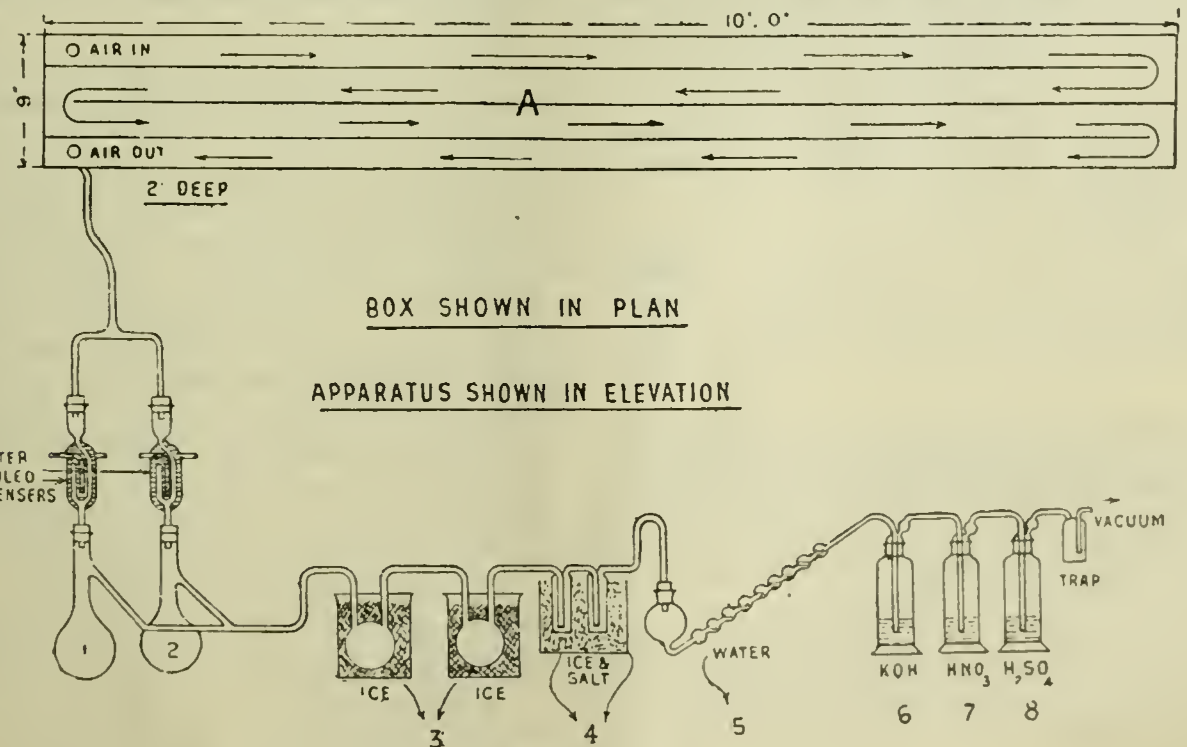


FIG. 2.

In order to decide between these alternatives, the experiment with litharge was repeated with the following alterations:—

(1) Flask No. 1 was heated by a boiling water bath so as to drive off any volatile lead compound in solution, it being obvious from the previous experiment that if a volatile compound were formed it was volatile at this temperature.

(2) Flask No. 2 and the tower were exposed to the air. The distillation was continued during half an hour. On examining the distillates, lead was found in the first flask but not a trace was detected either in the second flask or in the tower or in the distillate—showing that lead had been carried from the distillation flask mechanically into Flask No. 1 and that, although the liquid in this was kept boiling, the lead compound travelled no further: proof was thus obtained that the lead compound was sprayed over from the distillation flask.

Painting Experiments.

None of the experiments so far described nor, indeed, any other of the experiments that have been reported, can be said to be exactly comparable with the practice of painting: the following experiments were made, therefore, *to ascertain whether, under ordinary painting conditions, using an ordinary white lead paint, a volatile lead compound could be isolated.* It must be pointed out that these experiments are quite comparable with the conditions under which the painter works and are of value in consequence.

The apparatus used is shown in Fig. 2.

Apparatus used in paint drying experiment.

"A" is an air-tight box, 10 ft. long by 9 in. broad by 2 in. deep, arranged so that the air which was aspirated through it should travel over the surface of the box by means of channels, the air thus travelling the length of the box four times, as shown. The box was fitted with a glass top, in order that the paint should dry under normal conditions as regards light. This feature has been omitted in all other reported experiments, although the important influence of light in the drying of paint is well known. The joints between the top of the channels and the glass were made by laying thick walled rubber tubing on the top side of the partitions and tightly screwing down the glass cover, so as to render it air-tight, thereby compelling the air to travel through the 40 ft. of channel. The box was painted with an ordinary linseed oil and turpentine paint and at once closed; aspiration was then commenced, the air passing through the various devices shown, in order to absorb, if possible, any volatile compound which might be formed. The outlet tube was fitted into the box through a cork, so arranged that the tube was above the painted surface. Where possible, all joints were of fused glass; otherwise they consisted of paraffined cork.

Area of painted surface, 20·80 sq. ft. = 1·94 sq. metres. Weight of paint used for each coat, 130 grammes, approximately 67 grammes per square metre

Time of aspiration:

	hours.
1st coat	48
2nd coat	12
3rd coat	18
	78

Rate of aspiration, approximately 300 c.c. per minute.

Volume of air aspirated through, at least 1400 litres.

Three successive coats of paint were applied before the apparatus was disconnected and the contents of the scrubbers examined; therefore the apparatus had received the paint fumes from 390 grammes of paint covering, as a single-coat, an area of 62·5 square feet.

Flasks 1 *and* 2. Empty:—odour of paint.

Bulb 3. Contained 5 c.c. of colourless liquid, smelling of turpentine. When boiled with nitric acid, this became yellow; on adding ammonia, there was no change; on adding acetic acid, no change; colourless when cold; sulphuretted hydrogen produced very slight straw discolouration.

Trap 4. 3 c.c. colourless liquid, smelling of turps. Tested as above, very slight straw discolouration; quantity, if any, too small to afford a positive result.

Washer 5. Colourless liquid—free from lead.

Wash bottle 6. Yellow liquid; crystals on bottom; soluble in water. Sweet ester-like smell. Free from lead.

Wash bottle 7. Brownish-yellow liquid. Evaporated to dryness and ignited. Left a large quantity of carbonaceous residue. Extracted with nitric acid—free from lead.

Wash bottle 8. Very pale yellow—free from lead.

Conclusion: Volatile lead compounds are not produced in appreciable quantity when a freshly-painted surface is dried under normal conditions.

The experiment was repeated but without obtaining any indication of lead.

Effect of age on white lead ground in oil.

Baly has suggested that the formation of volatile lead compounds in white lead and oil takes place during the period of nine months. This suggestion was based on indirect evidence and was rendered necessary by the fact that workers engaged in the grinding of white lead do not suffer from lead poisoning. If, however, the volatile products were formed at once the occupation would be most deadly, as the temperature of grinding is often higher than that at which Baly has stated volatile lead products are produced.

In order to investigate this suggestion experimentally we examined a sample of white lead paste ground in September, 1907, which meant a period of 51 months between time of grinding and examination; the results obtained were exactly the same as those obtained on using new white lead and linseed oil, showing that it is impossible to detect any volatile lead compound in white lead paste which has been stored during 51 months, so that on experimental grounds the suggestion is unsound.

Further, we have compared the rates of blackening of leaves exposed over white lead paste 1 day, 9 months and 55 months old and can find no difference.

Professor Baly's second communication.

A second communication on the toxicity of white lead paints was brought before the Liverpool Section of this Society on March 13, 1912, and was published in the Journal issued on June 15, 1912, 31, 515. No word of reference is to be found in this to the previous communication—not the slightest apology is offered to white lead for the slur previously cast upon its character but it is subjected to a further damaging accusation: again, we think without justification.

The opening sentences of this second communication are somewhat more guarded than those of the earlier paper—moreover an interesting indication is given of the true inwardness of the object Professor Baly had in view in making his experiments, as he states: "The matter was brought particularly under my notice during a discussion of the relative merits of the basic carbonate and basic sulphate of lead as pigments. Even without any previous experience I at once detected a most decided difference between the smell of the two substances when ground in linseed oil. It occurred to me that this matter could easily be put to a strict scientific test and in the present paper are contained the results of some experiments I have made in this direction. It may safely be said that any statements as to smell and even as to cases of poisoning are somewhat unsatisfactory unless there is forthcoming some proof of the exhalation of poisonous vapour by the paint in question. It was to investigate whether or no any volatile and poisonous emanations truly occur that the present work was undertaken."

It is a little difficult to understand how the relative merits of carbonate and sulphate as *pigments* could be determined by the study of vapours given off from mixtures of the substance with oil: and the logic of the statement—"I at once detected a most decided difference between the smell of the two substances when ground in linseed oil"—is not easily perceived: what smell has to do with the merits of a substance *as a pigment* is not clear.

The spectroscopic observations described are obviously those described in the first communication. But at the end of the account that is given of them, we read :—" It may be of some interest to record the fact that the smell of the glass tubes after they had been heated in the above experiments was singularly nauseating, and in the case of the tubes containing the white lead the vapours produced certain specific symptoms such as lassitude and severe localised headache followed by diarrhœa."

Now it is well known that the smell of an expiring tallow candle is " singularly nauseating," yet we put up with it occasionally and are unhurt. Professor Baly must have gone very much out of his way to make himself ill and one would like to know exactly how he did it. The value of his evidence depends entirely on this—on his sensitiveness to impression and on proof being given that when his health was disturbed the said vapours were the actual and sole factors of the disturbance : their average effect rather than their Baly effect should have been determined—he may well have been subject to mental impressions during the inquiry.

We are interested in having our observation (that no volatile compound containing lead is given off on heating white lead with oil) confirmed by Professor Baly in the positive way in which it is confirmed in this second communication. As the following statement shows, he is uncompromising in his admission but he might have had the candour to confess that he had repeated his experiments because of our failure to confirm his results.

" Comparative tests were made with white lead and basic sulphate and in the earlier experiments distinct evidence seemed to be obtained that there was produced a small quantity of a volatile lead compound in the case of the white lead. More recent experiments did not confirm these results and therefore it was concluded that the lead in the earlier experiments must have been mechanically carried over in the form of carbonate. In order to obtain more definite evidence as to the question of volatile lead compounds, about 4 lb. of the stiff paste of white lead and linseed oil was heated *in vacuo* by an oil bath and the products condensed in a vessel cooled by liquid air. On allowing the temperature of the receiver to rise, a considerable quantity of gas was evolved, leaving about 30 c.c. of liquid. This liquid contained a large quantity of water and was tested for lead but no definite evidence of the presence of this metal was obtained."

The lead bogey being perforce thus cast aside, the nauseous vapour bogey is now dragged upon the scene.

" It was found that the gaseous product possessed an indescribably nauseous odour and was undoubtedly poisonous, similar results being produced as those already described. This experiment was repeated with basic lead sulphate but little or no distillate was obtained."

Experiments are then described to establish the self-evident proposition that when a hydrated substance is heated vapour of water is given off and that this does not happen when no water is present as in the case of basic lead sulphate.

Finally we read : " I cannot claim that the above experiments represent the last word upon the subject but I do feel that as far as they have gone they establish the fact that a poisonous volatile substance is given off paints made with white lead or red lead. It seems to me to be a necessary conclusion that we must recognise the existence of a source of poisoning in connexion with painting that is to be differentiated from lead poisoning proper. The symptoms described in the earlier portion of this paper were experienced by me both with the vapours from the manganese dioxide and oil mixture so that it would seem impossible to attribute them to lead poisoning. These symptoms, my experiments shew, are doubtless due to the evolution of unsaturated aldehydes and these are given off by any paint containing oxidising agents, white lead or red lead. The cases of poisoning which have been noted amongst people inhabiting rooms freshly painted with white lead would seem therefore to be due to these unsaturated aldehydes and not to be true lead poisoning.

" It is perfectly possible to minimise the amount of this poison by utilising either basic lead sulphate or zinc white and by using as little drier as possible : I say this with the more confidence, because, of the white paints, white lead was the only one that gave at ordinary temperatures a measurable amount of the aldehyde in my experiments. For this reason the conclusion must be drawn that danger attends the use of white lead paints.

" The same must be said of red lead, for it seems that the poisonous volatile compound is even more readily given off by this substance."

It is to be noticed that the nauseating vapours were only obtained by heating the mixture of white lead and oil to 60°—65° and that apparently similar vapours were obtained when Purex and zinc white were used, though only at higher temperatures. Such results are clearly in no way comparable with those obtained in practice when paint dries at atmospheric temperatures—no one thinks of describing the smell then obvious as singularly nauseating.

Objection may be taken, on similar grounds, to the comparative experiments in which the relative amounts of silver reduced in equal times by the vapours given off from various mixtures were determined.

The term " poisonous volatile compound " after all is a purely relative expression. Chloroform is a most poisonous volatile compound—yet people are daily, of set purpose, subjected to its vapours and, as a rule, are but temporarily affected by it. Ammonia has extraordinary toxic powers and yet it is used by women all the world over as smelling salts and in recovering them from fainting fits. Every known volatile substance is more or less toxic. Cheese is regarded as a valuable food all over the world, yet at times, in some people, it produces considerable stomach derangement. Clearly the poisonous vapour bogy has been manufactured by Professor Baly as a means of escape from a difficulty in which he had placed himself by discovering volatile lead where there was no lead and he has used it as a stone to cast at white lead.

As a matter of fact, he has adduced no more evidence in his second communication that white lead *under conditions of practice* gives rise to an amount of vapour capable of producing effects such as would justify the use of the term poisonous than he has that lead itself is volatilised.

In condemning white lead, moreover, he has condemned paints altogether. As Mr. Morris said in the discussion :—" As regards the use of dryers, it was necessary for the paint to dry quickly. How could they get away from the commercial aspect of the case by using less dryers or none at all ? "

If a paint is to be of any practical use, it must dry : the nauseous substances of Professor Baly will arise : but every one connected with the industry—every painter throughout the country—knows full well that the rate at which the change takes place is so slow, the quantity of vapour given off so slight, that it is quite easy, in practice, to avoid ill effects. It is only necessary to ventilate a little and to give the paint time to dry.

Paints cannot be made without oil and cannot well be applied unless thinned by a volatile liquid ; and some drying agent must be present in them. Whatever volatile liquid be used to thin a paint, it will be capable of producing effects such as turpentine produces—in Baly language, it will be poisonous. But it is perfectly well known that it is possible by very simple precautions to prevent any serious effects arising—those painters who, like Professor Baly, are specially sensitive to the influence of vapours must not be allowed to flat large surfaces in closed apartments.

And we must set on the other side the hygienic value of painting with an oil paint containing a drying agent and a penetrating volatile substance such as turpentine, to which Dr. Goadby, we believe, has drawn special attention ; no more effective means—probably no such effective means—of destroying micro-organisms can possibly be devised. If a room be well washed down, then rewhitewashed and repainted, especially if it be shut tight while the paint is still fresh and left for the vapours that are given off—both those of turpentine and those of the Baly bogey—to act antiseptically, the chance of organisms surviving will be very small. None of the conventional recognised methods of disinfecting can be so effective.

M. JULES-LOUIS BRETON'S REPORT.

"Rapport fait au nom de la commission de l'hygiène publique chargée d'examiner le projet de loi, adopté par le Sénat, sur l'emploi des composes du plomb dans les travaux de la peinture en bâtiments." Paris, Imprimerie de la Chambre des Deputés, Motteroz et Martinet, 7, rue Saint-Benoit, 1907.

This report is to be regarded as of special importance, owing to the action taken by the French Government in legislating prospectively against the use of white lead even for outside painting purposes. Probably everything that can be said against white lead is to be found in its pages. We are concerned only with the chemical evidence adduced by M. Breton himself, by M. Trillat and by MM. Heim and Hébert.

Before referring to these, we may mention that it is on record that the great Stas, when questioned, in 1855, whether the symptoms sometimes shown by delicate persons, after living in a room recently painted with white lead, could be due to lead poisoning, is said to have replied that experience showed that a recently painted room could be inhabited with impunity.

In giving evidence before the Chamber of Deputies, in 1903, Prof. Armand Gautier expressed the opinion that persons inhabiting rooms painted with white lead do not run any risk, as lead paint does not emit either emanations or dust.

M. Breton (Report, p. 334), in objecting to the removal of paint by burning off, which he speaks of as provoking "la production d'émanations plombiques," refers to an opinion expressed by M. Gautier to the effect that painters are subject to poisoning from this cause "parce qu'ils ne peuvent pas se soustraire *aux poussières* plombeuses ainsi produites." It is noteworthy that he does not suggest that lead is ever *volatilised* during the operation.

M. Breton's experiments.—M. Breton gives details (Report, p. 335) of experiments made by himself, in 1903, which he considers prove that a volatile compound of lead is produced during the drying of lead paint. He appears to have arranged a series of freshly painted metallic boxes concentrically under a bell jar, through which he then aspirated air, this air being afterwards bubbled through a 10 per cent. solution of sulphuric acid. At the end of a day lead was detected in the acid. M. Breton explicitly states, however, that the quantity of lead present was "*extrêmement réduite* et que les réactifs ordinaires du plomb ne pouvaient la révéler." He based his assertion that lead was present on the use of Trillat's agent—which is not specifically a test for lead.

M. Trillat, at his request, repeated the experiment but did not confirm the result. To this M. Breton objects that M. Trillat had only painted the interior of the bell jar "au lieu d'employer notre dispositif de boîtes en chicane qui nous donnait une très grande surface d'émanation !"

He then proceeds :—

"Cette disposition opératoire différente explique parfaitement la différence des résultats obtenus ; car, nous le répétons, nous n'avons pu dans notre expérience constater l'entraînement que de traces infinitésimales et presque indosables de plomb et la diminution, d'ailleurs considérable, de la surface d'émission devait nécessairement rendre impossible cette constatation.

"Mais, comme nous avons renouvelé à plusieurs reprises, en prenant toutes les précautions possibles, et en contrôlant soigneusement tous nos réactifs, l'expérience ci-dessus décrite et que toujours nous sommes arrivés au même résultat, nous pouvons assurer formellement que, quoique très faibles, ces émanations se produisent réellement.

"Nous avons d'ailleurs varié notre dispositif en faisant barboter l'air dans la peinture de céruse contenue dans un ballon de verre et avons pu constater de cette manière l'entraînement du plomb en utilisant simplement les réactifs ordinaires, acide sulfhydrique ou monosulfure de sodium."

With reference to this last experiment, we have no hesitation in asserting that the lead detected by M. Breton was carried forward mechanically ; we have failed in obtaining evidence of the presence of lead, when the precaution was taken of preventing any spray that is formed as the bubbles burst at the surface of the paint from being carried forward by interposing a scrubbing flask between that containing the paint and the receiving flask. And, as we have already stated, we have been unable to detect lead in air aspirated during hours through a box exposing a freshly painted surface which we imagine was far in excess of that exposed in M. Breton's experiment with *boîtes en chicane.*

Heim and Hébert's experiments (Report, p. 339).—In 1907 MM. Heim and Hébert carried out a series of experiments with the object of detecting and measuring the amount of lead in the atmosphere of workshops where white lead was used. Ultimately they devised a method based on the use of Trillat's agent.

In examining the air of workshops, the air was drawn through a plug of cotton wool (*ouate*). They were struck by the fact that they very often found traces of lead in their absorption apparatus, even after such filtration of the air ; they therefore assumed that some portion of the lead in the atmosphere was in a state of vapour and capable of passing through the filtering plug without being caught by it. No proof was sought for that a larger or more tightly packed plug, if not a series of plugs, would be effective.*

They made various experiments, in which air scrubbed by passing through two vessels, one containing sulphuric acid, the other potash, was passed through a long tube 1–2 cms. in diameter containing the material to be tested. When the material was a powder, the two ends of this tube were plugged with cotton wool. The air from the tube, after passing through a U tube "bourré de coton bien serré, assurant sa filtration parfaite," was conducted through a Gautier absorber containing about 10 c.c. of dilute sulphuric acid. The rate of passage was from 3—4 litres per hour and the experiment was continued until 100 litres had been passed through the tube.

In the experiments with litharge and white lead, the tube contained a mixture of 150 grammes of emery with 11 grammes of the former and 15 grammes of the latter. The amount of lead carried forward in 100 litres of air was estimated to be as follows :—

	Milligrammes.
White lead at 15°—20°	0·15 0·20 0·12
Litharge at 15°—20°	0·01 0·01
at 100°	0·01 0·01

We venture to think that if lead was carried forward, of which the experiments afford no actual but merely inferential proof, it was carried forward in the form of dust. On making experiments in the manner described by Heim and Hébert, using sulphuretted hydrogen as the test for lead, we have found that dust may be carried forward in the air stream unless particular care be taken in packing the cotton wool plug tightly.†

Trillat's test for lead.—This test is based on the fact that when the compound formed by condensing formaldehyde and dimethylaniline is subjected to oxidation, it is converted into the carbinol $HO.CH(C_6H_4 \cdot NMe_2)_2$, which gives coloured salts with weak acids, though those with strong mineral acids are colourless. The use of the diphenylmethane base as a test for lead depends on the fact that it is oxidised and converted into the carbinol by lead peroxide; but it is acted upon equally well in the same way by manganese peroxide and not a few other oxidising agents.

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* The difficulty of constructing efficient filters to remove lead dust from air is recognised in the report of the Home Office Committee on the use of lead in potteries.

† It is of interest that Baly was unable to find any absorption took place when light from a cadmium arc was passed through tubes containing dry white lead and that this observation is cited by him to show that even spectroscopic methods allow of no volatilization of white lead being detected at ordinary temperatures.

Finally, in the Report of the Medical Inspector of Factories, contained in the Annual Report of the Chief Inspector of Factories for the year 1911, Cd 6929 page 210, we find the following :—

"Experiments were carried out in the laboratory of a lead smelting works in London to determine the temperature at which lead fumes arise from the surface of open baths of molten lead. They showed that unless pure lead is heated to about 500° C. and at the same time stirred, no appreciable fume comes off. . . . When a bath of molten lead is not stirred at all it can be heated to over 740° C. without finding oxides in the air."

This statement is not in agreement with the figures of Heim and Hébert who claim to have shown that lead volatilises at ordinary room temperatures.

To use the test, the solution of sulphuric acid supposed to contain lead is evaporated to dryness in a small dish and a drop or two of a solution of sodium hypochlorite is added to convert the lead sulphate into the peroxide; according to Trillat, the excess of the hypochlorite is removed either by washing or by calcining. The agent is then added to the residue in the dish. The presence of lead is indicated by the appearance of a blue colour, either at once or on warming. Trillat recommends the use of acetic acid in preparing the agent but there are objections to this and Carney has proposed to substitute citric for acetic acid. We can support his recommendation.*

We are in no way satisfied with the test as one suitable for the detection of minute amounts of lead, especially on account of the difficulty of removing any excess of hypochlorite by washing; obviously calcining is out of the question, as it is likely to decompose lead peroxide. In our hands the results have been somewhat irregular and we are not inclined to rate it as much more if at all more sensitive than the sulphuretted hydrogen test.

The results obtained by Heim and Hébert do not carry conviction. In the first place, no blank experiments are quoted showing that they had tested all the materials they used, though it is to be supposed that they took this precaution. They state that after passing 100 litres of air over lead filings at 18° C., they found as much as 0·5 mgrm. of lead to be volatilised; when, however, the lead was heated to its melting point (335°), the amount volatilised was only 0·4 mgrm. and fused type metal (m.p. 260°) and plumber's solder (m.p. 224°) gave only 0·2 mgrm. If lead volatilises under such conditions at all, it does not seem probable that there would be no increase in the amount volatilised on raising the temperature from 18° to over 300°; the difference is scarcely accounted for by Heim and Hébert's contention that the surface exposed is greatly reduced by the fusion of the metal. We are inclined to think that the lead was carried forward as dust, as on repeating the experiment, using a tightly packed plug of cotton wool, we have not been able to detect lead by the sulphuretted hydrogen test.

Trillat's experiments (Report, p. 344).—M. Trillat's experiments consisted in placing four Petri dishes at different heights under each of three sterilised bell jars of 10 litres capacity; these dishes contained Raulin's fluid inoculated with a culture of *Penicillium glaucum.* Nothing else was put under the one bell jar but the second had in it a dish containing about 50 grammes of powdered white lead and the third one containing a paste of white lead and linseed oil. In the case of the blank bell jar, growth set in at the beginning of the third day; in the second, containing dry white lead, a slight retardation was noticeable; in the third, the retardation of the growth of the organism was obvious.

In a second set of experiments, *Aspergillus niger,* a more sensitive organism, was substituted for *Penicillium.* The experiment began on Jan. 15th; on Jan. 19th a few colonies were seen in the blank bell jar and in that containing dry white lead, though they were slightly less numerous and less compact in the latter. No growth had set in under the third bell jar at the end of 15 days, when the cultures under the two other jars were fully developed. An experiment carried out with oil alone showed that this had no influence in retarding the growth of the organism. It was also found that a paste made by mixing white lead with water had no appreciable effect.

Precisely similar results were obtained by Dr. Marie (Report, p. 346), using *Ebert's bacillus.* This observer also tried the effect of a mixture of zinc white and oil and found that the growth of the organism was "plus net et complexe" than that in presence of the mixture of oil and white lead, "rappelant celui de la première culture en présence d'huile pure mais moins florissante bien que nettement plus vivace qu'avec le plomb."

It is obvious, however, that such results in no way justify the conclusion that Dr. Marie draws when he says: "elles montrent l'action d'arrêt *des vapeurs métalliques* par rapport aux phénomènes organiques vitaux élémentaires."

The very slight initial effect observed by Trillat, in a single case, on exposing organisms in presence of white lead alone, is of no significance in view of the irregularities often manifest in such experiments.

M. Breton quotes an experiment (Report, p. 348) made with a guinea pig, which was killed by exposure to air aspirated through a vessel containing a mixture of 300 grammes of white lead, 100 grammes linseed oil and 25 grammes of turpentine.

After calling attention (Report, p. 349) to the opinion expressed by MM. Riban and Bouchardat that turpentine exercises toxic effects, M. Breton then states that he had exposed a guinea pig in a precisely similar manner to the vapours given off from a mixture containing zinc white in place of white lead and that no ill effects were produced.

Dr. Goadby, who has carried out an exhaustive series of experiments with various bacteria, similar to but far more extensive than those made by MM. Trillat and Marie, has failed entirely in detecting any effect in the case of organisms exposed in presence of white lead alone. He has also shown that whether the paint used be made from white lead, zinc white or lithopone, the vapours given off from painted surfaces always affect guinea pigs more or less prejudicially. The fact that a guinea pig was unaffected by zinc white paint in the single experiment made by Breton can only be attributed to some accidental cause —guinea pigs, like painters, doubtless are not all equally sensitive to turpentine vapours.

Such then is the case against white lead. The French evidence that a minute amount of vapour containing lead is given off under the conditions of practice is not only unsubstantial but we have failed to corroborate it; and it is easy to see how the mistake arose. Prof. Baly's evidence, we venture to say, is rebutted by our observations; and he has himself admitted that he was in error in asserting that volatile compounds of lead are produced on heating white lead with linseed oil.

Prof. Baly, however, has introduced a new terror into painting in asserting that poisonous volatile organic substances are given off during drying—unsaturated aldehydes and so forth. But practice shows and all knowledge of the subject confirms this experience that this danger does not exist. Under the ordinary conditions of practice, such vapours are given off at such rate and in such quantity that their effect is negligible: only ultra-sensitive persons and those who are bent on being affected are likely to be disconcerted by them.

The production of such vapours is in no way confined to lead paints—as Prof. Baly recognises, they are the necessary outcome of the drying process. At most, it can be said, that they are produced most rapidly from white lead paint because this dries most rapidly—a circumstance which gives to white lead paint its special value.

It is clear that the real sinner in paint is turpentine; and any efficient substitute for turpentine that can be used will produce effects similar to those which this hydrocarbon produces, because the effects are those that are produced by volatile vapours generally.

Obviously, the only logical way to get over the vapour difficulty will be to abolish paints altogether.

After all, the real difficulty is the old one and on this point we need merely quote the closing sentences of the General Editor's Preface to the recently published authoritative work on Lead Poisoning and Lead Absorption by Dr. Legge H.M. Medical Inspector of Factories, and Dr. Goadby:—

"The authors bring forward convincing evidence, experimental and statistical, in favour of the causation of lead poisoning by the inhalation of dust. This makes prevention a comparatively simple matter and the methods of prevention are effective and will contribute greatly to the health of the workers and the prevention of phthisis, which is so prevalent among lead-workers. Exhaust fans and hoods or vacuum cleaners, for carrying away the dust formed in the various processes—these are the simple means by which the dust can be removed and the workers' health assured."

In recent years, six European countries have made the use of lead paints the subject of exhaustive inquiry and the

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*Comp. R. J. Carney, J. Amer. Chem. Soc., **34**, p. 32, and Chem. News, May 31, 1912.

French alone have decided to prohibit their use. The law is due to take effect on January 1, 1915 but it is significant that it applies only to house painting and that its application is open to great latitude, being subject only to the ruling of a single Minister. There is doubt whether the law will be enforced. Thus the British Consul at Lille reported in August, 1912, as follows :—

" White lead.—There was no sensible modification in the white lead industry. The law prohibiting its use for outdoor painting purposes, which comes into operation three years hence, does not appear to be in favour with the public. For the use thereof has not decreased, whereas substitutes such as lithopone, etc., are being gradually left aside as consumers begin to discover their inferiority to white lead and it is doubtful whether the law will ever come into force."

From the history of the French enquiries, it appears that since 1786 French ministers have decreed on nine occasions that the use of white lead was to be discontinued, so far without any permanent result. It can scarcely be doubted that, as a rule, hygienic interests have been subordinated to polemics and it is important to note that the quantity of white lead used in France at the present time is greater than ever.

Regulations affecting the painting industry have been introduced in Austria, Belgium, Germany and Switzerland*; Holland has not yet taken action though inquiries have been held in that country.

In our own country, it is difficult to judge of the danger attending the use of white lead, as the Home Office returns are particularly weak regarding the incidence of disease and the death-rate among painters, as notification is not legally compulsory. Judging from the returns issued by the Registrar General, it would seem that the painter is in no way subject to any abnormal risk. It is beyond question that, in the past, symptoms have often been put down to lead poisoning which were in no way caused by lead and that the medical profession have much to learn in this respect. Now that the true sources of danger are understood, there should be no difficulty in reducing the risk to a minimum.

The properties of paints which are of practical consequence.—In conclusion, we venture to point out that these are broad issues to be discussed in connexion with the paint industry besides the question of possible toxicity, for is not the time at hand when those who are connected with its various branches will be called on to consider whether they will regulate or whether they will merely allow themselves to be regulated ?

We are advancing into an age when the " liberty of the subject " may become an unknown quantity ; when sentiment and the opinion of an uninstructed majority will more and more prevail over sense and intelligence : unless these latter elements are organised not merely in their own defence but in the interest of the unintelligent majority. We need in this country to get rid of the prevailing belief in the ability of the so-called man of business to understand everybody's business besides his own and of his own absolute belief in himself ; also we must be alive to the worse danger that is ahead of us, the calculating politician whose sole appeal will be to Demos. In some way or other, the belief in true expert knowledge, in the collective wisdom of men thoughtful and experienced, of knowing men, must be made to live among us and our proceedings must be ordered more upon their advice than is now the case. Some sense of our individual ignorance must come upon us all. Through ignorance, democracy has ruined many civilisations in the past : our one great chance of survival and improvement is to organise and apply science to neutralise ignorance ; if we cannot do that, our science will not avail us in the end.

It should be possible for a Society such as this to help in promoting the promulgation of a code of industrial ethics. The public will expect the introduction into the code of articles protecting them more than is the case at present against the use of unfit materials, against the bold and unblushing advertisement of rubbish.

The special question we would raise is whether it be not desirable to determine by collective action what are truly fit materials for painters' use—whether it be not to the interest of the trade to promote systematic inquiry which will make it possible to offer sound advice, if not to lay down rules for the general guidance. The Americans are already alive to this necessity and have conducted extensive inquiries with paints. There are very many problems awaiting solution.

The use of lead compounds in white paints.—Given the undoubted fact that lead can be so used that it need be no source of danger to the user, the question still remains—is it essential ? The verdict of experience is undoubtedly strong if not absolute in its favour, as is shown for example by the following quotation from the Report of the inquiry carried out by our Home Office twenty years ago :—

" In the past a large amount of thought, labour, time and money have been expended by many experts in the search for a substitute for carbonate of lead. Several compounds have been mentioned to the Committee as being equal to white lead and capable of taking its place, if only the prejudice of middle-men and dealers could be removed so as to secure for them a fair field in the paint market. One of these compounds and the one on which most stress has been laid is oxide of zinc. This has been used with success for internal decoration but for rough surfaces and for exposure to heat, cold and rain it does not possess the qualities for which white lead is conspicuous, namely, covering power and durability. Moreover, the price of oxide of zinc is greater than of carbonate of lead. With regard to all these so-called substitutes the Committee have invariably found that on closer inquiry of persons competent to judge and unprejudiced on either side, the substance in question was in some particulars inferior ; and they have come to the conclusion that there is at present no substitute that can take the place of carbonate of lead."

In the interval, many improvements have been effected and the various substitutes are greatly superior in quality to those formerly offered. Nevertheless, at the present time, it cannot be maintained that any single pigment is suitable for all purposes and it is scarcely probable that such a pigment will ever be found. It is more probable that the solution of the problem will always lie in the proper selection of the pigment or pigments suitable for the particular purpose in view ; it has been clearly shown that the weakness of one pigment can be met by the addition of another or other pigments and that, in many cases, a mixture is advantageous.

The white pigments now in use in considerable quantity are only four—basic lead carbonate, basic lead sulphate, zinc oxide and the mixture of zinc sulphide and barium sulphate known as lithopone.

Basic lead sulphate.—This substance was introduced as a pigment by Bartlett in 1866—it has been used to a considerable extent in the United States of America during recent years. Lead sulphate has been proved to be a failure in practice. The oxy-sulphate apparently owes its value to the fact that, like white lead, it is a basic material. Being acted upon by acids, it is practically just as poisonous as white lead. Apparently it is less active than white lead towards drying oils but it is just as readily blackened by sulphuretted hydrogen.

Zinc white.—The use of zinc oxide as a pigment was first suggested by Courtois in 1780. It was introduced into commerce about 1846. Many improvements have been made in the methods of manufacturing it and in its quality, the result being, that it now occupies a definite position as a pigment, but the statements that have been circulated of its superiority to white lead and in relative disparagement of this latter are not merely exaggerated but often false.

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* The following conclusions arrived at by a majority of the Swiss Commission are of interest :—

1. Le danger d'intoxication par les composés de plomb, employés dans les travaux du bâtiment, a Genève, est minime.

2. Il est possible, par des mesures de police, applicables aux chantiers, de diminuer encore, sinon d'éliminer complètement le nombre des cas de saturnisme professionnel parmi les ouvriers peintres en bâtiments.

3. Le remplacement de la céruse par l'oxyde de zinc mettrait l'industrie du bâtiment a Genève dans un état d'infériorité injustifiée.

4. L'oxyde de zinc n'a pas les qualités industrielles requises pour pouvoir remplacer avantageusement la céruse.

5. L'oxyde de zinc n'est pas si inoffensif qu'on veut bien le dire. En cherchant bien, on trouverait peut-être aussi quelques peccadilles à lui reprocher et pouvant motiver l'horreur que MM. les entrepreneurs en général et ceux de Genéve en particulier éprouvent à son endroit.

La Céruse, etc. Genève : W. Kündig et Fils. Rue du Vieux-College, 4. 1907.

There are two types of zinc oxide on the market—the one known as "indirect" prepared by burning spelter; the other termed "direct" prepared from the ore. The latter usually but not always contains lead (as basic sulphate), owing to the presence of galena in the ore; when lead is present, this variety often has a bad colour owing to impurities other than lead contained in the ore. There is no generally accepted opinion as to the superiority of the one or the other type but it is claimed by the makers of the direct product that the presence of a small amount of lead increases the stability of the paint film. In view of the question we have raised as to the possibility of "lead" promoting the oxidation of the oil, this contention is well worth consideration. In Europe, the production of zinc oxide is practically limited to Belgium, owing to the monopoly this country has of zinc.

Lithopone.—This pigment is prepared by precipitating zinc sulphate with barium sulphide and is therefore a mixture of barium sulphate and zinc sulphide: but as it is subjected to furnace treatment to improve its physical condition it often contains some zinc oxide. One remarkable peculiarity of this pigment, which seriously affects its use, is the manner in which it changes in colour and darkens on exposure to light.

Ready-mixed paints.—The direct sale of ready-mixed paints is increasing in this country though the bulk of the white pigment sold is in the form of paste. In the United States of America ready mixed paints are purchased on a large scale by the painter. The paints sold are often composite, being mixtures of two or more of the following:—Zinc sulphide, white lead, zinc oxide, leaded zinc, lithopone, gypsum, talc, silica, alumina, barium carbonate, barytes (natural and artificial), calcium carbonate, magnesite, china clay, French chalk, asbestos. It has been found necessary in certain States of America to introduce legislation with regard to the labelling of such paints, requiring the chemical composition of the paint to be stated on every package so as to guard against fraud.

Value and suitability of paints.—The value of a paint is necessarily the outcome of a combination of more or less delicately balanced factors. The nature of the vehicle is of great importance and the fact that pigments other than the lead pigments require a larger proportion of oil is of fundamental significance in view of the well-known porosity of linseed oil films and of their tendency to shrink.

The ease with which white lead may be applied is explained by the changes which take place between the oil and white lead. During the time of its storage as paste, chemical action takes place to a small extent and some lead is dissolved in the oil; this materially assists in the subsequent drying operations. In the case of zinc oxide or allied pigments, little or no change takes place, while the mixture is in the form of paste. When applied as a paint, in both cases the drying takes place by oxidation, although physically the two products differ considerably. In the case of lead paint, a film is obtained which has considerable elasticity, so that the contraction and expansion produced by variation of climatic conditions do not result in fracture of the film; whereas in the case of zinc paint, the oxidation product has a hard, brittle, inelastic surface, which does not change in unison with the surface on which the paint is applied. The ultimate product is hard and finally blisters and cracks or becomes translucent and peels off. The final result is a surface which is not so suitable for repainting as is that obtained when lead paint is used. We believe that for many purposes a mixture of white lead with zinc white is far superior to either singly.

The physical condition of a pigment must also be considered in relation to its powers of lasting. White lead is not a powder of uniform size, being invariably graded to some extent, as is apparent when the product is elutriated. This gives the film mechanical stability. The condition is imitated to some extent, in what are termed "reinforced paints," which consist of the previously named white lead substitutes ground together with asbestos or other inert materials of larger size, in order to imitate as closely as possible the condition naturally obtaining in white lead. White lead substitutes are invariably in an extremely fine state of division and regular in size; therefore, the reinforced effect cannot be obtained with these pigments alone. A practical result of this is the defect observed when the mouldings on doors are painted with the substitutes for white lead. It is quite useless to attempt to determine the painting value of any pigment on what might be termed straight painting: the intricacies afforded by mouldings and similar structures are the most conclusive test.

It is commonly objected that lead paints (both basic carbonate and sulphate) are blackened by sulphuretted hydrogen. But as a matter of fact, the blackening of paint out of doors is rarely due to this cause, being usually effected by smoke and dirt; convincing proof of this fact has been afforded of late years, since the process of cleansing by steam has been introduced.

The great cause of the decay of paints exposed out of doors appears to be the sulphurous and sulphuric acid in the atmosphere, especially in towns. It is stated that no less than 150,000 tons of sulphur are projected annually into the air of London, forming eventually some 600,000 tons of sulphuric acid.

Lead paints are scarcely affected by sulphurous and sulphuric acids, which if they act at all serve only to convert the oxide in the basic material into insoluble sulphate; but zinc paints (zinc white and lithopone) are most seriously affected by the conversion of the zinc oxide or sulphide into zinc sulphate—a substance easily soluble in water; the change is fatal to the painted surface. On this account, such paints are only suitable for use wherever rain has not access and should only be used in dry situations.

It is on points such as these we venture to think that the public and even painters need authoritative information: in the end, it must be to the interest of the trade as well as of the public that proper materials should be used and that the work done should be sound.

Conclusions. In conclusion we submit that it is clearly shown:—

1. That the vapours produced during the drying of white-lead pastes and paints do not contain lead.
2. That the vapours given off as paints dry consist of turpentine, for the most part, together with oxidation products of the oil and that these latter are common to paints generally containing oil so treated that it will dry.
3. That the oxidation products formed from the oil during drying are harmless under the conditions of practice, as has been shown by experiments with animals.
4. That the toxic effects sometimes experienced from drying paints are to be ascribed to turpentine and that due allowance must be made for this in dealing with the hygienic phase of the problem. Our inquiry also shows that in many cases effects have been regarded as due to "lead poisoning" which are attributable to other causes, especially to turpentine.
5. The whole available evidence indicates that the dangers attending the use of lead compounds are only the well-known mechanical dangers.
6. There is no foundation for the importation of a new element of danger into the consideration of the question of paints. Lead paints are to be objected to only on the ground that they may enter into the system through careless handling or in the form of dust such as is produced by rubbing down old paint.

DISCUSSION.

Mr. **Pearce**, M.P., said that there appeared to be some fear lest there might be some legislative interference with white lead. Parliament acted carefully and with reluctance in those matters, and looked to the Departmental Committee for definite advice. If the question came seriously before the House of Commons, the paper would be of great advantage to the Members. He was sorry that Professor Baly was not present; he would like to have heard his views. They had no means of judging

Professor Baly's case; he was an authority on the subject. It was still more important from the House of Commons' point of view that the French Government had decided to prohibit the use of lead paint in 1915. If those two facts (although after the Paper he had heard they carried very little weight indeed, to his mind) had reached the House uncontradicted and unchallenged, they might have led to some legislative result, although even then he hardly thought so. At any rate Prof. Armstrong had rendered service by showing that white lead had been attacked unjustly. He was glad to know that a member of the Departmental Committee was present, and after what had been said and after the Report had been received and the Paper published he would be surprised if the House of Commons were ever called upon to take any action against white lead.

Mr. **Vickers** said that for the last four or five years he had been periodically going to lectures on lead and zinc. One came away from one lecture feeling that zinc was the right and only thing, and from the next lecture that lead was the right and only thing. Manufacturers wanted to obtain durability. The question of inside painting presented little difficulty, but for outside work they always seemed to be faced with something. White lead always became chalky, with zinc there was hardness, and with lithophone there was no durability. A series of fences had been put up in America with the idea of applying to them paints made of all sorts of materials, and then having them watched. Two or three years ago the same suggestion was made to the Paint and Varnish Society, but nothing had been done. He would be very pleased to erect, and would give 150 guineas towards the cost of putting up, fences wherever the Paint and Varnish Society, the National Association of Master Painters, the Society of Chemical Industry, the Royal Institute of British Architects, the Society of Arts, or a combined Committee of them all, might desire, and let them supervise the fences and arrange what paints were to be put on them. As manufacturers, they wanted to know which was the most durable type of paint for outdoor work, and perhaps some small experiments might be made at the same time on iron work. If the Committee would accept the offer to continue for a test for three years or longer, he would be very pleased.

Mr. **Noel Heaton** said that all technical men looked upon Baly's paper as of no real practical importance. Unfortunately, however, it was likely to have a very damaging effect amongst people who had no technical knowledge of the subject. On that account they must be grateful to Prof. Armstrong for so clearly putting before them the many weak points in his arguments. He hoped that those who had been trying to asperse the character of white lead would pay as much attention to Professor Armstrong as they had to Professor Baly. But from his point of view he did not think that the section of the paper dealing with the work of Baly was the most important part. To him the conclusions at the end of the paper were most valuable, and particularly the suggestions that were brought forward for the necessity of collective inquiry into the whole matter. During the past two years there had been far too much talk on this subject. An enormous amount of evidence had been collected by the Departmental Committee. But very little had been done in the way of getting at the bottom of the matter on scientific and practical lines. A practical investigation had been made in the United States, to ascertain whether they could do without white lead or what were the real facts about its use, and their results led inevitably to the conclusion to which Professor Armstrong had arrived, viz., that nothing could be substituted for it. Nevertheless they ought not to take their results at second hand, and should do something over here, as after all, the two climates were not the same. In common with a good many others he had been agitating for practical experiment on an organised scale for a considerable time, and he was indebted to Prof. Armstrong for putting forward the same proposition. From his own experience it was not possible to replace white lead by any substitute without loss of durability.

Mr. **Davidson** said that Prof. Armstrong had well said that one must be very careful what deductions they made from the result of experiments. That it was proved conclusively that lead was not volatile in paints was of great service, and it was to be hoped that with the experiments suggested, they ought to be able to deal conclusively with the questions of efficiency and durability of the various paint pigments.

Mr. **Kimber** referred to the tests carried out in America by H. A. Gardner, which indicated that zinc and zinc compounds behaved differently in different oil media.

Mr. **Rowell** said that if white lead or manganese dioxide were mixed with linseed oil, a peculiar smell was produced. If that smell or emanation were poisonous, men who were daily boiling oil and varnish with oxidising agents such as manganese dioxide and lead oxide should be most subject to some sort of poisoning corresponding to Professor Baly's symptoms; but it was a fact that in varnish houses and oil boiling shops poisoning of that description did not occur, so that it might be said that emanations from paint, other than the turpentine smell, were not toxic in a marked degree.

A member said that he had had occasion to examine the deposit formed on the iron doors and ceilings in rooms where lead driers were used and on analysing he had found there was 10 per cent. of lead.

Mr. **Coste** said that ordinary Russian turpentine was certainly very much more irritant and had very much more marked rubefacient properties than American turpentine. He had tried it by experiments.

Dr. **Mollwo Perkin** said that if Russian turpentine were properly purified it was not so; it was a splendid drier.

Professor **Armstrong**, in reply, said he was very glad to hear of the willingness on the part of the trade to take up these matters and investigate them systematically; the results were likely to be of extreme value to the industry. Chalking was one of the great objections to white lead; on the other hand there was a difficulty with zinc paint, that it gave a very brittle film, and as had been pointed out, it was known that by combination of the two a very superior result was obtained. It ought to be possible by varying the medium and by working more in the direction of studying the effects produced by oils, something could be found which would get over the one real objection raised to white lead paint. There was no doubt that the medium played a very important part with zinc oxide, but the subject had been very inadequately studied. As regards the volatilisation of lead in the boiling house, he was certain if the speaker who made those remarks would look into the matter he would find there had been a mechanical transfer. It was very difficult to believe that anything like 10 per cent. of lead could ever be present through volatilisation.

He thought he might claim to have discovered Russian turpentine sometime in the seventies; he used then to examine all the turpentine that came into the Port of London to see whether it was contaminated with petroleum. In the paper he had pointed out that Russian turpentine produced effects which the American and French did not; especially were its physiological effects much more marked. What Dr. Perkin meant by properly purifying he did not know. By fractionation it was possible to get a product very similar to the French and American. Its peculiar effect was due to the presence of small quantities of products of heat and of destructive distillation. He believed that during manufacture it was customary to heat to a point very much beyond that which was customary in the case of the extraction of French and American oils. Of late years the smell which distinguished Russian turpentine had been got rid of by some method of treatment.

Mr. **Klein** wrote that in England no organised attempt had yet been made to determine the relative efficiency of the respective paint bases on scientific lines and until that was done little progress could be made in solving "the paint question." If it could be shown that the use of white lead constituted an abnormal source of danger to the user, and that at reasonable prices efficient substitutes were available then the case for prohibition might be considered to be on a sound footing. Recent work clearly showed that lead poisoning was readily amenable to regulations, and he had little doubt that regulations of a reasonable type would effect a real improvement amongst house painters.

With reference to coach painting, he quoted the remarks of Dr. Collis (H.M. Medical Inspector of Factories) in the Annual Report of the Chief Inspector of Factories and Workshops, for the year 1910 (Cd. 5693, p. 175), dealing with coach painting, stating that he had visited three large railway works: "At the third works lead paint is used generally, but great care is exercised to prevent plumbism, no surface covered with lead is sandpapered, no burning off of lead paints is done, there is good lavatory accommodation and an excellent dining room and kitchen, where food brought by the men is cooked, are provided. The general health of the men is good." Such a statement left no question as to the efficiency of hygienic control in rendering coach painting a healthy occupation. At first sight prohibition would appear to be the simplest and most effective method of dealing with problems of industrial hygiene, but its logical application would prove the most effective barrier to progress yet devised, and its interference with chemical industries in particular would be intolerable.

Meeting held at Burlington House on Monday, March 3rd, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

THE HEAT TEST. I.—GUNCOTTON. II.—NITROGLYCERIN AND CORDITE. III.—THEORETICAL.

BY ALFRED C. EGERTON.

Introductory.

The purpose of stability test is firstly to measure the extent of decomposition of an explosive, and secondly to gauge its liability to decompose. The latter is especially important when the test is used for accepting a new explosive, while both are important when the extent of deterioration of an old explosive is being determined. A stability test should be easy and quick to carry out and require an inexpensive apparatus. The test should be carried out under conditions similar to those to which it is normally exposed; it must not be affected by moisture and other volatile products in the explosive; lastly, it should be suitable for all explosives. In reviewing the many stability tests which have been devised, it cannot be said that any one of them satisfies all these conditions. A simple test is required which will satisfy these requirements and combine the good qualities of the Abel test, the Will test, and the Silver Vessel test; and which will be capable of differentiating between an impure and an unstable explosive, and which can be used either as an acceptance test or as a test of decomposition.

The present work started with an application to the amount of nitrogen oxides liberated during an Abel test, of a method of analysis of small quantities of gases by means of drops used as indicators. In the course of this analysis it was found necessary to investigate many features of the heat test not explainable from previous work. The work points to a method of carrying out the Abel test which might make it a thoroughly reliable and efficient stability test.

From the result of many observations the heat test has been found open to numerous errors. There is difficulty in securing absolute constancy in the reagents and in the paper employed; substances volatilising affect the reagent on the paper, and moisture causes dilution. Moreover the time taken for the test paper to be affected does not necessarily imply the rate at which the explosive will decompose, especially if small quantities of unstable substances are present: the assumption must be made with all due caution that these very slight decompositions mean that the explosive is so unstable as to give rise to dangerous decomposition on storage.

Robertson and Smart (this J., 1910, 130) have settled many points about the test, but there still remains much to be done, so some of their experiments were repeated and new ones devised to settle the more difficult points. The main points to be cleared up were:—

(1) What conditions affect the rate of decomposition of an explosive, and what substances are evolved from it?

(2) What is the source of the nitrogen oxides?

(3) Whether the indications of the test paper can be relied on?

(4) What is the relation connecting the concentration of NO_2 with time of colouring of reagent?

PART I.

Experiments with paper reagents.

To begin with, a large number of heat tests were made on samples of guncotton, the heat test tube and its contents were kept in the air out of the bath for an interval of 20 minutes between each test; tests were thus repeated on the same sample many times over. The experiments are set forth in detail in the complete paper.

The main results are, (a) that a test repeated a second time on guncotton is always lower than a first test; (b) that evacuation, which tends to draw out the products of decomposition, may either cause a rise or fall of the test depending on the condition of the guncotton and the circumstances of the test; (c) that the presence of moisture has a great deal to do with the time of the test.

A theory has been deduced from the experiments and it is probably a correct view of what occurs within the tube, since it is found to afford explanation for so many apparently discordant results. The reaction may be due to:—(1) The nitrogen oxides produced by a true decomposition of the guncotton during the test; (2) The nitrogen oxides from incompletely removed impurities; 3 The nitrogen peroxide dissolved in the guncotton. A proper stability test should distinguish between these three possibilities and measure the amount of nitric peroxide produced from each cause. Robertson and Smart describe experiments which show that normally prepared guncotton does not contain any appreciable quantity of peroxide in solution. The authors proceed to test the view that impurities give rise to the nitrogen peroxide produced during the test. They perform a continuous test on guncotton and find a fall in the test occurs, followed by a rise. The rise, according to them, does not indicate that the guncotton is getting more stable by the elimination of an impurity, but is simply due to the desiccation of the paper by the dried and heated guncotton, for when a trace of moisture is added the heat test again falls. The work here described shows that this is not the main cause of the rise in the test, though it agrees with the contention of Robertson and Smart that the heat test of a normal guncotton is not due to unremoved impurities. Robertson and Smart's view, then, of the heat test is that the nitrogen peroxide is produced by the decomposition of the explosive during the test, that any nitrogen peroxide in the tube is readily removable and that it is this peroxide which tends to lower the test on repetition, and that prolonged tests on dry guncotton are due to the desiccation of the paper. During this work, it was found, on the contrary that evacuation always lowers the test at first; if it was only the nitrogen peroxide left in the guncotton which tends to lower the test, evacuation must always increase it.

The idea of the actions in the tube gleaned from the work described in this paper is the following:—That on heating the guncotton nitrogen peroxide is evolved, some of the nitrogen peroxide is absorbed by the moisture in the guncotton, which latter also tends to vaporise and condense on the paper and on the walls of the tube, nitric and nitrous acids are thus formed in the guncotton, on the walls and on the paper. It is in the form of nitric acid that the guncotton absorbs "easily removable nitrogen peroxide": not so much an absorption by the nitrocellulose itself as Robertson and Smart seem to imply in experiment (*loc. cit.* p. 132) of their paper, but an absorption of nitrogen peroxide by moisture present in the guncotton. The amount and strength of nitrogen peroxide so formed during a test determines the behaviour of the guncotton in subsequent tests. Evacuation will concentrate the acid, or, if carried further remove it altogether. The acid tends to catalyse or increase the rate of decomposition. A dry guncotton will give a high test not merely because the paper is dried by the guncotton, thus spoiling the sensitiveness of the indicator, but because the peroxide evolved has no water with which to form any nitric acid and so the rate of decomposition is not accelerated.

The experiments on the following sample will serve to illustrate the theory:—first test 18 minutes; the gas in the tube was then removed by blowing air through the tube; the nitric acid formed will accelerate the rate of change during the next test and a fall to 11 minutes results. If the peroxide was merely absorbed by the guncotton a steady test should be obtained, because the pressure of peroxide in the guncotton would be a definite quantity at the temperature of the test. The next test is shorter, 10 min. 35 sec., but the one after rises again in spite of the fact that moisture is condensed on the sides of the tube, in fact, the air within must be nearly saturated with moisture and the paper can hardly be dried to any great extent, this rise must therefore be due to the drying of the guncotton and removal of the acid. The next test is about the same and then after 10 m. interval rises to 18 m. 30 s. because most of the acid has been removed and a normal test of the guncotton is obtained. The sample was then set aside with the tube open for one night, the heat test next morning was 20 m. 15 s.; on repeating 10 minutes later it fell to 12 m. 15 s. A little moisture has been absorbed so an acceleration of the heat test is obtained, but the acid is soon all removed and the heat test rises quicker than before; the guncotton had not absorbed all the moisture that it is able to take up and the heat test soon rises to 15 min. 30 sec. Pure anhydrous sodium sulphate is then added; the test only rises very slightly, 17 m. 45 s., this seems to indicate that no great increase in the time is due to desiccation of the paper. A guncotton evacuated on the bath for one hour before testing, gave a very long test because the nitric acid tends to be removed as fast as it is formed; it is not a question of concentrating the acid already formed as in the other cases. Besides the addition of sodium sulphate having made very little difference to the time of the test, another reason for believing that prolonged tests are not primarily due to dessication of the paper, is that on adding water to the sides of the tube before a test on a fairly dry guncotton, the test is not decreased; of course the water may absorb some of the nitrogen peroxide, but this has been found not to affect appreciably the time of colouring of the paper. In very long tests, on the other hand, the paper gets dried and then tends to colour more slowly; but the point is that this is not the main cause of the rise of the test in the above mentioned experiments. A drop of water placed on a platinum wire by the sides of the paper during the test, made no difference to the time of the test.

A good many tests were made *continuously*, *i.e.* as soon as the paper came up to tint it was changed and another fresh one inserted. A dry guncotton does not give a fall in test so rapidly as a wet sample, and it rises sooner to the definite value which the conditioned guncotton eventually reaches. In both cases a fall is followed by a rise, and when a drop of water is allowed to moisten some silica wool placed above the guncotton a pronounced fall is obtained, but this fall is not immediate.

The results are readily explainable: first the higher nitrocelluloses decompose giving rise to nitrogen peroxide, water is present and nitric acid is produced; the nitric acid accelerates the change and as the water present gets more and more saturated with NO_2 the decomposition tends to be more and more accelerated and the concentration in the tube rises rapidly; less rapidly in the case of a dry guncotton because the amount of water is soon all saturated, and so the acceleration is not so great. The acidulated water then tends to vaporise and condense on the upper part of the tube, the acid becomes concentrated, dissolves more nitrogen peroxide (tending perhaps to renitrate to some extent the lower nitrates) until an equilibrium state is reached. The concentration in the tube does not rise above a certain value, which indicates the normal decomposition of the explosive; it is the *apparent* solution pressure of the peroxide in the guncotton which is thus measured; this *apparent* solution pressure depends on a variety of circumstances and it should be a valuable indication of the stability of the explosive. On adding water to the silica wool dilute, nitric acid is obtained again and a greatly accelerated time of test arises. These views do not agree with the idea of Robertson and Smart, that these effects can be explained by the dessication of the paper; in the first place, the dried guncotton shows the effect, and secondly the presence of moisture in the tube does not accelerate the test at once.

The following experiments on the effect of evacuation of a heat test tube containing guncotton support the ideas expressed above:—

1. Test after evacuating at pressure 60 m.m. and 76·8° C.	for 30′	31′ 0″
2. Test after evacuating at pressure 60 m.m. and 76·8° C.	for 120′	39′ 0″
3. Test after evacuating at pressure 60 m.m. and 76·8° C.	for 180′	26′ 30″
4. Test after evacuating at pressure 60 m.m. and 76·8° C.	for 30′	21′ 45″
Left evacuating in bath	for 120′	26′ 30″
,, ,, ,,	,, 180′	25′ 0″
,, ,, ,,	,, 240′	24′ 0″

These results show that the effect of evacuation is such that it removes water and nitric acid and gives a high test; but that if the evacuation is continued a long while, the explosive itself sometimes begins to decompose a little more rapidly.

5. Test after evacuation at pressure 360 m.m. and 76·8° C.	for 30′	15′ 30″
Left evacuating in bath	for 120′	9′ 0″
,, ,, ,,	,, 180′	5′ 0″
,, ,, ,,	,, 230′	14′ 20″

So that unless the pressure is fairly low, the nitric acid is not removed, but only concentrated and the results are similar to a repeated test somewhat exaggerated.

6. Test after evacuating at pressure 60 m.m. and 65° C.	for 30′	27′ 0″
Left evacuating in bath	for 120′	22′ 0″
,, ,, ,,	,, 180′	24 0″

In this case the nitric acid is not quite so completely removed as in the case of sample 4, but the results are somewhat similar.

Another set of experiments was interesting, as it lent confirmation to these views. Pure sand mixed with the guncotton raises the test slightly whether the sand is wet or dry. The moisture on the sand absorbs a good deal of peroxide, the nitric acid produced being unable to act on the guncotton; the dry sand similarly dilutes the effect of the nitric acid on the guncotton. Sodium sulphate added shows that the effect of the dessication of the paper during short tests is negligable. Copper or sawdust added to the guncotton causes a lowering of the test and would seem to show that the nitric acid is really produced in the guncotton, for it is decomposed by these substances giving rise to nitrogen oxides, which lower the test. The effect of adding copper nitrate, as would be expected is to lower the test; while the effect of adding oxalic acid is to accelerate the decomposition very much, similar to the effect of adding a drop of very weak nitric acid itself; the production of acids by the explosives is thus the main influence which causes acceleration of decomposition and therefore possibly, eventual explosion. Sulphuric acid from cellulose sulphates may also take part in the acceleration of the test. Chalk added to the guncotton takes hold of any nitric acid produced and prolongs the test enormously. Mercuric chloride added in solution to the guncotton tends to lower the test, *e.g.*, to 9 minutes; added dry it tends to raise the test, *e.g.*, to 24 m. 30 s. The reagent we have used in our drop experiments to be described is unaffected by mercuric chloride, *e.g.*, drop test 14 min. obtained with the sample of guncotton and mercuric chloride as against

15 min. with guncotton alone (for method of drop test see later). The action of mercuric chloride on the heat test paper is only too well known.

The starch iodide indicator cannot be relied upon, as Robertson and Smart point out, for long tests. While the paper is colouring the starch iodide tends to be decomposed; tests of over 25 minutes are drawn out therefore to a longer extent than they should be according to the actual concentration within the tube. An experiment illustrates this: three tubes are taken, A, B, and C. A normal test with the paper indicator is carried out in A., giving a heat test of 16 m. 30 s. A similar sample is commenced to be tested in B, but the tube is taken out from the bath after ten minutes and is left for ten minutes in the air with the paper still inside it. C. is meanwhile heated for 10 minutes in the bath, closed, but without any paper, and the paper from B is now transferred to it, the test line appearing in 10 m. 30 s. A total test of the B and C sample is therefore 20 m. 30 s. in comparison with the normal test of 16 m. 30 s. It appears that during the period in which the paper is resting in the first tube, a back reaction on the iodine liberated is taking place.

Application of the drop method.

Having come to the conclusion that the starch iodide reagent is not satisfactory, it was thought that a drop of suitable reagent of a definite surface, and colouring to a standard tint, would give much more reliable results. The remainder of the work consisted in applying to the study of the test this new method of analysis; and in the following experiments the nitric acid theory, which explains well the former results, is given further support. Before the drop method could be employed, various indicators were investigated to discover which were most applicable to such a method. A nitrogen peroxide indicator must be (1) stable to heat, (2) not acted on by nitric acid but only by nitrous acid or, otherwise, completely by nitric acid, (3) very sensitive.

Of the reagents tried α-naphthylamine and dimethylaniline were found the most reliable. The first is made up thus:—

0·1 grm. α-naphthylamine in 100 c.c. of acetic acid $N/100$	5 c.c.
0·5 grm. sulphanilic acid ,, ,, ,, ,, ,, ..	5 c.c.
And acetic acid (glacial)	10 c.c.

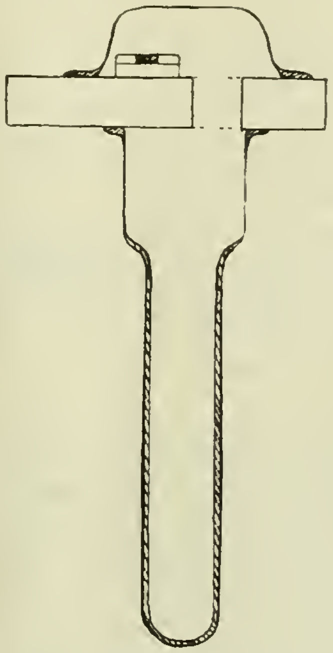
The second is a nearly saturated solution of dimethylaniline in glacial acetic acid.

Apparatus used for drop method.

The following is a description of an apparatus giving a small and definite liquid surface which absorbs nitrogen peroxide and colours to a certain standard tint in a time depending on its concentration. The apparatus consists of two small circular discs 1·3 cm. diameter, one of opal glass and the other of clear glass with a small hole in the centre (0·5 cm. diameter and 0·2 cm. depth); the two discs are cemented together and thus form a thicker disc with a depression in the centre, into which can be pipetted some suitable reagent until its surface is flat, and level with the top surface of the disc; always the same thickness of liquid and area of surface are thus present. The drop is exposed to the action of the gases and the reagent absorbs a small quantity of them, and colours to a certain tint in a measured time, the tint being observed by means of a drop of liquid of standard tint in another similar disc. The drop holds 0·03 c.c. and can be filled every time with the same volume to within 1 mgrm.

Now this method can be readily adapted to the measurement of the concentration of the nitrogen oxides liberated in heat tests instead of the heat test paper, thus any doubts arising from the actions on the paper and starch iodide reagents can be eliminated.

A special heat test tube was designed in which to expose the drops, in the shape depicted in the figure. The upper portion measured 1″ × 1″, the other four inches were of ordinary heat test tube dimensions. On the ground flange rested a slab of glass $\frac{1}{4}'' \times 3'' \times 2\frac{1}{2}''$ with a half-inch hole nearer one end of the slab than the other. The disc rested on the upper surface of the slab close to the hole; a cap of glass with ground flange and clean flat upper surface rested on a slab so as to cover over the disc and hole. The slab could be so slid that the hole communicated with the inside of the test tube thus exposing the disc to the action of the gases within, and then the slab can be slid back so that it closes the tube once more. Convection currents cause a convenient circulation of the air in the tube. The drop of liquid can be changed and the slab slid back again and so on, thus the apparatus is very convenient for doing tests at intervals on the heated cordite or guncotton. The standard tints used were a solution of magenta for the α-naphthylamine tint, and a solution of methyl orange for the dimethylaniline.



A few of the results of some of the experiments are given in the tables.

TABLE I.

Sample.	1.	2.	3.
1st test	16′ 0″	14′ 0″	15′ 0″
20′ interval			
2nd test	13′ 30″	13′ 0″	11′ 30″
20′ interval			
3rd test	12′ 0″	16′ 0″	19′ 30″

The experiments show that reliable results are obtainable with the α-naphthylamine reagent. The time was within one minute of 15 minutes in four tests. The results obtained by such a method would appear to be quite satisfactory: a definite absorbing surface is exposed: a definite reaction on the indicator is known to be occurring, and it only reacts with nitrous acid; while with potassium iodide and starch paper none of these criteria are satisfied.

Two errors might arise, (a) the drop might become heated and alter its rate of absorption; (b) convection currents might not be sufficient to thoroughly stir up the vapours in the tube; experiments have been made to test the magnitude of these errors and they are found only to be slight. It may be noticed that a fall in the test similar to that which was found when using the paper and which has already been described, is obtained on repeating tests on a single sample. The effects of the evacuation, etc., are also similar, and they therefore support the idea that the high tests are not due solely to the desiccation of the paper but rather to the desiccation of the guncotton and the gradual depletion of acid from it.

The rise in the test is much more pronounced than in a continuous test with a potassium iodide paper. Now this cannot be due to absorption of nitrogen peroxide by the drop, for it has been shown, by exposing several drops within the tube at a time, that not enough is absorbed to make appreciable difference. The most reasonable view is that something is present in the tube which reacts with the potassium iodide paper but not with the α-naphthylamine or dimethylaniline reagents. It is probably nitric acid which reacts with the paper reagents; the drop reagents are not affected by it and give a heat test time very much as would be given by a sample of dry guncotton (the results of the tests with dimethylaniline, which is unacted on by nitric acid, bear this out). The time of the first test therefore of a sample of guncotton must depend on the amount of moisture which it contains; the test is rather below what would be given by a dry sample, because towards the end of the test the decomposition is being accelerated, while at the beginning, owing to the initial heating up of the tube, the production of nitrogen oxides is slow. The first test then, is somewhat of a balance of errors; a true knowledge of the decomposition of the explosive can only be obtained by a continuous test. A continuous test can be most conveniently carried out by leaving the tube in the bath and only exposing the reagent at intervals: and then plotting the time of test against the time of immersion in the bath.

A number of tests were made from day to day on samples of two lots of guncotton, the results vary amongst themselves considerably with the heat test paper, but were much steadier with the α-naphthylamine drop. The variation with the heat test paper was not in any way proportional to the barometric pressure or to the hygrometric state of air.

Investigations similar to those of Robertson and Smart on the effect of moisture on guncotton were made; and it was found that only an extreme variation in the amount of water present causes a variation in the time of a single test; but it is quite incorrect to maintain that the effect of conditioning is only to permit the guncotton to take up a quantity of water sufficient to prevent the drying of the heat test paper. "Conditioning" allows the guncotton to take up moisture; this moisture, owing to absorption of peroxide, causes the apparent rate of decomposition to be slower at the beginning of a test but quicker towards the end of a test: therefore it has a levelling effect on all guncottons, it tends to make all guncottons, whether stable or unstable, give approximately the same heat test times, it makes the single heat test, an untrue and fictitious test. It is only by the aid of a continuous test that the stable or unstable nature of the guncotton can be detected.

Continuous tests have been made in order to determine the concentration of water vapour in the heat test tube, by employing a drop of a reagent which is sensitive to water, viz: anhydrous cobalt chloride in dry alcohol. The production of water appears to vary in the same way as the production of nitrogen oxides and supports very strongly the notions put forward to explain the various effects.

Heat tests were made at different temperatures and tests were made on various lesser points connected with the heat test, as for instance on the influence of the volume of the tube, of the strength of the indicator, of the state of division of the guncotton, of the quantity of guncotton present in the tube and of the positon of papers and drops in the tube; for the results reference should be made to the complete paper. In the case of the paper reagent the position of it slightly affects the time of the test; the absorption is quicker than that by the drop, so the nearer the guncotton the quicker the time. A drop placed in the upper part of the test tube coloured in the same time as a similar drop in the usual position on the slab of glass.

A test on old guncotton was done; the first test did not detect much deterioration but a continuous test showed that it had deteriorated very considerably (see Table 3 and Curve I.)

CURVE I.

Time. Continuous Test. G.C. Dry, old. 70° C.

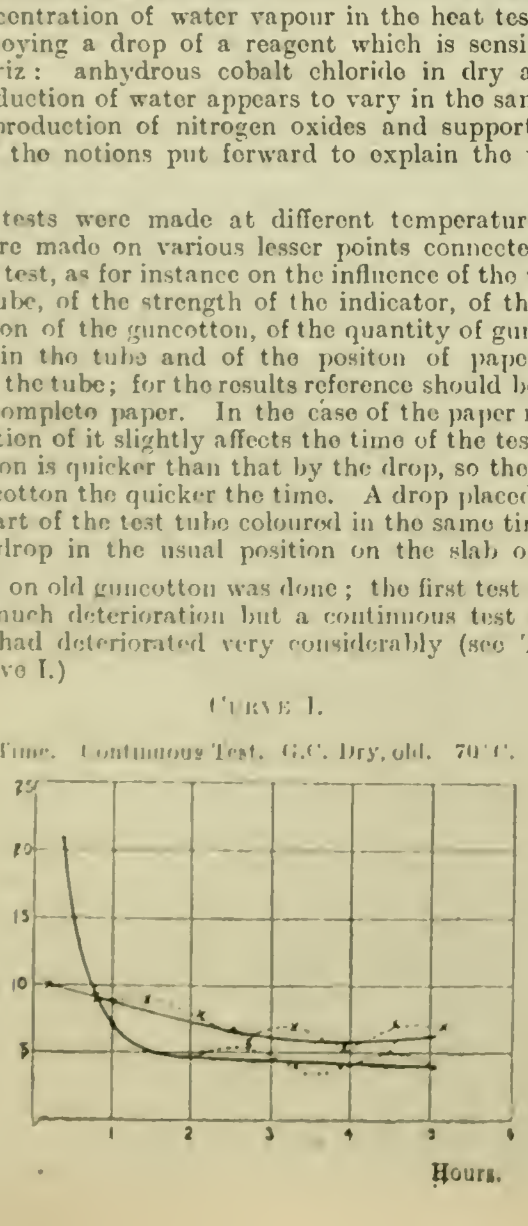


TABLE 2.

Sample 1.	Sample 2.
Paper KI. 70°.	Drop α-Naphthylamine. 70°
21′ 0″	10′ 0″
7′ 30″	9′ 0″
5′ 0″	9′ 0″
5′ 0″	8′ 0″
5′ 30″	6′ 0″
4′ 0″	7′ 0″
—	5′ 30″
—	7′ 0″

Summary.

1. Tests were made with the starch iodide paper repeatedly and continuously on various samples of guncotton, and in some cases the tubes were evacuated. A fall in the test occurs on repetition of a heat test, which is followed by a more or less marked increase; the presence of moisture has much to do with the time of the test.

2. It is not enough to assume that the nitrogen peroxide produced by the decomposition of the explosive during the first test, is responsible alone for the fall in the succeeding test, and that drying of the paper subsequently increases the tests. The fall and rise of the tests are connected with the production and removal of nitric acid formed by the solution of nitrogen peroxide in the moisture on the guncotton. Experiments are given which show that the drying of the paper has little to do with the increase of the test.

3. Many experiments with the paper indicator, such as the effects of evacuation, of moisture and of the addition of various substances are described in support of this view. But the starch iodide indicator is untrustworthy, for it is unstable and the paper absorbs irregularly.

It is hoped that this work will make it possible to submit guncotton to a reliable stability test without altering to any great extent the apparatus necessary for the carrying out of an ordinary heat test; and also that a further idea of the significance of the heat test on guncotton may be gained from it. The author wishes to remark that, although he submits some corners of the work of Robertson and Smart to criticism he recognises the importance of their communication, and how much they have added to what is known about the heat test.

HEAT TEST OF NITROGLYCERIN AND CORDITE.

(PART II.)

Nitroglycerin.

The methods described in the preceding paper are here utilised to make clearer the real significance of a heat test on nitroglycerin and more especially on cordite. The heat test as applied to nitroglycerin has been carefully investigated by Robertson and Smart (this J., 1910, 130); they conclude that the test obtained would be very much higher than would be expected from its known rate of decomposition, owing to the solubility of nitrogen peroxide in the nitroglycerin; they were led to these conclusions by experiments on the comminution of the nitroglycerin by means of silica wool, a larger surface being thus afforded for the escape of nitrogen peroxide. The time of the test is dependant on the amount of peroxide held already in solution by the nitroglycerin, so that the nitroglycerin should be heated in a bath of water at 70° C. for some time before testing to remove the dissolved nitrogen peroxide: in fact, a test on nitroglycerin which signified anything at all would have to be made according to the following plan:—One portion should be heated at 70°C. in the air for 20′, cooled and then comminuted on silica wool (0·8 grm. added to 2 grms. silica wool), the other portion should be comminuted without the previous heating; the results of the heat test should be different, and from them it should be possible to deduce the amount of nitrogen peroxide held in solution owing to previous decomposition, also to find the decomposability of the nitroglycerin itself, especially if continuous tests are used.

The statement of Robertson and Smart (*loc. cit.* p. 132) contradicts that on page 131 which deals with the nitrogen peroxide absorbed by guncotton: for guncotton, experiment 1, shows that it contains no easily removable nitrogen peroxide in solution; experiment 2, shows that after being tested guncotton retains some of the nitrogen peroxide formed in the previous test, but that this can be readily removed. With nitroglycerin it is different, experiments show that it does hold nitrogen peroxide in solution and experiment 4 shows that the lower test obtained on repetition of a heat test on uncomminuted nitroglycerin is due to the absorption of nitrogen peroxide during the first test, which can be removed by evacuation. However experiment 5 shows that, after the comminution, no nitrogen peroxide is absorbed by the nitroglycerin. This result is contrary to what would be expected from the experiments on guncotton, which is in much the same state as comminuted nitroglycerin and is not such a good absorbent of nitrogen peroxide. It would not be possible to bring the two experiments into line on the hypothesis that nitrogen peroxide is retained by guncotton itself, but they substantiate the view that the nitrogen peroxide in the case of guncotton is retained in quite a different manner, namely, by water which dissolves it giving nitric acid. A few heat tests on nitroglycerin have been made by the continuous method:—

Table I.

Temp., 78° C.

Sample : Reagent.	1. Paper.	2. Drop.	3. Paper.
	12′	40′	8′
	3′	9′	5′
	1½′	6′	4′
	3′*	6′	—
	—	4½′	—

* Left in air ¾-hr. and retested.

It will be noticed that the first test is high and uncertain especially in the case of the drop, presumably because the nitroglycerin reabsorbes the nitrogen peroxide produced until an equilibrium is obtained; the drop gives a high first test because the nitroglycerin absorbs the nitrogen peroxide before it has an opportunity of being absorbed by the drop situated in the cap. The nitroglycerin did not contain much dissolved nitrogen peroxide, so a preliminary heating tended to hasten the test rather than to raise it. These experiments show the advantage of using a continuous test and these few notes about the testing of nitroglycerin serve as an introduction to the following work on Cordite.

Heat test on cordite. Robertson and Smart's work on the addition of guncotton to nitroglycerin, which causes first a rise and then a large fall in the test, as the amount of the guncotton increases from 2·5 to 40 per cent., show that it is the effect of the comminution of the nitroglycerin. The significance of the heat test on cordite required more thorough investigation, for the heat test is largely used for the testing of cordite and the empirical results obtained are very diverse and often lead to incorrect conclusions. The short study here described has been made on the same lines as the work on guncotton.

(1) *Repeated Tests.*—The following results were obtained by heat testing 4 samples of cordite with potassium iodide paper, repeatedly with intervals of 20 minutes.

Table 2.

M.D. Temp. 76·8° C.

Sample.	1.	2.	3.	4.
First test	53′	51′	50′	53′
20′ interval	—	—	—	—
Second test	35′	35′	35′	35′
20′ interval	—	—	—	—
Third test	30′	30′	31′ 30″	32′

(2) *Continuous Tests.*—The results of continuous tests at 76·8° C. on samples of M.D. cordite are also appended. A high initial test is obtained followed by a sudden fall, and the time of the test gradually gets shorter until a fairly steady state is reached after about 5 hours heating. When using the drop indicator, the high initial test is not usually obtained, and the difference in the behaviour of the two indicators would seem to indicate that there is some difference in the effect of the decomposition of the cordite upon them; in both cases after the first five or six tests a fairly steady state of decomposition is reached, and the explosive is then in equilibrium with its products of decomposition at the temperature of the test (see Curve II.). Tests on Mark 1, cordite at 76° C. and at 82° C. show that, for either indicator, a fairly high test is obtained to start with followed by a fall to a steady value.

A change of temperature from 77° to 82° about halves the time of the test for both indicators. Some tests were done in order to find out what would be the best temperature at which to carry out a continuous test on cordite. The most convenient temperature, at which to make the test is 77°: many experiments on good and bad samples of cordite show that this gives the best results. Experiments with good and bad samples done with the drop and paper indicators are tabulated. The potassium iodide paper is more sensitive to change of concentration than the drops and exaggerates the badness of the explosive; while on the whole, the tests with both drop and paper are comparable except for the first test. Some tests done at 65° show that this test is too low for any good cordite to give a test in a reasonable time, but the bad cordite from the tropics gives quite a low test; on storage however this test rises and the quality of the cordite apparently improves (as shown by a single test) instead of deteriorating, nevertheless a continuous test soon brings down the time of the test and demonstrates the badness of the cordite. Some other tests were done at 70° on some old cordite which had been kept in a museum for some years; they were done continuously, but only at intervals of 30 minutes, the tube being left in the bath during the interval with

Curve II.

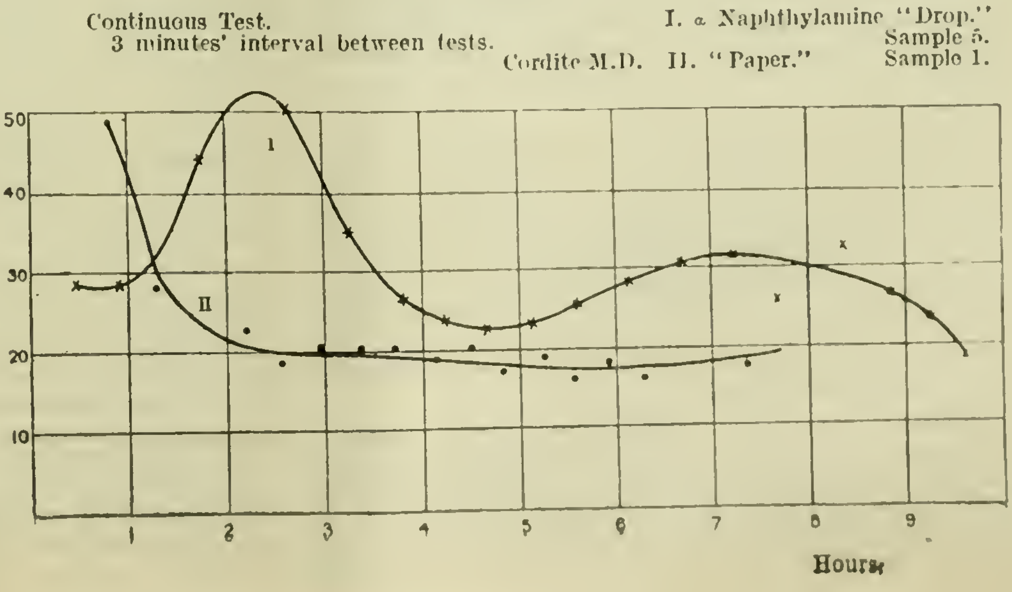


TABLE 3.

Sample :	1.	2.	3.	4.	5.	6.	7.	8.
	M.D.	M.D.	MKI.	MKI.	M.D.	M.D.	M.D. Tropical.	M.D. Tropical.
Reagent :	Paper.	Drop.	Paper.	Drop.	Drop.	Paper.	Drop.	Paper.
Temperature :	76·8	76·8	82	82	76·8	76·8	76·8	76·8
	49′	29′	26′	16½′	17½′	20′	15′	6′
	28′	28½′	10′	8′	13′	8′	18½′	3½′
	24′	44′	7′	7′	15′	9′	10½′	4½′
	23′	50′	5′	10′	22′	9′	12′	3′
	19′	35′	5′	7½′	15′	9′	13′	3′
	21′	26½′	4′	9′	15½′	8½′	12′	3′
	20½′	25′	—	—	—	—	—	—
	20¼′	23′	—	—	—	—	—	—
	19¼′	23½′	—	—	—	—	—	—
	20′	26′	—	—	—	—	—	—
	18′	27½′	—	—	—	—	—	—
	20′	30′	—	—	—	—	—	—
	17′	31′	—	—	—	—	—	—
	18¼′	26′	—	—	—	—	—	—
	17′	33′	—	—	—	—	—	—
	18′	27½′	—	—	—	—	—	—
	—	24′	—	—	—	—	—	—
	—	19′	—	—	—	—	—	—

the slab of glass closing the tube : this is the most convenient method of doing these tests.

There are several points which it is important to settle; firstly, what influences a high or low value in the first test; secondly, why does a rise occur after the first few tests when using the drop indicator and why is the drop not influenced the same way as the paper in the first few tests, especially with M.D. cordite ?

When the cordite is heated, it will tend to give off dissolved nitrogen peroxide, acetone or other solvent or moisture ; as the heating is continued the nitroglycerin tends to decompose at a steady rate and at a constant temperature, equilibrium is set up ; the concentration in the tube will depend partly on the stability of the explosive (for the more unstable it is, the greater the amount of nitrogen peroxide is liberated before equilibrium is established), and partly on the solution pressure of the nitrogen peroxide in the explosive ; thus, in deducing the stability of an explosive from its continuous test, it should be compared with that of a good example of the same explosive. The first test of a bad old explosive will generally be low, owing to the peroxide held by the explosive, and also to the absence of volatile substances which have dispersed and which tend to raise the first test. A good cordite on the other hand will generally have an exaggeratedly high first test, because moisture acetone etc. prolong the test. The mineral jelly, no doubt, absorbs some of the nitrogen peroxide evolved during the first part of the heating, and also is probably nitrated itself in the process of manufacture and subsequent storage, and the compounds formed tend to decompose during the first few tests. The results of many experiments have led to these ideas.

(3) *The effect of evacuation.* The results show that : (a) Something is removed which causes an increased test time for the paper indicator, but does not lengthen the drop test time (probably volatile solvent) ; (b) That evacuation tends to remove NO_2 dissolved in the explosive, so that in some cases the drop tests become increased ; (c) That there is also a possibility that moisture on being removed gives nitric acid which tends to accelerate the rate of decomposition (further evidence can be brought to bear on this last action).

(4) *Effect of moisture.* Different samples of cordite were tested after exposure to air of different degrees of dryness : two samples were left in a vacuum desiccator for 24 hours, a few samples were dried for 3 hours at 80° C. and subsequently over phosphoric anhydride, and two were exposed over water for 24 hours. The results show that a dry cordite gives high first tests, partly because the drying takes dissolved peroxide out of the cordite and mineral jelly, and possibly, also, because the accelerating influence of nitric acid is removed. A wet cordite gives low test, but these rise on continuing the test because the accelerating influence is removed.

The view is held that moisture plays some part during the earlier tests on cordite, especially when using the drop, because in this case the nitric acid vapour has no effect on the reagent as it has on the paper ; a rise in the time of the test often occurs after the third test with the drop indicator, showing that all the acid has been removed, while no such rise occurs in the case of the paper, because nitric acid removed probably affects the paper. There is reason to believe this must be the explanation of the curious difference between the continuous tests obtained with the drop and paper indicators. Moisture does not seem to effect the rate of decomposition of Mark 1. cordite nearly so much as that of M.D. cordite, and this must be because the guncotton is not present in such large amounts : it has been shown in the first of these papers that the rate of decomposition of guncotton is greatly affected by moisture.

(5) *Effect of impurities.* Some experiments were made on the effect of adding chalk to M.D. cordite : the first test was 64 minutes, the second 67 minutes, and subsequent ones gradually decreased to 28 minutes ; nitric acid appears to be absorbed by the chalk and high values are obtained. A similar test on Mark 1. cordite does not raise the test inordinately, showing that nitric acid does not affect the decomposition.

A test on cordite exposed to acetone vapour gave a heat test with the paper indicator of one hour 35 minutes, and subsequent tests of 28 minutes, 23 minutes and 18 minutes. Another sample giving a normal test of 13 minutes with the paper, after exposure to acetone for one hour gave a test of 32 minutes and a drop test of 18 minutes. The vapour of acetone prolongs the first test greatly, especially with a paper indicator. Guttman holds that acetone affects the iodine liberated on a heat test paper ; besides this the effect of acetone is to *raise* the test so long as the acetone is *in* the cordite, but when it is removed the test is considerably lower than if the cordite had not been exposed to the acetone vapour : this is shown by results of tests using the drop indicator. The reason must be, that a compound of acetone and NO_2 which is first formed decomposes on vaporisation. A cordite which gives a high test will often give a lower test when left in the air before testing so as to allow the solvent to evaporate away; the solvent should be removed as far as possible before testing a cordite.

A ground up sample of cordite which has been left in the air gives high tests at first (because the partially decomposed explosive on the surface tends to reabsorb nitrogen peroxide); after some heating equilibrium is set up and normal tests are obtained; whereas an unground sample will tend to give short tests after storage because any peroxide formed during storage is held by the explosive and is evolved on heating. The state of division of cordite makes a considerable difference to the time of the test; finely ground cordite will offer a bigger surface for the liberation of peroxide and for the action of any catalysing agent; quicker tests then are obtained from finely ground cordites.

(6) *Effect of varying temperatures.* The rate of decomposition of cordite has been tested between 90° and 60° C.; the drop test gives a much more even curve than the one given by the paper, the fault lies in the instability of the starch iodide reagent.

Conclusion. A heat test on cordite is somewhat complicated and its significance is not at once apparent. The numerical results leading to the following conclusions are given in full in the complete paper:—

Influence.	Effect.	Avoidance.
(1). Volatile solvent.	Raises first test then accelerates.	Expose cordite before test in warm cupboard.
(2). Absorption of nitrogen peroxide by cordite.	Raises test, depends on physical condition of explosive.	Compare with and treat same as a normal cordite.
(3). Moisture.	Gives nitric acid which will accelerate the test.	Expose cordite before test in warm cupboard.
(4). Physical condition of the cordite.	If fine ground shorter tests. Gelatinisation of surface.	Make to definite degree of coarseness.
(5). Temperature.	The higher the quicker the test.	Standard temperature taken between 70° and 80°, best at 77°.

A good stable cordite might give a lower test than a bad cordite which contains some volatile solvent: if it was slightly moist it might give quite a quick test, and if over dried give too long a test. Therefore, as a test for accepting a cordite, the heat test as at present carried out would not be reliable. In testing an old cordite the heat test should be fairly reliable, because the solvent will have dispersed and the test will show whether much peroxide has been absorbed by the explosive during storage owing to gradual decomposition; but as a test for the future behaviour of the cordite *i.e.* of its decomposability, it is useless when done according to ordinary procedure.

To summarise then the result of this work:—the drop has been applied to the testing of cordite and gives results which differ little except in detail from the tests with the paper indicator, though on the whole more reliable. The results emphasise the difficulty of gathering knowledge about the explosive from a single heat test; but continuous tests give much more information about its stability, especially on comparison with a continuous test on a standard sample of the same explosive. It is possible to notice whether the explosive contains much dissolved peroxide, whether it contains volatile solvent, whether it is liable to rapid decomposition or is fairly stable. The method of doing continuous tests with the drop is very convenient. It has been pointed out that, both for accepting a new explosive and for ascertaining the extent of deterioration of an old explosive, it is necessary to subject it to a stability test; and a stability test has firstly, to measure the extent of decomposition of the explosive and secondly, to gauge the liability of it to decompose under fairly normal conditions of storage. It appears that the above method of testing by means of continuous tests satisfies these conditions for a good stability test, and has the advantage of being easy and quick to carry out.

HEAT TEST (PART III).

Theoretical.

Introduction. The connection between the time of colouring of the indicator and the concentration of nitrogen peroxide in the heat test tube has been dealt with by Robertson and Smart in their paper (*loc. cit.*); they have found the time of colouring of a paper indicator in a constant concentration peroxide by their "glass box" experiments; and have shown also, that knowing the amount absorbed by the paper, it is possible to calculate the rate of rise of concentration of nitrogen peroxide during a heat test. It is important that the heat test should be established on a quantitative basis; there are certain points still requiring to be explained.

1. *Absorption by paper and drop indicators.* Experiments have been made in which several papers have been exposed together in the same heat test tubes; the results have already been quoted but are found again below.

TABLE I.

Number of papers.	Time of test.
1	15′
2	16′
4	20′
Number of drops.	Time of test.
1	17′
2	16′

It may be noticed that the presence of two papers or even of two drops in the same tube make very little difference to the time of the test. One must therefore deduce that the amount absorbed by the paper or drop is quite a small fraction of the concentration of the peroxide which corresponds to the time of colouring of the indicator. This is borne out by the results of a continuous test done successively on one sample, while another sample is only tested after a considerable interval of time, and yet a similar result for both these tests is obtained after a certain time from the commencement of the test has elapsed. If the indicators absorbed much nitrogen peroxide one would expect that the tests done successively should be higher than the corresponding tests done at longer intervals.

Now the quantity of nitrogen peroxide absorbed by the paper in coming up to tint, according to Robertson and Smart, is 135×10^{-6} mgrms. of NO_2; this figure has been confirmed by a similar experiment to theirs. The quantity absorbed by a drop of the naphthylamine used in these experiments in colouring to the standard tint, is $4{\cdot}0 \pm 0{\cdot}5 \times 10^{-4}$ mgrms. of NO_2. This figure has been found in two ways: firstly, by the decrease in the concentration produced by a number of drops introduced successively into an atmosphere containing a small measured quantity of nitrogen peroxide; secondly, by comparing the standard colour with the colour produced by a known quantity of a nitrite solution added to a solution of α-naphthylamine and sulphanilic acid:—5 c.c. of a solution of sodium nitrite (equivalent to 0·024 mgrms. NO_2 per c.c.) added to sulphanilic acid and α-naphthylamine and water (making 50 c.c. of solution) possessed the same depth of colour after leaving to stand for 5 minutes, as 10 c.c. of the standard magenta solution made up in another Nessler tube to 50 c.c. (the tint of the magenta solution being the standard tint to which the drop is coloured during tests). The volume of the drop is 0·03 grms. The quantity Q absorbed by the drop is therefore

$$5 \times 0{\cdot}0024 \times 0{\cdot}03 \div 10 = 3{\cdot}6 \times 10^{-4}$$

Several experiments of this sort lead to the above value of $4{\cdot}0 \pm {\cdot}5 \times 10^{-4}$ mgrms. of NO_2 as being the quantity of nitrogen peroxide absorbed by the drop in coming to the standard tint chosen. With this knowledge a solution of magenta can always be made of the same tint; in course of time the magenta solution is apt to undergo a change of tint and requires re-making.

The drop absorbs therefore about three times as much NO_2 as the paper, but still the character of the results in a continuous test is similar; and although on the whole the drop gives test times nearly twice as long as the paper, yet for longer times the drop gives relatively shorter tests. It must therefore be remarked, *that the quantity of nitrogen peroxide absorbed by the indicators makes little difference to the concentration of nitrogen peroxide within the heat test tube as measured by the time of the test.*

This point is difficult to explain. It would appear perfectly reasonable to contend that during a heat test the concentration within the tube is increasing according to the rate of evolution of NO_2 from the explosive, but is being decreased owing to the absorption of the NO_2 by the indicator. The formula for the rate of rise of concentration within a heat test tube developed by Robertson and Smart from these considerations was perfectly straightforward, provided the assumption is made that during a small interval of time the indicator is absorbing according to a law tc=k, where c is the concentration (constant for the moment), t the small interval of time during which an amount dq of NO_2 is absorbed, and k is a constant.*

The formula is:—

$$T = \frac{KV}{Q} \log_e \frac{r}{r - \frac{QTr}{KV} + \frac{Q^2}{KV^2}}$$

where T is the heat test time, r the rate of rise of concentration of peroxide due to the explosive. Q is the quantity absorbed by the indicator and V is the volume of the tube. The constant K connects the time of colouring of the indicator with the concentration, when the latter is constant. Robertson and Smart found that $TC=K=31\times10^{-6}$ for the heat test papers. Taking the value of Q at 135×10^{-6}, they were able to find from the above formula, values of r (in mgrms. of NO^2 per c.c. per minute), at various assumed heat test times. However if in such calculations the value of Q be doubled—corresponding to the exposure of 2 papers in the tube—the value of r will alter considerably; *e.g.*, for T=10 minutes the value of r would increase from $1\cdot2\times10^{-6}$ to $1\cdot9\times10^{-6}$—a difference of 37 per cent. in the value of r. But instead of altering a test time of 7 minutes to one of 10 minutes, the presence of 2 papers in the tube has little effect. Either the theory of growth of concentration of nitrogen peroxide in a heat test tube, as contained in the above formula, must be incorrect; or the value of K has been found too small by the glass box experiments, in which case the calculated values of r would also be too small. The latter possibility was first investigated.

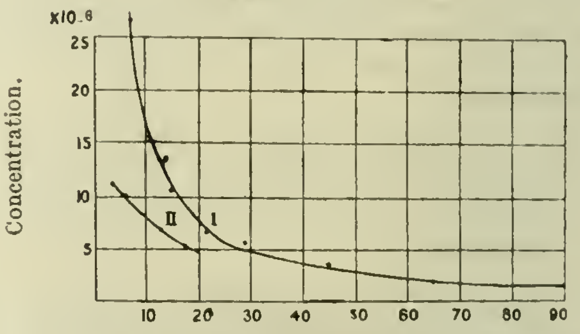
2. *The law governing the absorption at constant concentration.* Robertson and Smart have employed the large glass box of one cubic metre capacity, in which a tube containing a small weighed quantity of liquid nitrogen peroxide is broken. They found that between 3×10^{-6} and 6×10^{-6} mgrms. of nitrogen peroxide per c.c. corresponding to times of 12 to 5 minutes on the paper, the curve connecting the time of colouring of the paper and the concentration of peroxide is a rectangular hyperbola and that $TC=31\times10^{-6}$. Above and below these concentrations, the results obtained with starch iodide paper are no longer reliable and do not obey the above law.

Possessing no metre cube glass box, as used by the above investigators, another method of obtaining an atmosphere containing a small measured concentration of nitrogen peroxide was looked for. The results are given in Curve III.

The results with the drop show that the absorption by it follows the law TC=K and that K approximates the mean value 156×10^{-6}. The mean value of K for the paper is about 80×10^{-6}, but the results cannot be said to show that the above law holds: the dryness of the atmosphere, no doubt, prevents proper absorption by the paper (the paper would not be very suitable then for measurements of concentrations during heat tests). The values of K are thus considerably larger than those found by the glass box method.

CURVE III.

Concentration, Time Curves.



I. α Naphthylamine Drop.
II. KI. Paper.

3. *Calculation of the rate of decomposition.* It is important to establish whether this greater value of K, correct or incorrect as it may be, makes it possible to explain how the amount absorbed by the paper or drop makes so little difference to the time of the test.

The following results are obtained for different values of K in the calculation of r from the formula already mentioned.

TABLE 3.

T	r	r	r
	$K=31\times10^{-6}$ $Q=135\times10^{-6}$ V= 18 c.c.	$K=80\times10^{-6}$ $Q=135\times10^{-6}$ V= 18 c.c.	$K=156\times10^{-6}$ $Q=400\times10^{-6}$ V= 30 c.c.
5′	3·56	7·40	14·28
10′	1·20	2·13	4·06
20′	0·472	0·682	1·26

Now if Q be doubled using $K=80\times10^{-6}$ instead of 31×10^{-6}, we find that T=10 minutes, r=2·73 mgrms. of NO^2 per c.c. $(\times10^{-6})$—*i.e.*, a 22 per cent. rise in the value of r; therefore the presence of 2 papers in the tube ought to make a considerable difference in the test time, but not quite so great a difference as when K is a lower value.

The results of the experiments made with a special apparatus on the whole show that owing to the dryness of the atmosphere, the apparatus is unsuitable for accurately measuring the value of K for the papers, though the work points to a somewhat higher value than 31×10^{-6}; but it shows that with fair accuracy TC=K, a constant equal to 156×10^{-6} for the drop. The point however which is made clear is that a change in the value of K is insufficient to explain why the presence of several papers in a tube makes little difference to the time of a test. The results with the drops, which absorb quite a considerable amount of NO_2, are still more incompatible with the theory on which the formula is based.

4. *Equilibrium attained during a heat test.* It is necessary, then, to look for an explanation of the behaviour within the heat test tube. It is explained in the following way:—When the test tube containing the explosive is placed in the bath it gradually heats up, and as the temperature rises so the decomposition of the explosive increases. Then the concentration continues to increase until the partial pressure of the nitrogen oxides within the tube is equal to the dissociation pressure of the explosive and equilibrium is soon established. If the peroxide is being absorbed, an equivalent quantity is evolved by the explosive to maintain equilibrium; this explains why the explosive tends, in a continuous test,

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* As the concentration in the tube increases, so the amount dq absorbed by the indicator during a small interval of time will increase, the quantity absorbed is proportional to the concentration and dq=Mdc, where M is a constant. If the assumption mentioned above holds, $dq=\frac{Q}{K}dc$, so that if $M=\frac{Q}{K}$ that assumption is correct. The fact that the slope of the C,Q curve decreases as the value of K increases, and increases as Q increases, makes it probable that this is so.

to reach an equilibrium state giving a definite heat test time however many drops or papers are added. It is this equilibrium, the value of which is obtained by submitting the explosive to a "continuous" test, that determines the stability of the explosive: it is the actual dissociation pressure of the explosive as modified by the impurities present, which is measured. The value of the dissociation pressure can be simply calculated from the equilibrium test time:—

$$p = \frac{760 \times 350 \times 22{\cdot}4}{273 \times 46} \times C \times 10^{-6} = 4{\cdot}47C \times 10^{-4} \text{ mm.}$$

and since C is approximately constant its value is given by TC=K.

If copper sulphate crystals were heated in a closed tube at a constant temperature, equilibrium would be obtained and the water of crystallisation would possess a definite dissociation pressure. It is the same with an explosive when submitted to a heat test. This case is practically identical with the dissociation of such a substance as copper nitroxyl, $Cu_2(NO_2)_2$, which possesses at —55° a dissociation pressure of about the same value as ordinary guncotton at 77° as is shown by exposing a drop in the usual way. It is probable that the explosive undergoes such a change, that the nitrogen peroxide evolved is capable of adding on to the residual molecule.

The following example of a continuous test will make the point clear:—

TABLE 3.

	Guncotton (old and dry).	Temperature 70° C.
	Time.	
	Paper	Drop.
	21′	10′
	7½′	9′
	5′	9′
	5′	8′
	5½′	6′
	4′	7′
	4′	–
	5′	–
	4′	–
Equilibrium value	4½′	7′

Although the first paper test is quite high, the equilibrium values are such that the drop and paper results are in accord with each other, that is to say, the drop is nearly twice as long a time as the paper result. If the value of K was accurately known, the value of the concentration C corresponding to the equilibrium value could be found, *i.e.*, taking $K=156 \times 10^{-6}$, p would equal 11.9×10^{-3}. In many cases the constant equilibrium value is not obtained during the first few tests because moisture, impurities, etc., are present, and these as they change in quantity upset the equilibrium. It is only when the moisture is saturated, the acetone is liberated, etc., that approximate equilibrium is obtained.

According to these views, the first test is composed of a period during which the tube is being heated up, a period during which the equilibrium dissociation pressure is tending to be set up, and finally towards the end of the test a state is reached in which equilibrium has been more or less obtained. Of course, it is not a real equilibrium which is obtained, because the indicator is absorbing the gas and also the amount of the impurities is changing.

Imagine a continuous test in which a steady state is just reached towards the end of the test; in such a case it would be possible to calculate the value of the rate of rise of the concentration due to the explosive from Robertson and Smart's formula, and also in the way which follows.

TABLE 4.

	Guncotton Temperature 77° C.	
	Paper.	Drop.
	17′ 30″	16′ 30″
	8′ 0″	7′ 30″
	4′ 0″	7′ 30″
	3′ 0″	8′ 0″
	5′ 0″	—
Equilibrium value	4′ 0″	7′ 30″

For the paper, C, the concentration in the tube at the end of the test, may be taken as given by the constant concentration corresponding to a time of 4 minutes, *i.e.* 7×10^{-6} $(K=31 \times 10^{-6})$. At the end of the first test C=rT—Q/V where T is the time of the test less the lag, *i.e.* 13′30″. Therefore $r=1{\cdot}06 \times 10^{-6}$. The value as calculated from the above authors' formula is $0{\cdot}8 \times 10^{-6}$. For the drop, a similar calculation will give a value of r equal to $2{\cdot}66 \times 10^{-6}$, as calculated from the long formula the corresponding value of r would be $3{\cdot}0 \times 10^{-6}$. (If the value of K for the paper is taken as 80×10^{-6}, the value of r becomes $2{\cdot}04 \times 10^{-6}$, and $1{\cdot}8 \times 10^{-6}$ as calculated from the long formula.) The results as calculated from the equilibrium value and C=rT—Q/V are thus in better agreement than those calculated in the other way. The mean value then for r for the drop and paper tests is $2{\cdot}35 \times 10^{-6}$ mgs. NO_2 per c.c. per minute. It is not possible to get this value accurately unless the value of K for both drop and paper is known for certain. However, it is not this rate which gives quantitatively the most reliable information about the stability of the explosive, for it depends on the total time of the test, the presence of moisture on the edge of the tube, and the absorption of the paper. The concentration or partial pressure of the nitrogen peroxide in the tube when equilibrium is established is a far better measure of the stability of the explosive.

Summary. 1. It is found that the heat test is little altered by the presence of more than one paper or drop within the tube during the test, consequently the absorption of the nitrogen peroxide makes little difference to the time of the test.

2. Calculations by the formula used to find the rate of decomposition of the explosive show that the presence of several papers in the tube should make considerable difference to the time of the test.

3. The papers and drops were standardised by means of a long tube apparatus devised for the purpose. The constant for the papers was found to be considerably higher than the value obtained in the glass box experiments. The value for the drop was about twice that for the paper, viz. 156×10^{-6}.*

4. The values of K, found in the long tube experiments, although higher than those obtained in the glass box experiments, are not sufficient to explain that absorption during a heat test makes so little difference to the time of the test.

5. The reason given for this is that the explosive tends to attain a state of equilibrium at the temperature of the test in the closed tube.

6. This view is developed, and it is shown how the final concentration in a tube during a first heat test can be calculated from the result of a continuous test. It is also pointed out that the equilibrium dissociation pressure is a more certain measure of the stability of the explosive.

The above summary ends the third part of the experimental work on the heat test.

The author wishes to emphasise very strongly the following four points before concluding: firstly, on the practical side, that:

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* It will be necessary to check the concentration-time curve for the drop by the glass box method, and it is hoped that this will be attempted in a laboratory which possesses such an apparatus.

(1) A continuous test is a reliable and satisfactory stability test by which the actual tendency of the explosive to decompose can be accurately measured; because equilibrium is attained. A continuous test should be plotted graphically.

(2) A drop test has been devised which is not open to the errors of a paper indicator, and is even simpler than an ordinary heat test.

On the theoretical side that:

(1) Nitric acid formed in the explosive during the test renders a single heat test untrustworthy and therefore valueless. Of course it may give fair results, but just where it is most needed it often fails absolutely.

(2) After very many experiments, with the possibility of leakage and other interference eliminated, the author is obliged to consider that a state of approximate equilibrium is attained during a continuous test, and the explosive tends to reach such a state even towards the end of a first test. Though contrary to preconceived ideas, it is impossible otherwise to interpret the tendency of a constant concentration of nitrogen peroxide to be obtained, than to say that an equilibrium is soon set up, at the temperature of a continuous heat test and for the comparatively short period necessary for testing.

The author desires to thank the late and the present Commandant and the Chief Instructor in Science at the Royal Military Academy for their permission to carry out this work and the interest they have taken in it. The author is also indebted to his assistant, Mr. S. R. Hole, for his help and diligence.

Discussion.

The Chairman said he welcomed the modification shown to them. Some years ago he had tried to employ α-naphthylamine and sulphanilic acid in a particular way for guncotton examination but found it much too delicate for ordinary use.

Mr. W. F. Reid did not quite agree with the method of experimenting. He thought that there were certain disadvantages connected with the apparatus as compared with the ordinary heat test. One of them was that the gases evolved had not such ready access to the reagent as in the case of the paper. With regard to the theory that the acid fumes evolved condensed on the moist guncotton, it seemed to him the guncotton in the ordinary heat test was heated higher than the upper part of the tube, and therefore the acid should leave the guncotton in the very early stages and not condense upon it. The Abel heat test in any of its forms was a crude one from the scientific point of view, but it was extremely useful for the manufacturer for testing the degree of purification of the material. But he was inclined to think that a great deal depended upon the guncotton itself. In the guncotton there were a large number of infinitely fine capillary tubes, and however one might attempt to purify them in that form the purification was only a relative one. Therefore all the tests that were employed must be dependent to some extent upon the method used in purifying the guncotton which was tested in them. De Mosenthal had pointed out how very fine that capillary tube was. It was a matter of the greatest difficulty to get a liquid out of a capillary tube. He thought that was at the bottom of the difficulties with guncotton. There were so many causes of error, that if one could eliminate the error of the paper and the glycerin he thought it was a very happy idea indeed. But he did not like the arrangement of the apparatus, and the fixing for instance of the glass on the top of the tube did not seem to him to be even approximately perfect. Then there was the difficulty of the circulation of the vapours which ought to be encouraged rather than diminished The principle of having a drop he thought was a very good one: but why not have the drop in such a way that it was accessible from the top and from the bottom. Would it not be possible to have the drop in suspension as it were in a very shallow tube or several shallow tubes made in the same way as the little cell was. He remembered when experiments were made with paper obtained from different sources and all proved unreliable and gave bad results. He thought it was Col. Majendie who had insisted upon having some uniform kind of paper, and special paper was tried and adopted ultimately for the test; up to that time they had been using all kinds of "pure filter paper," which was by no means pure enough for the test. Again glycerine might be all right when first bought, but if it was kept some time in a laboratory and little drops were continually taken out one found it was no longer the same article they had begun with. He thought if Mr. Egerton could devise a method of adapting this, perhaps by a vertical drop or a vertical hole in a little plate or something of that kind, it would perhaps work a little better than the very ingenious method he had adopted.

Dr. R. Robertson, after remarking on the neatness of the apparatus that had been shown them, said that on some points he was not in agreement with the author. Thus, in the continuous test as applied to guncotton, when the rise in time of test occurred, the paper was observed to dry, this being indicated by a change in its translucency; and dried papers gave prolonged tests. The damp silica wool was intentionally placed in such a position that the vapour arising from it would moisten the air in the tube, whereupon a fall in test resulted. He scarcely thought that sodium sulphate could be expected to act as a suitable desiccating agent, under the circumstances. In the continuous test it was presumed that a constant test was ultimately obtained. He could not agree that the conception of an equilibrium between the guncotton and the nitric peroxide disengaged from it, was an explanation for a constant time of test. Experience showed that explosives heated in the presence of their products of decomposition, decomposed faster and not slower. Thus in a vacuum test, the velocity of evolution of gaseous products increased in an accelerating manner, after they attained a certain concentration in the system. The minimum of decomposition is in fact attained when they are most effectively removed. There must be therefore some other reason for this constancy, if it exists, such as leakage, absorption by the reagent, or, most likely, the degradation of nitric peroxide to nitric oxide and to nitrogen, an action which went on in the presence of heated guncotton, and which would bring about a longer test, although the concentration of decomposition products was actually increasing.

Mr. Egerton, in reply, said that the nitrogen peroxide diffused very rapidly in the tube. One of the reasons for having the drop in the position chosen was that the drop itself could not get heated to any very great extent, owing to the thickness of the glass slab. He had put the drop disc down in the wide part of the tube and found that there was no difference to the time of colouring, so he considered that the hole in the slab was in the best place, and was quite sufficient to permit the gases to reach the drop. Mr. Reid had also mentioned the fact that moisture was contained in the pores of the capillary tubes of the guncotton; that made it all the more probable that nitric acid would be formed in the pores of the guncotton.

With regard to the drying of the starch iodide paper, he quite agreed with Dr. Robertson that that effect did come in, but he did not agree that it was the main effect which caused the rise in concentration obtained in his experiments. For instance, damp silica wool added at the end of a continuous test on guncotton, affected the drop test in the same way as it did the test with the paper indicator. He saw no reason why sodium sulphate should not be as efficient a drying agent for guncotton at 77° C. It was very difficult to explain the continuous test in any other way except that a constant concentration of nitrogen peroxide was obtained. If the drops or papers absorbed according to the concentration there must be a more or less constant concentration of the nitrogen-peroxide in the tube. He had tested it in every way he could. He had made the tube absolutely watertight with a little grease round, and he had found no leakage effect. Dr Robertson suggested that the nitrogen oxides might be reduced by guncotton, as in a Will test when the products of decomposition are left in presence of the guncotton, but that could not explain the constant results obtained, because the rate of reduction of nitrogen oxides would have to accelerate as the decomposition of the guncotton proceeded; which was most unlikely to be the case. Further, the reduction of nitrogen oxides would be very much greater at the much higher temperature of the Will test. He thought it quite natural that there should be equilibrium for the short time of a continuous test, and at a low temperature as compared with that of the Will test. There was no real reason why guncotton should not be in equilibrium with its products of decomposition any more than with such an unstable substance as copper nitroxyl.

NOTES ON THERMOMETRY.

BY J. H. COSTE.

Although measurements of temperature form part of the work of most chemical laboratories it cannot be said that as a rule much attention is paid to the subject. A brief consideration of some points which are frequently disregarded may be useful.

The mercury in glass thermometer is usually used for temperatures within its range, which may be said to be from —39° to +500° C. although above, say, 300° its use is not to be recommended. The advantages of thermoelectric and electrical resistance thermometers are not such as to enable them to replace mercury thermometers for all kinds of work in the ordinary laboratory.

Since all thermometers are referred to the fundamental interval of temperature (F.I.) it is desirable that its limits, should be ascertainable on direct temperature measuring thermometers used within these limits. This cannot always advantageously be arranged, and the sodium sulphate transition point, which is independent of barometric pressure, may advantageously be used in establishing an interval 0—32·384° C. which is convenient for many purposes.

In actual practice the ideal condition, that an expansion thermometer should consist of a fluid enclosed in an envelope so that the apparent coefficient of expansion is a linear function of temperature, is never obtained. It is well known that even the gas thermometer does not fulfil this condition exactly. The various kinds of glass used introduce further correcting terms into any formula intended to represent the apparent expansion of the system mercury in glass.

A consideration of the errors affecting the mercury thermometer will show what precautions may be necessary in using it for various kinds of work.

The following errors are inherent in glass-mercury thermometers and cannot be avoided: (1) Deviation of scale from hydrogen scale. (2) Temporary depression of zero after heating. For thermometers made of the same kind of glass these errors at any given temperature will be approximately the same. The curves (Fig. 1) show the magnitudes of these errors at different points for well-known glasses and their sign between 0° and 100°. Obviously the former error disappears in all cases at these points. The second error it will be seen is nearly proportional to the temperature above zero in each case. It represents the maximum effect after say 20—30 minutes' exposure to the temperature to which it refers. Since the mercury-glass scale for each of the four glasses mostly reads too high, that error is to some extent compensated by the depression of zero. The sum of these errors, which is represented by the difference in height between the two curves for the same glass, is never greater than 0·11° for the French "verre dur," 0·099° for Jena normal glass 16‴ (this has a violet stripe) or 0·038° for the borosilicate glass 59‴. Around the points 70°, 80°, and 54° respectively the two errors balance. These errors are very low up to say 30° for English glass. For short immersions when the full depression of zero is not reached, slightly greater errors may occur, but never in any case seriously above 0·1°. There are not many cases in ordinary chemical practice in which such errors would be serious. For most purposes they may be neglected altogether.

It is to be regretted that the English glass which shows very small differences from the hydrogen scale should be so erratic as to zero errors. These are both much greater and less regular than those of the "verre dur" or either of the Jena glasses, at any rate at the higher temperatures; between 0° and 26° the value, taken from experiments on an old Kew Standard of 1853 or earlier, appears to be very low. Experiments on other Kew Standards constructed between 1881 and 1903 gave depressions after 100° C. of the same order, *i.e.*, between 0·201° and 0·174° C. English glass appears to be clearer and better made than the normal glass 16‴, and is used very largely for clinical thermometers in all countries. Its properties appear to render it more particularly suitable for thermometers to be used at ordinary temperatures such as those used in calorimetry or meteorology. It is also known to be very durable. Analyses of these glasses will be of interest.

	I. Verre dur.	II. 16‴	III. 59‴	IV. Cristal anglais.	V. Whitefriars "lead-potash" glass.
SiO_2	71·85	67·5	71·95	49·49	53·17
PbO	—	—	—	33·90	32·95
ZnO	—	7·0	—	—	—
CaO	14·27	7·0	—	1·20	—
Al_2O_3	1·30	2·5	5·0 }	0·35	—
Fe_2O_3	0·24	—	— }		—
B_2O_3	—	2·0	12·0	—	—
Na_2O	11·02	14·0	11·0	1·54	—
K_2O	0·40	—	(M_2O_3 0·05)	12·26	13·88
MgO	trace	—	—	0·67	—
Mn O	trace	—	—	0·13	—
SO_3	0·73	—	—	—	—
Cl	trace	—	—	—	—
	99·81	100·0	100·0	99·54	100·00
Depression	0·07	0·05	0·03	0·15	—

The above figures are taken (I., II., IV.) from Guillaume's Traité Pratique de la Thermometrio 1889, (III.) from Chree's Notes on Thermometry Phil. Mag. LXVI. 1898, 217, and (V.) from a private communication from Mr. Harry Powell, to whom I am indebted for most of the information as to English glass.

The Cristal anglais and Whitefriars glass are probably practically the same material: the former was made previous to 1889, the latter is the material as made at present.

None of the glasses, it may be noted, contains large quantities of both soda and potash. The zero effect is always very large in glasses rich in both of these alkalis.

The effect on the glass of the necessary heating incurred in making the thermometer, although reduced to a very small amount by annealing, lasts for years, as the zero gradually rises owing to shrinkage of the bulb. The complete recovery from a heating to 100° takes several weeks.

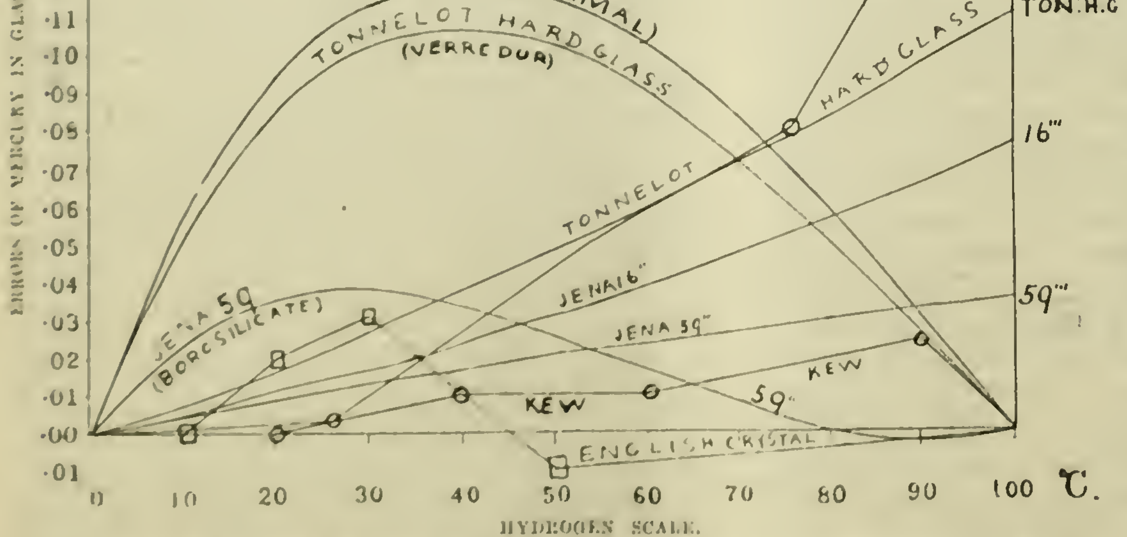
It is probable that in the near future mercury in fused quartz thermometers will replace *verre dur* for standards. The advantages of an envelope having practically no coefficient of expansion are obvious.

We now have to consider some errors which are proper to each individual thermometer. (3) The F.I. may be, almost certainly is, incorrectly marked. Two errors are usually introduced: (*a*) The magnitude of the interval is incorrect, and the mean value of the degree within the interval is too great or too small. This is obviously easily corrected by a factor. (*b*) The interval is incorrectly placed or may have changed since graduation, so that an additional + or — correction for zero is introduced. This must be determined on the thermometer when it has not been heated for some time. (4) The bore of the best thermometer tubing is only approximately cylindrical, or rather the area of cross section varies in different parts of the tube. English thermometer makers say that English tubing is of much more uniform bore than the normal (16‴) tubing which they are able to obtain here. When one considers that tubing is all pulled by hand the very small variations of bore are amazing. Two other closely allied errors may be considered here, although they are partly dependent on the glass of the thermometer and on the way in which it is used. They are caused by the variation of the volume of the bulb by reason of the variations of (5) internal pressure and (6) external pressure exerted on it. The former error alters the value of the degree according to the position in which the instrument is used. The external pressure, on the other hand, will appreciably affect the zero point only, since increased pressure on the bulb, due either to atmospheric variations (very slight) or to immersion in water or mercury will decrease the volume of the bulb only inappreciably affecting that of the tube. The two corrections can be determined separately for any thermometer, or the external coefficient, βe, may be determined experimentally, and the internal coefficient, βi, deduced from the formula:

$\beta i - \beta e = C.$ $C \times 10^7 =$ 154 for *verre dur*
143 for 16‴
138 for 59‴

Note.—The coefficients are expressed in degrees per millimetre of mercury-pressure (Amaury and Descamps, quoted by Guillaume).

The following errors will depend largely on the manner in which the thermometer is used: (7) Exposure error. The readings of a thermometer can only be correct if the whole of the expanding system is at the temperature to be measured. Rimbach (Zeits. f. Instrkunde, **10**, 150. 1890) has published tables based on actual experiment with stem and enclosed thermometers of 16‴ glass, using an auxiliary thermometer shielded from the source of heat with the bulb on a level with and 1 decimetre from the middle of the exposed column which give values different from those calculated by the usual formula. As one cannot determine the true mean temperature of the materials of the emergent column, it is best to keep this correction as small as possible. (8) *Lag*, or slowness of response to changes of temperature, may affect meteorological observations or calorimetry. Its effect is seldom sufficiently great to be worth correcting for most laboratory purposes. For small alterations of temperature a determination of the time (*t*) in minutes for a thermometer immersed suddenly in a bath of lower temperature than that which it has been indicating, to reach the half-difference of temperature will give the cooling constant by means of the formula, $\frac{1}{2} = e^{-at}$; or a graphical method proposed by Richards, Henderson, and Forbes (Zeits. physikal. Chem., 1905, **52**, 551) may be used.



The curves showing high values at 100° indicate the error due to temporary depression of zero. (Sign of error —).
The curves showing no errors at 100° indicate the divergence from the hydrogen scale. (Sign of error + above line).
-- below line).

It is not to be expected that anyone should make eight corrections to every reading which he takes of a thermometer, and some of these corrections are obviously in any case very small. On the other hand, their cumulative effect may sometimes be considerable. A practical decision as to the course to be taken must be made in each case or for classes of cases.

An accuracy of 0·01° or less on a single reading, even between 0° and 100°, is not easy to obtain. Fortunately it is seldom necessary in applied chemistry, as more often only small differences of temperature are required to be measured to this accuracy, and most of the errors affecting the two necessary readings differ but little in value, so that the total error is usually very small. A carefully examined thermometer is needed, and the effect of all the errors mentioned should be considered. That due to emergent column must be eliminated or very much reduced, or the error of the correction may easily be greater than that allowed for the reading.

For an accuracy of 0·1° between 0° and 100° the errors (1) and (2) should be considered, (3) and (4) will probably have an appreciable effect, as will (7). (5), (6), and (8) will hardly need correction. If an accuracy of 0·5° is sufficient, the only error likely to be appreciable in a well-made thermometer is (7) that due to emergent column. This may be serious if an accuracy of only 1° is sufficient. It is the most objectionable of all errors, as being at once the least amenable to correction and the greatest under most conditions. The use of thread thermometers or auxiliary thermometers is not very satisfactory. Probably a thermo-junction fastened to the middle of the emergent column with a rubber band with the other junction coiled round the bulb, would be more satisfactory.

The error of parallax is appreciable, especially with thermometers graduated on the stem, unless care is taken in reading. The use of a lens is to be recommended. Those used on the Boys calorimeter are very convenient.

Apart from any other considerations, thermometers with fine short lines, cylindrical threads, and cylindrical bulbs as small as is consistent with a reasonable degree length, should be chosen.

Thermometers are used in a chemical laboratory for indicating the temperature of baths and thermostats for determining melting or solidifying points, boiling points, flash points, viscosities and the like, and for calorimetry. Mr. Huntly (this J., 1910, **29**, 917) has dealt very fully with the thermometers used in bomb- and similar one-thermometer calorimeters. I have discussed elsewhere the errors incident to thermometers used in flow calorimeters (Calorific Power of Gas, p. 257). It may be useful to consider the choice and use of thermometers for the other purposes mentioned above.

The respective merits of the German enclosed pattern and the English and French thermometers graduated on the stem have frequently been discussed. The enclosed thermometers can be made with a scale which does not shift and of which the position can be verified by datum marks on the outer case at either end or both ends of the scale. The divisions are seen through the tube with the mercury in front, and the thickness of the lines does not obscure the thread which crosses them. On the other hand the solid stem is stronger and more homogeneous. If desired the position of the thread can be read through the glass by turning the thermometer, provided the tube is of clear glass. This is not usually the case. Even then the ends of the lines can be made to coincide with the mercury thread and their thickness eliminated. It is on the whole a matter of taste which is used, provided they are well made. One good thermometer with the fundamental interval divided into single or half degrees and having a degree length of, say, 2 mm. should serve as a standard instrument. One divided into $\frac{1}{5}$° with a degree length of 4 mm. is capable of greater accuracy, and represents about the extreme length of the thermometer divided throughout the interval. It is probably better to get a certificate of examination at, say, every 10° or every 5° from the National Physical Laboratory rather than to attempt the calibration oneself. At this institution the work is done most carefully, and a table of differences, at the points examined, from the hydrogen thermometer is given. This includes the errors due to (1), (2), (3), (4), (5). The external pressure will clearly vary according to circumstances and will seldom come in except when a thermometer is used in a mercury bath or for taking the temperature of deep water. Negretti and Zambra's deep sea thermometer with external partly-filled bulb is well known.

For most laboratory purposes between 0° and 100° C. thermometers, divided in single degrees, with both these points marked and with the errors at these points determined, will be good enough, provided these errors are well under 1°. They can, if desired, be compared with the laboratory standard at intermediate points either in a well-stirred large waterbath (not recommended) or by means of the vapours of boiling liquids. For melting or boiling points where a determination to 0·1° or 0·2° is sufficient, I see no reason why the F.I. should exceed in length 100 mm. Immersion errors can thus be avoided and the use of a lens will give the required accuracy of reading, that is, if the graduation lines are reasonably fine.

Measurements of temperature above 100° are less simple. Again it is well to have a reference thermometer which has been compared with standard instruments. The instrument one used to see, and which is not yet altogether extinct, graduated from 0° to 360° C. in single degrees on a very long stem is to be avoided. The correction for exposed column on this type must have been enormous, and therefore very uncertain. Probably two thermometers, each with the F.I. and an auxiliary bulb, having principal graduations in degrees or $\frac{1}{2}$ degrees from 100° to 200° and 200°—300° respectively, form the best reference instruments. They would, in my opinion, represent the limits of the reasonable range of the mercurial thermometer. Above 300 the errors are of a variable nature even with borosilicate glass 59''',* and great care must be observed not to over-heat by reason of too great an exposed column. I do not consider that it is desirable for most work to use thermometers for temperatures above 100°, which are more than a few inches long, as any advantages supposed to be attained by greater length or subdivision of the degree are lost in the uncertainty of the exposure correction. Anschütz's or Kahlbaum's sets of several instruments, each having 70° or 50° range and about 12—20 cm. long, are convenient, although at times a fractional distillation cannot be carried out with a single thermometer. I see no advantage in having these thermometers divided in fractions of a degree. So many closely-ruled long lines have a very distracting effect on the eye, and it is easier to estimate 1/10 of 1° than $\frac{1}{2}$ of $\frac{1}{5}$° under such circumstances.

Above 100° exposure corrections should be avoided wherever possible. This is easy in determining the b.pt. of a pure substance, but in fractional distillations and melting points it cannot always be done. In the former the desire that the thermometer bulb should be at the level of the issuing vapour on the one hand, and that the part of the scale to be read should not be obscured by the cork on the other, often necessitates the use of a longer thermometer than is otherwise necessary. The correction need not, however, be large if a suitable thermometer is used.

The comparison of high temperature thermometers in a stirred oil bath by the private individual is hopeless. The useful table on page 1148 of this Journal for last year may be supplemented by the following figures :—

	Boiling point at 760 mm.	Alteration for 1 mm.
Toluene	110·7	0·044
Monobrombenzene	156·2	0·060

These values appear to be certain to within 1°, the former to within perhaps 0·2°.

If not pure enough to be used for fixed points, the substances will be useful for comparing two thermometers.

I should add that although up to 100° the hydrogen scale is by international agreement the standard there is no such agreement as to higher temperatures. The N.P.L. use the air scale, accepting 444·5° C.* as the boiling-point of sulphur. On their certificates the useful warning against a probable slight distillation of the mercury column at high temperatures is given. This if unnoticed may lead to very erratic results.

It is not often that measurements of temperature in the range 300°—500° are required in the ordinary laboratory. For these and for some work at lower temperatures the use of copper-eureka (= constantan) thermocouples is to be recommended. In many cases sufficient accuracy can be obtained by using a pivot moving coil galvanometer† of fairly high resistance and calibrating the couples by means of substances of known melting-, boiling-, or transition-points, assuming a linear relationship between temperature and galvanometer readings for points not far apart. The cold junction for elevated temperatures should be kept in a liquid or vapour of constant known temperature not far removed from the temperature to be measured if it is desired to work in the above manner.

Discussion.

The Chairman said that he would not like to see all his thermometers swaddled by a pyrometer. It would be rather awkward if a great number of them were at work. As to the solid threads, there was nothing to equal the Geissler tube with the internal fine thread and the outer tube which did a great deal towards correcting the temperatures outside. It was not always necessary to have a thermometer extending outside in an ordinary distillation, the tube could be elongated so as to enclose the thermometer, and have a back-flow tube from above to below the vapour outlet.

Mr. H. Powell said that his attention was first drawn to the matter of standard physical thermometers about 1895 or 1896, in connection with the development of the National Physical Laboratory. A letter in the "Times" stated that no "high-class" thermometer glass was made in England, and attributing ignorance and obstinacy to English glass manufacturers, because they refused to make a glass suitablo for standard physical thermometers. It is true that there was no English glass suitable for making the standard physical thermometers, but English manufacturers had developed a very high-class and perfect glass for making clinical thermometers. If, when the need of a special glass was first discovered, the physicists had approached the manufacturers and offered co-operation, there was no doubt that quite as good glass could have been made in England as in France and Germany. When the want for this special glass was made known to him, he had approached Dr. Chree, who very kindly tested a great many meltings of glass for him. The great difficulty in trying to make glass for that purpose was the enormous time it took to test it. After a "melt" was made, at least twelve months must elapse before one could know whether it was better or worse than a preceding "melt." The best glass he had made gave a variation of zero-point of 0·050. Specimens of that and other experimental glasses were shown at the exhibition of the Optical Convention in 1905, but attracted no attention. He would like to know whether those who had been using borosilicate and other Jena glasses had found them hygroscopic, or that there was any tendency to decay owing to their complex nature. In his experiments he had found the best results were obtained by having as much alumina as possible without rendering the glass opaque. He thought the virtues of the Jena 16‴ were rather due to the alumina than to the zinc. Was glass for use in thermometry likely to be superseded altogether by fused quartz?

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* At 200° air theromometer the mercury 59''' theromometer reads 200·4; at 300° ,304·1°; at 400, 412·3°; at 500, 527·8°. As these thermometers are filled with nitrogen above the mercury the internal pressure becomes very great at the higher temperatures.

* Callendar (Bakerian Lecture; Phil. Trans. A. 212, 18) adopts 444·53° C. This is probably within 0·1° of the truth.

† A mirror galvanometer can only be used conveniently when supported on the wall or a basement floor of a very steady house. It is not suitablo for use in an ordinary town house.

Mr. W. F. Reid said the question of the reliability of thermometers was clearly one of the reliability of the glass of which they were made. Undoubtedly quartz was a material that gave excellent results, but there was very great difficulty in producing those thermometers and he thought they would always be an article-de-luxe for the ordinary chemist. They would be expensive although undoubtedly efficient. He could see great difficulties in securing uniformity in the tube of a quartz thermometer even more than in a glass one. He remembered many years ago when he was a pupil of Geissler trying to make thermometer tubes of uniform section and one way he had adopted in order to get the bore absolutely true was to get a tube approximately the size of a platinum wire which he could then get quite uniform by fusing the platinum wire in and dissolving it out again. It was an extremely slow process, but he had got thermometers which were very good indeed; and later on in another experiment, the idea of which Edison gave him, he had fused some carbon filaments in the glass. That was easy and they could be burned out; but he was afraid those would not be practical processes. The National Physical Laboratory had appointed a Committee, consisting of Sir William Crookes, Dr. Beilby, and himself to investigate the question of glass for scientific purposes, in the first instance for optical purposes and also for scientific purposes of every kind, including thermometers and chemical ware of all descriptions. They had had very great help from English glass makers. Messrs. Chance especially had made a great number of experiments for them and had supplied them with material. But Mr. Powell had rightly said that the private manufacturer could not be expected to carry out experiments which involved a very long period of experimentation, and which might ultimately lead to no financial return whatever. The German Government gave a subsidy to the Jena factory in its days of infancy, and now a great industry had grown up. All the best glasses that were used in the Navy in the optical instruments were made from German glass, and in case of any difficulty they would be absolutely dependent on foreigners for the glass necessary for the defence of the country. He thought under those circumstances the National Physical Laboratory, in conjunction with the Royal Society, had done very wisely in starting the inquiry. They hoped in time to be able to help the glass manufacturers who were helping them. The Germans were sometimes much more ready to take up a new idea than the English; for example, after an eruption of Vesuvius, he had found the country round covered with several feet of ashes, consisting of powdered pumice. Samples were sent to an English firm, but he never heard anything more about it; he had also sent a sample to Germany, where it was taken up, and, he believed, was now being used by the shipload. With the oxy-acetylene flame they could with the greatest ease and cheaply fuse any mineral practically that existed, and it was only a question of the difficulties of manipulation. Very few substances were as easily manipulated as glass in a red hot state; but there was no doubt that if they could carry on sufficient experiments they would find substances which were much more easily dealt with in the direction of producing thermometers more stable than those they had at present. Recently he had been up Mont Cenis and he had taken with him some thermometers which had been verified at the National Physical Laboratory, and had compared them with some old thermometers which had been put in the meteorological observatory which the monks before they left the Hospice at Mont Cenis had erected there and had in use for many years. There were four of these thermometers of French make and probable the best available at the time (before Jena glass had come into existence). All of them were different, and one of them was over 2° higher than the thermometers he had with him. In all probability at the time the thermometers were put there they were accurate. As they were very frequently indeed below zero, and in the course of a number of years must have been hundreds of times below zero, the effect of a low temperature on the glass seemed to be as bad as a high one.

The Chairman said it raised the zero.

Mr. Reid said that was so, and therefore he thought the variation was not so much dependent on the temperature to which the glass was subjected. It was more dependent on the molecular structure of the glass itself, which he thought was borne out by experiments that had been made.

The Chairman asked Mr. Powell if any experiments were ever made with glass intended for thermometers or with a tube after it was drawn, on the same lines as the steel treatment, heating to different temperatures, cooling, heating again to another temperature, and so on. He had not heard whether any manufacturers of thermometers ever did that. He remembered a great many years ago Sir William Perkin had boiled thermometers in napthalene and other high-boiling liquids for some three weeks to get them steady, and he thought that might be done perhaps with the glass before it was finished.

Mr. Calderara said he had conducted a good many heating experiments on the lines just suggested, and had found that the continued heating was necessary not only to settle the glass, as it were, but to bring the mercury itself into a suitable condition. A certain amount of vapour was given off from the mercury. It appeared in the tube, but was not there when it was first put into the higher temperature.

The Chairman suggested that the mercury dissolved a little of its own oxide.

Mr. Calderara continued that annealing thermometer bulbs and tubes before they were finished caused a very considerable change in the thermometer, a change that seemed to keep on increasing much as the temperature was raised to which it was subjected, and in some cases some of the English glass manufactured by Mr. Powell and some by the firm of Tomey of Birmingham showed that as much as 20° rise in zeros took place with the heating up to 300° and 350° C. The rise in Jena normal glass was about 7° to 8°. In graduating thermometers of ranges higher than 100° C., the general practice was to take into account the divergence of the air and mercury scales and graduate the tube accordingly, so that the departure from the air scale did not show in the thermometer. That was fairly accurately carried out, and was done according to formula at certain fixed points. The necessity for any correction (to reduce the readings to "air scale") would not arise unless it was an equally divided thermometer.

Mr. A. Chaston Chapman said he had often wondered that short scale thermometers were not more frequently used in chemical laboratories, for although the errors of calibration were slightly greater, the results obtained when using them for the determination of melting and boiling points were certainly much more accurate than could possibly be the case by applying corrections for the emergent column.

Mr. W. J. A. Butterfield said Mr. Coste had advocated the use of a series of short thermometers in fractionation work carried to high temperatures. The error of the emergent column in a single long thermometer no doubt was very considerable; but in many fractionations over a wide range one constantly wanted merely to compare results with successive samples. Using the ordinary fractionation flask one had the same length of emergent column, and he thought therefore one got comparable figures which, for that class of work, was very often all that was necessary. It certainly would be troublesome when working at temperatures approaching 300° C. to have to change the thermometer. He had used the nitrogen-filled thermometers of ordinary glass a great deal, and he knew they remained constant after many years for the higher temperatures (250°—320° C.), so that the results obtained by them were comparable. In regard to the error quoted by Mr. Coste for the boro-silicate thermometers, viz., about 28° at 500° C., he wondered whether it applied only to one thermometer. Then in regard to the disintegration of boro-silicate glass, he had had a boro-silicate thermometer, graduated continuously from somewhere about 280° to 550°, in use intermittently during six years and there was no indication of any disintegration of the glass in that case. The ordinary thick walled thermometer glass was generally much more regular in bore than the tubing with the white or coloured enamel background. He had observed that when calibrating long burettes with a 20 in. stem for air analysis it was almost impossible to get anything like regularity of bore with the glass with the enamel background; whereas one could get very fair uniformity with many specimens of the plain thick-walled thermometer glass-tubing.

Mr. Coste in reply said the Chairman had misunderstood him a little about the pyrometers. What he was thinking of was two little wires about 30 gauge fused together at the ends and just twisted round the emergent column. He did not think that would do any harm.

The Chairman said he did not think it would do any good.

Mr. Coste said that one could probably get something nearer the mean temperature of the emergent column than by the use of a thread—or auxiliary thermometer. He did not like the correction at all himself. Then as to using a long tube above the point at which one took off the vapour, it was always a question in his mind as to whether the space above the side tube of the distilling flask was really at the temperature of the vapour, because it was a dead end. He mentioned that the Verre Dur of Tonnelot was really the glass used for the Sevres standards at the National Physical Laboratory and other such institutions. Jena glass was not used for such secondary standards. He thought that for some time quartz thermometers would be a luxury that the ordinary person could not use. What Mr. Butterfield had said about boro-silicate glass was undoubtedly true. If a thermometer was always used under the same conditions the same results would be obtained; but he would like to know whether on the thermometer Mr. Butterfield had used for some time he had periodically taken such a well-known point as the boiling point of sulphur: whether he was able to satisfy himself that it remained in about the same condition as when he first had it.

It was interesting to hear what Mr. Calderara told them, that actually the divergence from the hydrogen scale was noted in graduating high temperature thermometers. That must be so, because he had some himself that went up to 300° with very small errors indeed. The figure he had quoted for the error at 500°—527·8—was from a series of experiments by Mahlke quoted in the last edition of Landolt and Börnstein, showing a divergence from the hydrogen scale of the 59‴ glass from 100° up to 500°. He could not say how many thermometers were examined, but he thought Mr. Butterfield was probably right, that only one was; of course the error would vary according to the pressure of the nitrogen above the mercury. No doubt the error in such a case was very complicated and was very largely due to internal pressure as well as to other causes.

Manchester Section.

Meeting held at the Grand Hotel, on Friday, March 7th, 1913.

DR. GILBERT J. FOWLER IN THE CHAIR.

THE EFFECT OF ATMOSPHERIC CONDITIONS ON THE HARDNESS OF RAINWATER.

BY S. WOLFF, D.SC.

During the last 4 or 5 years the hardness of the water used in Messrs. Mather & Platt's Park Works at Newton Heath near Manchester has frequently caused trouble. With a view to ascertaining the cause of the hardness of the water, which consists chiefly of rain and surface water, I undertook an examination of the reservoir water and various inlets into the same. The results of this led to a special investigation of the rainwater itself.

I have only been able to find one reference to a "hard" rainwater. Many years ago it was noticed that the rainwater in Paris had become unusually hard; on examination it was found that this was due to the dust of the Macadam roads being swept into the air, which was afterwards washed down by the rain.

The water in the two large reservoirs at the Newton Heath Works is carried from the roofs of the works into the underground main. From this main the water runs into the smaller reservoir, which is connected with the large reservoir in front of the lodge. Surface water also runs into both reservoirs. The water flows from the large reservoir into a well, from which it is pumped through a filter into a storage tank; the water from the well is treated with "alumina-ferric" and filtered. The water has objectionable properties in washing, no true lather is obtained, and a thick scum is produced on the surface.

For the purpose of this investigation I collected samples of water from every source flowing into the reservoirs.

All the samples were tested, and it was found that they were all hard before entering the reservoirs; not a single one could be termed soft. About 13 samples were tested, all of which were alkaline. Samples of rainwater were collected during three weeks; of all the samples only one showed the approximate normal hardness of rainwater, whilst all the others were considerably harder. In all cases calcium and magnesium salts were in solution, in fact the last sample I examined contained so much free lime in solution that on blowing on the top of the liquid in a test tube and shaking, a thick precipitate of calcium carbonate was at once produced. The hardness of the samples varied considerably, and it was found practically impossible to produce a lather with soap; others were strongly alkaline and the hardness was chiefly permanent.

Two samples of rainwater collected in the Rusholme district exhibited the normal properties of rainwater whilst two samples collected on the top of the roof of Messrs. Mather & Platt's Salford Iron Works showed a distinct variation in hardness.

Experimental Results.

1. Manhole of the main (middle part) running right across the works. Hardness 19 to 20° Clark.
2. The well water entering the filter. Hardness 19 to 20°.
3. Storage tank above the offices. Hardness 19 to 20°.
4. Manhole of the main (at the end) running right across the works. Hardness 48 to 49°.
5. Water from a pipe in the corner of the large reservoir (surface water). Hardness 60°.
6. Water from wooden pipe running into smaller reservoir (water from roofs). Hardness = 30°.
7. Water from the surface of the smaller reservoirs. Hardness = 19 to 20°.
8. Water from the surface of the larger reservoirs. Hardness = 19 to 20°.
9. Water from the bottom of the smaller reservoir. Hardness = 19 to 20°.

10. Water from the bottom of the smaller reservoir. Hardness = 19 to 20°.

11. Water from a drain at the back of works. Hardness = 25°.

12. Canal water near the works = 5°.

Rainwater.

1. (Direct from the air into basin.) Collected December 11th, 1912. Hardness = 109°.

2. (Direct from the air.) Collected December 12th, 1912. Hardness = 4°.

3. (Direct from the air.) Collected December 16th, 1912. Hardness = 1·5°.

(From gulley.) Collected December 16th, 1912. Hardness = 3°.

4. (Direct from the air.) Collected December 18th, 1912. Hardness = 50°.

(From gulley.) Collected December 18th, 1912. Hardness = 50°.

5. (Direct from the air.) Collected December 19th, 1912. Hardness = 55°.

(From gulley.) Collected December 19th, 1912. Hardness = 54°.

This last water contained :—

Total Hardness.	107·8	parts per 100,000
Temporary ,,	19·65	,, ,, ,,
Permanent ,,	88·15	,, ,, ,,
Magnesia ,,	35·10	,, ,, ,,

When this water was boiled a precipitate was formed due to the precipitation of the temporary hardness.

6. Rainwater (direct from the air). Collected December 23rd, 1912. Hardness = 35·5°.

This water contained :—

Temporary Hardness	= 10	parts per 100,000
Total ,,	= 63	,, ,, ,,
Permanent ,,	= 53	,, ,, ,,

7. (Direct from air.) Collected December 27th, 1912, Hardness = 30°.

(From gulley.) Collected December 27th, 1912, Hardness = 29°.

This water contained :—

Total Solids in Solution.	170	parts per 100,000
Total Hardness =	87·20	,, ,, ,,
Temporary ,, =	15·75	,, ,, ,,
Permanent ,, =	71·45	,, ,, ,,

8. (Direct from the air.) Collected December 31st. 1912. Hardness = 165°.

(From the gulley.) Collected December 31st, 1912. Hardness = 165°.

This water showed an alkalinity of 163 parts per 100,000. it contained so much free lime in solution that by simply blowing on the water a precipitate of calcium carbonate was produced.

Rusholme Rainwater.

1. Hardness = 3·5°
,, = 1·7°

This water is slightly acid.

Salford Iron Works Rainwater.

1. Hardness = 14·4°
2. ,, = 1·8°

It seems thus evident that the average sample of water entering the reservoir is hard, and it is therefore no longer surprising that an average sample taken from the reservoirs in front of the Works is from 19 to 20° in hardness, a figure much below that of the average hardness of the samples of rainwater collected, *i.e.* about 58°. This may be explained by the fact that precipitation of some of the solids in solutions takes place either before entering the reservoir or in the reservoir itself, especially if acid constituents of the atmosphere or other influences aid the precipitation.

Thus, the water running from the underground main in the works into the small reservoir contains a white precipitate in suspension which consists chiefly of calcium carbonate.

It seems, therefore, perfectly clear that the hardness of the water in the reservoirs is mainly due to the original hardness of the rainwater.

I venture to suggest that these results may tend to throw light on various other phenomena, and that they open a new field of research in connection with air analysis. It seems to be clearly proved that the rainwater carries down not only soot but other soluble or insoluble substances floating in the air, which in an ordinary air analysis might not be found in such appreciable quantities.

DISCUSSION.

Professor **KNECHT** suggested that if the subject were taken up by a number of investigators in various parts of Manchester and district, some valuable statistics would probably be obtained. Some 10 years ago Mr. W. Irwin and he had (unknown to each other) examined the constituents of snow which had lain in the district for about 9 days, during which foggy weather had prevailed (see this J., 1902, 533). Among other constituents, he had found a considerable amount of calcium sulphate, a substance which he had found to be present in every sample of Manchester household soot that he had examined. He took it that this substance might, in part at least, account for the abnormally high degree of hardness of some of the rainwater samples. It was not conceivable that calcium sulphate should volatilise with the products of combustion of the coal, but possibly some calcium chloride might be carried up by the gases from a very hot fire, and this, reacting with the ammonium sulphate in the molten snow or rainwater would produce calcium sulphate. That the other product of such reaction, viz., ammonium chloride, was actually present in the aqueous extract of Manchester soot he had shown on a previous occasion (Mem. Manchester Lit. and Phil. Soc., 1905, **49**, No. 14). He had recently obtained the following results from samples of rainwater taken at the Municipal School of Technology :—

Date.	Rainfall during which sample was collected.	Direction of wind.	Hardness.
Jan. 30–31 ..	0·366 inch	S.S.E. to W.	None
Feb. 4–5* ..	0·003 ,,	S.S.W.	,,
,, 6† ..	0·121 ,,	S.S.W.	,,
,, 7 ..	0·011 ,,	S.S.W. to W.S.W.	,,
,, 24‡ ..	trace	light variable	17° Clark
,, 26 ..	0·042 inch	S.W. to W.	16° ,,
,, 27 ..	0·023 ,,	N.W. to N.E.	11° ,,

* On this sample mould grew on standing; it then showed 7° of hardness.

† This sample smelled of ammonia (methylamine).

‡ This sample showed a very slightly acid reaction.

All the samples with the one exception mentioned were either neutral or very faintly alkaline, requiring not more than one drop of $N/10$ sulphuric acid to turn the indicator (methyl orange) in 100 c.c. When no hardness was found this generally coincided with the prevalence of strong winds.

Mr. J. H. **LESTER** said that the presence of flue dust in the air was largely responsible for the hardness of rainwater. Boiler flues became more or less choked in time, and dust had to be removed by the cart-load, whilst still greater quantities must be blown up the chimney. Flue dust, of course, contained a considerable quantity of calcium sulphate and other products. He thought it was not necessary to say anything further in that respect. Flue dust did certainly go into the air from the top of chimneys, and a great quantity must fall on the roofs of buildings. The variation in the hardness of rainwater was easily accounted for. After a period of drought rain would perhaps come down slowly and there would be very considerable exposure to finely divided calcium salts and other salts lying on the roofs, and under those conditions very hard water was produced. He had made microscopical tests of spherical and other flue dust particles taken from roofs.

Mr. W. H. **COLEMAN** suggested that Dr. Wolff should repeat some of his experiments and at the same time keep a record of the direction of the wind. In the neighbourhood of Park Works a great deal of coal was used which came from the Bradford Colliery. This coal frequently contained considerable quantities of crystallised calcium carbonate. He thought the abnormal hardness of the water in that district might be accounted for in that manner.

Mr. Hübner said that he had collected water in porcelain basins on the roof of the Dye-house of the Municipal School of Technology between March 1st and 3rd (over the Sunday) which was perfectly neutral. It contained appreciable quantities of calcium, magnesium, chlorides and sulphates, and to his surprise, appreciable quantities of iron. The total hardness of the water was 8·48°, and it was practically all permanent hardness. Water collected between March 3rd and 4th gave the same results on analysis, but the hardness was only 3·2°. From March 6th to 7th the analysis gave very similar results. The water was neutral and the hardness 6·85°. There was always a considerable amount of soot and finely divided ashes in the basin. This led him to examine the sludge, which collects in the gulleys. On taking a quantity of this, equivalent to 50 grammes dry, and boiling it in a litre of water, it was found to contain large quantities of calcium and magnesium salts and iron. The hardness was 5·2°. He quite concurred in Mr. Lester's opinion that the rainwater took up these substances chiefly from the dust which was emitted by chimneys. Some years ago Dr. Knecht had analysed the screen washwater, which was used for washing the air in the School of Technology before it entered the ventilating plant, and found that it contained, especially in foggy weather, a considerable quantity of iron. This Dr. Knecht had attributed to the iron being washed down from the screens, but from what he, the speaker, had now ascertained, he was of opinion that it was quite possible that the iron may have been present in the water before it came to the screens. He, the speaker, had also examined some of the dust found in very large quantities in the air ducts of the School of Technology, which was deposited from the air, and on boiling this in the same way with water, large quantities of iron, calcium and magnesium were found. 50 grms. of this dust boiled in 1 litre of water produced a water of 40·2° hardness. In water collected in Cheadle Hulme (Cheshire) during one night, it was just possible to detect traces of lime and magnesium, iron being entirely absent. He was of opinion that the investigations of Dr. Wolff should be carried further, as no doubt results would be obtained which would prove of great importance to various industries, particularly to bleaching, dyeing and calico printing.

Mr. F. H. Terleski remembered some years previously taking water from the Bury and Bolton Canal. During ordinary semi-fine weather when there were only slight showers the hardness did not vary, but when, after a long dry period, two or three days hard rain occurred, the hardness would jump from 11 to 22°.

The Chairman said that in past investigations more particular emphasis had been laid upon the acidity or otherwise of the air examined, and also on the actual solid impurities, whereas, now it was found to be the case that soluble impurities were the most deleterious. Dr. Wolff had spoken of specially bad samples having been taken direct. Did that mean in a rain gauge or a funnel out in the open, or did it mean taken direct from the roof, and for example, in the vicinity of a work's chimney? He thought that the position in which the samples were taken must have been exceptional, otherwise it would scarcely seem possible that people could live under such conditions.

Mr. F. S. Sinnatt said that beginning on January 14th he had collected samples of rain-water daily from 11 a.m. to 11 a.m. for the purpose of determining the free and the fixed ammonia present. It was thought that this might give an insight into the manner in which the sulphur was combined in the water. At the same time the solid matter which collected was estimated. These latter figures seem of interest in connection with the paper of Dr. Wolff. The samples were collected on the roof of the School of Technology at a height of about 120 feet, in a porcelain basin, 78·5 square inches in area. In order to exclude dust from the roof the dish was placed on a grid. The weight of solid matter varied a great deal from day to day. The minimum being 0·013 grm. and the maximum 0·103 grm. In the month the weight of solid obtained was 1·158 grm. (equal to 0·75 ounce per square yard). The air-dried solid gave on analysis:—moisture, 1·71 per cent.; ash, 23·28 per cent.; volatile matter, 13·15 per cent.; coke, etc., 86·85 per cent. The coking test was carried out on a small weight of substance, and was therefore not altogether dependable. The chief bases were iron and calcium.

Mr. H. J. Bailey said that if the extraordinary hardness of the water was due to flue dust it might easily be proved by testing for silica. Had Dr. Wolff made such tests?

Mr. Gaunt thought samples should be taken systematically from the various rain gauge stations where also data could be collected as to the velocity and direction of the wind and the periods since previous rainfalls. Rain gauges were established at various parts of the city, and should be the means of affording very valuable information.

Dr. Wolff, in reply, said he had always placed the dish upon the flat portion of the roof. In employing the term "direct" he meant that the water did not touch anything else but the basin. The question of the hardness of rain-water was an extremely complicated one. During the previous week he had examined four samples at Park Works and found there were only 5° of hardness. It was very difficult to say whether colliery coal was the cause of the hardness. There was a big destructor chimney close to Park Works which might produce some deleterious effect. He had not made any test for silica. He had observed that in the case of the reservoir near the works, when the water was very shallow, there was a large patch of white solids similar to the effluent from a chemical works which again confirmed the experiments made. He was pleased to find his experiments confirmed. He had heard that the water in certain reservoirs had suddenly increased by 2° of hardness.

TAR FROM CONTINUOUS VERTICAL RETORTS.

BY T. STENHOUSE.

Although vertical retorts have become practicable comparatively recently, some attention has already been given to the nature of the tar produced by them, and the subject is discussed in the most recent books on the manufacture of coal gas, etc.

As mere carbonisers of coal when a large yield of gas is required, it is difficult to see how vertical retorts can be much improved upon. As regards the question of residuals, it was estimated in 1908 that smaller quantities of coke and tar would be produced, but an increased market value of 5s. per ton for the improved quality of the tar. I do not think this expectation has been confirmed. So far no increase in tar-value has been apparent at Rochdale, where vertical retorts of the continuous type have been in continuous use for nearly 18 months. There may, however, be a greater yield of tar per ton of coal carbonised, but this has not been proved, as circumstances do not allow of the tar from the verticals being kept separate.

During the last 30 years the tar made at Rochdale Gasworks has been distilled and separated into such products as 50/90's benzol, solvent and heavy naphthas, crude carbolic acid, creosote oil and pitch. Ample opportunity has therefore been afforded of ascertaining the quality and quantities of the products obtained from tar derived solely from the horizontal and inclined retorts which were in use before the verticals were erected.

The tar from the continuous verticals at Manchester has a specific gravity of only 1·074, compared with 1·113 for the tar from the intermittent verticals at Sunderland.

As the coal slides through the cold upper parts of the continuous vertical retorts a considerable time must elapse before it attains to the highest carbonising temperature of the setting. Possibly a considerable portion of the coal entering each retort is subjected to low-temperature carbonisation, and the resulting gas as well as the tar must be richer in the saturated hydrocarbons of the paraffin series, but poorer in unsaturated and aromatic hydrocarbons.

Probably the tar-yielding vapours given off in the upper part of the verticals could be altered somewhat in character, without destroying any of the saturated hydrocarbons of the gas itself, by being deflected by means of a shield, to a slightly greater extent than is the case at present, to a hotter part of the retort before they escape by the ascension, or descension, pipe as the case may be. This would probably cause some of the liquid low-temperature paraffin products to be broken up into permanent gas and compounds richer in the benzene group. Especially might this be expected from the decomposition of the pseudolefines, like hexahydrobenzene and its homologues. It has also been shown by Haber that hexane breaks up almost entirely at a comparatively low temperature into ethylene and methane.

In the gas from the verticals, the unsaturated hydrocarbons seldom amount to more than 2·1 per cent., while the gas from the inclined retorts rarely gives less than 3·6 per cent. with the same class of coal. The gas from the verticals is poor in ethylene.

Respecting the quality of the tar the following particulars may be given. When taken from the hydraulic main the tar is quite fluid, but becomes very viscid on cooling. After it has stood for a few hours at this temperature patches of water separate on the surface. When this water is removed, the well-mixed tar at 50° C. has a sp. gr. of 1·09 to 1·10. After standing some time in the common tar well, the tar from the verticals contained much more water in suspension than that from the inclined retorts when allowed to accumulate in the same way. This was very noticeable when the new tar came to be distilled in charges of about 11 tons: the tar had a great tendency to froth up and boil over: at the end of the condensing worm rushes of steam escaped irregularly along with foul-smelling gases from the contained water, and unusual little explosions in the tar still could be heard. It therefore took many hours to get rid of the water before quiet distillation was established.

During the working of a tar still, a change of receivers was made from light oil to creosote oil at 4° Twad., and steam was applied to the boiling tar when the density of the distillate was equal to 7° Tw.

On finishing a still so that the hot pitch would run off freely and yield the medium soft grade, it was necessary to stop distillation when the anthracene oil was at 13° Tw., at 15° C. If this 13° finish was not adhered to, the pitch would not leave the stills fully.

With the tar from the horizontal and inclined ovens, however, the distillation had to be continued to at least 19° Tw., or the resulting pitch would be too soft.

Creosote oil. The creosote oil from the old tar had a density of 9° to 10° Tw., with a tendency to become pasty and deposit naphthalene. With the advent of the new tar, the density of the oil began to fall until it stood at less than 3° Tw., and the oil would remain quite fluid at 0° C., though much naphthalene was present. This creosote contained at least 16 per cent. of tar-acids, but none of a crystallisable nature that could be sold as crude carbolic. Such creosote oil was obviously rich in cresylic acid.

This low-density creosote consisted partly of what came from the distillation of the tar between 4° and 13° Tw., and partly of the oil-residues from the light-oil and naphtha stills when these were worked until the distillates became pasty on cooling. These latter residues were therefore sufficiently light and of sufficient quantity to reduce the whole of the creosote below 3° Tw., so long as the tar came entirely from the verticals.

Owing to the low density of the oil, it is difficult to get it sufficiently free from water for commercial purposes.

Some contract notes for creosote oil stipulate that it must contain not less than 8 per cent. of tar acids, that the boiling point must not be less than 400° F., that at least 25 per cent. of the oil must not distil over at 600° F., and that the first 25 per cent. that does distil over must be heavier than water. The light creosote oil yielded by the tar from the verticals complied with all the particulars just given with the exception of the last one. The first 25 per cent. distillate was lighter than water. On the other hand, the oil contained twice the amount of tar-acids required. Thus paraffinoid compounds of a low specific gravity were present in much greater quantity than in ordinary creosote oil derived from coal tar.

Crude carbolic acid. The amount of phenol or crude carbolic acid obtainable from the new tar was at least 25 per cent. below the usual quantity, and the crystallising point of the usual distillate fell from about 60° F. to below 40° F. This decrease in quantity was due to the use of a weaker solution of caustic soda in order to obtain a crude acid that would crystallise and be merchantable.

From 800 gallons of the light oil given by the old tar from horizontal and inclined ovens, 40 gallons of 60's crude carbolic were readily obtained; but less than 30 gallons of a lower quality came from the new tar—all other conditions of treatment being similar.

The new tar is therefore poorer in phenol but richer in the acids of higher boiling points. In the usual distillation test for crude carbolic, a distinctly higher temperature than usual was reached before the required 62½ per cent. distillate was obtained, owing to the difference between the boiling point of carbolic acid and that of cresylic and other acids.

Benzol and naphthas. With the new tar came a smaller yield of benzol but a larger one of solvent and heavy naphthas. Their composition and specific gravity also differed. For many years the density of benzol and solvent naphtha stood very steadily at about 0·880, and that of the heavy naphtha at 0·910 to 0·920, but recently the specific gravity of the 50/90's benzol had dropped from 0·880 to 0·860, and that of the solvent naphtha to 0·845.

By fractionating either ordinary benzol or solvent naphtha it was easy to obtain successive distillates having boiling points which rose steadily, while the specific gravities of the distillates decreased considerably; the residue in the flask—about 20 per cent.—was the lightest portion of all. That part of the solvent naphtha which distilled over between 140° and 160° C. would often have a density less than 0·840. The ordinary heavy naphtha, of which the tar from the continuous verticals gave a good yield, would give no distillate below 160° C., though the specific gravity did not exceed 0·880 and was often less, and therefore lighter than ordinary 90's benzol.

It would appear from these results that the benzol and solvent naphtha contain appreciable quantities of the paraffin hydrocarbons which boil between 70° and 175° C. In the heavy naphtha and light creosote oil a greater percentage of the still higher members of the paraffin series must be present, all of which lower the density of the tar products in which they occur without materially affecting their boiling points or distillation properties.

Tar taken from the hydraulic main and heated in porcelain dishes in an ordinary air oven gave 65 per cent. of medium soft pitch or about 50 per cent. of very hard pitch. A similar pitch result was obtained when the tar was distilled in glass vessels without the aid of steam.

So far as can be judged by the experience with the continuous verticals at Rochdale, there is no naphthalene trouble with the gas nor with the creosote oil or the naphthas, nor has there been any difficulty in selling the various liquid products at the ordinary ruling prices. It was different, however, with the crude carbolic acid of which there was a considerable shortage in both quantity and quality.

As the tar from continuous vertical retorts becomes more plentiful throughout the country it will be found, I think, that the large amount of "tar-acids" present causes much greater corrosion inside the tar-stills than has occurred hitherto.

It appears quite certain, that in the near future ordinary gasworks tar will contain a considerable amount of paraffin or low-temperature compounds, particularly where carburetted water-gas is also made, and this fact will have to be taken into consideration when the final products are placed upon the market in increasing quantities. At present the quantity is probably insignificant. Even in gas-works where vertical retorts have so far been established, much more tar is obtained from the older plant than from the new and the whole mixture will not show any great difference to the general tar-distiller.

Discussion.

Mr. W. H. **Coleman** thought that the conclusion that there was an increase in the content of paraffinoid bodies in the tar could not be controverted, and the tar appeared to approximate rather to some of the old tars that were obtained in the very early days of gas making when the coal was heated to a very much lower temperature than at present. He would like to have some comparative results of the tests of the two tars; for instance, the percentages obtained at different temperatures on distillation on a small scale would better enable the chemist to compare the difference. He presumed that the vertical retort tar was entirely unmixed with any horizontal retort tar or any inclined retort tar. Then there was the question of the different specific gravity. The variation between the various kinds of tar from vertical retorts was interesting, but he did not think it was very important, because with ordinary horizontal retort tars considerable variations were obtained, say, between 29° Twaddel up to 44° Twaddel, depending upon the method of distilling the coal. One important point Mr. Stenhouse had not mentioned was that of the pitch and the free carbon in both the tar and the pitch. One of the greatest differences between vertical retort tar and horizontal retort tar was in the content of free carbon. Present day ordinary tar contained anything between 15 and 25 per cent. so called free carbon. All the samples of vertical retort tar he had seen, or the analyses he had seen, showed only from 3 per cent. to 7 per cent., this having a very important bearing upon the uses to which the pitch was put, especially that of road making. It was interesting to learn that there was less crystallisable phenol obtained from vertical retort tar, though one or two laboratory samples he had had did not quite bear this out.

Mr. **Scholefield** said it would be interesting to learn how the percentage of anthracene in tars from vertical retorts compared with that from tars from other retorts. It would also be interesting to learn if Mr. Stenhouse was in possession of figures showing the relative percentages of carbazole, which had of late become an important product as the starting point for vat dyestuffs.

Mr. **Bailey** said one interesting point in Mr. Stenhouse's paper was that in the case of one distillate it had been discovered that as the boiling point went up the specific gravity came down. This was entirely contradictory to ordinary tar distillation. It seemed as though when the boiling point went up the percentage of the paraffin series increased in the particular distillate. Perhaps Mr. Stenhouse's paper might be the means of inducing someone to try and separate the paraffins and the benzol series. It would be very interesting if it was found by future work at what temperature coal would give off paraffin oil bodies and at what temperature it would give off benzol bodies. It seemed to him, the speaker, there was a great deal in Mr. Stenhouse's suggestion as to carrying the shield further down the retort, and possibly getting the gases and the tarry vapours given off from the retort at a different temperature. It certainly seemed at present as if distillation in vertical retorts was really a fractional distillation of the coal; that those constituents were first driven off which would distil off at a comparatively low temperature, and that as the coal came down the retort a higher temperature was obtained, until it reached the centre of the retort where the whole of the remaining volatile products were driven off. From the point of view of the coking industry the paper was exceedingly interesting, as in the case of that particular industry an endeavour was always made to maintain the highest possible temperature in order to get the hardest coke. It was well known in the coking industry that at the start of the charge, when the cold wet coal had considerably cooled the inside wall of the oven, that very different products were given off as compared with those obtained five or six hours afterwards.

Mr. **Ardern** said he had not gathered any definite opinion with regard to the relative value of the two tars. He understood the author to state that the market values of the two products were similar. From the percentages of free carbon, it would appear that the vertical retort tar pitch might be much more valuable for road making purposes than that derived from the horizontal retort tar; in fact the figure of 4 to 7 per cent. for free carbon more nearly approached a natural bitumen, which was considered very much more preferable for road purposes than the ordinary coal tar pitch. Again, he gathered that the creosote remained much more fluid, and that there was very little if any separation of crystalline compounds; consequently, it would appear, that for the impregnation of wood or any other similar purpose, such creosote might possess considerable advantages over the creosote yielded by the tar obtained from horizontal stills.

Mr. R. H. **Clayton** said he was very pleased to hear Mr. Stenhouse's statement that the tar obtained from vertical retorts was of no greater value than the ordinary tar obtained from horizontal or inclined retorts. Such a remark coming from such an unbiassed source must have great weight, and was therefore of great value to the tar industry. He, the speaker, would like to mention the presence of the paraffin oil bodies. Of course in previous times the presence of paraffin bodies in benzol was a matter of great objection to aniline makers, and very strict tests and rules were made that no paraffin should be contained. The times had now changed. The amount of benzol used for the colour industry was now comparatively small compared with the quantity produced. The greatest outlet for benzol was for motor purposes, and the product from vertical retorts in that respect was practically equal to the benzol which was previously obtained. He would have liked to have heard something as to the comparative value of phenols in connection with bacteria work. It was possible these bodies might have a much greater efficiency. As regards road treatment it was possible that the pitch being comparatively free from carbon would tend to flow more, which was a very objectionable quality if used for that purpose.

Mr. **Stenhouse** in reply said he did not make an analysis of the tar on a small scale as it was difficult to get a fair sample of the whole product. At that time it was more interesting to note the ordinary working results. When cold, the tar from the hydraulic main was very thick from some cause or other, but was quite fluid when warm. The mixed tar from the well was thin and light, something like that referred to by Mr. Newbigging as obtained at Manchester. One point he did not quite understand was that when some of the tar was heated in an open dish in an air oven all the ordinary volatile products readily passed away though the temperature never exceeded 190° Centigrade. At least half the weight of the tar could be driven off at that temperature, yet if the tar were heated in a large glass retort or flask it required at least that temperature to expel the water and light oil, and a much greater heat to get away the creosote and anthracene oils. With regard to the tar acids, phenol was undoubtedly scarce in the tar from the verticals, while the acids of a higher boiling point were plentiful. After applying steam to a charge of tar when the distillate was about 7° Twaddel there was a rather rapid run to a finish and less anthracene oil than usual was obtained. The quality of this oil was ignored as it all went to the creosote portion, therefore he could not say what amount of carbozole was present in the anthracene.

He scarcely thought the pitch was more like bitumen because it was often quite brittle and small pieces could readily be crushed to a fine powder between the finger and thumb. So far as could be judged by appearance there was no material difference between the pitch obtained from the new retorts and that derived from the old. For this and other reasons he was of opinion that a better price was not to be expected for tar from vertical retorts.

There was not now the same necessity for benzol and naphtha being of the particular quality required by colour makers. A large amount of naphtha was used for cleansing purposes and there was now a great demand for benzol for motor cars and motor wagons.

Scottish Section.

Meeting held at Glasgow, on Tuesday, November 26th, 1912.

DR. THOMAS EWAN IN THE CHAIR.

THE ACTION OF NEUTRAL SALTS ON BLEACHING SOLUTIONS.

BY S. H. HIGGINS, M.SC.

In the bleaching of weak solutions of a number of dyestuffs by hypochlorite solutions the author found that the bleaching action was accelerated by the presence of such neutral salts as sodium chloride, sodium fluoride, calcium chloride, barium chloride, and potassium bromide. These salts caused a sudden acceleration of the action, but their effect was no longer noticeable on allowing the solutions to stand for a longer time. The same observations were made during the bleaching of boiled linen cloth by the hypochlorite solutions. Thus bleaching baths containing the following were made up: (1) 25 c.c. of potassium hypochlorite solution, 225 c.c. of water; (2) 25 c.c. of potassium hypochlorite solution, 75 c.c. of water and 150 c.c. of *N* sodium chloride solution. Into each bath 12·11 grms. of boiled linen were placed, and titrations of the solutions were made at the intervals stated.

	Pot. hypochlorite.	
	(1) Alone.	(2) (+ Salt.)
	c.c.	c.c.
Original	5·55	5·55
After 15 minutes	4·8	4·6
,, 30 ,,	4·6	4·35
,, 45 ,,	4·4	4·2
,, 60 ,,	4·35	4·1
,, 3½ hours	3·65	3·45
,, 46 ,,	1·25	1·05

The results show that the acceleration produced took place during the first few minutes of immersion, after which period there was a steady parallel action. It is therefore evident that the increased bleaching effect cannot be due to the production of chlorine according to the equation,

$$NaOCl+NaCl+H_2O=2NaOH+Cl_2$$

because (1) calcium chloride and sodium fluoride have precisely the same action on sodium hypochlorite solution as sodium chloride has, and (2) if the bleaching were entirely performed by the chlorine produced from the action given the sodium chloride would cause a steady acceleration, that is, it would stimulate the production of chlorine as long as any hypochlorite remained in solution, instead of causing merely a transient initial action. Moreover, this equation affords no explanation of the observations (to be described later) that the chlorides of sodium and calcium stimulate the bleaching action of chlorine water and of hypochlorous acid.

During the bleaching action of chlorine water on the dyestuffs the chlorides mentioned caused a stimulation of that action, whereas sodium fluoride and mercuric chloride did not have this effect. Bleaching trials on linen cloth showed the same results. In further experiments using hypochlorous acid as the bleaching agents similar observations were again made. Thus the following solutions were made up: (1) 100 c.c. hypochlorous acid, 150 c.c. of water; (2) 100 c.c. hypochlorous acid, 150 c.c. *N* sodium chloride solution; (3) 100 c.c. of hypochlorous acid, 150 c.c. *N* sodium fluoride solution; into each solution 12·1 grms. of boiled linen were placed and titrations made at intervals.

	Hypochlorous acid		
	(1) Alone.	(2) (+NaCl)	(3) (+NaF)
Original	2·8	2·8	2·8
After 15 minutes	1·9	1·3	1·85
,, 30 ,,	1·65	1·05	1·65
,, 75 ,,	1·3	0·7	1·3

The sodium chloride caused an immediate acceleration which was also evident from the colour changes of the pieces of linen immersed in the solution and the sodium fluoride had no effect. As the total acceleration took place during the first few minutes of the immersion just as in the case of the potassium hypochlorite solution it is evident that the action of the sodium chloride is of the same nature in both cases.

In further experiments it was found that on adding sodium chloride, calcium chloride, or hydrochloric acid to a strong solution of chlorine in water the odour and colour of that solution were greatly increased. Lunge has shown that chlorine is less soluble in solutions of chlorides than in pure water. It was therefore evident that those salts which turn out chlorine from solution also stimulate the bleaching activity of the chlorine water. The reversible actions,

$$(1)\quad H_2O+Cl_2\rightleftarrows\underbrace{HOCl+HCl}_{\text{chlorine water}}$$

$$(2)\quad NaOH+Cl_2\rightleftarrows HOCl+NaCl.$$

offer an explanation of these observations. Thus on adding hydrochloric acid to chlorine water it is evident that reaction (1) is driven from right to left and some chlorine is developed until equilibrium is again established. On adding sodium chloride the action is probably that represented by equation (2), chlorine being developed by the action proceeding from right to left until equilibrium is again produced. von Tiesenholt has shown the truth of action (2), and Klimenko found that chlorides retard the decomposition of chlorine water in sunlight. During the bleaching actions above described the production of chlorine in the nascent state from the above equations stimulates the bleaching action until that chlorine is used up and equilibrium is produced. For chlorine in the free state like free oxygen has no bleaching power, but likewise in the nascent state is very active. As regards the action of chlorides in stimulating the bleaching properties of hypochlorite solutions the above explanation is again found to apply. Thus on dissolving bleaching powder in water some of the calcium hypochlorite hydrolyses producing free lime and hypochlorous acid. The extent of the hydrolysis is determined by the amount of the free lime and of the calcium chloride in the solution. On adding more calcium chloride to the solution the equilibrium is disturbed and chlorine is produced by the interaction of the hypochlorous acid according to von Tiesenholt's equation,

$$CaCl_2+2HOCl=Ca(OH)_2+2Cl_2.$$

This action results in the production of more free lime as shown, but as this accumulates it, along with the other lime in solution, tends to reverse the above action. In this way a new state of equilibrium is produced at the expense of the generation of some chlorine. The production of nascent chlorine accounts for the stimulation of the bleaching action of bleaching powder solution when calcium chloride is added, and the fact that equilibrium is soon again established accounts for the observation that this stimulating effect is a momentary and not a continuous one. This initial effect is quite separate from the main bleaching action which is probably due to the direct production of oxygen from the hypochlorous acid and the hypochlorites present in solution. (Higgins, Chem. Soc. Trans., 1912, 101, 222.)

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Notes on thermometry. J. H. Coste. *See* London Section, p. 341.

Patents.

Pulverising various materials; Mills for ——. C. Butters and Co., Ltd., London. From C. Butters, Oakland, Cal., U.S.A. Eng. Pat. 4903, Feb. 27, 1912.

A tube mill is provided with a discharge pipe, the inlet to which is turned upwards inside the tube, above the level of the axial line of the tube. The tube is filled with pebbles up to from 70 to 95 per cent. of its capacity. The pulverised material being thus withdrawn at a point above the axis of the mill. it is found that a more uniformly pulverised product is obtained.—W. H. C.

Furnaces. A. J. Boult, London. From Soc. Anon. des Brevets Magnee, Brussels, Belgium. Eng. Pat. 4908, Feb. 27, 1912.

Smoke from the stack is passed through a water-saturator or moistener, and then, after being mixed with air, is delivered by a fan into the furnace.—W. H. C.

Refrigerating machines. P. Schou, Copenhagen, Denmark Eng. Pat. 16,509, July 15, 1912.

The machine has a vacuum chamber with walls of "porous" metal (*i.e.*, metal with artificially produced, though imperceptible holes) with one side of which the liquid to be refrigerated is in contact. Part of the fluid passes through the porous wall into the vacuum chamber, where it is evaporated, and by its evaporation cools the remainder. Only so much fluid passes through the porous wall as will be instantaneously evaporated.
—W. H. C.

Iron retorts; Process and apparatus for the maintenance of —— exposed to the destructive action of heating gases. A. Messerschmidt. Ger. Pat. 254,222, Jan. 21, 1912.

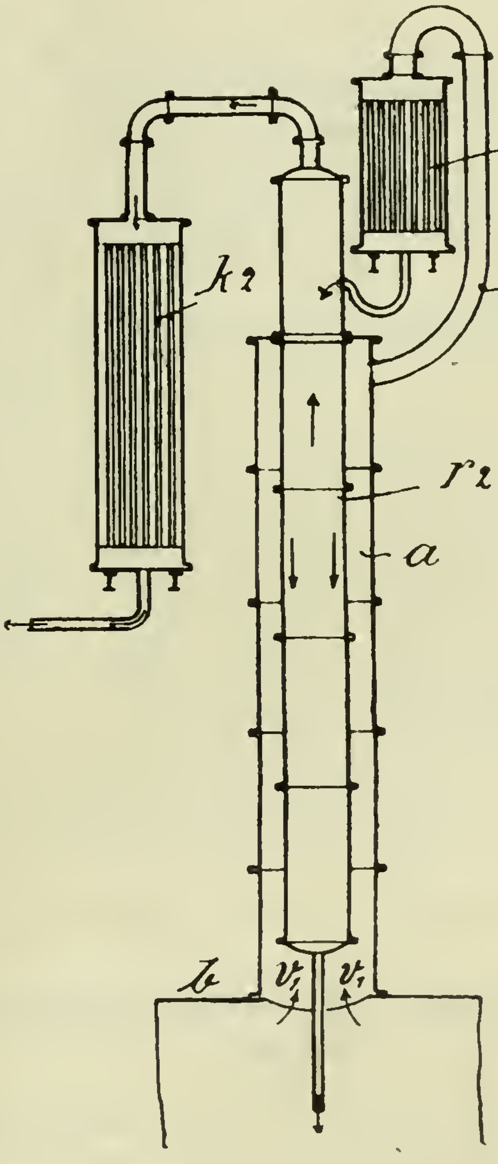
The retorts are kept in good condition by exposing them, whilst incandescent, to the action of reducing gases. Two or more furnaces may be connected together, so that the reducing gases may be allowed to act upon the retorts in one furnace and then burned for the purpose of heating the retorts in the other furnaces. For example, several furnace chambers, communicating one with the other, are provided with fittings so that they can be connected alternately with the gas-supply pipe and with the chimney, and means are provided whereby when a furnace chamber is connected with the gas-supply pipe, the air supply thereto is cut off, whilst when it is connected with the chimney, the air-supply pipe is opened.—A. S.

Flotation process for the separation of materials by means of a layer of foam. R. Jaffé. Ger. Pat. 255,531, April 6, 1911.

The materials are made to pass through a permeable layer of foam, emulsion, or liquid floating on another liquid, and the different constituents are withdrawn at different places in accordance with the duration of their passage through the layer of foam or the like. For example a layer of soap lather floating on a layer of water may be used, and either the lather or both the lather and the water may be in motion.—A. S.

Rectifying apparatus. A. Golodetz, Berlin. Eng. Pat. 18,741, Aug. 15, 1912. Under Int. Conv., Aug. 16, 1911.

The vapours from the still, *b*, pass through the openings, *v*, upwards through the outer annular space, *a*, of the column and through the pipe, *c*, to the condenser, *k*, which is maintained at any desired temperature. The condensed liquid flows down the inner column, r_2, to the still, and the uncondensed vapours pass on to the condenser, k_1.
—W. H. C.



Gases; Disintegrator-like device for the purification or absorption of ——. L. Honigmann. Ger. Pat. 255,534, June 11, 1911.

A cylinder mounted on the central rotating shaft is provided with series of scoops, arranged radially, below the annular "trickling plates" fixed to the wall of the casing. The washing or absorbing liquid as it flows from the "trickling plates" is not only converted into spray but is thrown violently outwards against the wall of the casing.—A. S.

Concentrating liquids ; Method of and apparatus for ——. J. E. Dunn, Philadelphia, U.S.A. Eng. Pat. 10,877, May 7, 1912. Under Int. Conv., Nov. 6, 1911.

See U.S. Pat. 1,033,559 of 1912 ; this J., 1912, 802.—T. F. B.

Cleaning and conveying stiff masses such as starch, clay, or the like, from channels, troughs, basins, and the like ; Method of and apparatus for ——. V. Taschl, Wessely, Austria. Eng. Pat. 15,258, June 29, 1912.

See Fr. Pat. 446,008 of 1912 ; this J., 1913, 125.—T. F. B.

Dehydrating apparatus. G. D. Harris, Bay Shore, and J. S. Pollard, Mamaroneck, N.Y., Assignors to General Dehydrator Co., New York. U.S. Pat. 1,054,765, March 4, 1913.

See Eng. Pat. 28,990 of 1911 ; this J., 1913, 209.—T. F. B.

Furnace of the channel or tunnel type. A. H. Cowles. Fr. Pat. 448,167, Sept. 11, 1912.

See U.S. Pat. 1,040,895 of 1912 ; this J., 1912, 1124.—T. F. B.

Raising or forcing liquids or compressing gases ; Processes and apparatus for ——. H. A. Humphrey and W. J. Rusdell. Fr. Pat. 448,233, June 29, 1912. Under Int. Conv., Aug. 15, 1911.

See Eng. Pat. 18,465 of 1911 ; this J., 1912, 972.—T. F. B.

Raising and forcing liquids ; Processes and apparatus for ——. H. A. Humphrey and W. J. Rusdell. Fr. Pat. 448,234, June 29, 1912. Under Int. Conv., Nov. 30, 1911.

See Eng. Pat. 26,829 of 1911 ; this J., 1913, 10.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Illuminating gas ; Composition of ——. P. Lebeau and A. Damiens. Comptes rend., 1913, **156**, 797—799.

By application of methods recently described by them (this J., 1913, 126, 186), the authors have made very complete analyses of three samples of illuminating gas. The results are given below :—

	Paris.	Arcueil.	Montlhéry.
Oxygen	0·04	0·85	traces
Carbon monoxide	5·66	5·08	5·74
Hydrogen	54·08	50·15	55·98
Nitrogen	3·47	8·09	3·36
Absorbed by KOH (CO_2, etc.)	1·81	3·48	1·65
Methane	28·59	28·01	29·11
Ethane	0·75	0·77	
Propane	0·12	0·118	0·42
Butane	0·014	0·017	
Acetylenic hydrocarbons	0·096	0·095	0·08
Propylene and homologues	0·48	0·40	0·18
Ethylene	2·12	1·69	1·81
Vapours (by difference, benzene, water, etc.)	2·77	1·25	1·67

The most noteworthy fact is that the percentage of carbon monoxide is lower than is usually found in similar analyses. This is due to the fact that in the authors' method, absorption of carbon monoxide takes place from a mixture which does not contain any other gas capable of acting on cuprous chloride.—W. H. P.

Gas producer ; Reactions in the ——, *studied on the basis of the second law of thermodynamics.* K. Neumann. Stahl u. Eisen, 1913, **33**, 394—402.

The action of air and steam on glowing carbon at any temperature leads to a definite chemical equilibrium in the gaseous mixture. Formulæ are given, based on the second law of thermodynamics, expressing the relation between the temperature and the equilibrium constants $\frac{[CO]^2}{[CO_2]}$ and $\frac{[CO][H_2O]}{[CO_2][H_2]}$ for the two reactions :—

$$(a)\ C+CO_2 \rightleftarrows 2CO\ ;$$

$$\text{and}\ \ (b)\ CO_2+H_2 \rightleftarrows CO+H_2O.$$

Experiments were made by leading measured quantities of air and steam through coke in a producer and determining the temperature, pressure and composition of the gas at different levels in the bed of fuel. The results show that both of these reactions take place in the fuel-bed, and reaction (*b*) continues after the gas leaves the glowing fuel. This leads to an alteration in the composition, and a decrease in calorific value, as shown in the following table in which the columns A refer to samples of gas taken at the top of the fuel-bed, and columns B to corresponding samples taken at the outlet of the producer.

	Using steam in producer.				Without steam.			
	A.	B.	A.	B.	A.	B.	A.	B.
Temperature of gas	690° C.	410° C.	820° C.	510° C	730° C.	360° C.	960° C.	550° C.
CO_2 per cent.	8·45	9·77	2·86	5·95	1·20	6·23	0·30	2·28
CO ..	17·9	12·98	29·80	24·18	32·20	21·80	33·60	30·40
H ..	15·9	13·12	11·04	11·90	2·40	2·73	2·00	2·09
CH_4 ..	0·33	0·47	0·38	0·57	0·60	0·49	0·90	0·50
H_2O ..	17·10	21·97	4·76	5·56	0·06	2·62	0·03	0·82
N ..	40·32	41·69	51·16	51·84	63·54	66·13	63·17	63·91
Calorific power, lower value (calories per cub. m.)	1078	908	1181	1061	1005	732	1057	945

The decomposition of steam, the reduction of carbon dioxide to monoxide, and the formation of carbon monoxide directly from carbon take place in the upper as well as in the lower parts of the fuel-bed, and a deep bed of fuel is therefore of advantage. For producing power gas of good quality, the composition of the gases in the lower layers of the fuel bed is important, since the subsequent changes are of a secondary kind, and this composition depends upon the proportion of steam to air in the blast. The following table refers to samples of gas taken from the lower part of the fuel-bed, when using different proportions of steam and air.

Partial pressure of steam in blast ..	0·335	0·244	0·184	0·140	0·137	0·117
Weight of steam per kilo. of carbon ..	1·820	1·105	0·708	0·495	0·459	0·379
Temp. of gas, ° C. ..	1120	1180	1220	1260	1280	1290
Composition of gas :—						
CO_2 per cent. ..	8·81	8·39	6·88	5·26	4·73	4·11
CO ,, ..	11·68	16·10	20·22	24·02	25·35	25·84
H ,, ..	12·12	11·39	10·31	9·49	9·09	9·19
CH_4 ,, ..	0·23	0·26	0·27	0·28	0·28	0·29
H_2O ,, ..	22·60	14·35	9·46	5·99	5·28	4·15
N ,, ..	44·56	49·51	52·86	54·96	55·27	56·42
Calorific power of gas, lower value	720	863	919	978	1000	1005

The use of a high temperature does not ensure the production of good gas, unless the proportion of steam to air is correct, and the best gas is obtained with about 0·4 kilo. of steam per kilo. of carbon, but in practice more steam is used in order to avoid excessive temperatures. The reaction, $CO_2+C \rightleftarrows 2CO$, does not reach an equilibrium

during the short time for which the gases are in contact with the fuel. The reaction, $CO_2+H_2 \rightleftarrows CO+H_2O$, reaches equilibrium. The change in the composition of the gas after leaving the fuel-bed can be avoided by using a water-jacketed outlet pipe so as to cool the gases rapidly.
—A. T. L.

Mine gas problems ; Notes on ——. G. A. Burrell. J. Ind. Eng. Chem., 1913, 5, 181—186.

The author gives an account of some recent work of the U.S. Bureau of Mines on the explosibility and physiological effects of mine atmospheres, on flame extinction and on after-damp. Reference is made to the suggestion of Harger (this J., 1912, 413) that mine explosions could be prevented by reducing the percentage of oxygen and increasing that of carbon dioxide in the mine air. It is stated that experimental results indicate that in order to prevent all explosions, the oxygen percentage would have to be reduced much below the figures mentioned by Harger, and that so much carbon dioxide would have to be added to prevent all fire-damp explosions, that its use for that purpose is precluded. The composition of some samples of gas collected in mines wherein ventilation had been interrupted for some time, is shown in the following table ; these were all explosive except Nos. 1 and 3.

Sample number :	Carbon dioxide.	Oxygen.	Methane.	Nitrogen.
	per cent.	per cent.	per cent.	per cent.
1	8·28	10·50	4·49	76·73
2	0·48	17·49	9·20	72·83
3	5·81	13·95	5·07	75·17
4	1·75	17·63	7·60	73·02
5	0·34	19·46	5·79	74·41
6	0·35	18·81	7·25	73·59
7	2·00	15·64	7·37	74·99

—A. S.

Petroleum water from Grosny ; Occurrence of undecanaphthenic acid in ——. M. A. Rakusin. Petroleum, 1913, 8, 797—798.

A sample of petroleum water obtained from a Grosny well at a depth of 197 feet had a brownish-yellow colour an alkaline reaction, and strong odour of naphtha. Its sp. gr. at 18° C. was 1·080. It contained 9·812 grms. of total solids per litre, including the following constituents: Cl 0·53; SO_3 0·257; CO_2 2·70; SiO_2 0·03; CaO 0·18; Na_2O 4·389; MgO trace, and naphthenic acid. 1·382 grms. per litre. The naphthenic acid was in combination with the sodium, and agreed in its properties with the undecanaphthenic acid isolated by Markownikow and Oglobin from Baku petroleum oil.—C. A. M.

Tar from vertical retorts. T. Stenhouse. *See* Manchester Section, p. 347.

Patents.

Peat ; Utilisation of ——. T. Rigby, Dumfries, Scotland, and N. Testrup, London. Eng. Pat. 26,349, Nov. 24, 1911.

The peat is first dried by pressure or by exposure to air, and is then powdered and exposed to a current of hot gases consisting of the products of combustion of gas made in a by-product recovery producer, using the dried peat as fuel. In this way, the large consumption of fuel necessary for the drying process is immaterial, since it leads to the production of correspondingly large amounts of ammonium sulphate and of tar.—A. T. L.

Lignite ; Treatment of ——. T. Rigby, Dumfries, and N. Testrup, London. Eng. Pat. 969, Jan. 12, 1912.

The lignite is finely pulverised and then introduced into a current of hot inert gas such as waste gas from boilers. After remaining in the current of gas for a time sufficient to effect the amount of drying desired, the pulverised lignite is separated from the gas by means of cyclone separators. The partly dried lignite is then further dried in a " Schultz " or any other suitable dryer, and is finally briquetted. If desired the dried lignite may be conveyed to the hopper of the briquetting machine by the current of gases separated from the lignite in the cyclone separator.
—W. H. C.

Coal ; Means or apparatus for extracting water or other liquids from ——. C. Burnett, Durham. Eng. Pat. 3837, Feb. 15, 1912.

The coal is fed on to an inclined drainage belt by plungers or by other suitable means, and after partial drainage on the belt the remainder of the moisture is extracted by passing the coal between one or more pairs of rollers.
—W. H. C.

Briquettes from coal waste ; Process for the manufacture of ——. E. and O. Efrem, Berlin. Eng. Pat. 4377, Nov. 26, 1912.

The coal waste as it issues from the drying machine at about 90° C. is thoroughly mixed with from 3 to 20 per cent. of powdered asphalt. The resulting mixture is then cooled to between 40° and 50° C. and from 2 to 12 per cent. of naphthalene or paraffin is added. After thorough mixing the mass is briquetted without further heating.—W. H. C.

Chamber oven with vertical tapering carbonising chambers and horizontal heating flues. Stettiner Chamotte-Fabrik A.-G. vorm. Didier. Ger. Pat. 254,664, April 19, 1912.

The lower heating flues communicate at one end with gas- and air-inlet mains, the upper flues communicate at one end with outlet mains, and all the flues communicate at the other (inner) end with a common vertical conduit. In this way there is a continuous flow in the same direction of fresh heating gases through the lower flues and of waste gases from the lower flues through the upper flues. There may also be provided, between the lower and upper heating flues, a middle group of flues, which also communicate at their inner ends with the common vertical conduit, but at their outer ends are provided with valved connections with the gas- and air-inlet mains on the one hand and with the outlet mains on the other hand, so that they may be supplied as desired either with fresh heating gases or with the waste gases from the lower flues.—A. S.

Coke and gas ; Process for the continuous production of —— *in vertical retorts.* Bunzlauer Werke Lengersdorf und Co. Ger. Pat. 254,746, May 4, 1910.

The carbonising chamber is surrounded by an annular combustion chamber in which the heating gases are burned. This combustion chamber has no horizontal division walls or partitions, and inlet pipes for the heating gas and air open into it at different heights, so that the heating zone proper can be displaced at will in order to increase either the preheating zone or the cooling zone as demanded by the character of the coal being carbonised.—A. S.

Gas producers. Q. Moore, Glasgow, and The Dowson and Mason Gas Plant Co., Ltd., Manchester. Eng. Pat. 5500, Mar. 5, 1912.

Relates to the construction of the grate and ash-pit in producers such as are described in Eng. Pats. 28,053 and 28,054 of 1908 (this J., 1910, 550), which in sectional plan are of greater length than width. The grate is formed of two or more conical or basket-like parts which merge into one another at their adjacent parts and follow the contour of the producer at their remoter parts. The grate is formed in one with an outer casing of similar shape into which the blast is delivered. Beneath each basket-like portion of the grate is an ash-table and a rotary scraper, and the whole is enclosed in a conical casing having a discharging hopper for the ashes at its lowest point.
—A. T. L.

Gas producers. Tangyes, Ltd., Soho, and J. Robson, Handsworth, Staffs. Eng. Pat. 28,504, Dec. 10, 1912.

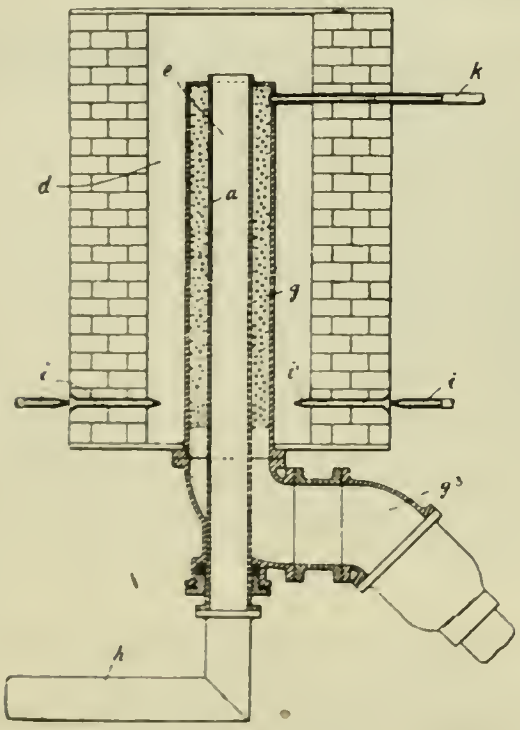
A cooler for use with producers for gasifying bituminous coal comprises a vertical tower through which the gases together with water pass downwards from inlets at the upper part to an outlet at the bottom leading directly to the tar-extracting fan. The cooler is fitted with removable baffle-plates inclined downwards.—A. T. L.

Crude mineral oils : Treatment of ——. R. de Fazi, Rome. Eng. Pat. 25,496, Nov. 15, 1911.

After the usual treatment with sulphuric acid the crude mineral oil is distilled over a mixture of slaked lime and water. The vapours of oil and water from the still are, before being condensed, passed through a mixture of lime and carbon, which may be in the form of powder or may be moulded into slabs. The carbon used may be "in the form of a soft coal or other ligneous material." —W. H. C.

Retorts [for treating mineral oils]. J. H. Noad, London. Eng. Pat. 3607, Feb. 13, 1912.

The apparatus consists of three concentric chambers, *e*, *g*, *d*, the annular chamber, *g*, serving as the retort and the chambers, *c*, *d*, as a heating furnace. The oil to be treated enters through the pipe, *k*, passes down through the annular space, *g*, which may be packed with iron borings or other suitable material, and the products of the reaction pass away by the pipe, g^3, to a condenser. The furnace is heated by gaseous or liquid fuel introduced by the burners, *i*, i^1, into the outer chamber, *d*, and the products of combustion pass away by the inner tube, *e*, to the flue, *h*. If desired the oil or gas may be burnt in the inner chamber, *e*, the outer chamber, *d*, being connected with the flue. —W. H. C.



Briquettes, ovoids, and other combustible matter from waste ; Manufacture of ——. A. D. Furse. Fr. Pat. 448,000, Sept. 5, 1912. Under Int. Conv., Sept. 26, 1911.

See Eng. Pat. 21,192 of 1911 ; this J., 1912, 275.—T. F. B.

Coke ovens and the like. E. Hohmann, Stettin, Germany. Eng. Pat. 1569, Jan. 20, 1913. Under Int. Conv., March 14, 1912.

See U.S. Pat. 1,027,845 of 1912 ; this J., 1912, 631.—T. F. B.

Retort furnaces or the like having upwardly tapering vertical retorts. Stettiner Chamotte-Fabrik A.-G. vorm. Didier, Stettin, Germany. Eng. Pat. 19,097, Aug. 20, 1912. Under Int. Conv., April 18, 1912.

See Ger. Pat. 254,664 of 1912 ; preceding.—T. F. B.

Retort-oven with vertical retorts contracting towards the top and with horizontal heating flues. Stettiner Chamotte-Fabr. A.-G. vorm. Didier. Fr. Pat. 447,398, Aug. 20, 1912. Under Int. Conv., April 18, 1912.

See Ger. Pat. 254,664 of 1912 ; preceding.—T. F. B.

Gas producer systems. E. C. R. Marks, London. From Standard Gas Power Co., Atlanta, Ga., U.S.A. Eng. Pats. 5080 and 22,722, Feb. 29, 1912.

See Fr. Pat. 441,049 of 1912 ; this J., 1912, 806.—T. F. B.

Water-gas ; Production of ——. A. Choury, Puteaux, France. Eng. Pat. 5742, March 7, 1912.

See Fr. Pat. 440,946 of 1912 ; this J., 1912, 806.—T. F. B.

Shale and other bituminous substances ; Distillation of ——. J. Noad. Fr. Pat. 448,596, Sept. 23, 1912.

See Eng. Pat. 21,441 of 1912 ; this J., 1913, 278.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Production of formic and acetic acids by boiling wood with water. Bergström. *See* V.

Destructive distillation of sewage sludge. Fiske and Earle. *See* XIXb.

Patents.

Charcoal masses ; Production of active —— *by ignition of suitable supports in carbonaceous distillation gases.* A. Heinrich. Ger. Pat. 255,348, Feb. 2, 1911.

The material which is to act as a support for the charcoal is caused to pass downwards through a closed chamber, in which there are three distinct zones maintained at different temperatures. In the upper zone the distillation gases condense on the supporting material, in the middle zone the material is ignited to induce separation of the carbon, and in the lower zone the material covered with carbon is cooled. Conical or step-like plates or the like are mounted one above the other in the chamber.—A. S.

Active carbon masses ; Process and apparatus for the production of ——. A. Heinrich, Charlottenburg, Germany. Eng. Pat. 2862, Feb. 3, 1912.

See Ger. Pat. 255,348 of 1911 ; preceding.—T. F. B.

Animal charcoal from refineries ; Regeneration of —— *by electric incandescence heating.* A. H. Imbert. Fr. Pat. 448,335, Nov. 22, 1911.

See Ger. Pat. 254,148 of 1911 ; this J., 1913, 206.—T.F.B.

Incandescent electric lamp filaments ; Process for the manufacture of ——. R. Jahoda, and Elektrische Glühlampenfabr. "Watt," Scharf, Löti und Latzko, Vienna. Eng. Pat. 7977, April 2, 1912. Under Int. Conv., Sept. 30, 1911.

See Fr. Pat. 441,914 of 1912 ; this J., 1912, 914. Reference is directed in pursuance of Sect. 7, Sub-sect. 4 of the Patents and Designs Act, 1907, to Eng. Pats. 12,163 of 1902, 21,513 of 1906, 23,499 of 1909, and 2759 of 1910. —T. F. B.

III.—TAR AND TAR PRODUCTS.

Tar from vertical retorts. T. Stenhouse. *See* Manchester Section, p. 347.

Patents.

Aminonaphtholsulphonic acids; Manufacture of halogen substituted ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,152, June 17, 1912.

The 1-chloro- or 1-bromo-derivatives of 2·8-aminonaphthol-6-sulphonic acid may be obtained by chlorinating or brominating the diacidyl derivatives of these acids, containing acidyl groups both in the amino and in the hydroxyl groups, and finally eliminating the acidyl groups. Four examples of the process are given.—T. F. B.

Mononitrothiophen from thiophen; Process for preparing ——. W. Steinkopf and G. Lützkendorf. Ger. Pat. 255,394, Feb. 21, 1912.

Thiophen may be converted into its mononitro derivative, in good yield, by treating it with a mixture of acetic anhydride and concentrated nitric acid, preferably at a low temperature.—T. F. B.

Dichloro-isatin; Process for preparing a ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,772, Feb. 8, 1912.

Isatin or 5-monochloro-isatin, either suspended in water or in solution in the form of the bisulphite compound, is treated with chlorine or a substance which liberates chlorine, with or without addition of a chlorine carrier, and at the ordinary temperature. Dichloro-isatin is obtained quantitatively as a brick-red crystalline powder. It contains a loosely combined chlorine atom, which can be eliminated by dissolving in bisulphite solution and treatment with mineral acid. When treated with hot concentrated sulphuric acid, the loosely combined chlorine changes its position in the molecule, resulting in the formation of 5.7-dichloro-isatin, of m.pt. 221° C.—T. F. B.

Chlorobromo-isatin; Process for preparing a ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,773, March 19, 1912. Addition to Ger. Pat. 255,772 (see preceding abstract).

When 5-bromo-isatin in aqueous suspension or in solution as bisulphite compound, is treated at the ordinary temperature with a chlorinating agent, with or without addition of a chlorine-carrier, a chlorobromo-isatin having a loosely combined chlorine atom is produced.—T. F. B.

5.7-Dichloro-isatin and 5-bromo-7-chloro-isatin; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 255,774 and 255,775, Feb. 8 and March 19, 1912.

(1) The dichloro-isatin described in Ger. Pat. 255,772 (see above) is converted into 5.7-dichloro-isatin by treating with concentrated sulphuric acid, with or without the use of a chlorine-carrier. (2) When the chloro-5-bromo-isatin described in Ger. Pat. 255,773 (see above) is treated with concentrated sulphuric acid, with or without addition of a chlorine-carrier, 5-chloro-7-bromo-isatin is produced.—T. F. B.

Sulphonic acids of the naphthalene series; Process of producing ——. A. Vagt, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,055,103, March 4, 1913.

See Fr. Pat. 438,737 of 1912; this J., 1912, 579.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indole. R. Weissgerber. Ber., 1913, **46**, 651—659.

The labile nature of the imide-hydrogen atom of the pyrrole ring has made difficult the systematic preparation of derivatives of indole. The substitution of this group, the hydrogen of which behaves similarly to the hydroxyl-hydrogen of phenol, removes this difficulty, however, the benzoate being a suitable derivative for the purpose. Monobromoindole benzoate (m.p. 97°—98° C.) is formed smoothly by the action of bromine, and this is hydrolysed with great ease by alkalis to give monobromoindole, which when crystallised from alcohol, forms silvery leaflets easily soluble in all the usual solvents except petroleum-benzine and water and decomposing at 67° C. The new monobromoindole is converted with great ease by dilute acids into α-oxindole, and in this and other respects is analogous to monochloroindole, which Mazzara and Borgo (Chem. Zentr., 1906, **1**, 854) consider to be an α-derivative. The author, however, considers that both of these halogen compounds are β-derivatives, like the β-iodoindole of Pauly and Gundermann (Ber., 1908, **41**, 4001). β-Indolecarboxylic acid is converted into indigo by the action of ozone. The reaction proceeds readily in aqueous solution, but the yield is very poor. α-Indolecarboxylic acid gives no indigo.—J. B.

Colour lakes of hydroxylated dyestuffs. R. Möhlau. Ber., 1913, **46**, 443—456.

Werner (this J., 1908, 439) considers that the properties of colour lakes, such as stability, insolubility and the variation in shade according to the co-ordinatively linked groups, correspond with the character of "inner complex salts," in which the metal atoms are bound to the organic compound by "main" and "side" valencies. He therefore defines a mordant dyestuff as one possessing at the same time a salt-forming group and a group capable of forming a co-ordinative linkage in such a position that an inner complex salt can be formed. This simple explanation, according to the author, cannot be applied generally when the extreme fastness, beauty and brightness of the lakes commonly employed in dyeing and printing are taken into account, and the fact that they usually contain as necessary constituents, in addition to a metallic sesquioxide, also a protoxide, *e.g.*, calcium oxide, and in some cases a hydroxy-fatty acid. Turkey red has always received the greatest share of attention and various conflicting formulæ based on ash analysis have been given to it. Light is thrown on the part played by the fatty acid by the fact that aluminium ricinoleate forms a bright coloured lake with alizarin which is unaffected by boiling soap and can be dyed on cotton from alcohol or ether solution. Whether, however, the aluminium ricinoleate is formed on the fibre in the dyeing of Turkey red, and what is the part played by the calcium, still remains in doubt. The author has now prepared in a pure state the compounds of the trivalent elements, aluminium, chromium and iron (represented in formulæ following as Me'''), with various mordant dyestuffs, and determined their exact constitution by analysis. They have found them to have the formulæ $M'''(—O{\cdot}R{\cdot}OH)_3$ and $Me'''(—O{\cdot}R{\cdot}COOH)_3$ in the case of Alizarin and Alizarin Yellow R, only one of the two salt-forming groups in the dyestuff molecule being attached, and in the latter case, curiously, the hydroxyl group in preference to the carboxyl group. The mixed calcium salts of these dyestuffs were prepared and shown to have the constitution $Me_2'''Ca_3(—O{\cdot}R{\cdot}O—)_6$ and $Me_2'''Ca_3(—O{\cdot}R{\cdot}COO—)_6$ respectively, both salt-forming groups being substituted in this case. A comparison of the properties of these lakes is made and the simple salts, sesquioxide of the metal plus dyestuff, are found to be more resistant to dilute acids and alkalis than the complex salts containing calcium. Of the complex lakes those containing aluminium are faster than those containing chromium, which in turn are faster than those containing iron. The chromium compounds of Ponceau 4GB and Cloth Red G are soluble in hot water and easily decomposed by alkali. They are therefore merely normal dyestuff sulphonic acid salts and the fact that these dyestuffs by chroming give on wool shades fast to milling and alkali must be put down to the action of the hydroxyl group in the ortho-position to the chromophor.—J. B.

Tetramethyldiaminodiphenylcarbinol ; Action of concentrated sulphuric acid on ——, and the pinacone of Michler's ketone. S. Fischl. Monats. Chem., 1913, **34**, 337—350.

By the action of dilute mineral acids on tetramethyldiaminodiphenylcarbinol, the leuco-base of Crystal Violet is formed (this J., 1895, 475, 1041). When the carbinol is heated with concentrated sulphuric acid, on the other hand, Michler's ketone (tetramethyldiaminobenzophenone) is first formed and this condenses with the unaltered carbinol to produce the leuco-base of a greenish blue dyestuff of the triphenylmethane series. The leuco-base (m.pt. 212°—213° C.) has the formula

$$[C_6H_4N(CH_3)_2]_2CH.C_6H_3[N(CH_3)_2].CO.C_6H_4N(CH_3)_2,$$

the carbonyl group being in the ortho-position to the methane carbon atom. The zinc chloride double salt of the dyestuff produces greenish-blue shades on tannin-mordanted cotton and on wool and silk.—A. S.

2-*Methylanthraquinone ; Investigations on* ——. F. Ullmann and K. L. Klingenberg. Ber., 1913, **46**, 712—725.

The method of Thiele and Winter (Annalen, 1900, **311**, 353) is the most suitable one for the preparation of small quantities of anthraquinone-2-aldehyde by the oxidation of 2-methylanthraquinone, but it is too costly for larger quantities. The authors used a modification of the method described in Eng. Pat. 16,632 of 1905 (this J., 1906, 368), according to which the 2-methylanthraquinone is brominated under pressure to yield ω-dibromomethyl-2-anthraquinone, and the latter is converted into anthraquinone-2-aldehyde by heating with concentrated sulphuric acid. By dissolving the 2-methylanthraquinone in nitrobenzene and adding the bromine very slowly (during 7 hours) at 145°—160° C., it was found possible to effect bromination at the atmospheric pressure, and a yield of 70 per cent. of the theoretical quantity of the aldehyde was finally obtained. Anthraquinone-2-aldehyde yields an azine which dyes cotton from the vat in dirty bluish-green shades changing to pale yellow in the air. When condensed with dimethylaniline it yields the leuco-compound of a green dyestuff, somewhat yellower than Malachite Green, and like the latter, not fast to light. The same leuco-compound is obtained if the ω-dibromomethylanthraquinone be used in place of anthraquinonealdehyde, and condensation be effected on the water-bath in presence of zinc chloride. If, however, ω-dibromomethylanthraquinone be heated rapidly to a high temperature with dimethyl-, or preferably with diethyl-aniline, a different reaction ensues, and a vat dyestuff, identical with the Anthraflavone of Ger. Pat. 199,756 (Fr. Pat. 355,100 of 1905 ; this J., 1905, 1223) is obtained. This dyestuff has not the constitution assigned to it in the patent, but is 2·2-dianthraquinonylethylene, $C_{14}H_7O_2.CH:CH.C_{14}H_7O_2$. When ω-dibromomethylanthraquinone is heated to 240°—250° C., hydrogen bromide is evolved and 2·2-dianthraquinonylacetylene dibromide, $C_{14}H_7O_2.CBr:CBr:C_{14}H_7O_2$, is formed. The latter loses its bromine when heated with diethylaniline or alkali phenolate, and is converted into 2·2-dianthraquinonylacetylene, $C_{14}H_7O_2.C\vdots C.C_{14}H_7O_2$, a vat dyestuff which dyes cotton pale, somewhat greenish yellow shades.—A. S.

Anthraflavone G. E. Hepp, R. Uhlenhuth and F. Römer. Ber., 1913, **46**, 709—712.

By the method of preparing Anthraflavone described in Ger. Pat. 199,756 (Fr. Pat. 355,100 of 1905 ; this J., 1905, 1223) (treating 2-methylanthraquinone with alkalis, lead peroxide, milk of lime under pressure, etc.) an aldehyde should normally result. As, however, the product is the dyestuff together with a large quantity of anthraquinonecarboxylic acid, it is deduced that the aldehyde first formed is split up into the carboxylic acid and the alcohol, $C_{14}H_7O_2.CH_2OH$, the latter being converted immediately into the dyestuff. From this it is concluded that Anthraflavone is a stilbene derivative and not diphthaloylanthracene as supposed by Bohn (this J., 1910, 619). This view is confirmed by the synthesis of the dyestuff from ω-dibromomethylanthraquinone by removing bromine by the action of copper, or of sodium iodide in acetone solution. Under these circumstances only a stilbene derivative could result. This new method of preparation can be used to obtain substituted anthraflavones and a new dichloroanthraflavone is described. Its dyed shades hardly differ from those of Anthraflavone G. (See also preceding abstract.)—J. B.

Saffron ; Occurrence of boric acid in ——. R. Kržižan. Z. öffentl. Chem., 1913, **19**, 90—92.

Six samples of French saffron of undoubted purity yielded from 3·81 to 4·97 per cent. of ash, and in each instance gave a distinct reaction by the turmeric test for boric acid. The presence of that acid was also confirmed by Robin's test with tincture of mimosa flowers (this J., 1912, 956), and by means of the spectroscope. Saffron preparations containing, *e.g.*, 10 per cent. of borax are of common occurrence, but if only a faint reaction is given in the turmeric test by the ash from a sample, the trace of boric acid indicated may be a normal constituent of the plant. —C. A. M.

PATENTS.

Dye and process for preparing the same. B. S. Summers, Port Huron, Mich. U.S. Pat. 1,053,676, Feb. 18, 1913.

The sodium salt of azoxystilbenedisulphonic acid (Curcumine S) is heated with sodium sulphide.—T. F. B.

Azo dyestuffs of the anthracene series for wool ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,590, Dec. 16, 1911.

The diazosulphonic acids of anthra-isothiazoles are combined with aceto-acetic ester or its amides or arylides. —T. F. B.

2-*Anthraquinone sulphide ; Process for preparing* ——. I. Ullmann-Goldberg. Ger. Pat. 255,591, May 12, 1910.

2-Anthraquinone sulphide may be obtained by treating β-chloroanthraquinone with an alkali xanthate. It dyes cotton from the vat yellow shades, fast to soaping, boiling, and light.—T. F. B.

Vat dyestuff of the anthracene series ; Process for preparing a yellow ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 255,641, March 30, 1912.

A dyestuff which dyes cotton from the vat in yellow shades, fast to chlorine, is obtained by heating pyrazolanthrone with alkali hydroxides. The pyrazolanthrone may be prepared by the elimination of water from anthraquinonyl-1-hydrazine.—T. F. B.

Indigoid dyestuffs ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 255,691, Dec. 19, 1911.

Indoxyl or indoxylic acid, or their homologues or derivatives, are heated with alkaline substances in presence of water, and the resulting leuco compounds are oxidised to the dyestuffs.—T. F. B.

Condensation products of the anthraquinone series containing nitrogen ; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,821, Aug. 13, 1911.

Halogenated anthraquinonylketones of the general formula, A.CO.R(hal)X, where A represents substituted or unsubstituted anthraquinonyl or anthraquinonylene and R an arylene radical, are condensed with amino-anthraquinones. The ketones may be obtained by the condensation of anthraquinonecarboxylic chlorides with halogen-hydrocarbons. The products are of value as dyestuffs or for the preparation of dyestuffs.—T. F. B.

Wool-dyestuffs of the anthraquinone series; Process for preparing acid ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,165, Oct. 25, 1911.

By the sulphonation of 4-arylamino-1.1′-dianthrimides dyestuffs are obtained which dye wool from acid baths very fast black shades.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,822, Oct. 10, 1911.

4.4′-Dinitro-1.1′-dianthrimide is reduced to the corresponding diaminodianthrimide, which is then treated with an alkaline condensing agent or with a metallic chloride, and the resulting product is treated with an oxidising agent. A grey vat dyestuff is thus obtained.
—T. F. B.

[Azo] dyestuffs of the anthracene series; Manufacture of yellow wool ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,027, July 22, 1912.

See Ger. Pat. 255,590 of 1911; preceding.—T. F. B.

Diazotisable [azo] dyestuffs; Process for producing —— Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 448,362. Sept. 16, 1912. Under Int. Conv., Sept. 25, 1911.

See Eng. Pat. 22,529 of 1911; this J., 1912, 529.—T. F. B.

Azo dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 448,759, Sept. 26, 1912. Under Int. Conv., Oct. 9, 1911.

See Ger. Pat. 253,933 of 1911; this J., 1913, 79.—T. F. B.

[Azo] dyestuff suitable for the preparation of lakes; Production of a greenish-yellow ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 448,958, Oct. 2, 1912. Under Int. Conv., Oct. 12, 1911.

See Eng. Pat. 23,791 of 1911; this J., 1912, 634.—T. F. B.

Dianthraquinonyl thio-ethers; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,467, July 27, 1912.

See Ger. Pat. 254,561 of 1912; this J., 1913, 188.—T.F.B.

Anthraquinone derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 448,066, Sept. 7, 1912. Under Int. Conv., Sept. 14, 1911.

See Ger. Pat. 253,089 of 1911; this J., 1913, 16.—T. F. B.

Vat [anthracene] colouring-matter; Blue-green ——. H. Wolff, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,054,888, March 4, 1913.

See Ger. Pat. 242,621 of 1911; this J., 1912, 278.—T.F.B.

Vat dyestuffs and process for producing them. Badische Anilin und Soda Fabrik. Fr. Pat. 447,971, June 25, 1912. Under Int. Conv., Oct. 12, 1911.

See Eng. Pat. 2346 of 1912; this J., 1912, 1025.—T.F.B.

Vat [anthracene] dye; Yellow ——. D. Nissen, Fechenheim, and E. Saul, Frankfort, Germany, Assignors to Cassella Color Co., New York. U.S. Pat. 1,055,287, March 4, 1913.

See Eng. Pat. 28,874 of 1911; this J., 1912, 867.—T. F. B.

[Azo] dyestuffs for wool; Process for making red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 448,442, Sept. 18, 1912. Under Int. Conv., Dec. 6, 1911.

See Eng. Pat. 21,729 of 1912; this J., 1912, 1174.—T.F.B.

Lakes [from azo dyestuffs]; Process for making reddish blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 448,956, Oct. 2, 1912. Under Int. Conv., March 15, 1912.

See Eng. Pat. 23,427 of 1912; this J., 1913, 97.—T.F.B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Fibres of animal and vegetable origin; Identification of ——. W. P. Dreaper. J. Soc. Dyers and Col., 1913, **29**, 78—79.

The reagent used is made by adding 2 grms. of sodium hydroxide in 30 c.c. of water to 2 grms. of lead acetate in 50 c.c. of water. The mixture is boiled until clear, cooled to about 60° C., and 0·3 grm. of Magenta in 5 c.c. of alcohol added. The volume is made up to 100 c.c., and the solution filtered if necessary. A portion of the fabric is heated in this solution nearly to the boiling point for two minutes, then washed and finally treated with dilute acetic or formic acid. After drying, silk will be found to be coloured red, wool black or dark brown, and cotton, artificial silk or other vegetable fibre, will have remained white. A solution of litharge in sodium hydroxide may also be used and the Magenta may be replaced by picric acid. Artificial silk is readily detected in the presence of real silk by this test. A method of identifying silk in admixture with wool is to place a length of the yarn on a microscope slide under a cover-glass and allow a drop of concentrated sulphuric acid to work its way in between the two surfaces by capillary action. Within two minutes the silk will be seen to have dissolved, leaving the wool intact. Lecompte's test can be considerably shortened and at the same time performed in daylight by boiling the fabric for two minutes with a solution of 0·5 grm. of sodium nitrite in 10 c.c. of water to which a few drops of hydrochloric acid are added. The fibre is then introduced into the alkaline β-naphthol solution, which is brought to the boil. Ordinary silk takes a dark red colour, Tussah or wild silk a dark chocolate brown. Vegetable fibres are not coloured. Tussah silk can be differentiated from ordinary silk by Millon's reagent [a solution of 1 part by weight of mercury dissolved in 1 part by weight of nitric acid of sp. gr. 1·4, and diluted with twice its volume of water], with which it gives a deep brown against the red of ordinary silk; it also merely becomes transparent when boiled with concentrated hydrochloric acid or 5 per cent. caustic soda solution, whereas ordinary silk dissolves completely. Degummed Tussah silk dissolves in boiling concentrated nitric acid in thirty seconds, giving a darker coloured solution than that yielded by ordinary silk.
—J. B.

Cellulose esters of benzoic acid and its derivatives. O. Hauser and H. Muschner. Z. angew. Chem., 1913, **26**, 137—139.

The authors have investigated the conditions of the formation of cellulose benzoates by the action of benzoyl chloride upon cellulose and sodium hydroxide. Cross and Bevan had previously described a fibrous cellulose monobenzoate insoluble in organic solvents and a soluble structureless dibenzoate. The authors have failed to prepare either of these compounds and in fact could not prepare any ester at all when fibrous cotton cellulose was employed. Hydrocellulose, however, was found to be more reactive and gave a satisfactory product under the following conditions: 8·1 grms. of hydrocellulose were saturated with 20 grms. of benzoyl chloride and treated, whilst cooling, with 60 grms. of a 20 per cent. solution of sodium hydroxide, the product being washed with water, alcohol and ether. Analysis of the product gave figures corresponding to a hydrocellulose monobenzoate on the C_{12} basis (hemi-benzoate on Cross and

Bevan's basis). The concentration of the sodium hydroxide has no influence on the degree of benzoylation but only determines complete formation of the monobenzoate; there is no advantage in using a soda lye stronger than 20 per cent. Similar experiments with *m*-nitrobenzoyl chloride at a temperature of 40° C. yielded no ester, but with *p*-chlorobenzoyl chloride a monosubstituted ester on the C_{12} basis was obtained; partial esterification was obtained with *p*-bromobenzoyl chloride and a full mono-ester with *p*-toluyl chloride.—J. F. B.

Resinous woods; Pulp, paper and other products from waste ——. F. P. Veitch and J. L. Merrill. U.S. Dept. Agric., Bureau of Chem., Bull. No. 159, Jan. 18, 1913. 28 pages.

In the resinous pine forests of the Southern States it is estimated that 5,000,000 cords of waste wood are left annually in the forest; of this about one-half resists decay and in the shape of the resinous hearts of the trees is available, as "lightwood" (see this J., 1911, 934), and being extremely rich in resin is suitable for the recovery of resin products. In addition to the "lightwood," the stumps on the cut-over lands and the saw-mill slabs and edging are also available, bringing the annual production of waste up to 8,000,000 cords. The production of turpentine and rosin products would be most profitably combined with the manufacture of paper pulp from the extracted wood, such pulp being suitable for coarse strong wrapping papers. Two methods are available for such combined exploitation: (1) the wood may be treated with volatile solvents, in which case turpentine oil and rosin are recovered from the wood before digestion; (2) the wood may be distilled with steam in the preliminary stages of digestion to recover turpentine and heavier pine oils, whilst the destructive distillation of the resinous black lyes will yield rosin spirit, rosin oil, acetone, creosote and methyl alcohol. The authors' investigations deal with the latter method of exploitation, the experiments being carried out on an average specimen of long-leaf yellow pine "lightwood." The chips of wood, suitably graded, were treated in a rotary digester with a dilute caustic lye and heated under a steam pressure of 40—50 lb. per sq. in. The contents of the digester were then allowed to distil at this pressure and the volatile products were condensed. The digester was again closed, rotated for a further time and another fraction was distilled off: this operation was repeated four or five times until no appreciable quantity of volatile oil was obtained. The pressure in the digester was then raised and the chips digested for pulp in the usual manner. The black lye from the pulp was evaporated to dryness and destructively distilled, the products being separated into light rosin spirits, heavy rosin oils, phenoloids, and pyroligneous acid, sufficiently rich in methyl alcohol to make its recovery practicable. The following are the approximate quantities of products recovered from a cord of 4000 lb. of air-dry "lightwood" (3200 lb. dry): Refined wood turpentine oil, 6 galls.; heavier volatile pine oils, 7 galls.; rosin spirit, 11 galls.; rosin oils, 40 galls.; phenoloids, 12 galls.; crude methyl alcohol, 3·5 galls.; unbleached pulp, 1440 lb.—J. F. B.

Acetic and formic acids; Production of —— by boiling wood with water. H. Bergström. Papierfabr., 1913, 11, 305—306.

In these experiments, 250 grms. of various woods in the form of sawdust were digested with 1400 grms. of water in a bronze autoclave. The pressure was raised in the course of one hour to 6 atmospheres and digestion carried on at that pressure for two hours. 100 c.c. of the liquor obtained from the digestion were mixed with 20 c.c. of 33 per cent. phosphoric acid and distilled. After 100 c.c. of distillate had been collected, water was added drop by drop and distillation was continued at constant volume until a further 100 c.c. of distillate were obtained. One portion of the distillate was titrated for the determination of the total acid, whilst another portion was warmed for 2 hours on the water-bath with mercuric oxide to decompose the formic acid; the difference in acidity of the two portions was calculated as formic acid, whilst the residual acidity after treatment with mercuric oxide was expressed as acetic acid. The following results were obtained:—

Wood.	Acetic acid on dry wood.	Formic acid on dry wood.	Ratio of formic to acetic acid.
	per cent.	per cent.	
Spruce	1·53	0·23	1 : 6·65
,, ...	1·17	0.21	1 : 5·57
Pine	1·40	0·22	1 : 6·36
,, ...	1·24	0·19	1 : 6·53
Birch	3·13	0·16	1 : 19·56
Cellulose from spruce wood	Total acid.	0·08	

Thus the two coniferous woods yielded acetic and formic acids in fairly constant proportions, whilst deciduous wood yielded double the amount of acetic acid and rather less formic acid. A similar relationship exists in the pyroligneous acid obtained by the destructive distillation of the two types of wood, so that acetates prepared from the wood of deciduous trees contain less formate than those distilled from coniferous trees.—J. F. B.

Patents.

Drying apparatus for hair, wool, yarns, threads and other fibrous materials, leather, hide, hide-pieces, glue and the like. R. Higham, Warrington, Lancs. Eng. Pat. 3969, Feb. 16, 1912.

In drying apparatus in which air is heated by passing through open-ended tubes in a furnace, a smoke-chamber is placed at the back of the rear tube-plate so that the bell-mouth connecting the tube-plate with the hot air main is located in the smoke-chamber and its walls are thereby heated. A space or exit is left below the rear tube-plate, whereby the combustion products after first being directed by the usual bridge upwards, round and between the outside of the tubes, is then directed downwards towards and through the exit below the tube-plate into the smoke-chamber. The interior of the air-heating tubes is provided with helical blades to act as baffle-plates bringing the air into more intimate contact with the walls. The tubes are bell-mouthed at the inlet end where they project through the front wall of the furnace. A door is provided in the hot air main for regulating the admission of cold air to the main.—J. F. B.

Textile and like materials; Dryers for ——. B. Schilde Maschinenfabr. und Apparatebau Ges., Hersfeld, Germany. Eng. Pat. 15,441, July 2, 1912. Under Int. Conv., Nov. 14, 1911.

The material to be dried is carried through three different drying compartments in each of which it is treated at a different temperature but by one and the same current of air. The air is passed in succession through two vertically separated heaters, and through several superposed layers of wet material, then further heated and passed through several superposed layers of material partially dried during the first passage of the air; the layers of material are then moved singly into the space between the two preliminary heaters where they are finally completely dried.—J. F. B.

Cellulose plates and films; Hoppers for producing ——. J. E. Brandenberger, Thaon-les-Vosges, France. Eng. Pat. 4064, Feb. 17, 1912. Under Int. Conv., Jan. 11, 1912.

In hoppers for producing plates or films from cellulose solutions, provided with adjustable lips for varying the thickness of the film delivered, the walls of the hopper are made hollow for the circulation of steam, liquid or gas, in order to maintain the cellulose solution in the hopper at a suitable temperature.—J. F. B.

Cellulose solutions, such as viscose, in the manufacture of artificial silk ; Nozzles for squirting ——. J. E. Criggal, Wolverhampton. Eng. Pat. 18,965, Aug. 19, 1912.

The nozzle, consisting of a perforated plate fixed in the end of a tube, is constructed in separate parts secured by folding a flange on one part over a flange on the other part and then folding the double flange so formed against the body of the nozzle. The one part, consisting of a perforated plate, is very thin and perfectly uniform throughout, whilst the other part, forming the body of the nozzle, may be of any thickness necessary to give the desired strength for fixing in the spinning tube.
—J. F. B.

Spraying ; Method of and means for applying liquids or powders to webs of material. W. Loebel, Leipzig, Germany. Eng. Pat. 14,590, June 21, 1912.

The atomised matter, liquid or powder, is applied to webs of cloth or paper by means of a centrifugal sprayer. Means are provided for feeding the web past the sprayer so that the web intersects, in a direction more or less parallel with the axis of the sprayer, the path of spray ejected by the latter, and the spray sweeps across the travelling web. The web is caused, at the point where it intersects the path of the spray, to conform in shape to an arc struck from the axis of the sprayer, by being guided between a curved fixed guide-member and a curved resilient guide-member, and a suction device is arranged behind the web at this point. Arrangements are made for passing a number of webs across the path of a portion of the spray simultaneously.—J. F. B.

Testing paper and like fabrics ; Apparatus for ——. F. C. Blanchard and E. B. Crocker, Bridgeport, H. E. Eddy, New York, and The Ashcroft Manufacturing Co., Bridgeport, Conn., U.S.A. Eng. Pat. 18,672, Aug. 14, 1912.

See Fr. Pat. 447,562 of 1912 ; this J., 1913, 284.—T. F. B.

Production of ammonia from nitrogen and/or ammonia yielding compounds [*e.g., wool waste*]. Eng. Pat. 7740. *See* VII.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Bleaching solutions ; The action of neutral salts on ——. S. H. Higgins. J. Soc. Dyers and Col., 1913, 29, 85—89.

In the case of the dyestuffs Methyl Orange, Alizarin Sapphirole B, Acid Violet HW, and a basic blue, it was found that the bleaching of the solutions by hypochlorites is accelerated by the addition of certain neutral salts, viz., sodium chloride, sodium fluoride, calcium chloride, barium chloride, and potassium bromide. The same effect was observed in the bleaching of linen, but in both cases the whole of the acceleration takes place within the first five minutes, after which bleaching proceeds normally. The phenomenon cannot be due to the production of chlorine according to the equation : $NaOCl+NaCl+H_2O=2NaOH+Cl_2$, as calcium chloride and sodium fluoride have precisely the same effect as sodium chloride. This explanation is also disproved by the fact that the acceleration is a sudden one and is of short duration, while the reaction represented by the above equation would result n a steady acceleration, chlorine being produced so long as ny hypochlorite remained. In bleaching by means of hlorine water, sodium chloride and calcium chloride stimuated the action, but sodium fluoride did not. Bromine nd the hypobromites were found to behave just like hlorine and the hypochlorites, sodium chloride or bromide cting equally well. Hypochlorites are superior bleaching gents to chlorine and, in fact, the author attributes the leaching action of chlorine water to the presence of hypochlorous acid. It is suggested that these observations might be explained by the reversible reaction : $NaOH+Cl_2 \rightleftarrows HOCl+NaCl$, the chlorine produced being in the nascent state and therefore very reactive. The production of nascent chlorine would account for the stimulation of the action of bleaching powder by calcium chloride according to the equation ;

$$CaCl_2+2HOCl=Ca(OH)_2+2Cl_2.$$

The accumulation of lime tends to reverse the reaction, hence the effect is not continuous. After the initial stimulus of course the reaction is continued by the production of oxygen from the hypochlorous acid. The action of carbon dioxide on bleaching powder can be explained by the same equation, the carbon dioxide merely removing the lime from solution and determining the direction of the reversible reaction. The lack of any effect in the case of mercuric chloride would be explained by the known preponderance of the reaction in one direction under the conditions of the experiments. The evolution of oxygen from bleaching powder was found to be analogous to the production of oxygen by heating potassium chlorate, the oxides of copper, iron, cobalt, manganese and chromium having a stimulating effect, those of zinc and magnesium a negative effect. Neutral salts (sodium chloride, sulphate and nitrate) were also found to have a "catalytic" influence in accelerating the oxidation of oxalic acid by potassium permanganate.—J. B.

Neutral salt reactions [*in dyeing, etc.*]. M. Fort. J. Soc. Dyers and Col., 1913, 29, 80—85.

The action of weak bases on the salts of strong bases and of weak acids on the salts of strong acids, resulting in the setting up of an equilibrium in which a certain amount of the strong base or strong acid is set free, appears to be general. Hence, when the weakly acid alizarin is boiled with sodium sulphate, sodium alizarate is formed. Sodium chloride does not behave similarly to sodium sulphate, because of the fact that hydrochloric acid is a stronger acid than sulphuric acid. If, however, nitro-alizarin be used, which is somewhat more strongly acid, sodium chloride gives a neutral salt reaction and a colouration is obtained owing to the formation of sodium nitroalizarate. On the other hand when a weak base is employed as the indicator, an acid reaction should be shown by neutral salts. This is the case, and rosaniline base when boiled with sodium chloride gives the pink colouration of Magenta. Double neutral salt reactions should also be possible between two salts containing different acids and bases in combination. That this is the case is shown by the fact that neither calcium sulphate nor sodium chloride solution can affect alizarin on boiling, yet a mixture of the two gives a colouration, sodium sulphate evidently being formed. The apparent alkalinity of a boiling solution of sodium sulphate is thus explained, and Kraus's theory that the action of sodium sulphate in dyeing is due to its alkalinity when boiling is disposed of. The author thinks that the action of sodium sulphate on wool is due to neutral salt reactions in which the wool figures as a weak acid or a weak base. The reactions may be represented by the equations : (1) wool$+H_2O \rightleftarrows$wool hydrate (basic and acid), (2) wool hydrate $+$ Na_2SO_4+ water $\rightleftarrows$ wool hydrate sulphate $+$ $NaOH$, and (3) wool hydrate $+$ $NaOH$ $\rightleftarrows$ sodium wool hydrate $+$ water. The reaction (2) is a neutral salt reaction and would go mainly in the → direction, favoured by localisation and by the relative insolubility of wool hydrate sulphate. The injurious effect of sodium sulphate on the lustre of wool is probably due to the removal of one constituent of hydrolysed wool by the caustic alkali liberated, which would have a worse result than when the whole of the wool hydrate passed into solution, as is the case when water alone is used. The author has found that the addition of glue to the bath considerably minimises the bad effect of sodium sulphate.—J. B.

Indigo vat for cotton yarn ; An improved ——. R. B. Brown. J. Soc. Dyers and Col., 1913, 29, 71—72.

The vat is set with much less caustic soda than is usual for a hydrosulphite vat and an addition of common salt or Glauber's salt is made. The result is that with one dip a shade can be produced equal in strength to that obtained by three or four dips in the ordinary zinc-lime or copperas vat, and considerably superior in fastness to rubbing and washing. A special machine has been designed to minimise the amount of handling and to ensure thorough squeezing of the yarn the moment it leaves the vat.—J. B.

Helindone colours on wool. H. Kämmerer. J. Soc. Dyers and Col., 1913, **29**, 68—70.

Those of the Helindone colours which are suitable for wool dyeing belong to the Indigo or Thioindigo class, for instance Helindone Blue 2B (mainly 5·5′-dibromoindigo), H. Red B (dichlorothioindigo), H. Red 3B (dichlorodimethylthioindigo), H. Orange R (6·6′-diethoxythioindigo), H. Fast Scarlet R (brominated H. Orange R) and H. Grey 2B (5·5′-diaminothioindigo). The colours of the anthraquinone series with a few exceptions (H. Blue 3G) are unsuitable owing to the high temperatures and the excess of alkali required for dyeing. The vat is prepared with hydrosulphite, caustic soda and whatever additions are necessary, *e.g.*, "Turcon oil," glue and sometimes ammonia. The water in the dye-vat should be treated with a little sodium carbonate and hydrosulphite in order to precipitate any lime and remove dissolved oxygen. The vat should be distinctly alkaline and is worked at 70°—75° C. Helindone Yellow CG, however, can be dyed at 50° C., which enables it to be used along with indigo. After dyeing for half-an-hour the material is squeezed and oxidised in a warm place. Souring is advisable when any hydrosulphite is likely to be left in the material, as this causes considerable falling-off in the fastness, especially to light. In slubbing dyeing it is necessary to sour after dyeing, otherwise the alkali causes electrification in spinning. The colours are fast to carbonising, milling, potting and acids, while the fastness to light is unexcelled. In the discussion it was pointed out that wool dyed with Helindone colours gave on combing twice the percentage of noil compared with undyed wool but less than in the case of wool dyed with indigo and topped with an afterchrome colour. The reduction in strength of the yarn is very slight, however, whereas in the case of the topped indigo it was considerable. The milling properties of wool are also less affected by Helindone colours than by the topped indigo. There is no relation between the fastness to light of Helindone colours on wool and on cotton.—J. B.

The action of neutral salts on bleaching solutions. S. H. Higgins. *See* Scottish Section, p. 350.

Patents.

Dyeing; Process of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,150, June 17, 1912.

Violet shades, fast to washing, are produced on vegetable fibres by after-treating with formaldehyde goods dyed with either of the dyestuffs: resorcinol-1.6- or 1.7-naphthylaminesulphonic acid-dianisidine-resorcinol or resorcinol-1.6- or 1.7-naphthylaminesulphonic acid-dianisidine-1.6- or 1.7-naphthylaminesulphonic acid-resorcinol.—J. B.

Dyeing wool and hair hats (shapes); Machine for mordanting and ——. G. Bossi Nachfolger, Vienna. Eng. Pat. 16,721, July 17, 1912. Under Int. Conv., Sept. 30, 1911.

A rectangular dye-vat is fitted with a perforated cylindrical lining. The goods and liquor are stirred by means of arms or paddles fitted to a shaft which forms the axis of the imaginary cylinder of which the lining is a part. The shaft is rotated by suitable mechanism in such a way that the arms have a pendulum motion, swinging backwards and forwards over the cylindrical lining. The arms themselves are rotatable in sockets and carry a gear wheel which at the end of each stroke engages a revolving worm wheel for a short time.—J. B.

Dyeing silk and mordanted or unmordanted wool; Process for ——. A. Daniel. Ger. Pat. 254,360, Oct. 11, 1911.

When silk or mordanted or unmordanted wool is saturated with an ammoniacal sugar solution, and then heated under pressure or steamed, brown shades are produced which are fast to light, washing, and acid.—T. F. B.

Red dyeings on the fibre; Process for producing —— [*by means of azo dyestuffs*]. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,116, Feb. 10, 1911. Addition to Ger. Pat. 252,575 (this J., 1912, 1122).

In place of using the diazo compounds of *m*-amino-γ-5-hydroxy-7-sulpho-2-naphthylbenziminazole, as in the principal patent, it is proposed to use the diazo compounds of other derivatives of 2.5.7-aminonaphtholsulphonic acid, which are substituted in the amino-group by a radical containing one or two amino-aryl groups, and in which there is a ring-structure linking the nitrogen of the aminonaphtholsulphonic acid with the naphthalene or aryl nucleus by way of a carbon or nitrogen atom. When the dyeings are treated with nitrodiazobenzene, the results are similar to those obtained by the process described in the chief patent.—T. F. B.

Dyeings on cotton [*with azo dyestuffs*] *which can be discharged; Process for producing* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,253, Oct. 6, 1911. Addition to Ger. Pat. 246,288.

The dyestuffs obtained by combining diazotised 1.8-aminonaphthol-5.7-disulphonic acid with *m*-diamines are developed on the fibre by means of nitrodiazobenzene. Blackish brown dyeings, fast to washing and easily discharged, are thus produced.—T. F. B.

Dyeings; Process for increasing the fastness of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,117, June 1, 1912.

It is stated that the fastness to light of dyeings may be increased very considerably by treating the dyed goods with salts of metaphosphoric acid.—T. F. B.

Velvets, plush, and other material for upholstery; Process for rendering —— *dustproof.* J. Mendess, Gravesend. Eng. Pat. 12,128, May 22, 1912.

Upholstering material is rendered dustproof by giving it on the back a coating of collodion rendered flexible by mixing with it vegetable or mineral oils and camphor. —J. B.

Figured velvet, plush, etc.; Process for producing ——. L. Cassella und Co. Ger. Pat. 254,090, Nov. 12, 1911.

To produce figured effects on velvet, plush, and like goods, it is proposed to remove the lustre from portions of the surface. With cotton goods this can be effected by treatment with caustic soda, while for silk or wool goods calcium thiocyanate and zinc chloride give the best results.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid chamber; The new high form of ——. F. J. Falding and W. R. Cathcart. J. Ind. Eng. Chem., 1913, **5**, 223—231.

An account of the Falding sulphuric acid chamber (see this J., 1909, 1032), including some results obtained therewith in technical practice. Plants have been erected in the United States at Vandergrift, Pa. (1 chamber), at Copperhill, Tenn. (36 chambers for the production of sulphuric acid from copper smelter gases), and at Marquette, Mich. (1 chamber); also in Canada at Sydney, Nova Scotia (1 chamber), and at Saulte Ste. Marie

(1 chamber). These are all stated to have given satisfactory results, and the advantages claimed for the tall form of sulphuric acid chamber in regard to saving of lead and ground space, greater efficiency, economy of labour, etc., have been substantiated. It is stated that the chambers can be worked uniformly with a nitre-consumption of 1—1·5 per cent., using 6—7 cb. ft. of chamber space per pound of sulphur burned, and that the cost of repairs is about 20 per cent. of that usually attending the system of horizontal chambers.—A. S.

Ammonium salts; Distillation and sublimation of —— under diminished pressure. R. Escales and H. Koepke. J. prakt. Chem., 1913, **87**, 258—279.

The chief results of the authors' experiments are summarised in the following table, showing the temperatures at which a number of ammonium salts sublime (s) or distil (d) without decomposition at a pressure of 10 mm. :—

Normal salt.	Temperature.	Acid salt.	Temperature.
	°C.		°C.
Formate	90-140 (s)	Acetate	67 (d)
Acetate	90 (s)	Propionate	73 (d)
Thiocyanate	165 (d)	Butyrate	78 (d)
Cyanate	160-190 (s)	Glycollate	160 (d)
Nitrite	70 (s)	Lactate	145 (d)
Sulphite	70-120 (s)	Benzoate	60-130 (s)
Di-acid salt :		Salicylate	90-150 (s)
Valerate		Bicarbonate	40-120 (s)
($C_5H_9O_2NH_4,2C_5H_{10}O_2$)	79 (d)	Propion-acetate	68 (d)
		($C_2H_3O_2NH_4,C_3H_6O_2$)	
		Butyro-acetate	73 (d)
		($C_2H_3O_2NH_4,C_4H_8O_2$)	

The normal ammonium salts of propionic, butyric, glycollic, lactic, benzoic, and salicylic acids when heated *in vacuo* (10 mm. pressure) yield sublimates or distillates of the corresponding acid salts; ammonium thiosulphate is decomposed with formation of sulphite and sulphur. Ammonium carbamate is dissociated into ammonia and carbon dioxide, which do not re-combine. Urea and thiourea yield sublimates of ammonium cyanate and thiocyanate respectively. A sublimate of ammonium nitrite was obtained on heating a mixture of sodium nitrite and ammonium sulphate *in vacuo* (10 mm.). Ammonium sulphate and persulphate yielded the corresponding acid salts which did not distil at temperatures up to 300° C.—A. S.

Aluminium nitride; Formation of —— from alumina, carbon, and nitrogen. W. Fraenkel, P. Askenasy, and J. Silbermann. Chem.-Zeit., 1913, **37**, 334.

With mixtures of pure alumina and lampblack, notable absorption of nitrogen took place at 1400° C.; the absorption was more rapid at 1500° C. (about 7 per cent. of nitrogen absorbed in half an hour, 14 per cent. in 1 hour), whilst at a little above 1500° C., the velocity increased rapidly, high yields of aluminium nitride being obtained in a short time at 1550° C. At 1600° C. absorption took place just as rapidly with a mixture of 50 per cent. each of carbon monoxide and nitrogen as with pure nitrogen, but more slowly with a mixture containing 75 per cent. of carbon monoxide. It is probable that there is an equilibrium at 1600° C. in presence of carbon monoxide and nitrogen corresponding to a concentration of about 80—90 per cent. of carbon monoxide. Under suitable conditions alumina and lampblack interact at 1500° C. to form aluminium carbide.—A. S.

Magnesite; Temperature of decomposition of amorphous ——. O. Kallauner. Chem.-Zeit., 1913, 37, 182.

Amorphous magnesite begins to dissociate at about 500° C., but the greater part of its carbon dioxide is evolved suddenly at 620°—625° C.—O. R.

Carbonates; Temperatures of decomposition of ——, K. Friedrich. Centralbl. f. Mineralogie, 1912, 616—626. 651—660, 684—693. Tonind.-Zeit., 1913, **37**, 416—417.

The author subjected a number of pure mineral carbonates in the form of fine powder to the heating action of an electric current, which was so regulated as to raise each specimen to a temperature of 1130° C. within an hour. The periods of time, during which heating was in progress, and the corresponding temperatures were plotted on curves, which indicated for each substance under examination the point at which absorption of heat began, and the point at which it reached a maximum. The former indicated the temperature of incipient dissociation (*a*) and the latter the temperature of maximum decomposition (*b*) respectively, in all cases except those of barium and strontium carbonates, which were found to undergo molecular transformations at temperatures about 300° C. below their temperatures of decomposition. The values of (*a*) and (*b*) for the different minerals examined are as follow:—for cerussite ($PbCO_3$), (*a*) about 315° C., (*b*) 335° C.; smithsonite ($ZnCO_3$), (*a*) about 395° C., (*b*) 440° C.; siderite ($FeCO_3$), (*a*) about 400° C. (?), (*b*) 460°—500° C.; basic lead carbonate, (*a*) 430° C., (*b*) 460° C.; rhodochrosite ($MnCO_3$), (*a*) 510°(?)—525° C., (*b*) 550°—570° C.; magnesite ($MgCO_3$), (*a*) 570° C., (*b*) 600° C.; calcspar and aragonite ($CaCO_3$), (*a*) 895° C., (*b*) 910° C.; strontianite ($SrCO_3$), (*a*) over 1130° C.; witherite ($BaCO_3$), (*a*) over 1100° C.—O. R.

Monosulphides of the alkali metals. E. Rengade and N. Costeanu. Comptes rend., 1913, **156**, 791—793.

The anhydrous sulphides are obtained by heating excess of the pure metal and sulphur in an inverted glass U-tube. The metal and sulphur are placed in opposite limbs of the tube, which are connected by a capillary portion. The whole is exhausted and then heated to 200°—300° C. The combination takes place entirely in one limb, and when it is complete the excess of metal is distilled into the other limb and the sulphide sealed off at the capillary. The products are white and crystalline, becoming yellow on heating. The sulphides are less soluble in the molten metal than the oxides and consequently crystallise less easily. This solubility increases with the atomic weight of the metal, and is so slight in the case of sodium that it is difficult to get sodium sulphide definitely crystalline. On heating to the softening point of glass, the sulphides melt, forming polysulphides and giving off vapour of the metal. They are very oxidisable and burn readily in air. With the exception of sodium sulphide, which is fairly stable, they are very deliquescent.—W. H. P.

Sulphurous acid; Action of —— upon the sulphides of iron, zinc, and manganese. W. E. Henderson and H. B. Weiser. J. Amer. Chem. Soc., 1913, **35**, 239—244.

Two modes of procedure were adopted. (1). Sulphur dioxide was passed into water containing the freshly-prepared sulphide in suspension, the containing flask being cooled with ice-water. (2). The sulphide, suspended in water, was added, in small portions at a time, and with constant stirring, to a concentrated solution of sulphur dioxide. The results of the experiments show that primarily a double decomposition occurs, and that this, in as far as the conditions of the reaction allow of oxidation of the liberated hydrogen sulphide by sulphur dioxide, is followed by the formation of a corresponding quantity of thiosulphate as a secondary product. No indication of the formation of other thio-salts is obtained.—F. Sodn.

Monazite sands; Rare earths of the Carolina ——. C. James. Chem. News, 1913, **107**, 110—111.

A solution of monazite earths was treated with potassium sulphate in insufficient quantity to precipitate all the cerium metals, and oxalic acid added to the filtrate. The resulting oxalates were ignited to oxides, the oxides dissolved in nitric acid, and the solution boiled with some of the original oxalate. Magnesium nitrate was then added to the clear liquid, and the double magnesium nitrates fractionally crystallised from water acidified with nitric acid. The mother liquors containing samarium, etc., were diluted, a boiling solution of oxalic acid added, the precipitated oxalates ignited to oxides, and these dissolved in nitric acid, and the simple nitrates fractionally crystallised from nitric acid (sp. gr. 1·3). The nitrate solution containing the yttrium metals was diluted and oxalic acid added, and, after standing, the oxalates filtered off, converted into anhydrous sulphates, and fractionated by the bromate method (this J., 1908, 518). The results of the investigation indicate that Carolina monazite contains, in addition to lanthanum, cerium, praseodymium, and neodymium, considerable amounts of samarium, gadolinium, and yttrium, small amounts of dysprosium, holmium, and erbium, and minute quantities of europium, terbium, thulium, ytterbium, etc. Erbium occurs in much smaller quantities than holmium and dysprosium. The oxalates derived, as above, from the more soluble double sulphates are recommended as a source of samarium, gadolinium, europium, terbium, dysprosium, and holmium. In applying the bromate method, the material should be converted into nitrate before examining for holmium and dysprosium (by observing its absorption spectrum), and the solution concentrated.—F. Sodn.

Radium emanation; Solubility of —— in water as affected by temperature. M. Kofler. Monatsh. Chem., 1913, **34**, 389—400.

The following values have been found for the solubility of radium emanation in distilled water (that is, the equilibrium ratio of the emanation concentration in the liquid phase to that in the gaseous phase):—

Temperature.	Solubility.	Temperature.	Solubility.
° C.		° C.	
0·5	0·326	60	0·127
17·5	0·283	74	0·112
35	0·185	79	0·111
41	0·161	82	0·111
51	0·138	91	0·108

The temperature coefficient is of the same order of magnitude as for other gases, decreasing with increase of temperature, and, above 70° C., the solubility is constant, within the limits of experimental error; but no minimum, as has been observed with helium and hydrogen, is shown on the solubility curve, although it is argued from theoretical considerations, that such minima might be expected with gases generally.—F. Sodn.

Polonium; Method for the concentration of ——. F. Paneth. Monatsh. Chem., 1913, **34**, 401—402.

Polonium may be separated from lead and radium D (though not from radium E) by dialysis, lead and radium D quickly diffusing when a concentrated solution of radio-lead nitrate is introduced into a bag of thin parchment paper suspended in water, whilst the whole of the polonium (partly adsorbed by the paper) remains within the dialyser. If a solution of radio-lead free from polonium be required, it is allowed to diffuse for a period of about 12 hours before being used.—F. Sodn.

Radium rays; Chemical action of penetrating ——. The influence of the penetrating rays on sterilised aqueous solutions of sucrose. A. Kailan. Monatsh. Chem., 1913, **34**, 359—364.

Penetrating radium rays bring about the inversion of sucrose in aqueous solution (whether sterilised or unsterilised) and lead to the production of a feebly dissociated acid, but the effects are less marked with sterilised than with unsterilised solutions. The amount of acid produced is fully sufficient to account for the observed reduction of rotatory power on the ground of inversion, and the proportion of invert sugar, calculated from the rotation, is in agreement with that indicated by means of Fehling's solution.—F. Sodn.

Hydrogen peroxide, Production of——, from dissolved oxygen under pressure. F. Fischer and O. Priess. Ber., 1913, **46**, 698—709.

When air at atmospheric pressure is led through the cathode compartment of an electrolytic cell containing 1 per cent. sulphuric acid, hydrogen peroxide is formed at the cathode. Using oxygen instead of air the concentration of hydrogen peroxide in the cathode liquid is raised from 0·26 to 0·32 per cent. The current density amounts to about 0·02 amp. per sq. dcm. The yield is increased by increasing the pressure of the oxygen. The potential falls at the same time. Working with a potential of 2 volts, a current density of 2 amps. per sq. dcm. and a pressure of 100 atmospheres, a 2·7 per cent. peroxide solution can be obtained. 300—400 grms. of hydrogen peroxide can be obtained for each kilowatt-hour. Amalgamated gold appears to be the most suitable material for the electrodes. All metals which dissolve in acid without a current, except tin and iron, yield hydrogen peroxide when subjected to the action of dilute sulphuric acid and oxygen at a pressure of 25 atmospheres.—F. Sodn.

Carbon oxide; A new ——, $C_{12}O_9$. H. Meyer and K. Steiner. Ber., 1913, **46**, 813—815.

Tertiary polycarboxylic acids of appropriate structure, if completely anhydrised, should be capable of yielding binary compounds of carbon and oxygen. Thus furanetetracarboxylic acid should yield a substance of formula, C_8O_7, and pyronetetracarboxylic acid one of formula, C_9O_8. The authors have succeeded in obtaining such an anhydride from mellitic acid. When the acid is boiled for a long time with thionyl chloride or heated with it at 160° C., four of the six carboxyl groups are anhydrised, and a 1 : 4-carboxylic acid, of formula $(CO\cdot O\cdot CO)_2C_6(CO_2H)_2$ is produced. This is a white crystalline powder, which dissolves in hot water to re-form mellitic acid, and decomposes if heated dry, yielding pyromellitic anhydride and carbonaceous products. It cannot be further anhydrised; but if mellitic acid be heated for six hours or more under a reflux condenser with a large excess of benzoyl chloride, part goes into solution, but part is converted into the anhydride; the latter separates out as shining colourless crystals, which can be recrystallised from hot benzoyl chloride. It is insoluble in cold water, but takes up water when heated for some time with it, to form mellitic acid. It can be dried at 160° C. without decomposition, and sublimed in a vacuum, but decomposes above 320° C. Its analysis gave results corresponding with the formula $C_{12}O_9$, or $C_6(CO.O.CO)_3$.—J. T. D.

Oxygen; The rendering active of —— by radiation. F. Weigert. Ber., 1913, **46**, 815—820.

Photochemical reactions of oxygen may be due to any of three causes: 1. The sensitiveness of the oxygen itself to the radiation. 2. The sensitiveness of the oxidisable substance. 3. The sensitiveness of an added substance, which does not finally share in the chemical change. Only in the first case is there a real rendering active of the oxygen, and the third case should be spoken of as "sensitising." The reaction of ozone on hydrogen was examined under the influence of radiation (ultraviolet rays of about 256 $\mu\mu$ wave-length) which is absorbed by ozone but not by oxygen. No hydrogen peroxide was in any case formed. The decomposition of the ozone was very much more rapid than when the ozonised oxygen alone, without any hydrogen, was irradiated. The amount of ozone destroyed in a given time was almost proportional to the ozone-concentration, whilst the amount of water formed increased towards a limit, which limit was higher in proportion to the hydrogen-concentration. The photochemical relations amongst the substances oxygen, ozone, hydrogen, and water are complex, and the final equilibrium in any case is determined by the nature of the radiation. The reactions occurring are four: 1. $H_2O=H_2+O$, caused by the ultraviolet rays of shortest wave-length, absorbed by water. 2. $3O_2=2O_3$, caused by the rays of medium wave length, absorbed by oxygen. 3. $O_3+H_2=H_2O+O_2$, and 4. $2O_3=3O_2$, both caused by the rays of longest wave-length, absorbed by ozone. The effect of this radiation on ozone is shown also by its quickening of the reaction of ozone on carbon monoxide, and even nitrogen seems, according to Fischer and Hene (this J., 1913, **82**, 288), to be oxidised by ozone under ultraviolet irradiation.—J. T. D.

Action of neutral salts on bleaching solutions. Higgins. *See* VI.

Neutral salt reactions [*in dyeing, etc.*]. Fort. *See* VI.

The action of neutral salts on bleaching solutions. S. H. Higgins. *See* Scottish Section, p. 350.

Patents.

[*Sulphuric*] *acid concentrating plant.* H. Harris, Sheffield. Eng. Pat. 7728, Mar. 30, 1912.

A number of acid-proof pipes, closed at the ends, are arranged in steps one somewhat below the other. Each pipe is provided with an opening near one end, surrounded by a lip, the openings being disposed alternately for each pair of adjacent pipes. The end of each pipe, opposite to the end containing the opening, carries a bent tube, which extends from near the bottom of the pipe to a point above the opening of the next, lower pipe, or, in the case of the lowest pipe, to an exit channel. The position of the bent tubes in relation to the pipes is such that liquid flows through the tubes before the pipes are full. The pipes are supported by the walls of a flue, the openings and tubes being outside the flue, and the middle portions of the pipes extending across it. The ends of the pipes projecting through the flue walls are enclosed in a suitable channel on each side of the flue. The latter is preferably heated by the gases issuing from the roasting furnaces, in which case the vapours from the channels at the sides of the flue join the furnace gases on their way to the chambers. The flue and channel floors and the side walls are preferably made of acid-proof material, and provided with suitable drainage slopes. The bottom of the flue floor is composed of porous bricks, which are situated over an acid-gutter, so that any spilt acid may be continuously removed.—O. R.

Alumina; Production of compounds of ——. H. Spence, W. B. Llewellyn, and Peter Spence and Sons, Ltd., Manchester. Eng. Pat. 3805, Feb. 15, 1912.

Purification of solutions of aluminium sulphate from iron oxide by means of potassium salts (see Eng. Pat. 23,036 of 1904; this J., 1905, 1066) is effected by treating the solutions with unground and calcined shales from the coal-measures, the digestion of solutions obtained from such shales, by treatment with sulphuric acid or with an acid solution of aluminium sulphate (at 60°—90° C.) being continued in presence of the shale, until the desired purification (and neutralisation) has been effected. Purification being more rapid as acidity diminishes, the shales are preferably digested in progressive stages, the more exhausted shale being treated with solutions containing a higher proportion of free sulphuric acid than the less exhausted material, and a lower temperature being employed with the latter. Potassium sulphate is added in case of deficiency, and ferrous oxide may, if necessary, be oxidised; also, the process of neutralisation may be assisted by adding alumina. Shales, in the presence of which the purification has been effected, are treated with sulphuric acid or with highly acid solutions of aluminium sulphate, in such a way that most or all of the substances previously precipitated are dissolved, and a considerable proportion of the iron reprecipitated, in combination with potassium and sulphuric acid as a crystalline salt insoluble in the liquor employed, but subsequently removed by solution in water or dilute liquor.
—F. Sodn.

Wear-resisting bodies [*sintered alumina*] *and methods of manufacturing the same.* The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 4887, Feb. 27, 1912.

Pure alumina is mixed with about 10 per cent. of a binding agent, such as gum tragacanth, moulded under pressure to the desired form of a tool, die, or the like, and baked in an ordinary kiln at 1300°—1400° C. The article, which has the consistency of chalk, is then machined and fired at 1800°—2000° C., preferably in a tungsten- or molybdenum-wound resistance furnace (see this J., 1911, 1264) whereby the alumina is sintered (but not used) into a very dense, amorphous condition, in which it has the sp. gr. 3·8 to 3·9, is very strong, fine-grained, and hard as sapphire.
—O. R.

Aluminium carbides; Manufacture of ——. S. Peacock, Philadelphia, Pa., U.S.A. Eng. Pat. 11,394, May 13, 1912.

A higher aluminium carbide than is formed in ordinary practice, namely Al_2C_6 instead of Al_4C_3, is obtained by subjecting a mixture of alumina and carbon to a temperature of about 1400° C. at a pressure below 500 mm. of mercury, preferably not exceeding 200 mm. An apparatus suitable for carrying out the process comprises a rotary furnace containing at the feed end a suction pipe connected with an air-pump, means for rendering both ends of the furnace air-tight, means for revolving the furnace, which is preferably conical in shape, and a single graphite resistance piece supported by graphite springs for the production of the required temperature. The resulting aluminium carbide evolves acetylene when treated with water.—O. R.

Aluminium, carbon, and nitrogen; Compound of ——. S. Peacock. Fr. Pat. 448,550, Sept. 20, 1912. Under Int. Conv., Sept. 23, 1911.

See U.S. Pat. 1,031,581 of 1912; this J., 1912, 773. The product may be made by heating alumina (102 parts) and carbon (72 parts) in presence of nitrogen and under reduced pressure, to about 1500°C. —T. F. B.

Ammonia from nitrogen and/or ammonia bearing compounds [*e.g., wool waste*]; *Production and/or recovery of* ——. P. O. Rowlands, Liverpool. Eng. Pat. 7740, March 30, 1912.

Products such as wool waste, shoddy, or the like, are treated with an alkaline electrolyte, preferably a 5 per cent. solution of caustic soda, heated to about 100° C., agitated and subjected to the action of an electric current having a density of 25 amps. per sq. ft., when ammonia will be freely evolved at the cathode.—O. R.

Sulphate of ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pats. 12,845, and 14,114, May 31, and June 17, 1912.

Ammonium bisulphite, preferably in aqueous solution, is heated in the presence of a suitable catalyst. Sulphur is the catalytic agent preferred, and a favourable initial temperature is 50°—100° C., but selenium, tellurium, and arsenic, or their compounds, besides many metals, oxides, and salts are mentioned as applicable. A small quantity of ammonium bisulphite solution may be first decomposed, thus producing some sulphur, and then further quantities of solution gradually added, so that the process is continuous, or, a solution of bisulphite, without added sulphur, may be subjected to local heating (for instance by pumping a concentrated solution through tubes at about 180° C. under 10—15 atmos. pressure); ammonium sulphate and sulphur are thus formed. The reaction may also be effected in the presence of the normal sulphite, this being mixed in a proportion somewhat less than that indicated by the equation: $6NH_4HSO_3+3(NH_4)_2SO_3=6(NH_4)_2SO_4+3S+3H_2O$. The solution of sulphate produced is preferably saturated with ammonium bisulphite or treated with ammonia and sulphur dioxide, when the ammonium sulphate crystallises out and liquor for a fresh operation is obtained. The temperature during the process, which is complete in a few hours, may be regulated, if necessary, by cooling means. Extremely small quantities of selenium are sufficient to promote the reaction, and in this case a temperature of about 60° C. or below is sufficient.—F. SODN.

Potassium compounds out of felspar or minerals containing felspar; Process for producing soluble ——. A. R. Lindblad, Ludvika, Sweden. Eng. Pat. 23,898, Oct. 19, 1912. Under Int. Conv., Oct. 23, 1911.

FELSPAR, or a mineral containing such, is heated in an electric furnace with carbon or other reducing material, in such a way that the contained silica is partially or entirely decomposed, and potassium compounds, soluble in water, hydrochloric acid, or other acids (such as humic acid), are formed. A metal, or compound of such, reducible in the furnace and having the property of forming an alloy with the reduced silicon, is preferably added to the charge, in order that the silicon may be the more easily separated from the potassium compound obtained, a charge, for example, consisting of felspar, iron or iron ore, and charcoal, in which case silicide of iron is obtained as a valuable by-product. Any desired proportion of silica may be removed in the process, according to the nature of the product required. Thus, by removing only one-third of the silica from pure potassium felspar, a product similar to the mineral leucite ($KAlSi_2O_6$) is obtained, and this may be used directly as a fertiliser, whereas by removing all the silica, potassium aluminate results, and this may be employed as a fertiliser or for the production of alum or pure alumina (together with potassium carbonate). Suitable fluxes may in every case be added to the charge.—F. SODN.

Potassium sulphate, etc.; Process of making ——. C. A. Doremus, New York, Assignor to J. S. Hoyt, Darien, Conn. U.S. Pat. 1,054,518, Feb. 25, 1913.

AN alkali silicofluoride is treated with a sulphate of one or more of the alkaline earth metals. For example, potassium silicofluoride is heated to incipient redness with an equimolecular proportion of calcium sulphate, and the resulting potassium sulphate dissolved out from the product.—F. SODN.

Chrome-alum by electrolysis; Manufacture of ——. H. Chaumat, Paris. Eng. Pat. 1636, Jan. 20, 1913. Under Int. Conv., Jan. 24, 1912.

PURE, crystallisable, violet chrome alum is prepared by the electrolysis of a solution of potassium bichromate mixed with sulphuric acid. The liquor is circulated in the cathode compartment, which is separated from the anode by a porous vessel, the cathode preferably consisting of graphite powder packed round a carbon core. Dilute sulphuric acid is circulated in the anode compartment, and to utilise the SO_3-ion, which is disengaged at the anode, the latter may take the form of a copper electrode surrounded by copper shavings, whereby copper sulphate is formed in the course of electrolysis.—O. R.

Ferric chloride; Method of making ——. H. H. Dow and A. E. Schaefer, Assignors to The Dow Chem. Co., Midland, Mich. U.S. Pat. 1,054,400, Feb. 25, 1913.

A SOLUTION of ferrous chloride containing the solid salt, is chlorinated, by acidifying with hydrochloric acid and treating with chlorine.—F. SODN.

Sodium perborates rich in active oxygen; Process for the preparation of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 256,920, April 27, 1911.

THE sodium salts of perboric acid, or substances capable of yielding them, are dissolved in concentrated hydrogen peroxide, and the resulting products separated by crystallisation, evaporation, or precipitation. In order to render them non-deliquescent, they are mixed with solid acid substances. The products contain hydrogen peroxide instead of water of crystallisation and are hence richer in active oxygen than ordinary sodium perborate.
—A. S.

Hydrogen peroxide; Production of ——. J. Härdén, Luton. Eng. Pat. 25,681, Nov. 17, 1911.

Two electrolytic cells are arranged in a tank containing water, which is rendered conductive by the addition of a small quantity of an electrolyte. On the passage of a direct electric current, the oxygen from two anodes and the hydrogen from one cathode rise and are collected in a vessel of the bell-jar type, which surmounts the tank in which electrolysis is taking place. The mixture of oxygen and hydrogen, which is now in the required proportions, is subjected to the action of a silent electric discharge, a series of electric sparks, or an electric arc, formed between two electrodes situated inside the bell-jar, and the hydrogen peroxide, which is produced, is dissolved by a spray of water issuing from a rose, and is collected in a funnel situated at the bottom of the bell-jar.—O. R.

Nitrogen; Process and apparatus for the production of —— and for obtaining useful products in the said process. R. W. Wallace and E. Wassmer, London. Eng. Pat. 3147, Feb. 7, 1912.

A CURRENT of gas containing nitrogen and oxygen (*e.g.*, air, furnace gases mixed with air, waste gases from sulphuric acid manufacture or from gas engines) is treated with phosphorus in a suitable chamber, and the phosphoric anhydrides produced are subsequently separated, so that nitrogen of any desired degree of purity is obtained. The gas to be treated is freed from admixtures, such as carbon dioxide, moisture, sulphur compounds, etc., during any convenient stage of the process. The procedure is as follows:—Two chambers or towers are placed in parallel immediately in connection with the distillation furnaces (which may contain a mixture of crushed phosphatic ore and a reducing material), the towers being constructed of refractory material and filled also with such material, in such a manner as to present large surfaces upon which the phosphorus may be condensed. The gases from the phosphorus furnace pass through the towers alternately, and these are maintained at a sufficiently low temperature to secure deposition of the phosphorus. When one of the towers (or series of towers) has been charged with phosphorus, the mixture of oxygen and nitrogen is passed in, so that nitrogen together with phosphoric anhydrides issues from the tower; the anhydrides may be caused to deposit or the mixture may be passed through a water tower or tank, so that phosphoric acids are formed, which may be utilised to give the phosphate required. If carbon monoxide be present in the gases, it may be oxidised with an excess of air and the carbon dioxide absorbed by spraying with ammonia solution, preferably before introducing the gases into the separating tower, or, if desired, partial oxidation may be allowed to take place in the tower itself, and the treatment with ammonia be made subsequently. The treatment with phosphorus may be supplemented by bubbling the gases through liquid phosphorus, contained, for example, in the bottom of the tower.—F. SODN.

Hydrogen from metals and water; Process and apparatus for producing ——. F. Bergius. Fr. Pat. 447,080, Aug. 9, 1912. Under Int. Conv., Oct. 23, 1911, and July 15, 1912.

SEE Ger. Pat. 254,593 of 1911; this J., 1913, 195. Lower oxides of metals may replace the metals themselves. The water may contain neutral salts, acids, or other conductive compounds. The reaction is also accelerated by the use of a second metal, such as copper, nickel, or platinum, more electropositive than the principal metal.
—T. F. B.

Electrolysis of alkali chlorides; Impts. in, and apparatus for, the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 16,779, July 18, 1912.

SEE Fr. Pat. 446,640 of 1912; this J., 1913, 142.—T. F. B.

Formates of chromium, aluminium, and iron ; Process for the preparation of ——. A. Wolff, Cologne, Germany. U.S. Pat. 1,054,735, March 4, 1913.

See Fr. Pat. 435,446 of 1911 ; this J., 1912, 386.—T. F. B.

Silicon and nitrogen ; Compounds containing —— *and process of producing such compounds.* C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,054,901, March 4, 1913.

See Fr. Pat. 405,712 of 1909 ; this J., 1910, 424.—T. F. B.

Barium oxide ; Process for making high percentage, porous —— *from barium carbonate.* Chem. Fabr. Coswig-Anhalt Ges.m.b.H. Fr. Pat. 448,158, Sept. 11, 1912.

See U.S. Pat. 1,041,583 of 1912 ; this J., 1912, 1078.—T.F.B.

Hydrochloric acid and alkali silico-aluminate ; Process and mixture for producing ——. A. H. Cowles. Fr. Pats. 448,165 and 448,166, Sept. 11, 1912.

See U.S. Pats. 1,040,893 and 1,040,977 of 1912 ; this J., 1912, 1124.—T. F. B.

Salt ; Processes for making ——. J. H. Webster, and International Salt Co., Ltd. Fr. Pat. 448,430, Sept. 18, 1912. Under Int. Conv., Sept. 19, 1911.

See Eng. Pat. 20,706 of 1911 ; this J., 1912, 773.—T. F. B.

Aluminium nitride ; Process for making ——. Soc. Générale des Nitrures. Fr. Pat. 448,924, Dec. 9, 1911.

See Eng. Pat. 8348 of 1912 ; this J., 1912, 875.—T. F. B.

Nitrogen [from air, etc.] ; Process and apparatus for preparing —— *and obtaining useful by-products.* R. W. Wallace and E. Wassmer. Fr. Pat. 448,511, Sept. 19, 1912.

See Eng. Pat. 3147 of 1912 ; preceding.—T. F. B.

VIII.—GLASS ; CERAMICS.

Glasses ; Hydrolytic classification and testing of —— *with iodeosin.* F. Mylius. Silikat-Zeits., 1913, **1**, 2—5, 25—28, 45—48.

The author describes the methods of testing glasses with iodo-eosin as carried out in the Physikal.-Techn. Reichsanstalt, Berlin (see this J., 1908, 899 ; 1910, 628, 818). Full details are given of the preparation of the reagents and of the glass to be tested and of the mode of carrying out determinations of the solubility, natural alkalinity, and "weathering alkalinity" of the glass.—A. S.

Patents.

Quartz glass. F. Wolf-Burckhardt, Biebrich, and W. Borchers, Aachen, Germany. Eng. Pat. 2176, Jan. 27, 1913. Under Int. Conv., Feb. 1, 1912. Addition to Eng. Pat. 18,053, Feb. 20, 1911 (this J., 1912, 130).

The titania or zirconia used as additions to the quartz are replaced by the rare earths, *e.g.* the oxides of cerium, lanthanum, praseodymium, neodymium, samarium, or thorium, or by the oxides of chromium or metals related to chromium, such as vanadium, niobium, tantalum, tungsten, or uranium.—H. H. S.

Metallising ceramic and other surfaces. G. P. M. Lee, London. Eng. Pat. 25,980, Nov. 21, 1911.

A solution of nickel fluoride is applied to the surface and is then reduced by friction with a suitable metal such as zinc, copper, cadmium, or bismuth, either in the form of powder or as a brush made of the metal. The nickel is thereby precipitated from the solution and dried and rendered adherent by the friction.—H. H. S.

Drying of grooved or gutter-tiles or other tiles and similar objects or materials ; Process and apparatus for the ——. F. Haas, Ges.m.b.H., Lennep, Germany. Eng. Pat. 13,527, June 10, 1912. Under Int. Conv., June 14, 1911.

See Fr. Pat. 444,560 of 1912 ; this J., 1912, 1130.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Mineral production of Canada. J. McLeish. Dept. of Mines, Mines Branch, No. 213.

The following table shows the amounts of the more important metals and minerals produced in Canada during 1911 and 1912 :—

	1911.		1912.	
	Quantity.	Value.	Quantity.	Value.
		$		$
Copper ...lb.	55,648,011	6,886,998	77,775,600	12,709,311
Gold .....oz.	473,159	9,781,077	607,609	12,559,443
Pig iron . tons*	917,535	12,307,125	1,014,587	14,550,999
Lead .....lb.	23,784,969	827,717	35,763,476	1,597,554
Nickel .... ,,	34,098,744	10,229,623	44,841,542	13,452,463
Silver .....oz.	32,559,044	17,355,272	31,931,710	19,425,656
Other metallic products ...	..	411,332	..	982,676
Total		57,799,144		75,278,102
Less pig iron credited to imported ores	875,349	11,693,721	978,232	14,100,113
Total metallic		46,105,423		61,177,989
Asbestos and asbestic tons	127,414	2,943,108	131,260	2,979,384
Coal ..... ,,	11,323,388	26,467,646	14,699,953	36,349,299
Gypsum . ,,	518,383	993,394	576,498	1,320,883
Natural gas ..	..	1,917,678	..	2,311,126
Petroleum, brls.	291,092	357,073	243,336	345,050
Salt .....tons	91,582	443,004	95,053	459,582
Cement ..brls.	5,692,915	7,644,537	7,120,787	9,083,216
Clay products .	..	8,359,933	..	9,343,321
Lime .... bush.	7,533,525	1,517,599	7,992,234	1,717,771
Stone	..	4,328,757	..	4,675,851
Miscellaneous non-metallic	..	2,142,842	..	3,364,017
Total non-metallic ..	..	57,115,571	..	71,949,500
Grand total ..	..	103,220,994		133,127,489

* Short tons throughout.

Ferrous oxide and carbon ; Reactions between —— *and between carbon monoxide and iron.* V. Falcke. Ber., 1913, **46**, 743—750.

The paper deals mainly with a repetition of the experiments of Schenck and his co-workers (this J., 1905, 803 ; 1907, 692) on the system with ferrous oxide, iron, and carbon as solid phases and a mixture of carbon monoxide and dioxide as gaseous phase. It was found practically impossible to prepare pure ferrous oxide by ignition of ferrous oxalate ; even after prolonged heating at temperatures up to 700° C., gas was still slowly evolved. Comparative experiments with mixtures of ferrous oxide and iron (to reduce any higher oxides of iron) and of ferrous oxide, iron, and sugar charcoal showed that the gas pressure produced was essentially the same whether charcoal was present or not. Further experiments on the action of carbon monoxide on metallic iron showed that this varies according to the experimental conditions, and is of a more complicated character than has been supposed. When the iron is heated at 600° C. in a current of carbon monoxide, carbon is separated. When, however, carbon monoxide is admitted to iron heated in a closed vessel, although considerable absorption takes place—the values of the equilibrium pressure agreed with those given by Schenck—the residue dissolves completely in hydrochloric acid, without any separation of carbon. It is suggested that under these conditions possibly the carbon monoxide is absorbed with formation of cementite. The author's results show that in the experiments of Schenck and his co-workers, carbon was not present as a solid phase or present only in insignificant quantity, and hence the conclusions drawn by Schenck in regard to reduction and carbide formation and the mutual relations of the different modifications of carbon have no experimental foundation. —A. S.

Sherardised wrought iron; Researches on the rusting and corrosion of ——. F. Halla. Z. Elektrochem., 1913, **19**, 221—226.

In the process of sherardising, *i.e.*, galvanising by heating the articles in zinc dust, the author shows that the higher the temperature of the furnace the greater is the amount of zinc taken up per unit of surface. When sherardised articles are immersed in dilute sulphuric acid, the velocity of solution (as measured by loss of weight) falls rapidly to a minimum, then rises somewhat to a value which remains constant for some time, and finally falls practically to zero. There is always some iron dissolved along with the zinc, and the iron is therefore in the active condition during the corrosion. The interval of time in which the solution takes place with practically constant velocity gives an idea of the resistance to corrosion of the metal, and in this respect the corrosion experiments agree with the experiments performed under the optimal conditions for carrying out the sherardising process. The effect of sherardising on the resistance to rusting is decidedly favourable.—W. H. P.

Nickel and manganese steels; Thermo-electric properties of some irreversible ——. S. Hilpert and F. Herrmann. Z. Elektrochem., 1913, **19**, 215—219.

In a 27·5 per cent. nickel steel it is found that the thermo-electric power measured against constantan varies with the previous heat treatment of the metal. The values for the thermo-electric power when plotted on a curve show a temperature hysteresis exactly similar to that obtained in the study of the magnetic properties of similar steels (this J., 1912, 132). For a nickel steel with 12·6 per cent. of nickel, and for steels with 4·58, 11·7, and 20·8 per cent. of manganese, no appreciable effect on the thermo-electric power was produced by the previous thermal treatment.—W. H. P.

Zinc; New method of precipitation by ——. [*Cyanide process of gold extraction.*] J. S. MacArthur. J. Chem. Met. and Min. Soc., S. Africa, 1913, **13**, 310—311.

Zinc for precipitation purposes is almost always used in the form of fine threads or shavings. These are very efficient chemically, because of the large surface which they expose; but they are mechanically weak, and are broken down into a kind of mud long before they are eaten through, so that the bullion precipitates contain from 50 up to 90 per cent. of zinc. The author substitutes sheet zinc cut by a bookbinder's guillotine into oblongs, say 1 to 2 inches by ¼ to ½ inch; these fall into the cells of the zinc box, and arrange themselves. The slight distortion at the corners produced by the guillotine prevents sticking and secures that there shall always be channels between the plates for the passage of the liquid; and the flow is sensibly uniform in all parts of the box. The resistance is greater than with filiform zinc, so that the fall should be twice as great as usual, and the boxes are better if only half the usual depth. When this form of zinc was used, it was found that the bullion precipitate contained only about 3 per cent. of zinc and 12 per cent. of other impurtities (largely the impurities of the zinc itself), and that no acid treatment was necessary. The zinc wafers became gradually thinner and after three or four weeks they disappeared without leaving any sensible debris. The method is economical both of zinc and acid besides saving labour; and the cost of the guillotine for clipping the zinc is less than that of a zinc turning lathe of equal capacity.—J. T. D.

Copper in ores containing arsenic, antimony or bismuth; Electrolytic determination of ——. D. J. Demorest. J. Ind. Eng. Chem., 1913, 5, 216.

Copper can be completely precipitated as thiocyanate, free from arsenic, antimony, or bismuth, from a solution containing ammonium sulphate, ammonium tartrate, and tartaric acid (see following abstract). The cuprous thiocyanate is washed with a solution containing 1 per cent. each of potassium thiocyanate and tartaric acid, dissolved from the filter in nitric acid (1 : 2), and the solution boiled to destroy thiocyanic acid, or the cuprous thiocyanate may be ignited with the filter paper, and the cuprous oxide dissolved in nitric acid. The copper is then deposited electrolytically on a gauze cathode.—A. S.

Copper in ores; Thiocyanate-permanganate method for ——. D. J. Demorest. J. Ind. Eng. Chem., 1913, **5**, 215—216.

In determining copper by the method of Guess (this J., 1902, 1247), an empirical factor for the permanganate has to be used. The author has found that if the titration with permanganate be carried nearly to the end in alkaline solution, the reaction proceeds in accordance with the equation:

$$5NaCNS+6KMnO_4+4H_2SO_4=5NaCN+3K_2SO_4+6MnSO_4+4H_2O.$$

The modified method is as follows:—A quantity of ore containing 0·05—0·30 grm. of copper is heated with 5 c.c. of strong hydrochloric acid, then digested with 10 c.c. of nitric acid until completely decomposed, evaporated with 10 c.c. of sulphuric acid (1 : 1), cooled, and heated with 50 c.c. of a solution containing 3 grms. of tartaric acid until all soluble salts are dissolved. The solution is cooled, treated with excess of ammonia, acidified with sulphuric acid (1 c.c. in excess), treated with 1 grm. of sodium sulphite dissolved in 20 c.c. of water, heated nearly to boiling, and 1 grm. of potassium thiocyanate dissolved in 20 c.c. of water added slowly with vigorous stirring. The precipitate is digested with the nearly boiling solution for several minutes, cooled somewhat, filtered hot, washed well, and dissolved from the filter with 30 c.c. of a hot 10 per cent. solution of sodium hydroxide, followed by hot water. The filtrate is titrated at about 50° C. with permanganate, until a drop when tested with an acid solution of ferric chloride gives only a faint red colour. The solution is then acidified with 30 c.c. of sulphuric acid (1 : 1), and when the manganese dioxide is all dissolved, the titration with permanganate is completed.—A. S.

Copper; Determination of ——, *in white metal alloys.* F. Ibbotson and L. Aitchison. Chem. News, 1913, **107**, 121.

The copper is precipitated by hydrazine hydrochloride in strongly alkaline solution, the antimony being held in solution by tartaric acid. The details are as follows:—0·5 grm. of drillings or filings is dissolved in 10—15 c.c. of nitrohydrochloric acid, the solution is diluted with an equal bulk of water and cooled. If crystals of lead chloride deposit, they are filtered off on a pulp filter, and washed with cold water. To the solution 1 grm. of tartaric acid is added, and when it has dissolved, the solution is nearly neutralised with sodium hydroxide. The solution is now boiled, and run in drops (by a tap-funnel) into a boiling solution of 20 grms. of sodium hydroxide and 2—3 grms. of hydrazine hydrochloride in 250—300 c.c. of water, which is continuously agitated. After digesting for about 15 minutes, the metallic copper is collected on a pulp filter, washed with hot water, dissolved in nitric acid (equal volumes of acid of sp. gr. 1·20 and water), the filter well washed, the solution evaporated to pastiness, and taken up in water and a few drops of nitric acid. There should be no opalescence (due to tin), nor should the filter leave more than its own ash on ignition. Excess of sodium carbonate solution is now added to the copper solution, then acetic acid in slight excess, the solution is boiled, cooled, and the copper determined iodometrically.—J. T. D.

Tin in bronzes; Determination of ——. F. Ibbotson and L. Aitchison. Chem. News, 1913, **107**, 109—110.

A quantity of alloy containing about 0·1 grm. of tin is treated with 10—15 c.c. of nitric acid (sp. gr. 1·4), and, when action is complete, the mixture is evaporated to a paste, diluted with 75 c.c. of hot water, and boiled for a few minutes. The solution is filtered hot through a tightly-packed filter of asbestos pulp, and the precipitate washed by decantation as far as possible, with hot water containing a little nitric acid, and subsequently with water. The filter and precipitate are next transferred to the flask containing the greater portion of the residue, using as little water as possible (less than 20 c.c.), a volume of concentrated sulphuric acid equal to that of the water employed is added, and the solution boiled for 3 minutes, after which 50 c.c. of concentrated hydrochloric acid are introduced and the solution again boiled for 2 minutes, when it should be free from turbidity. About 1 grm. of very finely powdered antimony is then added, the mixture boiled for about a minute, and cooled rapidly, allowing a current of carbon dioxide to pass through the solution during the whole operation, and, finally, when quite cold, starch is added and the solution titrated as quickly as possible with $N/20$ iodine solution. When the proportion of copper is required as well as that of tin, the authors proceed as follows:—0·5 grm. of alloy is dissolved in 10—15 c.c. of *aqua regia*, and the solution diluted with an equal volume of water; sodium hydroxide solution is then added until most of the free acid is neutralised, without the formation of a precipitate, and the solution is heated to boiling. The mixture of copper and stannic chlorides is transferred to a tap-funnel and allowed to drop, with vigorous shaking, into a solution made by dissolving 20 grms. of sodium hydroxide in about 300 c.c. of water, heating to boiling, and adding 2—3 grms. of hydrazine hydrochloride (not sulphate). The mixture is digested for about 15 mins., until the evolution of gas subsides, and the copper, which is precipitated as metal, is filtered off, washed with hot water, and determined by a known method. The filtrate is then acidified with hydrochloric acid, concentrated, and the tin determined by the method given above or by precipitation as sulphide.
—F. Sodn.

Bronzes; Special —— *of aluminium and tin. The "needle" constituents of alloys.* F. Robin. Bull. Soc. d'Encour., 1913, **119**, 12—41.

The author has studied the effects of annealing, quenching and reheating, on the micro-structure of aluminium and tin bronzes, and on a large number of ternary copper alloys. It was specially desired to produce and study the needle-structure which is typified in the martensite of steels. The etching liquid found most suitable for revealing the structure is composed of ferric chloride 5, water 5, hydrochloric acid 30, isoamyl alcohol 30, ordinary alcohol 30, per cent. The areas representing the alloys which yield the martensitic structure were determined on composition-diagrams of the alloys of copper-aluminium-zinc, copper-aluminium-tin, copper-aluminium-antimony, and copper-tin-arsenic. The question of the equivalent amounts of different metals required to produce the same structure, when alloyed with some third metal, is considered theoretically, and laws are deduced which conform very well with practical results. The paper is illustrated with numerous microphotographs which are discussed in detail.
—T. St.

Aluminium alloys; Contribution to the constitution and analysis of ——. W. E. von John. Chem.-Zeit., 1913, **37**, 363.

The following method for the analysis of aluminium alloys containing copper, zinc, and magnesium is suggested. One gram of the turnings is dissolved in hydrochloric acid and after evaporation the silica determined in the usual manner. The lead and tin in the filtrate are determined by treatment with sulphuric and nitric acids, and the filtrate freed from silica, lead, and tin is treated with bromine water and excess of alkali, boiled, allowed to stand for several hours, and the precipitated copper, iron, manganese, and magnesium hydroxides filtered off and washed; the filtrate contains the aluminium and zinc. The precipitated hydroxides are dissolved in dilute sulphuric acid, treated with hydrogen sulphide to precipitate the copper and filtered. The filtrate is oxidised with bromine and the iron precipitated by ammonia after boiling off the excess of bromine. The manganese in the filtrate is precipitated by bromine or hydrogen peroxide, and after filtering, the magnesium is precipitated as magnesium ammonium phosphate. Ammonium sulphide is added to the filtrate containing the aluminium and zinc, and the precipitated zinc sulphide ignited with sulphur in a stream of hydrogen. It is then dissolved in hydrochloric acid and the absence of aluminium proved by the addition of ammonia. The aluminium is determined by difference. The alkaline solution of aluminium and zinc may also be poured into acetic acid with constant stirring and the zinc precipitated by hydrogen sulphide, but it is necessary to determine the aluminium co-precipitated with the zinc sulphide. Tables are given of a number of analyses showing the accuracy of the process.—A. H. C.

Aluminium; Electrometallurgy of ——. P. P. Fedotieff and W. Iljinsky. Z. anorg. Chem., 1913, **80**, 113—152.

As a preliminary to an investigation of the binary system, $NaF—AlF_3$, the authors have prepared pure anhydrous aluminium fluoride by sublimation from the commercial salt. This is heated to 1100° C. in a platinum crucible in a kryptol electric furnace and the pure salt sublimes in large crystals on the crucible lid. By thermal analysis of the system, $NaF—AlF_3$, the authors have established the melting point of cryolite as 1000° C. Cryolite is a very stable substance and can be melted frequently without decomposition. In addition to this there is another compound, $5NaF,3AlF_3$, corresponding to the mineral, chiolite, and having a transition temperature of 725° C. There are also eutectics at 885° C. (14 mols. per cent. AlF_3) and 685° C. (46·4 mols. per cent. AlF_3). When alumina is added to cryolite a binary system is produced in which there is an unbroken series of solid solutions up to about 21 per cent. by weight of alumina which represents the limit of solubility at ordinary pressures. The minimum melting point is reached at 935° C. The solubility of the alumina is increased by the addition of sodium fluoride, probably owing to the formation of an aluminate. Between the eutectic, $NaF—Na_3AlF_6$, and pure sodium fluoride the solubility of alumina again diminishes. Addition of aluminium fluoride to cryolite lowers the solubility of alumina. The decomposition voltage of alumina in molten cryolite is 2·1 to 2·2 volts, but there is a break in the voltage curve at 1·2 to 1·3 volts, caused by the formation of aluminium carbide (which is strongly exothermic) at the cathode. Investigations of the sparking phenomena at the anode during electrolysis show that it can be caused not only by the electrolyte becoming poor in alumina, but also by the presence of large quantities of alumina accumulating at the anode. Like other metals, aluminium when exposed to the action of a molten salt, forms a "metal mist" or fine suspension which diffuses to the surface and there volatilises or oxidises. Experiments were made to measure this "solubility" and showed that the current losses in the electrical manufacture of aluminium are largely to be attributed to this cause. The action of the molten electrolyte on carbon is also of importance. An addition of sodium fluoride to a solution of alumina in cryolite increases the rate of disintegration of the carbon crucibles very considerably. It was also established that aluminium and carbon under a layer of a molten mixture of cryolite and alumina at 1000°—1100° C. may form a considerable amount of carbide without the intervention of the electric current. Actual electrolytic experiments were carried out and showed the possibility of obtaining current yields of 60—70 per cent., the limit being set by the "solubility" of the aluminium referred to above. It is found that the addition of sodium fluoride to the molten cryolite leads to unfavourable conditions and a low yield. Although the melting point is lower, the concentration of alumina at the anode becomes so raised during electrolysis that sparking takes place, the anodes are attacked, and carbide formation is plentiful. The difference between the specific gravity of the bath and that of the metal is also not sufficient for proper working. Other alkali fluorides and chlorides have probably a similar action. With chiolite it is possible to get a normal electrolysis when the bath contains not more than about 7·5 per cent. of alumina, while for cryolite about 10 per cent. is best. The anode current density must not be more than 5 amp. per sq. cm. The advantage of an excess of aluminium fluoride over that present in cryolite is that the temperature of the bath is lowered, but it is not desirable to reduce this below about 900° C., otherwise the specific gravity of the bath becomes too near that of aluminium. The temperature is often lowered by the addition of calcium fluoride, but at the same time the solubility of the alumina is lowered and the specific gravity of the melt is increased. Mixtures of calcium fluoride and aluminium fluoride form an eutectic at 815°—820° C. (37·5 mols. per cent. AlF_3), but the solubility of alumina in this mixture is very slight and its specific gravity is greater than that of aluminium.—W. H. P.

Aluminium; Action of distilled water on impure ——. A. Scala. Atti R. Accad. dei Lincei, Roma, 1913, 22, I., 43—47, 95—102.

The aluminium used contained: Al 99·371, Fe 0·070, Si 0·401, Ca traces, and Na 0·039 per cent. A piece of it was formed into a beaker, the inner surface of which was polished with sand paper and rinsed well with tap water, distilled water, and the purest conductivity water. The beaker was then filled with pure distilled water and heated with a direct flame, the water being kept gently boiling for many hours, with addition of further quantities to make up for that lost by evaporation. After some hours the surface of the water and the aluminium became covered with a yellowish skin, and the water was found to contain colloidal aluminium hydroxide. Water in which strips of polished iron had been immersed for some time produced a coating on the aluminium more rapidly than pure water. In experiments with an aluminium alloy containing Fe 14·49 per cent., the oxide coating produced was black and consisted chiefly of iron. Two distinct kinds of coatings were observed on the aluminium, a yellow one consisting chiefly of aluminium oxide or hydroxide coloured by small quantities of iron, and one of a chestnut-brown colour containing iron, aluminium, and silicon. The gas evolved was hydrogen in all cases. The author concludes that the solubility of commercial aluminium in distilled water is due to the presence of iron, which goes into pseudo-solution in the colloidal form as ferrous oxide, and accelerates catalytically the oxidation of the aluminium.—A. S.

Electrical resistance; Changes in —— *produced by drawing and twisting wires and by the heating of drawn and twisted wires of gold, silver, copper, nickel and iron.* F. Credner. Z. physik. Chem., 1913, 82, 457—503.

If a drawn wire of gold, silver, or copper is heated to a temperature of 100° C. or upwards, and again cooled, its resistance will be found to have fallen. The rate at which this fall takes place is greater the higher the temperature of the treatment, and for a given temperature a constant resistance is soon obtained. If the treatment is now continued at a higher temperature, a further fall takes place until finally a minimum value is reached, after which further heating produces a rise in resistance. This rise begins for gold at about 300° C. and for silver and copper about 400° C. If the treatment consists in warming for a period of three minutes to successively rising temperatures, it is found that the resistance falls, independently of the thickness of the wire to a minimum value which is obtained at 480° C. for gold and for silver and at 450° C. for copper. These are the temperatures at which the crystallites of these metals unite to larger crystals, with the production of gaps in the metal which increase the resistance. In the case of nickel subjected to similar treatment there is a minimum at about 550° C. which does not change any further over a range of 300° C. The resistance of iron wires reaches a minimum at 600° C., and again increases, owing to chemical changes in the iron, on further heating. When a wire is twisted or bent, the resistance is increased by the formation of crevices between the crystallites and this increase is not removed by heating the wire. The relatively great resistance of a drawn wire is mainly due to the orientation of the lamellæ, produced in the drawing, in the direction least favourable to conduction. It is generally concluded that permanent changes in resistance only occur when a change in the crystalline structure of the metal is produced. The view that a new phase is produced in the mechanical working, is not supported by the author's experiments.
—W. H. P.

Niobium and tantalum separations [and determination], especially by means of potassium chloride in hydrofluoric acid solution. Meimberg and Winzer. *See* XXIII.

Volumetric determination of chromium, vanadium, and iron in presence of one another. Atack. *See* XXIII.

Effect of high pressures on the physical and chemical behaviour of solids. Johnston and Adams. *See* XXIV.

The reaction of metals and alloys with nitric acid. J. H. Stansbie. *See* Birmingham Section, p. 311.

Patents.

[Manganese] Steel; Manufacture of ——. S. M. Dixon, Birmingham. Eng. Pats. 4619 and 4620, Feb. 23, 1912.

(1) In the manufacture of manganese steel, ferrotitanium or powdered metallic titanium is added in such amount as to give a finished product containing substantially less than 0·2 per cent. Ti. It is claimed that such steel, containing 7·5 to 22 per cent. Mn, can be easily forged, punched, machined, etc., without special treatment. (2) To molten manganese steel (containing at least 7 per cent. Mn) is added 30 to 120 lb. per ton, of ferrotitanium containing about 22 per cent. Ti, or an equivalent proportion of metallic titanium. It is claimed that the steel produced is capable of being forged, welded, machined, and worked with considerable facility. The titanium has in the molten state a refining action upon the manganese steel, and in the course of the operation may be entirely lost, although it has had upon the structure of the steel the desired effect.—T. St.

Iron and steel; Refining process for —— *by means of ferrochrome alloy.* J. Büchel, Westfalia, Germany. Eng. Pat. 8479, April 10, 1912.

In the manufacture of chrome-steel, expeditious and uniform distribution of the chromium is stated to be obtained by introducing it into the steel in the form of a ferrochromium alloy free from carbon, in conjunction with an excess of a strongly reducing agent, such as silicon, aluminium, or an alloy thereof.—T. St.

Steel, even tool-steel; Process for the conversion of low-grade pig iron, scrap, etc., into ——. Gewerkschaft Agrippina. Ger. Pat. 256,759, March 5, 1911.

The molten pig-iron is treated in known manner with sodium salts, preferably calcined sodium carbonate, and is then poured into moulds, which are cooled by a refrigerating agent, preferably liquid carbon dioxide, whereby the molten metal is rapidly cooled. It is stated that in this way an extremely hard austenitic steel is obtained, suitable for use as a rapid tool steel. On annealing, a pearlitic steel of great toughness is produced.—A. S.

Coke; Preparing —— *for charging blast furnaces.* M. C. Steese, Assignor to R. C. Steese, Youngstown, Ohio. U.S. Pat. 1,054,051, Feb. 25, 1913.

The lumps or particles of coke are covered with a slurry of iron ore.—T. St.

Furnaces ; Roasting ——. M. van Marcke de Lummen, Cologne on the Rhine, Germany. Eng. Pat. 13,549, June 10, 1912.

In tier furnaces for the roasting of pyrites, etc., inclined screen-plates of the shape of segments, having the same inclination as the drop openings, are attached to the centre shaft directly underneath the rabble-arms of the tier above. The upper edge of each screen-plate projects upwards into an annular ring made of stone or similar material, to which the ore will not adhere. As ore is fed by the rabbles down the drop openings, it is thus protected against direct contact with the gas current travelling upwards, and the production of dust is avoided.—T. St.

Foundry sand ; Renovation of ——. A. Poulson, Widnes. Eng. Pat. 14,972, June 27, 1912.

Claim is made for the use of compounds of magnesium (other than the chloride) mixed with previously proposed materials for renovating foundry sand, with the object of rendering the sand moisture-proof. 1 cwt. of the sand is treated with about 3½ lb. of a paste-mixture consisting of (1) equal parts of magnesium sulphate, aluminium sulphate and water, or (2) equal parts of magnesium carbonate, aluminium sulphate, and water. The first mixture is used with sand for dry sand moulding, and the second for loam moulding. The process may be utilised with the gelatinous silica treatment for green sand, the paste in this case being made up with more water.—T. St.

Ingots ; Method of treating metal ——. G. H. Benjamin, New York City, U.S.A. Eng. Pat. 16,093, July 9, 1912.

The molten metal is cast in a mould which is provided with means for preserving one side of the ingot at a higher temperature than that of the other three sides and the bottom. This may be accomplished by heating the one side, or by applying a cooling medium to all but the one side. By this means the shrinkage of the ingot on cooling is accommodated by the soft metal on the heated side. As soon as the ingot is cool enough to handle, it is placed between jaws, and the warmer side is subjected to lateral pressure along a portion of its length by hydraulic means, while at the same time the ingot is slowly rotated. Segregation due to the different specific gravities of the components of the ingot is thus avoided.—T. St.

Vanadium ; Process of extracting —— from carnotite concentrates. S. Fischer, Golden, Colo., Assignor to R. E. Booraem, New York, and C. R. Hill, Golden, Colo. U.S. Pat. 1,054,102, Feb. 25, 1913.

Carnotite or vanadiferous sandstone concentrates are mixed into a paste with water and alkali hydroxide. The mass is then evaporated to dryness and roasted at a low temperature. Soluble vanadium salts are thus formed which can be leached out with water.—T. St.

Basic phosphate slags ; Process for the complete utilisation of ——. H. Naegell. Ger. Pat. 256,303, Feb. 29, 1912.

The slag is treated with a weak acid in order to separate the citrate-soluble from the non-citrate-soluble phosphate. Volatile acids, such as sulphurous or carbonic acid, are preferably used as solvents, and are subsequently recovered by evaporating the solution, the dissolved phosphoric acid being separated at the same time. The insoluble portion of the slag is used for the purpose of supplying the phosphorus required in the Thomas process for the manufacture of iron for the purpose of facilitating the "blowing" and the production of more valuable slag.—A. S.

Steel ; Process of making ——. P. P. Reese and S. S. Wales, Munhall, Pa., U.S.A. Eng. Pat. 5098, Feb. 29, 1912.

See Fr. Pat. 441,352 of 1912 ; this J., 1912, 821.—T. F. B.

Arsenical iron ores ; Process for rendering —— suitable for smelting. Cöln-Müsener Bergwerks-Aktien-Verein. Fr. Pat. 448,075, Sept. 9, 1912.

See Eng. Pat. 20,404 of 1911 ; this J., 1912, 992.—T. F. B.

Cast iron ; Process for dephosphorising —— in a basic or neutral converter of any form. A. F. Pasquier. Fr. Pat. 448,414, Nov. 25, 1911.

See Ger. Pat. 252,504 of 1911 ; this J., 1913, 29.—T. F. B.

Zinc from poor zinc ore and tailings ; Method of manufacture of ——. F. C. Beauchamp, East Finchley. Eng. Pat. 17,648 of 1911, date of Appl., March 1, 1912.

See Fr. Pat. 446,713 of 1912 ; this J., 1913, 146.—T. F. B.

Copper alloy ; Remelting and refining old or scrap ——. W. S. Rockey and H. Eldridge, New York. Eng. Pat. 5445, March 4, 1912.

See U.S. Pat. 1,019,524 of 1912 ; this J., 1912, 342.—T.F.B.

Electrostatic separating devices for sorting heterogeneous materials, more especially minerals, sulphur, phosphate of lime and like materials. A. M. F. Blanchard, Asnières, France. Eng. Pat. 6772, March 19, 1912.

See Fr. Pat. 441,053 of 1912 ; this J., 1912, 803.—T. F. B.

Ore ; Reducing —— by means of solid, carbonaceous material . S. E. Sieurin, Höganäs, Sweden. U.S. Pat. 1,054,873, March 4, 1913.

See Eng. Pat. 14,612 of 1911 ; this J., 1912, 440.—T. F. B.

Ores ; Apparatus for roasting or sintering ——. J. E. Greenawalt. Fr. Pat. 448,244, July 17, 1912.

See Eng. Pat. 14,805 of 1912 ; this J., 1913, 239.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Reduction of dissolved oxygen under pressure to hydrogen peroxide. Fischer and Priess. *See* VII.

Electro-analytical separation of copper from tungsten and molybdenum. Treadwell. *See* XXIII.

Patents.

Electrodes for galvanic cells. F. Dietz, Nuremberg, Germany. Eng. Pat. 21,739, Sept. 24, 1912. Under Int. Conv., Sept. 25, 1911.

A moistened mass of pyrolusite and graphite is pressed into the form of hollow ropes, the openings of which are less than the diameters of the carbon rods. The ropes are cut to the length of the separate depolarisers, and in each is inserted a carbon rod, account being taken of the elasticity of the still mouldable lengths of rope, so that the latter, in consequence of the contraction which takes place on drying, fit firmly on the carbon rods.—B. N.

Chlorine gas ; Preventing the generation of —— in cases where sea water penetrates into the interior of electrically driven vessels. H. Wehrlin, Steglitz, Germany. Eng. Pat. 28,518, Dec. 10, 1912. Under Int. Conv., March 25, 1912.

The sea water in the vessel is mixed with such substances as will combine with the chlorine at the moment of its production. The substance may be introduced in solution into the battery cells by the piping usually employed for the ventilation of the cells, and the superfluous solution may be taken out through other openings and allowed to mix with the sea water in the interior of the boat.—B. N.

(1) *Electric furnace.* (2) *Method of silicidising articles containing carbon.* F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pats. 1,054,371 and 1,054,373, Feb. 25, 1913.

(1) The furnace contains one or more carbon resistance cores, disposed so as to secure maximum radiation along their vertical surfaces, and means for supporting articles to be silicidised (converted into silicon carbide) in zones which

alternate with the cores and are substantially parallel with their vertical surfaces, whilst a silicidising envelope such as a porous mixture containing silicon carbide, silica, and carbon, surrounds and extends between the cores and the articles to be treated. (2) Articles containing carbon are assembled in self-supported piles in a carbon resistance furnace, in such manner that the piles are broken in the direction of current flow and disposed along the resistance (or resistances) in a position to be heated by the same, both resistances and articles being surrounded (see above) by a mixture capable of generating vapours containing silicon, and sufficient current passed through the resistances to silicidise the articles. The resistances are so shaped as to give a maximum horizontal and minimum vertical radiation.—F. Sodn.

Silicidising ; Process of ——. F. J. Tone and T. B. Allen, Assignors to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,054,372, Feb. 25, 1913.

Shaped carbonaceous articles are subjected to the action of silicon-containing vapours of high vapour pressure, produced by the electric arc, which is preferably formed within a mixture of silicious and carbonaceous material surrounding the articles.—F. Sodn.

Electric [silicidising] furnace. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,054,380, Feb. 25, 1913.

The furnace contains a silicidising chamber which is heated by means of resistances and communicates only with the furnace atmosphere. Means are provided for obtaining a circulation of vapours containing silicon in the chamber, which, in the example described, is placed between the resistances in such manner as to allow vapours to enter its side walls adjacent to the cores, a porous mixture containing silica and carbon surrounding and separating the chamber and resistances.—F. Sodn.

Electrolytic cells ; Device for heating ——. J. Nussbaum. Ger. Pat. 254,594, Jan. 13, 1911.

The claim is for the use of heating tubes of ceramic material, in each of which is a narrower tube of any suitable material, disposed in an analogous manner to the known Field tubes, for the purpose of introducing steam or leading off condensed water. The tubes of ceramic material are closed at one end, and are fixed only at the other end in the wall of the cell. The heating tubes may be U-shaped, in which case the condensed water is led off through a narrow tube reaching nearly to the lowest part of the bend. The limbs of the U-tube may be provided with jackets or protecting tubes, closed above, in order to prevent local overheating.—A. S.

Electric retort furnaces. J. Bally, Grenoble, France. Eng. Pat. 16,041, July 9, 1912. Under Int. Conv., July 11, 1911.

See Fr. Pat. 432,153 of 1911 ; this J., 1912, 32.—T. F. B.

Colloidal and finely divided substances ; Process for treating [separating by electro-osmosis] ——. G. B. Schwerin. Fr. Pat. 448,230, June 18, 1912. Under Int. Conv., June 19, 1911.

See Eng. Pat. 14,369 of 1912 ; this J., 1913, 241.—T. F. B.

Cathodic reduction [in electrolytic cells] ; Arrangement of electrode to prevent ——. A. Pietzsch and G. Adolph. Fr. Pat. 448,677, Sept. 25, 1912. Under Int. Conv., Oct. 7, 1911.

See Eng. Pat. 22,028 of 1912 ; this J., 1913, 31.—T. F. B.

Manufacture of chrome alum by electrolysis. Eng. Pat. 1636. *See* VII.

Production of ammonia from nitrogen and/or ammonia bearing compounds. Eng. Pat. 7740. *See* VII.

Production of hydrogen peroxide. Eng. Pat. 25,681. *See* VII.

XII.—FATS ; OILS ; WAXES.

Oil-fruit, Canarium polyphyllum, from German New Guinea ; A new ——. M. Krause. Tropenpflanzer, 1913, **17**, 147—150.

The nuts of the *Canarium polyphyllum*, a tree widely distributed over German New Guinea, after removal of the hard shell, contain 68·23 per cent. of a yellowish-white fat suitable for the manufacture of margarine. The fat has the following characters : solidif. pt., 19°—20° C. ; m.pt., 30° C. ; refractive index, 1·4750 at 21° C. ; saponif. value, 200·2 ; iodine value, 59·74 ; Reichert-Meissl value, 4·41. The residue left after extraction of the oil contains 9·77 per cent. of nitrogen (= 61 per cent. of protein) and is free from any poisonous substance.—A. S.

Hardened oils. A. W. Knapp. Analyst, 1913, **38**, 102—104.

Hardened oils are characterised by a high proportion of glycerides of stearic acid, but it is doubtful to what extent any test of identity can be based upon this. Removal of the last traces of nickel from the fat is difficult, the free fatty acids combining with the metal to form nickel soaps, which remain in solution in the fat. The following method of detecting nickel is suggested :—Fifty grms. of the fat are heated with 20 c.c. of strong hydrochloric acid, with constant shaking, the mixture then allowed to separate, and a little of the acid layer evaporated to dryness. The residue is dissolved in a little water and the solution tested on a white tile with a drop of ammonium sulphide. In the case of some samples of hardened oils the author has obtained negative results in this test. The dimethylglyoxime test suggested by Bömer (this J., 1912, 996) is more sensitive, but it has been found by Prall that a red colouration may also be obtained with certain pure untreated oils. The insoluble bromide test for fish oils is of no quantitative value, since the process of hardening the oil causes a great reduction in the percentage of brominated glycerides insoluble in ether. The following results obtained with fats prepared from a clear cottonseed oil illustrate the influence of the method of hardening upon the characteristics of the products :—

Catalyst.	Percentage of catalyst in oil.	Character of product.	Butyro-refraction (corr. to 40°C.)	M. pt. ° C.
Nickel	1·00	Hard	45·7	49
Platinum	0·10	Hard	47·8	46
Palladium	0·06	Brittle	45·5	52

These hardened oils keep very well. Samples exposed for about 18 months to damp air showed no signs of rancidity whilst the original acidity (0·70 per cent. as oleic acid) had not materially altered. They give soaps of good colour but deficient in lathering power. No objection is likely to be brought against their being used in admixture with other fats in soap-making. With regard to their use in the preparation of edible fats, investigation is needed to ascertain whether any injurious products are formed in the process, and whether proportions of nickel of from 1 to 2 parts per million can have any harmful effects. Account must also be taken of the possibility of a high proportion of tristearin rendering the fat indigestible. There is probably but little risk of any poisonous substances being introduced from impurities in the hydrogen used in the reduction, since most of these would inhibit the action of the catalytic agent (see also this J., 1913, 201).
—C. A. M.

Solid fatty acids ; Determination of —— *by Hehner and Mitchell's method.* A. Heiduschka and A. Burger. Z. öffentl. Chem., 1913, **19**, 87—89.

Good results are given by this method (Analyst, **21**, 316) in the determination of stearic acid in the presence of other fatty acids, provided that not less than 0·1 grm. of stearic acid per 100 c.c. of saturated alcohol is present. To detect smaller amounts of stearic acid recourse may be had to fractional precipitation with barium or magnesium acetate. Neither stearic acid nor palmitic acid could be detected by any of these methods in cocoanut oil. In applying Hehner and Mitchell's method to the determination of palmitic and myristic acid, the solubility of the former in 96 per cent. alcohol at 0° C. was found to average 0·5642 grm., and the solubility of the latter 0·4418 grm. per 100 c.c. In test determinations with pure palmitic acid the results were inaccurate when more than 0·5 grm. of the fatty acid was present, owing to the exceptionally voluminous form in which it separated from the saturated solution. On the other hand, the good results with pure myristic acid were independent of the amount of acid taken. In the case of mixtures of palmitic acid and stearic acid a very small amount of the latter (*e.g.*, 0·06 grm.) caused the results to be much too high, but the method gave good results in the determination of palmitic acid in the presence of oleic, lauric, caproic and caprylic acids. The method also proved satisfactory with mixtures of myristic acid with the same more soluble fatty acids, but could not be used for the determination of myristic acid in the presence of stearic acid.—C. A. M.

Saponins from various plants. Rousset. Les Matières Grasses, 1913, 6, 3004—3005.

Wheat blight :—The seeds of wheat blight (*Lychnes githago* L.) are rich in saponin-like substances and could possibly be utilised for the industrial preparation of saponin. They are obtained in large quantities in the sorting of wheat, and are sold at a low price in admixture with other foreign seeds. The saponin in the seeds of wheat blight differs essentially from other saponins in the fact that it is optically inactive, but in other respects it has similar properties. The name *saponigellin* has been suggested by Masson for this variety. In addition to saponin, the seeds contain a saponin-like substance, nigellic acid, which has similar frothing and detergent properties. The chief extractives in the seeds are :—Saponin, 35; nigellic acid, 10; reducing sugars (as dextrose), 6·5; and fat, 38 per cent. The fat is a pale yellow oil. At the present time the impure wheat grains containing the blight are frequently exported from France into Germany, where they are used in the manufacture of detergent preparations. *Soap worts* :—Two commercial varieties of soap wort roots are known—the officinal French kind and the Egyptian root. The French root had the following composition :—Fat, 3·1; saponins, 19; saponic acid, 3·5; saponitic acid, 2·25; reducing sugars (as dextrose), 28; and galactan, 10·7 per cent.; whilst a sample of the Egyptian root gave the following results :—Fat, 7·5; saponins, 61; strathiric acid, 2·25; gypsophilic acid, 3; and reducing sugars (as dextrose), 19 per cent. Both sorts of root appear to be too dear to be used as raw material in industrial processes of extracting saponin.—C. A. M.

Effect of certain pigments on linseed oil. Manganese content of raw linseed oil. Boughton. *See* XIII.

PATENTS.

Oil presses. L. Hoffmann, Vienna. Eng. Pat. 7364, March 26, 1912.

One or more of the side walls of a cage-press are made movable in the frame " in a direction normal to their face." These walls are forced inwards by means of springs or the like, whilst means may be provided for moving them outwards when the pressure is applied.—C. A. M.

Oils; Process for improving the lubricating power of ——, *and for the manufacture of consistent grease.* E. Lecocq, Forest-lez-Brussels, E. B. d'Orimont, Hainaut, and M. M. d'Orimont, Anderlicht-lez-Brussels, Belgium. Eng. Pat. 2382, Jan. 30, 1912. Under Int. Conv., Jan. 31, 1911.

See Fr. Pat. 439,467 of 1912; this J., 1912, 732.—T. F. B.

Vegetable oils; Apparatus for extracting ——. J. T. Hawkins. Fr. Pat. 448,041, Sept. 6, 1912. Under Int. Conv., Sept. 9, 1911.

See Eng. Pat. 20,061 of 1911; this J., 1912, 997.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Linseed oil; Effect of certain pigments on ——. *Manganese content of raw linseed oil.* E. W. Boughton. U.S. Dep. Agric., Bureau of Chem., Circular No. 111, Feb. 15, 1913.

Pigments of various kinds were mixed with raw linseed oil, without driers, and left in stoppered jars of uniform shape and size for periods of one and two years in dim diffused light. At the end of each period the contents of the jars were thoroughly mixed and samples were taken from each. These were thinned with ether and centrifuged to separate the pigments, the ether evaporated, and the oil dried at 105° C. in an atmosphere of carbon dioxide or hydrogen, and filtered through fine filter paper. The linseed oil used had a sp. gr. of 0·934 at 15·6° C., an acid value of 1·7, and an iodine value of 179·6, and yielded 0·13 per cent. of ash. The pigments included white lead, kaolin (containing calcium sulphate), Indian red, flake graphite, black magnetic oxide, zinc chromate, artificial graphite, zinc white, chrome yellow, chromium oxide and lampblack, and they were mixed with the oil in proportions ranging from 16 per cent. (lampblack) to 72 per cent. (white lead). In no case was the iodine value of the separated oil reduced below that frequently given by pure samples of raw linseed oil. The lowest values were obtained with the mixtures containing the so-called inert pigments, *viz.* 173·0 after 1 year and 171·6 after 2 years in the case of kaolin, and 173·8 and 172·5 respectively in the case of Indian red. The large amount of ash from the white lead samples (0·35 per cent. after 1 year; 0·40 per cent. after 2 years) showed that in the case of that paint some of the pigment had been dissolved by the oil. In the other cases, however, the proportions of ash (0·01 to 0·25 per cent.) did not prove with certainty that any appreciable amounts of pigment had been dissolved. In almost every instance the specific gravity of the oil had been raised (*e.g.* to 0·940 in the white lead sample; 0·939 in the Indian red sample), but, as was also the case with the iodine value, the values were practically the same after one year's or two years' exposure, indicating that probably the air inclosed in the jars had little influence upon the values. Many of the oils separated from the samples had a sp. gr. above 0·936, at 15·6° C., the value fixed as the upper limit for raw linseed oil (Proc. Amer. Soc. Test. Mat., 1909, 9, 164). These results indicate that if an oil extracted from a stored paint shows a sp. gr. that is near the lower limit for pure raw linseed oil (0·932), the presence of other oils of lower sp. gr. is suggested. In five of the samples the oil had been bleached, this effect being very pronounced in the case of kaolin. The other pigments that had bleached the oil were white lead. Indian red, chrome yellow, and chromium oxide. whilst the black pigments, and zinc yellow and zinc white had caused no appreciable change in the colour of the oil. Experiments in which white lead was made into a thick paste with linseed oil so as to give a greater proportion of pigment continually in contact with the oil, showed that under these conditions, also, there was little alteration in the constants of the oil. For example, samples of oil extracted from such pastes yielded fatty acids with an iodine value of 185. It is pointed out, however, that these results were obtained with pastes containing only raw oil and pigment and that the addition of driers and thinning agents would have affected the values. Examination of the lead paints showed that lead chromate had not combined with the oil to so great a degree as white lead. *Manganese in raw linseed oil* : Sixteen samples of raw linseed oil of known purity yielded 0·02 to 0·21 per cent.

of ash, which in every instance contained manganese. The amounts determined by the bismuthate method ranged from a faint trace to 0·008 per cent. calculated upon the original oil.—C. A. M.

Pulp, paper and other products from waste resinous woods. Veitch and Merrill. *See* V.

The behaviour of paints under the conditions of practice, with special reference to lead paints. H. E. Armstrong and C. A. Klein. *See* London Section, p. 320.

Patents.

Paint, varnish, and finish removers. J. M. Wilson and H. A. Harris, New York, U.S.A. Eng. Pat. 4161, Feb. 19, 1912.

The finish remover comprises a film-forming colloid, consisting of a secretion of the Mexican candelilla plant, and two volatile finish solvents, one of which acts as a solvent for the colloid, whilst the other acts as a precipitant of the colloid when in solution.—B. N.

Metal surfaces; Protection of ——. Continental Caoutchouc und Gutta Percha Co., Hanover, Germany, and M. Willenius, Meggen, Switzerland. Eng. Pat. 12,753, Jan. 19, 1912. Addition to Eng. Pat. 15,886 of 1911, dated July 22, 1910 (this J., 1912, 693).

Claim is made for applying the rubber or gutta percha "glue" mixed with a bituminous substance, on the top of existing layers of paint, as a protection for metal surfaces coming in contact with sea water. One or more coats of the "glue," not mixed with substances of a bituminous nature may be applied on the top of the protective coats.—T. St.

Linoleum or the like; Manufacture of ——. W. Esch, Hamburg. Eng. Pat. 18,825, Aug. 16, 1912.

A linoleum, odourless, elastic and sound-proof, is said to be obtained by mixing vulcanised rubber, or rubber waste, gutta percha or balata with hot linoleum cement, then incorporating the mixture with filling and colouring substances, and coating fabrics with the preparation in the usual way. —C. A. M.

White lead; Process and apparatus for making ——. F. H. Sharpe. Fr. Pat. 448,754, Sept. 26, 1912. Under Int. Conv., Sept. 27, 1911.

See Eng. Pat. 21,292 of 1911; this J., 1912, 939.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Artificial and natural rubbers; Hydrohalogenides of —— and the rubber-like bodies regenerated therefrom. C. Harries. Ber., 1913, 46, 733—743.

Weber (see this J., 1900, 215) stated that rubber yielded a hydrochloride, $C_{10}H_{18}Cl_2$, which split off hydrochloric acid on heating with organic bases, but that the other halogen acids did not yield similar products. The author finds, however, that rubber and guttapercha yield compounds, $C_{10}H_{18}Cl_2$, $C_{10}H_{18}Br_2$ and $C_{10}H_{18}I_2$. The only difference between natural and artificial isoprene rubber in this respect is that the former gives a hydriodide retaining 2HI, while the latter, after one re-precipitation, loses HI giving $C_{10}H_{17}I$. It is difficult to remove the whole of the halogen acid by merely heating with organic bases, but by heating with pyridine, piperidine, or the like, with or without the addition of a solvent such as benzene, in a sealed tube to 125°—145° C., a product free from halogen is obtained. This is not identical with natural rubber but is more like sodium-rubber, being difficult to ozonize and possessing a similar decomposition-curve. The products are not quite the same as those obtained by regeneration from the hydrohalogenides of sodium-rubber itself. Decomposition of the various halogenides with alkali hydroxides or sodamide gives a different halogen-free rubber. The hydrohalogenide of gutta-percha does not give gutta-percha again but a compound of rubber-like properties, and possibly in this way gutta-percha may be transformed into rubber. It is likely that the difficultly ozonizable rubbers contain conjugated double bonds, *i.e.*, instead of being 1·5 dimethyl-cyclo-octadiene-1·5, the double bonds may be in the 1.3- or the 1·7-positions.—H. E. P.

Patents.

Rubber; Process for making ——. G. Reynaud. Fr. Pats. 448,108, Nov. 17, 1911, and 448,663, Dec. 2, 1911.

See Eng. Pat. 27,802 of 1911; this J., 1912, 1087. The usual filling mixture is introduced into the rubber mass impregnated with turpentine, at the same time as the lime or other addition.—T. F. B.

Rubber; Process for preparing artificial ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,672, Jan. 26, 1912. Addition to Ger. Pat. 250,690, Sept. 12, 1909.

In carrying out the process described in the principal patent (see Fr. Pat. 419,316; this J., 1911, 226), it is advantageous to heat the isoprene in presence of a viscous liquid, *e.g.*, viscous aqueous solutions of albumin, peptone, etc. It is stated that the products are tougher, more elastic, and less brittle than those previously described. —T. F. B.

Butadiene-caoutchouc, its homologues and analogues; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,129, March 13, 1912.

Butadiene, its homologues or analogues (with the exception of isoprene), or mixtures of hydrocarbons of the butadiene series, are emulsified in viscous fluids, and the emulsions allowed to polymerise spontaneously (see preceding abstract).—T. F. B.

Caoutchouc-like substances; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5667, March 6, 1912.

See Fr. Pat. 446,600 of 1912; this J., 1913, 152.—T. F. B.

Manufacture of isoprene or a hydrocarbon similar thereto. Eng. Pat. 17,397. *See* XX.

Manufacture of linoleum or the like. Eng. Pat. 18,825. *See* XIII.

Plastic compositions. [*Artificial leather.*] Eng. Pat. 24,041. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Extraction of woods and barks; Laboratory ——. R. H. Wisdom. J. Amer. Leather Chem. Assoc., 1913, 8, 128—132.

The official method of the American Leather Chemists' Association for the extraction of wood and bark requires that the operation should be conducted in an apparatus consisting of a vessel in which water may be boiled, combined with a container for the material to be extracted. The container must be provided with a condenser so arranged that the condensed water drips on the material and the outlets are so arranged that the percolate may either be removed or returned to the boiling vessel. 500 c.c. of the percolate must be collected outside in about 2 hours and the extraction continued with 500 c.c. for 14 hours longer by the process of continuous extraction with a reflux condenser. The author carried out experiments on the extraction of chestnut wood, oak bark, hemlock bark, mangrove bark and quebracho wood, following the official method in every detail except that the continuous extraction lasted for 6 hours instead of 14. It was found that in all cases the increase of extracted matter in 14 hours over that extracted in 6 hours was so small as to be within the limits of experimental error and completely overshadowed by the advantages of the shorter time. By the first extraction with 500 c.c., 85 per cent. of the total tannin is extracted. Experiments made using glass and copper vessels gave practically the same results when the first 500 c.c. of the extract was collected outside the boiling-flask. Any destruction of tannin is due to the continued boiling and is not affected by the material of the flask.—D. J. L.

Chestnut extract ; Natural organic acids of ——. L. Pollak. Collegium, 1913, 86—88. (See also this J., 1913, 173—174.)

Fresh chestnut wood contains 0·06—0·075 per cent. of volatile acids calculated as acetic acid. Leached air-dry chestnut wood contains 0·06—0·09 per cent of volatile acids. The percentage of acids in some chestnut liquors during the process of manufacture is as follows :—

	Per cent. of volatile acid.	Per cent. of non-volatile acid.	Volatile acid per 100 parts of dry material.	Non-volatile acid per 100 parts of dry material.
Crude chestnut liquor	0·252	0·248	4·26	4·20
Same, decolourised with blood	0·243	0·187	3·09	4·78
Same, from first evaporating element	0·336	0·284	3·33	2·81
Finished extract	0·435	1·225	1·06	3·01

From the analysis of several chestnut extracts given, the total acid varies from 1·5—2·1 per cent ; reckoned on dry material this becomes 3·6—5·2 per cent., of which volatile acids represent 0·5—1·1 per cent and non-volatile 2·6—4·2 per cent. The figures were obtained from extracts manufactured under high pressure and heavily treated with blood. By the decolourising process some acids, principally lactic acid, are introduced by the blood.—D. J. L.

Sulphite-cellulose extract ; Detection of ——. F. M. Loveland. J. Amer. Leather Chem. Assoc., 1913, **8**, 132—133.

Gansser (Collegium No. 509, 482) has stated that leather tanned in extracts containing 2—5 per cent. of sulphite-cellulose will give an extract yielding the characteristic flocculent precipitate on treatment with aniline and hydrochloric acid. The author was unable to obtain the test with leather tanned in sulphite-cellulose extract alone in liquors as high as 50° Bkr. It appears that different sulphite-cellulose extracts give results at variance by the same tests or else the extract changes during the process of leather manufacture. The heavy white precipitate which settles out of certain classes of sulphite-cellulose extract consists of sulphur.—D. J. L.

Tannin analysis ; Use of chromed gelatin in ——. E. Giusiana. J. Amer. Leather Chem. Assoc., 1913, **8**, 143.

It is proposed to replace hide powder by fish glue or gelatin, previously tanned in a basic chrome solution prepared from 100 grms. of chrome alum crystals, 1 litre of water and 15 grms. of crystallised sodium carbonate. Thin leaves of pure gelatin are placed in this solution for 24 hours, after which time they will be completely tanned and quite insoluble in hot water. They are then washed and neutralised in a 1 per cent. ammonia solution, again thoroughly washed and dried between filter papers. The tanned gelatin may be kept indefinitely in distilled water. For 100 c.c. of the tannin solution the equivalent of 5 grms. of dry gelatin is used. The shaking, filtration, etc., are as in the hide powder method.—D. J. L.

Lime liquors ; Provisional method of analysis of ——. Collegium, 1913, 73—75. (See also Wood and Law, this J., 1912, 446.)

At the London Conference of the Internat. Assoc. Leather Trades Chemists the following suggested standard method of analysis of lime liquors was provisionally adopted : (1) *Alkalinity.* The liquor is filtered through a S. and S. 605 filter-paper ; if great accuracy is required the covered funnel fitted with soda-lime tube as described by Trotman (Leather Trades Chemistry, 63) should be used. 10 c.c. of the filtrate are titrated with $N/10$ acid, using methyl red as indicator. This gives total alkalinity including that due to sulphides. (2) *Ammonia.* 100 c.c. of the liquor are filtered through cotton-wool, and acidified with hydrochloric acid until acid to methyl orange. Excess of magnesia is then added and the ammonia distilled over into standard acid. (3) *Sulphides.* The liquor is filtered through a S. and S. 605 filter-paper, and titrated with $N/10$ zinc sulphate with the addition of ammonium chloride, using sodium nitroprusside as external indicator (see Blockey and Mehd, this J., 1912, 369 ; also McCandlish and Wilson, this J., 1913, 153). (4) *Nitrogen.* The liquor is centrifuged for three minutes, and the total nitrogen determined in 25—50 c.c. by Kjeldahl's method. The degree of hydrolysis may be determined by a combination of the figures obtained by the above Kjeldahl method and Stiasny's formaldehyde figure (this J., 1910, 771). As an example gelatin has a formaldehyde figure of 178 while ammonium salts have a figure of 2·8. If these be taken as representing the upper and lower limits of hydrolysis of skin-substance in lime liquors, *i.e.*, gelatin 0 per cent. hydrolysis and ammonium salts 100 per cent. hydrolysis, any intermediate figure obtained for a lime liquor between 178 and 2·8 can be converted into a figure expressing percentage hydrolysis. Thus, if the factor $\frac{\text{mgrms. N}}{\text{c.c. } N/5 \text{ soda}}$ for a lime liquor be a, the percentage hydrolysis of the dissolved nitrogenous matter will be $\frac{100\,(178—a)}{178—2{\cdot}8}$ or (simpler) 0·57 (178—a).—D. J. L.

Electrical tannage. O. J. Williams. Collegium, 1913, 76—78.

Roever (Wiedemann's Annalen, **57** [2], 397) has shown that an E.M.F. of 100 volts from a battery of accumulators will force 7·377 kilos. of tan-liquor through 1 sq. metre of hide per hour, so it is evident that the failure of electrical tannage is not due to the hide preventing the passage of the tanning solution. The optical activity of an aqueous solution of tannic acid is decreased by the passage of a direct electric current, $[\alpha]^{17^\circ}_{D}$ for a 5 per cent. solution falling from 56·6 to 51·2 in half an hour with a current of about 0·004 amp. per sq. cm. By estimating the non-tannins before and after passing the current, it was found that a direct current had a very rapid action in destroying the tannin, a current of less than 0·02 amp. per sq. cm. increasing the percentage of non-tannins in a solution in half an hour from 4·86 to 47·12. Alternating currents of the same and higher densities had practically no effect on the tannin, but should accelerate the tannage of hides by electrical endosmose. From these trials it follows that chemical tannage associated with chemical E.M.F.s (and therefore unidirectional currents) can never be a success, and the only satisfactory way to accelerate tannage is by means of alternating currents.—D. J. L.

Sugar determinations according to the directions of the committee on leather analysis, Amer. Leather Chem. Assoc. ; Results of ——. J. Paessler. J. Amer. Leather Chem. Assoc., 1913, **8**, 136—140.

Samples of oak-tanned and hemlock-tanned leather were examined for the percentage of sugar according to the prescribed directions with the exception of the following two points. (1) The preparation of the aqueous extract was carried out by leaving the sample of 30 grms., after the extraction of fat with petroleum ether, in a Koch flask for 12 hours under pressure. The leather was then extracted at 50° C. for 3 hours to 2 litres. The method of extraction recommended by using a Soxhlet apparatus at 50° C. appears very troublesome and long. (2) The solutions, after removal of tannin with basic lead acetate and with normal lead acetate, with and without addition of zinc oxide, having been freed from lead with an excess of potassium oxalate and inverted with hydrochloric acid, were rinsed into a 200 c.c. flask for neutralisation. After cooling, they were rendered neutral to phenolphthalein with sodium hydroxide and made up to 200 c.c. The results obtained by the use of normal lead acetate, with or without zinc oxide, for de-tannising were, without exception, higher than the truth. When basic lead acetate was used, the results were far below the theoretical calculated quantity of sugar. By Von Schroeder's method, *i.e.*, the use of basic lead acetate as precipitant and removal of the excess of lead with sodium sulphate, quantities of sugar corresponding to the theoretical were found, both in pure dextrose solutions and also in the hemlock-tanned leather extract, while according to the procedure of the Committee on Leather Analysis, Amer. Leather Chem. Assoc., even in the pure dextrose solutions on the addition of basic lead acetate and removal of the lead with potassium oxalate, much less sugar was found than corresponded to theory. It was found that the duration of heating with the Fehling solution was not the cause of the low results obtained, but that considerable quantities of dextrose were carried down with the lead oxalate when potassium oxalate and basic lead acetate were used simultaneously.—D. J. L.

Spent tan as fuel ; The rational use of ——. T. Budischowski. Allgem. Gerber-Zeit., Jan. 25, 1913. J. Amer. Leather Chem. Assoc., 1913, **8**, 144.

A CUBIC yard of freshly leached bark weighs 1100—1200 lb. and contains 75—85 per cent. of water. A good tan-press will reduce the water to 60 per cent. Rotten or frozen tan is useless as fuel and the many wet materials from cleaning-vats, etc., which must for the most part be burned to get rid of them do not help to save coal. When the bark has 60 per cent. of water the heat value is scarcely one-third of that of dry bark. The author has obtained good results by drying the bark in a slowly revolving drum placed over the boiler, through which the spent tan passes. An exhaust fan draws the gases of combustion through this drum and the dried material is delivered directly into the stoking apparatus. 100 lb. of the dried tan are equivalent to 25—30 lb. of coal. In operation, the apparatus is continuous and automatic, and the smoke-gases are expelled at a comparatively low temperature, thus utilising their heat to the greatest advantage. —D. J. L.

PATENTS.

Plastic compositions [*artificial leather*]. W. J. Luxmoore, London. Eng. Pat. 24,041, Oct. 21, 1912.

RUBBER, gutta percha, etc., are incorporated with the product termed "syrolit" (Eng. Pat. 13,601 of 1909 ; this J., 1910, 98), and the composition rolled to the desired thickness. The rollers may have a pattern upon them so as to imitate the surface of any kind of leather, whilst a coloured product is obtained by the use of coloured "syrolit."—C. A. M.

Drying apparatus for hair, wool, yarns, threads, and other fibrous materials, leather, hide, glue and the like. Eng. Pat. 3969. *See* V.

XVI.—SOILS ; FERTILISERS.

Soil constituents ; Some organic ——. E. C. Shorey. U.S. Dept. Agric., Bureau of Soils, Bull. 88, Jan. 8, 1913. 1—41.

THE chemical nature of the organic matter of soils has been systematically investigated in the Bureau of Soils (U.S.A.) laboratory (see this J., 1911, 40, 143, 227, 438, 1078 ; 1912, 350) and in all, thirty-five different organic constituents have been isolated. Fifteen of these are now described for the first time. The soil is extracted with 2 per cent. sodium hydroxide solution in a porcelain-lined vessel of 30 gallons capacity provided with a stirrer. The neutralised extract is concentrated to a small volume in a vacuum pan and acidified to precipitate the humus ("matiere noir"). The filtrate usually contains about one-half of the total solids extracted from the soil. Details are given of the isolation from it of the following compounds, viz., oxalic, succinic, saccharic, and acrylic acids, lysine, adenine, choline, trimethylamine, salicylic aldehyde, mannitol, rhamnose, trithiobenzaldehyde, a nucleic acid and an unidentified aldehyde. The still unidentified portion of the soil organic matter is made up largely of compounds related to the resins. The possible source of these compounds and the relationship between them and the organic matter is discussed. The complexity of the organic matter of soils is emphasised.—E. F. A.

Manganese as a fertiliser. M. X. Sullivan and W. O. Robinson. U.S. Dept. Agric., Bureau of Soils, Circular No. 75, Jan. 4, 1913.

IT was found that manganese was the most active element in promoting the oxidation changes brought about by oxidising enzymes in plants. In soils also, the power to oxidise easily oxidisable substances is related to the amount of manganese present and the nature of the organic matter. The growth of micro-organisms is modified and their biochemical activities in the soil changed. The absorption of lime and magnesia by plants is increased by the addition of manganese to the soil. Manganese is naturally present in soil in amounts up to 0·5 per cent. calculated as MnO, especially in the surface soil, the usual forms present being the silicates and the hydrated dioxide. The most effective compound as a fertiliser is the sulphate, the least effective being the dioxide. In large amounts the sulphate is more toxic than the carbonate. The amount of sulphate added should not exceed 100 lb. per acre.—J. H. J.

Fermenting manure ; Action of —— *on reënforcing phosphates.* W. E. Tottingham and C. Hoffman. J. Ind. Eng. Chem., 1913, **5**, 199—209.

A LARGE number of experiments have been made on the action of fermenting manure on phosphates. Fermentation over periods of 4—6 months was found to cause a decrease of water-soluble phosphorus both in farm manure alone and in mixtures of manure with finely ground rock-phosphate. The losses of water-soluble phosphate in mixtures of manure and rock-phosphate were greatly reduced by addition of antiseptics (chloroform and formaldehyde). When acid phosphate was mixed with fermenting manure, a similar loss of water-soluble phosphorus occurred as with rock-phosphate, and there was a considerable loss even in presence of chloroform. On growing a second crop of barley on the same soils, it was found that better results were obtained from the fermented mixtures in the case of both mono- and tri-calcium phosphate. It is concluded that it is advantageous to mix ground rock-phosphate with manure and allow it to ferment before application, but that acid phosphate is preferably added to the manure at the time of application to the soil.—A. S.

Disinfectants ; Action of some —— *on the germinating power of cereal seeds.* A. Frassi. Staz. sperim. agrar. ital., 1912, **46**, 25—56. Chem. Zentr., 1913, **1**, 1055.

ALL the gaseous disinfectants tried, with the exception of vapours of ether and chloroform, tobacco smoke, illuminating gas, and carbon dioxide, had a pronounced injurious effect on the germinating power. Of the liquids, soap solution had no influence ; hydrogen peroxide, potassium permanganate solution, "zimargol" (colloidal silver), "lysol," and "creolin" had a slight injurious action, and solutions of sulphuric acid, ammonia, copper sulphate, mercuric chloride, silver nitrate, and sodium chloride had a stronger injurious effect.—A. S.

Patents.

Calcium cyanamide; Process of treating commercial ——. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,053,761, Feb. 18, 1913.

Free calcium oxide present in commercial calcium cyanamide is made to react with an organic material (such as "stick water" or stick water and oil) which itself has a fertilising value, and the mixture is treated with carbon dioxide.—F. Sodn.

Drying superphosphates and their derivatives; Method of ——. T. L. Willson. Fr. Pat. 448,127, Sept. 10, 1912. Under Int. Conv., July 10, 1912.

See U.S. Pat. 1,040,081 of 1912; this J., 1912, 1046.—T.F.B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Relationship between the weight of the —— *and the composition of its juice.* J. A. Harris and R. A. Gortner. J. Ind. Eng. Chem., 1913, **5**, 192—195.

Using published data for Washington Klein Wanzlebener beets (Bull. 39, Bureau of Chem., U.S. Dept. Agric.) and for four different varieties grown in Nevada (Bull. 32, Nev. Agric. Expt. Stat.), the authors have calculated the correlation coefficients and the regression straight line equations connecting the percentages of total solids and sucrose in the juice and the coefficient of purity with the weight of the beet. The results show that as the weight of the beet increases, the percentages of total solids and of sucrose and the purity of the juice fall rapidly.—A. S.

Sugar; Determination of the loss of —— *[in the beet factory] from thin-juice to finished products.* H. Claassen. Z. Ver. deut. Zuckerind., 1913, 239—249.

The thin-juice was measured in tanks, whilst for ascertaining the amount of thick-juice, a "Libra" automatic weighing machine was used, and found to give uniformly satisfactory results. The weight of the massecuite was found in the usual way from the weight of sacked raw sugar and of the second massecuite. In all the analytical operations the standard methods prescribed by the German Committee were used, but in determining the sugar content of the thin-juice, in addition to the ordinary procedure involving the application of Schmitz' table, the so-called "gravimetric" process in which the normal weight or a multiple of it is weighed out (cf., this J., 1913, 300) was used, results higher by 0·05—0·10 per cent. being thus obtained. Depending upon whether the sugar in the thin-juice was determined by (*a*) the ordinary procedure employing Schmitz' table, or by (*b*) the "gravimetric" method, the losses expressed as a percentage of the roots sliced were found at the several stages to be as follows:—from thin-juice to thick-juice, (*a*) +0·016, (*b*) 0·068; from thick-juice to massecuite, (*a*) 0·015, (*b*) 0·015; from thick-juice to the final products; (*a*) 0·042, 0·042; thus giving a total loss while proceeding from thin-juice to the final products of (*a*) 0·026 and (*b*) 0·110 per cent. These losses are to be attributed in part to the destruction of the sugar in process of working, and in part to the unavoidable errors of weighing the several products, taking the samples, and determining the sucrose. The total loss due to destruction of sucrose during evaporation, boiling, and crystallisation does not exceed 0·1 per cent. on the roots, and probably is much less, so that the method of computation from the tables of Herzfeld and Duschsky (this J., 1911, 1177) may be regarded as substantially correct.—J. P. O.

Sugar-works products; Contribution to the study of the colouration of ——. J. Robart. Bull. Assoc. Chim. Sucr., 1913. **30**, 457—463.

The deeper colour of a solution of molasses (30 to 35 grms. of molasses per litre) containing the same quantity of mineral non-sugar as a purified juice is caused principally by the action of alkalis on sugar under the influence of heat. A solution of pure sugar heated for several hours acquires a light yellow colour, which becomes brown even in the cold if a small quantity of alkali be added. The colour thus produced is resistant to the usual treatment with sulphurous acid and hydrosulphites which cannot reduce it, even momentarily, more than 20 to 30 per cent. if the products are left slightly alkaline. The author's process of "carbosulphitation at low temperatures" is stated to avoid these colourations and allows of almost colourless products being obtained.—L. J. de W.

Table syrups in the refinery; The question of the formation of ——. Zuew and Nikiforow. Zapiski, 1912, **6**, 285. Z. Zuckerind. Böhm., 1913, **37**, 320—323.

The authors examined the decomposition of sucrose on heating its aqueous solutions in presence of glucose and the behaviour of glucose on heating its aqueous solutions in presence of various salts of inorganic and organic acids. Glucose when heated in pure aqueous solution or in aqueous solutions of salts of strong inorganic acids and strong bases (potassium chloride, etc.) is very stable, so that the solutions remain colourless, but with salts of weak inorganic acids and strong bases (potassium carbonate, etc.) it is not so stable and the solutions become first yellow and then cinnamon brown. With alkali salts of organic acids it is decomposed to a greater extent, the slighter the degree of electrolytic dissociation of the organic acid, *i.e.*, acetates produce a greater effect than propionates and the latter a greater effect than formates. The difference observed between the action of potassium and sodium acetates in this connection could not be explained. Glucose has no visible influence on the rate of decomposition of sucrose on heating in aqueous solution. The decomposition of glucose on heating in presence of aqueous salt solutions under refinery conditions shows it to be less stable than is usually assumed.
—L. J. de W.

Sugar [dextrose]; Determination of ——. *I.* Bang. Biochem. Zeits., 1913, **49**, 1—18.

A method for determining small quantities of dextrose is described. The sugar is boiled with an alkaline copper solution containing potassium chloride, and the reduced copper is determined directly by titration with standard iodine solution, thus:—$CuCl+I+K_2CO_3=CuCO_3+KCl+KI$. In alkaline solution the well-known reaction between potassium iodide and cupric salts does not take place. The copper solution is prepared as follows:—160 grms. of powdered potassium bicarbonate are dissolved in 700 c.c. of water at about 30° C., and 66 grms. of potassium chloride and afterwards 100 grms. of normal potassium carbonate are dissolved in the same liquid which is kept cool meanwhile. Finally, 4·4 grms. of crystallised copper sulphate, dissolved in 100 c.c. of water, are added and the whole solution is made up to 1 litre. The liquid should not be shaken violently, and it should be left for 24 hours before use. Of this stock solution, which does not change on storage, 300 c.c. are diluted to 1 litre, and 55 c.c. of the diluted liquid are used for each determination. The reduction is carried out in a 100 c.c. Jena-flask, over the neck of which a thick piece of rubber tubing is drawn, so that the flask can be hermetically closed by a clip. The 55 c.c. of copper solution, mixed with 0·1—2 c.c. or more of the sugar solution (containing not more than 10 mgrms. of dextrose), are heated over a flame of such size that the liquid is brought to boiling in 3½—3¾ mins. Boiling is continued for exactly 3 mins., and the flask is then closed with the clip, and cooled under a tap; the liquid continues to boil under the diminished pressure for about ½ min. The rubber tube is then removed, and after addition of 0·5—1 c.c. of starch solution (1 grm. of soluble starch in 100 c.c. of saturated potassium chloride solution), the liquid is at once titrated with standard iodine solution until a blue colour is produced which persists for at least 5—10 seconds. The liquid should be shaken as little as possible during titration. The number of c.c. of *N*/10, *N*/25 or *N*/100-iodine solution required, divided by the respective factors 0·285, 0·70 or 2·70, gives the weight of dextrose present in mgrms. The last factor (2·70) relating to $N/100$-iodine solution, is not accurate for quantities of sugar exceeding 8 mgrms., but the other two factors may be used with 10 mgrms.. the maximum quantity of sugar determinable by this method. The average error is 0·1—0·2 mgrms. of sugar. The method is as accurate as the one previously described by the author (see this J., 1907, 161) and it possesses the following advantages :—the colour change during titration is more distinct, the copper solution is cheaper, quite stable, and less readily reduced by substances other than sugar, very small quantities of sugar can be determined, and the colour of the sugar solution does not affect the results. No proteins or compounds capable of combining with iodine should be present in the sugar solution.—J. H. L.

Invert sugar [in honey]; Detection of commercial —— with β-naphthol. F. M. Litterscheid. Chem.-Zeit., 1913, **37**, 321.

The method is described with reference to the detection of commercial invert sugar in honey; it has been found to give satisfactory results with all the samples examined. 10—20 grms. of the honey are successively triturated with two portions of 10 c.c. of ether in which one or two crystals of β-naphthol have been previously dissolved. The unfiltered extract is transferred to a shallow porcelain dish and left in a dark place until the ether has evaporated. Four or five c.c. of chemically pure, 88—90 per cent. sulphuric acid are added to the residue, the latter being completely moistened with the acid, and the whole is allowed to stand. A dirty yellowish or reddish yellow colour, which in half an hour becomes dirty yellowish green, is obtained with natural honey, whilst a Bordeaux red to bluish-violet colour appears in the course of half an hour in the case of honey containing commercial invert sugar. A positive result was obtained with mixtures of natural honey and 5 per cent. of artificial honey containing commercial invert sugar, and sometimes, also, when the result obtained by Fiehe's method (this J., 1908, 1127, 1171) was inconclusive.—L. E.

Sugar factory waste waters; Purification of —— with "Humin" according to Hoyermann and Wellensiek. K. Andrlik and V. Stanek. Z. Zuckerind. Böhm., 1913, **37**, 283—303.

The authors find that the use of "Humin" and lime (see this J., 1911, 639) does not effect any greater purification of waste waters than is done by the use of lime alone.
—L. J. de W.

Hydrolysis of sucrose by various acids in presence of the sucrase of koji [taka-diastase]. Bertrand and Rosenblatt. *See* XVIII.

Patents.

Sugar from syrups or other sugar-containing solutions of sugar refineries; Manufacture of pure ——. A. Wijnberg and J. N. A. Sauer, Amsterdam, Holland. Eng. Pat. 11,860, May 18, 1912. Addition to Eng. Pat. 21,204, Sept. 26, 1911 (this J., 1912, 1047).

The process described in the original patent for the purification of raw juices may be extended to the treatment of syrups and other sugar refinery products. The syrup or solution is acidified to a certain degree by the addition of phosphoric or sulphurous acid and treated with carbon as originally described, the carbon being regenerated by alkaline solutions.—J. F. B.

Sugar liquors; Treating [purifying] ——. F. Hlavati, Berlin. U.S. Pat. 1,054,414, Feb. 25, 1913.

Sugar liquors, such as diffusion juices, are treated with ferrous sulphate and calcium carbonate; the mixture is then heated to a temperature not exceeding 75° C., a sulphide and zinc-dust are added, the precipitate formed is removed by filtration, and the filtrate is evaporated at a temperature below 100° C.—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Koji-diastase; Some properties of ——. G. Kita. J. Ind. Eng. Chem., 1913, **5**, 220—222. (See also this J., 1912, 833.)

Comparative experiments were made on the saccharification of starch and of maltose by an enzyme solution prepared from koji (a culture of *Aspergillus oryzæ* on steamed rice) and in the resulting solution the cupric-reducing power and the approximate quantity of dextrose (separated as glucosazone) were determined. The quantity of dextrose was very much larger in the solution from the saccharification of starch, and the author concludes that though koji may contain amylase and glucase, it "must contain some other kind of diastase which produces glucose directly from starch, without the aid of glucase." The destructive action of heat on koji-diastase is diminished somewhat by sodium chloride; but the same does not hold good for malt-diastase. Disodium phosphate, asparagine, and sulphuric acid promote the destructive action of heat. The inhibitory action of sodium chloride on the saccharifying action of koji-diastase varies according to the concentration of the enzyme. In dilute solutions of the enzyme, small quantities of sodium chloride have an injurious action, but in concentrated solutions, even large quantities of sodium chloride are without effect. Koji-diastase when preserved in brine maintains its activity for a long period.
—A. S.

Sucrose; Hydrolysis of —— by various acids in presence of the sucrase of koji [taka-diastase]. G. Bertrand and M. and Mme. Rosenblatt. Bull. Soc. Chim., 1913, **13**, 241—246.

Commercial taka-diastase, which the authors used in this investigation, is extracted from *Aspergillus oryzæ*, and contains various other enzymes besides sucrase. Towards sucrose it exerts its maximum hydrolytic activity in solutions neutral or very faintly alkaline to methyl orange. Sucrase from yeast and that from *Aspergillus niger*, on the other hand, are most active in solutions distinctly acid towards methyl orange (see this J., 1912, 294, 505).
—J. H. L.

(Bacillus hordei); Investigations on Bacillus subtilis, in relation to a new micro-organism in brewing ——. N. van Laer. J. Inst. Brew., 1913, **19**, 4—16.

The author found, on a number of English and foreign barleys, spores of a new micro-organism, *Bac. hordei*, very similar to *B. subtilis*, for which it has probably been mistaken hitherto. The spores are derived from the soil, and are characterised by great longevity and resistance to high temperatures. They withstand several hours' boiling in unhopped wort, but are destroyed by half an hour's boiling in hopped wort. The organism may develop in fermented beer, but not in hopped unfermented wort. Although it does not produce a high acidity, it may affect the brilliance and flavour of beer. Morphologically it resembles *B. subtilis*, but differs from the latter in producing indole, and in developing under aërobic and anaërobic conditions. When it sporulates, the spores acquire, after long storage in beer, a resemblance to the sarcina-type.—J. H. L.

Spirit rectification; New methods of ——. H. Masing. Chem.-Zeit., 1913, **37**, 329—330.

It has usually been the practice to dilute the crude spirit with water before rectifying it in a column apparatus, but comparative experiments recently made in Russian Government rectifying establishments have shown that for obtaining a given quantity of rectified spirit of definite quality, the consumption of heat is least if the crude spirit is subjected to rectification without dilution. An economy of heat of 20—30 per cent. is stated to be effected, which is larger than would be anticipated from Gröhning's tables showing the relation between the alcohol contents of a liquid and of the vapour therefrom. The author has made experiments with a glass rectifying column so constructed that the liquid could be drawn off from the different compartments as desired. Results obtained with this column show that the alcohol content of the liquid in successive compartments of the rectifying column increases much less rapidly than according to Gröhning's table, the difference being more pronounced the weaker the spirit —A. S.

Patents.

Brewing and like processes. A. Shelmerdine and F. C. Lewis, Liverpool. Eng. Pat. 5063, Feb. 29, 1912.

See Fr. Pat. 445,170 of 1912 ; this J., 1912, 1196.—T. F. B.

Fermentation ; Process of ——. A. Pollak, Allach, Germany. Eng. Pat. 18,844, Aug. 16, 1912. Under Int. Conv., Dec. 27, 1911.

See Fr. Pat. 446,903 of 1912 ; this J., 1913, 156.—T. F. B.

Alcohol from waste sulphite cellulose lyes ; Process for making ——. Aktiebolaget Ethyl. Fr. Pat. 446,718, July 31, 1912. Under Int. Conv., Jan. 15, 1912.

See U.S. Pat. 1,050,723 of 1913 ; this J., 1913, 192.—T. F. B.

Fermentation processes for producing acetone and higher alcohols from starch, sugars, and other carbohydrates. A. Fernbach and E. H. Strange. Fr. Pat. 448,364, Sept. 16, 1912.

See Eng. Pats. 15,203, 15,204, and 16,925 of 1911 ; this J., 1912, 1091, 1143.—T. F. B.

Rectifying apparatus. Eng. Pat. 18,741. *See* I.

XIXa.—FOODS.

Tin in canned food products ; Electrolytic method for the determination of ——. A. S. Cushman and E. B. Wettengel. J. Ind. Eng. Chem., 1913, 5, 217—218.

In the following method the usual tedious destruction of the organic matter is avoided. 50 grms. of the pulped material are heated slowly to boiling with 50 c.c. of concentrated hydrochloric acid and 25 c.c. of nitric acid, and boiled for 5 minutes, or, if there is danger of foaming, digested for 10 minutes, with continuous stirring. The solution is then diluted with about an equal volume of water, made alkaline with strong ammonia, and 25 c.c. of a saturated solution of ammonium sulphide added. Any insoluble organic matter is filtered off and washed with boiling water containing ammonium sulphide, and the solution (about 400 c.c.) is electrolysed hot with a current of 1·5 ampères at 6 volts, the tin being deposited on a rotating platinum cathode (a crucible held by a rubber stopper on a revolving spindle).—A. S.

Occurrence of boric acid in saffron. Krźiźan. *See* IV.

The determination of benzoic acid in milk. J. F. Liverseege and N. Evers. *See* Birmingham Section, p. 319.

Patents.

Flour and bread ; Manufacture of ——. C. W. Chitty, Dover, and W. Jago, London. Eng. Pat. 1194, Jan. 15, 1912. Addition to Eng. Pat. 2778, Feb. 3, 1911 (this J., 1912, 251).

A salt of pyrosulphuric acid ($H_2S_2O_7$), for instance, potassium pyrosulphate ($K_2S_2O_7$) may be used in place of the persulphate mentioned in the chief patent (*loc. cit.*). —W. P. S.

Milk and similar easily decomposable solutions or liquids containing albumin ; Process of separating solid substances from —— *by evaporation.* C. Finckenhagen and G. Jebsen, Christiania. Eng. Pat. 12,848, May 31, 1912. Under Int. Conv., June 1, 1911.

See Fr. Pat. 443,977 of 1912 ; this J., 1912, 1112.—T. F. B.

Foods ; Process for preserving ——. V. Frestadius, E. Norlin, and E. Cman. Fr. Pat. 448,212, Sept. 5, 1912. Under Int. Conv., Sept. 15, 1911.

See Eng. Pat. 20,262 of 1912 ; this J., 1912, 1144.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

Sewage sludge ; Destructive distillation of ——. A. H. Fiske and R. B. Earle. J. Ind. Eng. Chem., 1913, 5, 186—189.

At Worcester, Mass. (U.S.A.), the sewage, which contains large quantities of soluble iron salts, is treated with lime, allowed to settle, and the sludge filter-pressed. The authors' experiments were made with the cakes (about ¾ in. thick and containing 72 per cent. of moisture) from the filter-presses. The cakes dried to a brown friable mass in 10 hours in a current of warm air (70° —80° C.) or in about 4 days at the ordinary temperature. The distillation experiments were made with 60 grms. of the dried material in a small iron retort, and the best results were obtained by leading the distillation products through an iron coil heated to redness before conducting them to a condenser and a gas-washing bottle containing sulphuric acid. The results obtained indicate that in this way the dried sludge yields about 19·1 cb. m. of gas per 100 kilos. (6850 cb. ft. per ton), 13 per cent. of tar similar in appearance and odour to ordinary gas-tar, 0·27 per cent. of ammonia, and 58·3 per cent. of a black friable residue containing 18—19 per cent. of carbon and also chlorides, sulphates, phosphates, carbonates, iron and calcium. The gas contained : CO_2, 18·4 ; C_2H_4, etc., 15·9 ; O_2, 0·7 ; CO, 7·5 ; CH_4, 13·8 ; H_2, 28·2 ; and N_2, 15·5 per cent. —A. S.

Action of some disinfectants on the germinating power of cereal seeds. Frassi. *See* XVI.

Purification of sugar factory waste waters with "Humin" according to Hoyermann and Wellensiek. Stanek. *See* XVII.

The effect of atmospheric conditions on the hardness of rainwater. S. Wolff. *See* Manchester Section, p. 345.

Patents.

Water ; Apparatus for mixing liquids particularly applicable for the softening and purification of ——. Water Softeners, Ltd., London. From J. D. Riedel Akt.-Ges., Berlin. Eng. Pat. 3674, Feb. 14, 1912.

In apparatus where a reagent is added to the water, compressed air is admitted to the upper part of the reagent tank so that the solution is forced through a pipe into the water to be treated ; the quantity of reagent added is regulated by means of a tap on the pipe. A further volume of compressed air passes through a branch pipe into the reagent pipe below the tap and enters the water together with the reagent, effectual mixing of the reagent with the water being thus attained.—W. P. S.

Permutite [water-softening material] ; Process of revivifying or restoring ——. G. Schweikert, Vienna. U.S. Pat. 1,054,460, Feb. 25, 1913.

The permutite is heated to a temperature of 90°—100° C., and in any case not lower than 70° C., and is then treated with a solution of sodium chloride at approximately the same temperature. Contact of the permutite with the solution is maintained until the substance is revivified. —W. P. S.

Garbage ; Method of utilising ——. J. T. Davis, Alameda, Cal., Assignor to Technical Development Co., San Francisco, Cal. U.S. Pat. 1,054,282, Feb. 25, 1913.

Ordinary kitchen garbage is heated with sulphuric acid, and the resulting liquid and solid portions are separated ;

the liquid portion is ther neutralised, the salt produced is separated, and added to the solid portion after the latter has been ground. The object of the method is to obtain glucose, a fertiliser, and lubricating oil from the garbage. —W. P. S.

Refuse-destructor. H. N. Leask, Manchester. U.S. Pat. 1,054,850, March 4, 1913.

See Eng. Pat. 20,649 of 1908: this J., 1909, 1161.—T.F.B.

Water; Process for sterilising —— and freeing it from iron and other impurities. A. Hartog. Fr. Pat. 448,852, Sept. 30, 1912. Under Int. Conv., Oct. 2, 1911.

See Ger. Pat. 254,357 of 1911; this J., 1913, 105.—T.F.B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Camphor exports from Japan. Chem. and Drug., March 29, 1913. [T.R.]

The following table shows the exports of crude and refined camphor from Japan (which includes Formosa), also the destinations, during the past three years:—

Destination.	1910.	1911.	1912.
	Kin	Kin	Kin
Hong-Kong	13,095	30,776	·22,260
British India	452,881	570,714	643,745
Straits Settlements	4,973	8,146	9,814
Great Britain	657,838	657,657	724,250
France	872,534	795,893	502,996
Germany	357,024	520,387	489,317
United States	789,467	705,713	456,641
Canada	12,100	11,642	21,433
Australia	63,616	94,279	75,534
Other countries	51,574	47,892	115,603
Kin (=1⅓ lb.)	3,275,102	3,441,099	3,062,462

Medicinal plants; Influence of temperature on the formation of the active principles of some ——. J. Burmann. Bull. Soc. Chim., 1913, **13**, 246—248.

Observations relating to *Atropa belladonna*, *Digitalis purp.* and *ambig.*, *Aconitum napellus* and *Colchicum*, which extended over a period of six years (1907—1912), show that the alkaloid- or glucoside-content of these plants rises and falls from year to year with the average temperature. For example, the average temperature of 1911 was about 2° higher than that of 1909; in four of the five plants studied, the content of medicinal substance was twice as high in the former year as in the latter, but in the fifth case (*Colchicum*) the difference was only about 30 per cent.—J. H. L.

Opium and its preparations; Unification of the strength of ——. H. Hérissey. J. Pharm. Chim., 1913, **7**, 292—302.

The adoption of a total morphine content of 10 per cent. reckoned on opium dried at 60° C. would facilitate the unification of the strength of this drug. The assay method of the French Codex, which makes use of lime, is recommended as giving the most reliable results. Naturally the insolubility of a portion of the morphine complicates matters. In all cases the mode of producing a medicament should be precisely described as well as the analytical process by which it is assayed.—F. Sodn.

Zygadenine. The crystalline alkaloid of Zygadenus intermedius. F. W. Heyl, F. E. Hepner, and S. K. Loy. J. Amer. Chem. Soc., 1913, **35**, 258—262.

By extracting a large quantity of the leaves of *Zygadenus intermedius* and fractionally crystallising the crude alkaloidal mixture obtained, the authors have succeeded in isolating a crystalline alkaloid having the formula, $C_{39}H_{63}NO_{10}$, for which they propose the name *zygadenine*. It crystallises from benzene in shining needles, m. pt. 200°—201° C., and from alcohol in rhombic crystals containing alcohol of crystallisation; it is very soluble in chloroform, but ether is a poor solvent for the pure alkaloid. The specific rotation, in chloroform solution, is given as—48·2°. An acid solution of the alkaloid precipitates Mayer's reagent and gives a crystalline chloroaurate on addition of chloroauric acid. With concentrated sulphuric acid, it gives a yellowish orange colour changing to a brilliant cherry-red. Its physiological action resembles that of veratrine.—F. Sodn.

Glucosides of alcohols; Synthesis of —— by means of emulsin. Phenylethyl β-glucoside and cinnamyl β-glucoside. E. Bourquelot and M. Bridel. Comptes. rend., 1913, **156**, 827—829.

Phenylethyl alcohol and cinnamyl alcohol are both found in essential oils, and possibly exist in the plant as glucosides. The authors have prepared the β-glucosides of both alcohols by the action of emulsin on the alcohol and glucose in presence of a little water. The glucosides are colourless crystalline substances, without smell, readily hydrolysed in dilute solution by emulsin. —W. H. P.

Antipyrine in toxicological analysis. G. D. Lander and H. W. Winter. Analyst, 1913, **38**, 97—98.

Steensma's reagent (this J., 1907, 1214) used in conjunction with the Stas-Otto process of extraction will detect 1 mgrm. of antipyrine in 4 ozs. of material, but when smaller proportions are present the results of the test are doubtful or negative. No reaction is obtained in the test with methyl alcohol, acetone, acetic acid, petroleum spirit, aniline, ethyl acetate, aldehyde, or formalin; but a faint pink colouration is given by commercial amyl alcohol and by spirits of wine (undenatured), and this must be noted in applying the test. The best solvent for extracting antipyrine is chloroform. For example, on treating a solution of 10 mgrms. of antipyrine in 20 c.c. of water with 15 c.c. of chloroform, the amounts extracted from a neutral or ammoniacal liquid and from the solution after acidification with hydrochloric acid were 8 mgrms. and 5 mgrms. respectively. Under the same conditions no antipyrine was extracted by petroleum spirit, and only relatively small proportions by ether, ethyl acetate and benzene.—C. A. M.

Essential oils; Solubility of water in ——. J. C. Umney and S. W. Bunker. Perfum. and Essent. Oil Rec., 1912, **3**, 325—327; 1913, **4**, 4—5, 38—40, 77—79.

A quantity of freshly distilled essential oil was divided. One half was dried with sodium sulphate and the other half saturated with water (this J., 1912, 602, 794). The physical characters and the amount of the chief constituent were then determined. Portions of both were stored for six months under such conditions that the effects of light or darkness in the presence or absence of air during the storage period could be ascertained by repeating the above determinations. The results obtained for a larg number of oils of different classes are tabulated. Oil containing any considerable quantity of oxygenate constituents show a general tendency to increase in specifi gravity on keeping. The "terpene" group of oils show a decrease however. In nearly all cases, the optica rotation markedly decreases. In some cases oils store in the dark manifest the least decrease. Dry oils store in the dark show the greatest decrease in refractive index Oils stored in the dry condition show the least chang as regards the amount of the chief constituent.—F. Sodn

Marjoram oils of commerce. E. M. Holmes and J. C Umney. Perfum. and Essent. Oil Rec., 1913, **4**, 7 41, 69—75.

Botanical descriptions with illustrations are given of th following: *Origanum majoranoides*, Willd., *O. onite* Linn., *O. maru*, Linn., *O. hirtum*, Linn., *O. syriacum* Linn., *O. ægypticum*, Linn., *O. vulgare*, Linn., *O. floribundum*

Munby, *O. compactum*, Benth. The oil of sweet marjoram (*O. majoranoides*) is distilled chiefly in Spain; the characters have already been given (this J., 1913, 45). Cyprus origanum oil derived from *O. majoranoides* Willd. is rich in carvacrol, which amounts to 78—84 per cent. It has the sp. gr. 0·961 to 0·967, and is soluble in 2 to 3 vols. of 70 per cent. alcohol. It contains also cymene, origanene, and another phenol, possibly hydroxymethoxycymene. Trieste origanum oil has hitherto been regarded as derived from *O. hirtum*, but is really obtained from *O. onites*. The sp. gr. is 0·940—0·980. It contains 60—85 per cent. of carvacrol and is soluble in 2—3 vols. of 70 per cent. alcohol. A specimen of the oil of *O. hirtum* had a sp. gr. of 0·944, contained 66—67 per cent. of thymol, but no carvacrol, and was soluble in 2·8 vols. of 70 per cent. alcohol. Another sample distilled from plants grown on the islands of Curzola and Tissa had a sp. gr. of 0·923—0·940, and contained 51—60 per cent. of thymol, but no carvacrol. Some oil distilled from *O. maru* grown in Syria had the sp. gr. 0·9539, optical rotation +0°30′, and contained 72 per cent. of carvacrol. Oil distilled from another specimen of the same plant from the same source had the sp. gr. 0·9474, optical rotation +0°50′, and contained 67 per cent. of phenols consisting of about equal parts of thymol and carvacrol. Smyrna oil of origanum and the oil from *O. vulgare* are no longer of any commercial importance.—F. Shdn.

Chenopodium oil; Chemical investigation of the composition of ——. E. K. Nelson. U.S. Dept. Agric., Bureau of Chem., Circular No. 109, Jan. 2, 1913.

In continuation of his investigation of chenopodium oil (this J., 1911, 1279) the author has found that there is a pronounced increase in specific gravity and decrease in optical rotation after samples have been kept for a year at the ordinary temperature. For example, in the case of one oil with a sp. gr. of 0·9700 and $\alpha_D = -6·2°$, at 25° C. the corresponding values after a year were sp. gr. 0·9804 and $\alpha_D = -5·5°$. When the oil was kept in a refrigerator these changes were less pronounced. The formation of the glycol produced on hydrating ascaridol with ferrous sulphate (*loc. cit.*) has been found to correspond to the same re-arrangement of the molecule which takes place when ascaridol is heated. In addition to this glycol, two other crystalline products were also formed. One of these, termed β-glycol, melted in the anhydrous state at 103° to 105° C. It crystallised with one mol. of water and had the composition $C_{10}H_{18}O_3+H_2O$. When warmed with dilute sulphuric acid it was decomposed, with the formation of thymol. The other new body was an erythritol melting at 128° to 131° C., after drying *in vacuo*, and having the composition $C_{10}H_{20}O_4+H_2O$. When boiled with dilute sulphuric acid it was decomposed, the products of decomposition including a ketone with a strong odour of menthone, and a crystalline phenolic substance melting at 80° to 81° C. The formation of more than one glycol by the hydration of the re-arrangement product of ascaridol may be explained by adopting the view of Wallach, whose results (this J., 1912, 950) indicate that ascaridol is a 1—4- and not a 3—6-peroxide. Oxidation of the erythritol yielded an acid, $C_{10}H_{18}O_6$, which was regarded as one of the modifications of αα′-methylisopropyl-αα′-dihydroxyadipic acid differing in its properties from the two modifications previously described by Wallach. Oxidation of the α-glycol yielded an acid agreeing in its reactions with the structure of 1—4-cineolic acid.—C. A. M.

Essential oils; Constituents of ——. High-boiling camphor oil. F. W. Semmler and I. Rosenberg. Ber., 1913, **46**, 768—774.

A high-boiling fraction of camphor oil was fractionated at reduced pressure. Limene and cadinene were obtained from the first fraction. In addition a new sesquiterpene, *sesquicamphene*, was isolated. This boils at 129°—133° C. at 8 mm., has the sp. gr. 0·9015 at 20° C., $n_D = 1·50058$ and $\alpha_D = +3°$. The second fraction boiling at 150°—170° C. contained *sesquicamphenol*, $C_{15}H_{26}O$. This has an unusually low sp. gr. and a molecular refraction of 68·39, agreeing with that calculated for a bicyclic substance with one double linkage. When heated with potassium bisulphate a sesquiterpene is produced. The high-boiling fractions contain two diterpenes, α- and *β-camphorene*. α-Camphorene can be purified by treating its tetrahydrochloride, m. pt. 129°—131° C., with sodium acetate and acetic acid. It then boils at 177°—178° C. at 6 mm., has the sp. gr. 0·8870 at 20° C., and $n_D = 1·50339$, and is optically inactive. When reduced with hydrogen in the presence of platinum, octahydro-α-camphorene is produced boiling at 174°—176° C. at 9 mm., with the sp. gr. 0·8526 and $n_D = 1·46470$. β-Camphorene does not form a solid hydrochloride. It boils at 170°—180° C. at 7 mm., has the sp. gr. 0·930 at 20° C. and $n_D = 1·518$. It is optically inactive.—F. Shdn.

Unsaturated alicyclic hydrocarbons. Terpenes and essential oils. 124th Communication. O. Wallach. Annalen, 1913, **396**, 264—284.

The preparation and properties of Δ^1-dimethyl-(1·4)-cyclohexene, Δ^3-dimethyl-(1.3)-cyclohexene (tetrahydro-*m*-xylene), Δ^1-dimethyl-(1.2)-cyclohexene, Δ^3-methyl-(1)-ethyl-(4)-cyclohexene, and Δ^1-trimethyl-(1.3.5)-cyclohexene (tetrahydromesitylene) are described.—A. S.

Acetone; Catalytic hydrogenation of ——. A. Lassieur Comptes rend., 1913, **156**, 795—797.

The hydrogenation of acetone in presence of nickel at temperatures above 200° C. gives no isopropyl alcohol or pinacone. The main product is methyl isobutyl ketone, and there are also formed diisobutylketone (valerone), and small quantities of higher-boiling products and of unsaturated substances.—W. H. P.

Liquefied gases; [Apparatus for] Extraction with —— and the ammonolysis of hydrazine sulphate. F. Friedrichs. J. Amer. Chem. Soc., 1913, **35**. 244—247.

The apparatus, working on the principle of the Soxhlet extractor, consists essentially of an extraction vessel in which is suspended a container for the substance to be treated and to which is fitted by a ground joint a condenser of the screw type. The entire apparatus is insulated by means of a vacuum jacket, and the upper part of the condenser is provided with an inlet tube for the gas to be liquefied, the refrigerant (solid carbon dioxide and ether, liquid air, etc.) being contained in the screw. Hydrazine sulphate is decomposed quantitatively by liquid ammonia in this apparatus, anhydrous hydrazine being obtained as the extract, and all the ammonium sulphate (as ammonate, which is insoluble in liquid ammonia) remaining behind in the extraction thimble. With an iron apparatus and using ice as refrigerant, it should be possible to prepare large quantities of anhydrous hydrazine in this way.—F. Sodn.

Colloidal solutions; New method for the preparation of ——. A. Pieroni. Gaz. chim. ital., 1913, **43**, I., 197—200.

Solutions of silver nitrate (3·578 grms. per 50 c.c.) and of pyrogallol (1·142 grms. per 50 c.c.) in anhydrous pyridine were mixed together in the proportion of 2 c.c. of the former to 1 c.c. of the latter, and the resulting clear yellowish solution was diluted with water. In this way solutions of colloidal silver were obtained containing from 0·007 to 0·043 grm. of silver per 100 c.c. and varying in colour from light grey to brownish grey by reflected light and from yellow to violet by transmitted light. Darker-coloured solutions of colloidal copper were obtained when the silver nitrate was replaced by copper sulphate. Solutions of colloidal silver, of greater concentration (up to 0·06 grm. per 100 c.c.), were obtained in an analogous manner by using tannin instead of pyrogallol. Solutions of colloidal silver sulphide, mercury sulphide, and silver in pyridine were obtained respectively by adding pyridine saturated with hydrogen sulphide to a solution of silver nitrate or mercuric acetate in pyridine, and by reducing a solution of silver acetate in pyridine with a pyridine solution of pyrogallol.—A. S.

Patents.

Isoprene or a hydrocarbon similar thereto; Manufacture of ——. W. M. Callender, Guernsey. Eng. Pat. 17,397, Feb. 24, 1912.

Turpentine is mixed with an "oil or spirit" having nearly the same boiling point, and the vapours of the two liquids are passed through a tube heated to about 550° C.; the volatile product is fractionated and the fraction distilling up to about 70° C. is separated. Paraffin oil is mentioned as an example of the "oil or spirit" used, one part of turpentine being diluted with about three parts of the oil.—T. F. B.

Therapeutical composition containing a bromide. A. Ulrich, Zurich, Switzerland, Assignor to The Hoffmann-La Roche Chemical Works, New York. U.S. Pat. 1,054,258, Feb. 25, 1913.

The composition consists chiefly of alkali bromide in admixture with vegetable extracts, meat extracts, and a relatively small quantity of sodium chloride; it may be added to foods as a substitute for sodium chloride. —W. P. S.

β-Methyl-γ-hydroxybutyl-dimethylamine; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,713, Nov. 17, 1911.

β-Acetylallyldimethylamine, $CH_2:C(CO.CH_3).CH_2.N(CH_3)_2$, when treated with a reducing agent, is converted into β-methyl-γ-hydroxybutyldimethylamine,

$$CH_3.CH(OH).CH(CH_3).CH_2.N(CH_3)_2\ ;$$

the same hydroxy-base is also obtained by reducing the keto-base produced by the action of dimethylamine on methylenemethylethylketone. The acetylallyldimethylamine may be obtained by heating with dilute acid the β-acetyltrimethylene-tetramethyldiamine prepared according to the process described in Ger. Pat. 254,714 (see following abstract).—T. F. B.

Amino- and diamino-ketones; Process for preparing aliphatic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 254,714, Nov. 17, 1911.

Amino- or diaminoketones of the general formula, $CH_3.CO.CHR.CH_2.N(CH_3)_2$ or $CH_3.CO.CR[CH_2.N(CH_3)_2]_2$, where R represents hydrogen or alkyl, are obtained by the action of acetone or its homologues on dimethylaminohydroxymethane, $HO.CH_2.N(CH_3)_2$, or tetramethyldiaminomethane, $(CH_3)_2N.CH_2.N(CH_3)_2$, in presence or in absence of a condensing agent, such as an alkali, hydroxide, carbonate or bicarbonate, borax, sodium phosphate, aluminium hydroxide, organic bases or salts, etc. The reaction may be accelerated by heat. The dimethylaminohydroxymethane and tetramethyldiaminomethane may be used as such or they may be formed during the reaction by using suitable mixtures of formaldehyde and dimethylamine solutions.—T. F. B.

Formic esters from sodium formate; Process for preparing ——. P. Engelskirchen. Ger. Pat. 255,441, May 31, 1911.

A mixture of an alcohol, sodium formate, and sodium bisulphate is heated and the formic ester is distilled off, under the ordinary pressure if its boiling point is below 100° C., and under reduced pressure if its boiling point is above 100° C. The esters are stated to be obtained in very good yields and almost neutral.—T. F. B.

Dialkylaminoformic esters; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,942, Dec. 15, 1911.

The ammonium halogenides, such as $(CH_3)_3NCl.COOR$, produced by interaction of trialkylamines with halogen formic esters, are decomposed by heat, alkyl chloride and a dialkylaminoformic ester being obtained.—T. F. B.

Formaldehyde and malt extract; Production of a dry, pulverulent preparation from ——. Chem.-Pharm. Laboratorium "Sahir" G.m.b.H. Ger. Pat. 255,671, Feb. 19, 1911.

The product of the action of formaldehyde solution on malt extract is evaporated *in vacuo*, and quickly cooled whilst the vacuum is maintained; the cooling medium may, for instance, be introduced through channels in the surfaces used for heating. It is stated that a solid porous mass is thus obtained, which can be easily removed from the evaporating apparatus and powdered.—T. F. B.

Caffein and other alkaloids from aqueous extracts containing them; Process for separating ——. K. H. Wimmer. Ger. Pat. 255,899, Feb. 19, 1910.

The aqueous alkaloidal extracts are mixed with porous, absorbent substances, which do not combine chemically with water, and which are in a state of fine subdivision or present a large surface, and the alkaloid is extracted by treatment with a solvent or a succession of solvents. Peat dust or sawdust may be used as absorbents.—T. F. B.

Selenocyanogen compounds; Process for preparing aromatic ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 255,982, Jan. 19, 1912.

When aromatic diazo compounds are treated with salts of hydroselenocyanic acid in solutions of weak acids (*e.g.*, acetic acid), nitrogen is eliminated and the aromatic selenocyanogen compound, ArSeCN, is formed. The compounds are colourless or yellow crystalline substances, and may be used in medicine.—T. F. B.

β-Iminazolylethylamine from histidine; Process for preparing ——. F. Hoffmann-La Roche und Co. Ger. Pat. 256,116, April 4, 1912.

Histidine is submitted to putrefactive decomposition by means of pure cultures of bacteria which decompose carboxylic acids, with or without addition of small quantities of nutrient media (see also this J., 1912, 1201; 1913, 47).—T. F. B.

Morphine esters of halogen-fatty acids; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 256,156, June 2, 1911. Addition to Ger. Pat. 254,094 (this J., 1913, 213).

By esterifying morphine with halogenated fatty acids, their halogenides or anhydrides, a new series of esters is formed, resembling in properties those described in the chief patent. The mono-esters have a free phenol-hydroxyl group.—T. F. B.

*Nitro-3-aminobenzene-*1*-arsinic acid; Process for preparing* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,343, Dec. 22, 1911.

The urethane of 3-aminobenzene-1-arsinic acid is treated with a nitrating agent, and the carbonyl radical is eliminated, leaving 2-nitro-3-aminobenzene-1-arsinic acid. —T. F. B.

Radium compounds; Process for preparing solid —— for therapeutic purposes. E. Merck and W. Eichholz. Ger. Pat. 256,666, Feb. 20, 1912.

Solutions of radium salts are treated with solutions of alkali or alkaline earth salts of selenious or selenic acid or of tellurious or telluric acid, and the precipitation is completed by addition of alcohol. The products may be injected either in aqueous solution or in the form of paste. —T. F. B.

Hydrocupreine; Manufacture of alkyl derivatives and substituted alkyl derivatives of ——. G. W. Johnson London. From Verein. Chininfabr. Zimmer und Co. Frankfort on Maine, Germany. Eng. Pat. 16,619 July 16, 1912.

See Ger. Pat. 254,712 of 1911; this J., 1913, 213.—T. F. B

2-Aminobenzoyl-o-benzoic acids; Inner anhydrides (lactams) of ——, their derivatives and process for making them. Act.-Ges. f. Anilinfabr. Fr. Pat. 448,133, Sept. 10, 1912. Under Int. Conv., Jan. 10, 1912.

See Eng. Pat. 22,440 of 1912; this J., 1913, 130.—T. F. B.

Dihalogen hydrocarbons; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 448,246, July 18, 1912. Under Int. Conv., Oct. 27 and Dec. 27, 1911.

See Eng. Pat. 3870 of 1912; this J., 1913, 252.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gelatin; Action of hydrogen peroxide on pure ——. Lüppo-Cramer. Phot. Korresp., 1912, 501. Z. angew. Chem., 1913, **26**, 163—164.

When sheets of pure gelatin are subjected to the action of hydrogen peroxide vapour, washed for some hours, and then treated with a metol-silver intensifier, the parts where the vapours have come in contact with the gelatin become "developed" in a few minutes. The latent image is not destroyed by drying after washing, nor by thiosulphate. The vapours of oil of turpentine act similarly to hydrogen peroxide.—T. F. B.

Development from the back of the film. Lüppo-Cramer. Phot. Ind., 1912. Z. angew. Chem., 1913, **26**, 164.

The author has found that Balagny's development "*en profondeur*" (see this J., 1912, 662) also takes place with a 1 per cent. aqueous solution of amidol, without addition of sulphite. The phenomenon is probably due to deficiency of acid in the developer.—T. F. B.

Patents.

Multicolour screens particularly adapted for use in photography; Manufacture of ——. J. H. Christensen, Holte, Denmark. Eng. Pat. 7480, March 27, 1912.

In preparing multi-coloured screens as described in Eng. Pat. 20,971 of 1908 (this J., 1909, 491), it is found that the solution of commercial gum dammar in turpentine oil emulsifies readily, but the coloured particles become surrounded by a thick and uneven film of the gum. This may be avoided by adding to the gum or to the turpentine oil a small quantity of an acid or acids soluble in the solution of the colloid, such as acetic, benzoic, salicylic, or oleic acid. When using several such emulsions in admixture, the best results are obtained by making all of similar basicity or acidity; thus, emulsions which are too acid may be treated with ammonia, and those which are too basic may be mixed with boric acid. When it is desired to cover the coloured particles, forming the screen, with a layer of substance (*e.g.*, gelatin) which contains compounds which will react with the substance of the coloured particles, the gelatin or other coating may be impregnated with tannin or other similar substance. —T. F. B.

Uranyl-silver nitrate images; Production of photographic ——. E. Rickmann. Ger. Pat. 255,837, June 14, 1912.

In washing before fixing the photographic prints on paper sensitised with uranyl and silver nitrates, spots are very liable to appear unless distilled water is used. By adding a small quantity of a halide or thiourea or an alkylated thiourea to the sensitising solution, this difficulty may be avoided. These additions modify to some extent the colour of the finished print, halides tending to the production of yellow-brown shades, whilst thiourea gives rise to darker tones, and even black if sufficient be added. —T. F. B.

Three-colour screens; Process of producing ——. R. Krayn, Berlin, Assignor to Deutsche Raster-Ges. m. b. H., Berlin-Steglitz, Germany. U.S. Pat. 1,055,189, March 4, 1913.

See Fr. Pat. 409,397 of 1909; this J., 1910, 720.—T. F. B.

Photography of colours. A. Hamburger. Fr. Pat. 448,565, Sept. 21, 1912. Under Int. Conv., Sept. 21, 1911.

See Eng. Pat. 20,880 of 1911; this J., 1912, 1054.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

The heat test. I. Guncotton. II. Nitroglycerin and cordite. III. Theoretical. A. C. Egerton. *See* London Section, p. 331.

Patent.

Explosive compound. C. F. Dippel, Assignor to D. E. Teague and E. G. Langhammer, Brenham, Tex. U.S. Pat. 1,054,515, Feb. 25, 1913.

An anhydrous mixture of two parts of potassium chlorate. 1 part of white granulated sugar, and a small amount of alcohol and a volatile hydrocarbon.—T. St.

XXIII.—ANALYTICAL PROCESSES.

Barium sulphate precipitated in the determination of barium; Purification of ——. F. A. Gooch and D. U. Hill. Amer. J. Sci., 1913, **35**, 311—314.

Mar (Amer. J. Sci., 1891, **41**, 295) has shown that if precipitated barium sulphate containing occluded alkali salts be dissolved in concentrated sulphuric acid and the solution evaporated to dryness, the barium sulphate separates in granular crystals which can be washed free from other sulphates. Great care is needed in the evaporation, which takes several hours with a ring burner, but can be effected in ½ hour with a Hempel burner. The authors have found that if a cone of fine platinum gauze be fitted into the mouth of the crucible, the evaporation can be effected in ½ hour, without loss by spattering, by means of an ordinary blast-lamp, the flame of which is directed downwards against the apex of the cone.—A. S.

Potassium as platinichloride; Determination of ——. G. Meillère. J. Pharm. Chim., 1913, **7**, 281—282.

In determining potassium as platinichloride in the presence of sodium, the latter metal sometimes forms a compound insoluble in alcohol. This may be avoided by adding only a slight excess of platinum chloride and by the use of acetone instead of alcohol.—F. Shdn.

Niobium and tantalum separations [and determination], especially by means of potassium chloride in hydrofluoric acid solution. E. Meimberg and P. Winzer. Z. angew. Chem., 1913, **26**, 157—158.

Potassium tantalum fluoride is precipitated almost quantitatively, from solution in aqueous hydrogen fluoride on addition of potassium chloride, one re-precipitation being sufficient to render the precipitate free from niobium, and the following method of analysis, based on these facts, is given:—30 grms. of ore are decomposed by means of potassium bisulphate, an aliquot portion of the purified acids (5—10 grms.) is dissolved in hydrofluoric acid (sufficient for the formation of double potassium fluorides), and the solution mixed with a saturated solution of potassium chloride and allowed to cool, the total volume being so adjusted that the potassium niobium fluoride may remain in solution (its solubility being 1 in 12). The potassium tantalum fluoride, thus precipitated, is washed with potassium chloride solution and is then converted into tantalic acid by evaporation with sulphuric acid and again precipitated from hydrofluoric acid solution with potassium chloride, or, the double fluoride is dissolved in water containing hydrogen fluoride, potassium chloride is added, and the mixture allowed to cool completely. The double fluoride precipitate is converted into tantalic acid by heating with sulphuric acid, and the residue boiled with water containing hydrochloric acid and with ammonia and weighed as the oxide, Ta_2O_5, its freedom from niobium being finally tested colorimetrically. Niobic acid is determined in the solution, and titanic acid estimated colorimetrically in the obtained acid. The method is claimed to be well suited for the preparation of tantalic acid on the commercial scale, for which purpose finely powdered columbite or tantalite is treated in a rubber-lined vessel with about an equal quantity of crude concentrated hydrofluoric acid, whilst stirring and introducing steam at 3—4 atmos. The clear warm solution is then precipitated with the necessary quantity of a saturated solution of potassium chloride, as above, and the double fluoride, after conversion to the acid and purification, is again precipitated with potassium chloride from hydrofluoric acid solution. The product, which contains very little niobium, may be obtained entirely free from this element by recrystallisation from water containing hydrofluoric and hydrochloric acids. Experiments with oxalic acid and hydrochloric acid show that niobic acid is much less soluble when tantalic acid is present, and the lower oxides of niobium obtained by reducing niobic acid with zinc and hydrochloric acid, although readily soluble in hydrochloric acid, are found to be insoluble in the presence of tantalic acid. The separation of niobium and tantalum by the method of Weiss and Landecker, both in its original form (this J., 1909, 1169) and as modified by Hauser and Lewite (this J., 1912, 126), has given unsatisfactory results.—F. Sodn.

Copper ; Electroanalytical separation of —— from tungsten and molybdenum. W. D. Treadwell. Z. Elektrochem., 1913, **19**. 219—221.

When copper is present as chloride, nitrate, sulphate, phosphate or acetate, and tungsten as alkali tungstate, the copper is easily separated with an E.M.F. of 2 volts, if excess of ammonia and some ammonium sulphate are added to the solution. For the separation of copper from molybdenum, 2 volts is too high an E.M.F., since after reduction of the molybdate the black hydroxide is precipitated with the copper. In the presence of alkali sulphite which reduces the copper salt but not the molybdate, copper can be quantitatively separated with an E.M.F. of 0·9 to 1 volt. The current in this case is most conveniently obtained from an Edison accumulator.

—W. H. P.

Tin ; Volumetric determination of —— with potassium bromate by the method of H. Zschokke. F. Fichter and E. Müller. Chem.-Zeit., 1913, **37**, 309.

The method, which is based on the fact that stannous chloride, in presence of excess of hydrochloric acid, reduces bromates quantitatively to bromides in accordance with the equation : $3SnCl_2+6HCl+HBrO_3=3SnCl_4+HBr+3H_2O$, is carried out as follows :—0·15 grm. of aluminium wire (in pieces) is added to 20 c.c. of a slightly acid solution of stannous or stannic chloride, containing about 5·95 grms. of tin per litre, the mixture is allowed to stand for a short time, and the tin, which is thus precipitated (aluminium going into solution), is redissolved, as stannous chloride, by adding a mixture of 30 c.c. of concentrated hydrochloric acid and 20 c.c. of water, closing the containing flask with a Bunsen valve, and gradually heating to boiling ; the valve is then closed, the flask cooled, and the cold solution titrated as quickly as possible with a potassium bromate solution, containing in the litre 1/60 grm.-mol. = 2·7837 grm. $KBrO_3$, until a yellow colour appears (indicating liberation of bromine by interaction of hydrogen bromide and the excess bromic acid). The bromate solution is standardised iodometrically. The process may be employed in the presence of phosphoric acid and is said to be both rapid and accurate ; although devised specially for use in silk-dyeing works, it may be applied to the analysis of alloys and of tin compounds generally.—F. Sodn.

Chromium, vanadium and iron ; New method for the volumetric determination of —— in the presence of one another. F. W. Atack. Analyst, 1913, **38**, 99—102.

The method of determining molybdenum (this J., 1911, 450) and of determining tin in the presence of antimony (this J., 1913, 163) is not applicable to vanadium, owing to the slowness of the conversion of the VCl_3, first formed, into VCl_4. A method has therefore been based upon the oxidation of the leuco-dyestuff (Methylene White) by means of vanadate (V_2O_5), and determinations of the amount of Methylene Blue produced, whence the amount of available oxygen ($2V_2O_5=2V_2O_4+O_2$) can be calculated. In an analogous manner chromates are quantitatively reduced to chromic salts by Methylene White ($4CrO_3=2Cr_2O_3+3O_2$), whilst ferric salts are reduced to ferrous salts. In determinations based on these reactions there must be no nitric acid present. A solution of Methylene Blue (hydrochloride free from zinc) containing 4 grms. per litre is a suitable strength to use, and it should be standardised by one of the methods previously described (this J., 1913, 163), preferably that in which pure potassium chlorate is used. A definite volume of the standard Methylene Blue solution is heated to boiling with dilute hydrochloric acid in a current of carbon dioxide, and titrated while warm with titanous chloride solution until colourless. In this way the titanous chloride solution is standardised, while the Methylene White solution is left ready for the addition of the oxidising agent. An excess of Methylene White must be present to prevent the formation of chlorine (which would destroy some of the Methylene Blue), whilst all titrations must be done in an atmosphere of carbon dioxide, and at a temperature above 40° C., to obtain a sharp end-point. *Chromium* :—The chromium salt is oxidised to chromate by means of sodium peroxide, the excess of which is subsequently removed by boiling. A definite quantity of this chromate solution is added to the solution of Methylene White (obtained as described) and the Methylene Blue determined by titration with titanous chloride. *Chromium in presence of iron* :—The solution is oxidised with sodium peroxide, the excess of the latter destroyed by boiling, and the precipitate dissolved by the addition of dilute sulphuric acid. A measured quantity of the solution is then added to the Methylene White solution, and the Methylene Blue titrated with titanous chloride, the result corresponding to the iron as ferric salt and chromium as chromate. Iron is next separately determined by boiling an aliquot portion of the solution with hydrochloric acid, and, after complete reduction of the chromate, diluting the liquid to a definite volume, and adding a measured quantity to the Methylene White solution. In the case of ferro-chrome or chromium steel a weighed quantity of the powder or drillings is fused with sodium hydroxide and sodium peroxide, the mass extracted with water, the ferric hydroxide separated, and the chromate estimated in the filtrate by the Methylene White process. Or the iron and chromium may be estimated together, as described above, and the chromium found by difference. *Vanadium* :—The process is carried out in the same way as with chromium (after oxidation of the solution with sodium peroxide) which also applies to the determination in the presence of iron. *Chromium, vanadium and iron* :—After oxidation of the solution and addition of dilute sulphuric acid, aliquot portions are taken for the determinations :—(1) : Chromate, vanadate, and ferric salts are determined together by the Methylene White process. (2) Another portion is evaporated with concentrated hydrochloric acid to reduce the chromate and vanadate, and the residual ferric salt determined as in (1). (3) A third portion is reduced with sulphur dioxide, which, after a few minutes' boiling, is replaced by a current of carbon dioxide. The liquid is next oxidised with permanganate solution until faintly pink, and is then diluted to a definite volume, and an aliquot portion analysed by the Methylene White method. The result gives the vanadate and the ferric salt. In the case of chromium vanadium steel, fine drillings of the sample are fused with sodium hydroxide and sodium peroxide, the mass digested with water on the water bath, and the iron hydroxide separated by filtration. The vanadate and chromate in the filtrate are then determined as described above. The method is not applicable in the presence of tungsten or molybdenum.—C. A. M.

Manganese and chromium ; Determination of small quantities of —— in minerals and rocks. M. Dittrich. Z. anorg. Chem., 1913, **80**, 171—173.

The usual method of estimating small quantities of manganese in minerals is to oxidise with persulphate and silver nitrate and to determine the permanganate colourimetrically. In the presence of chromium, however, the colour produced is not a pure violet and cannot be readily compared with that of pure permanganate. To remove the chromium the coloured solution is treated with excess of ammonia and warmed. In this way manganese (with iron) is precipitated and chromium remains in solution as chromate. The precipitate can then be re-dissolved in the presence of a little sulphurous acid or hydrogen peroxide, and again oxidised to produce a satisfactory comparison solution. The chromium can be determined in the filtrate colourimetrically by removing the silver with sodium chloride, evaporating to small bulk, and comparing the colour with that of a solution containing a known amount of potassium chromate. At least 2 mgrms. of chromium must be present to give good results.
—W. H. P.

Arsenic ; Detection of —— by Bettendorf's reagent. L. W. Winkler. Z. angew. Chem., 1913, **26**, 143—144.

Most text-books direct that Bettendorf's reagent should only be used cold, since, on heating, the stannous chloride reduces any sulphuric acid and sulphides are formed. In the author's experience this is not the case. For the preparation of the reagent, 100 grms. of clear crystals of stannous chloride are dissolved in sufficient of the strongest commercial hydrochloric acid (36—38 per cent.) to make 1 litre of solution. The solution becomes slightly brown on standing, owing to the presence of traces of arsenic in the acid, and must not be used until the liquid is completely clarified. Clarification requires several days in a stoppered bottle standing in a warm place. It may be assisted after the first day by adding to a litre of the solution about 1 grm. of very finely powdered glass and shaking. The clear colourless liquid is decanted off for use. For the test, about 2 c.c. of the solution to be tested, prepared as far as possible with hydrochloric acid, are treated in a test-tube with 10 c.c. of the reagent, heated to boiling, and laid aside for half an hour. In testing concentrated sulphuric acid for arsenic, about 1 c.c. is diluted with an equal volume of water and then mixed with 10 c.c. of the reagent. The test is apt to fail if an insufficient quantity of the reagent be employed. The limit of sensitiveness of the test, using the above quantities, is about 0·001 grm. of arsenious oxide per litre ; 0·01 grm. per litre shows a strong reaction after half an hour. The test as described above has been adopted in the Hungarian Pharmacopœia, Ed. III.
—J. F. B.

Oxygen in organic compounds ; Direct determination of ——. M. C. Boswell. J. Amer. Chem. Soc., 1913, **35**, 284—290.

The method depends upon the fact that when a substance containing carbon, hydrogen, and oxygen is strongly heated in a current of hydrogen and the products are passed over a long layer of white hot charcoal, the oxygen present is completely converted into water, carbon dioxide, and carbon monoxide. It is applied by decomposing a known amount of substance (about 0·3 grm.) and determining the weight of each product. The substance is introduced into a silica boat in the hinder part of a quartz tube, 98 cm. long and 13 mm. internal diameter, 40 cm. of which are tightly packed with charcoal particles (free from dust), about 1 cb. mm. in size. A special form of generator for the production of electrolytic hydrogen, which is passed over white hot copper gauze (to get rid of oxygen) and very thoroughly dried before use, is described, and apparatus for the absorption of the water and carbon dioxide formed, as well as for the subsequent treatment of the carbon monoxide. This last gas is oxidised to carbon dioxide by passage through a U-tube containing iodine pentoxide, supported on asbestos ; the temperature is maintained at 160°—170° C., by means of an oil-bath, which also holds a second tube containing copper, to absorb any iodine liberated, and the carbon dioxide formed is finally absorbed by soda-lime. Detailed instructions are given for conducting the analysis, the heating operation requiring 1½ to 1¾ hours, and about the same degree of accuracy is claimed for the method as that obtainable in the determination of carbon and hydrogen by combustion.—F. Sodn.

Identification of fibres of animal and vegetable origin. Dreaper. *See* V.

Hydrolytic classification and testing of glasses. Mylius. *See* VIII.

Thiocyanate-permanganate method for copper in ores. Demorest. *See* X.

Electrolytic determination of copper in ores containing arsenic, antimony, or bismuth. Demorest. *See* X.

Determination of copper in white metal. Ibbotson and Aitchison. *See* X.

Determination of tin in bronzes. Ibbotson and Aitchison. *See* X.

Constitution and analysis of aluminium alloys. Von John. *See* X.

Hardened oils. Knapp. *See* XII.

Determination of solid fatty acids by Hehner and Mitchell's method. Heiduschka and Burger. *See* XII.

Detection of sulphite-cellulose extract. Loveland. *See* XV.

Use of chromed gelatin in tannin analysis. Giusiana. *See* XV.

Provisional method of analysis of lime liquors. *See* XV.

Results of sugar determinations according to the directions of the Committee on leather analysis, Amer. Leather Chem. Assoc. Paessler. *See* XV.

Determination of sugar [*dextrose*]. Bang. *See* XVII.

Detection of commercial invert sugar [*in honey*] *with β-naphthol.* Litterscheid. *See* XVII.

Electrolytic method for the determination of tin in canned food products. Cushman and Wettengel. *See* XIXa.

Antipyrine in toxicological analysis. Lander and Winter. *See* XX.

The determination of benzoic acid in milk. J. F. Liverseege and N. Evers. *See* Birmingham Section, p. 319.

Notes on thermometry. J. H. Coste. *See* London Section, p. 341.

Patent.

Pyrometer. F. J. Nice, Pontiac, Mich. U.S. Pat. 1,054,442, Feb. 25, 1913.

The pyrometer wires are connected with a plug which can be fitted into a socket. The line wires also connect with the socket, and the effects of the temperature to be measured, are confined to the pyrometer wires by circulating a cooling medium about the socket and line wires.
—T. St.

XXIV.—MISCELLANEOUS ABSTRACTS.

Pressures; Effect of high —— on the physical and chemical behaviour of solids. J. Johnston and L. H. Adams. Amer. J. Sci., 1913, 35, 205—253.

The authors critically review the existing knowledge of the effect of high pressures on solids and endeavour to reconcile some of the many contradictory statements that have been made. The subject is treated under the following headings: general effects of uniform pressure; general effects of non-uniform compression; correlation of the mechanical properties of metals with the (unequal) pressure required to depress their melting points to ordinary temperature; effect of compression of one-component solid systems; effect of compression in promoting chemical reaction between solids; the work of G. Spezia (this J., 1911, 550; 1912, 260); inter-diffusion of solids. It is pointed out that in any discussion of the effect of high pressures, a clear distinction must be drawn between uniform and non-uniform pressure. Neglect of this distinction is the cause of many of the contradictory statements that have been published. Uniform pressure usually causes a slight rise in the melting point (seldom greater than 10° and never greater than 30° C. per 1000 atmospheres; see this J., 1911, 809); its effect on solubility is so slight as to be negligible compared with that of temperature; and it has only a slight influence on reaction velocity. Non-uniform pressure produces considerably greater effects than uniform pressure. It lowers the melting point and increases the solubility by amounts many times greater than the corresponding changes with uniform pressure. The characters of a solid which mainly determine how far it is affected by high pressures are its melting point, latent heat of fusion, and density. The authors calculated the pressure (non-uniform) required to depress the melting points of twelve metals to the ordinary temperature, and it was found that when the metals were arranged in the order of these melting pressures, the same sequence was obtained as when they were arranged in the order of their flow pressure, tensile strength, elastic limit, hardness, compressibility, elastic modulus, or rigidity modulus. This suggests that the "flow" of metals—or indeed every permanent distortion of a crystalline aggregate—is due to an actual fusion (with subsequent re-solidification) of some of the particles.—A. S.

Enzyme action; Studies on ——. IV. Occurrence of a urease in castor beans. K. G. Falk. J. Amer. Chem. Soc., 1913, 35, 292—294.

Experiments made by digesting a solution of urea with material prepared from castor bean kernels by exhausting with ether and grinding to an impalpable powder, have shown that castor beans contain a urease which is rendered inactive by heating in aqueous solution or suspension.
—F. Sodn.

Books Received.

Agricola, Georgius; "De Re Metallica." Translated from the first Latin Edition of 1556 by H. C. and L. H. Hoover. The Mining Magazine, Salisbury House, London, E.C. 1912.

Volume measuring 14 ins. × 9 ins., contains 640 pages, bound in parchment, containing a biographical introduction, annotations, and appendices upon the development of mining methods, metallurgical processes geology, mineralogy, and mining law, from the earliest times to the 16th century. This work was for 180 years the textbook and guide to miners and metallurgists, and until Schlüter's great work appeared in 1738 it is said to have had no equal. It passed through ten editions in three languages. Though the methods and processes described in it have long been superseded, it appeals to those miners and metallurgists interested in the history of their own profession.

The Chemical Trade Directory of Chemical Manufacturers, Merchants, Brokers, and Agents, and Makers of Chemical Plant in Great Britain and Ireland. Fifth Edition, 1913. Davis Bros., 265, Strand, London, W.C. Price 10s.

Volume measuring 10ins. × 6½ins., and containing 458 pages, is arranged in three parts; as follows: (1) Alphabetical list of names with addresses; (2) Classified lists of chemical products, etc., with the names and locations of the makers; (3) Useful information on the Alkali, etc., Works Regulation Act, Alkali Inspector's report for 1911, census of production, price diagrams, exports and imports of chemicals and allied products, and the Factory and Workshop Act.

Chloride of Lime in Sanitation. Albert H. Hooker. Hooker Electrochemical Co., Niagara Falls, N.Y., U.S.A. 1913. Price 12s. 6d net..

Volume measuring 9 ins. × 6 ins., and containing 224 pages and index, with data on the use of chloride of lime in sanitation, water purification, sewage disinfection, street sprinkling and flushing, epidemics, surgery, on the farm, and against flies, together with abstracts and references from current scientific literature on sewage pollution, disposal and sterilisation, typhoid fever and other water-borne diseases, bacteriology of water, relative bacterial efficiencies, infection by flies, dust, and other agencies, street cleaning, and standardisation of disinfectants.

Patent Office Library, Guide to the Search Department of the ——. The Patent Office, 25, Southampton Buildings, London, W.C. Price 6d.

This, the fourth edition of the work (6½ ins. × 4¼ ins.), contains 154 pages and is an abridgment of a more extensive collection of notes kept in the Library for the benefit of searchers. Two appendices follow, one a concordance to the Patent Classifications of England, Germany, and the United States, and the other a select dictionary of words and phrases associated with patented inventions. This handbook indicates in what publications, and for what periods applications for and grants of patents, and registration of trade marks and designs are recorded, the methods of the classification of such material, and other administrative matters, all arranged under the names of countries.

Pyrites in Canada. Its Occurrence, Exploitation, Dressing, and Uses. By A. W. G. Wilson, Chief of the Metal Mines Division. Canada Dept. of Mines, Ottawa, No. 167.

This report contains 202 pages (10 in. by 6¾ in.). After an introductory chapter on sulphur and its compounds, the work deals with the mining, dressing, and roasting of pyrites, the manufacture of sulphuric acid, and the use of pyrites in paper making. A map showing the pyrites mines in Eastern Canada, and 56 illustrations are included.

Traité de la Couleur au Point de Vue Physique, Physiologique et Esthétique, comprenant l'exposé de l'état actuel de la Question de l'Harmonie des Couleurs. Par M. A. Rosenstiehl, D. ès Sc. Professeur au Conservatoire National des Arts et Métiers de Paris, etc. H. Dunod et E. Pinat. 47 et 49, Quai des Grands-Augustins. Paris (VI^e^). 1913. Price 20 fr.

8vo volume measuring 10 by 6½ ins., and containing 278 pages of subject matter with 56 illustrations and 14 coloured plates, followed by an alphabetical index of subjects. The subject matter is classified as follows:—I. The three significations of the word "Colour." II. Difference between the mixture of materials and the mixture of sensations. III. Definitions of colours. IV. Description of apparatus. V. Degradation of white and of colours bordering upon black. VI. Definition of colours. Mixed sensations. VII. Mixture of colouring matters with non-colours, whites or blacks. VIII. Influence of illumination on colour. IX. The phenomenon of complementary colours.

Is it physical or physiological? X. Mixed colours. Theory of the three primary colours. XI. Chromatic structures. XII. Study of Chevreul's chromatic circle. XIII. Theory of the three fundamental sensations. XIV. Colours tabulated according to Young's theory. XV. Maxwell's diagram. XVI. Various methods of producing the sensation of colour. XVII. Photography of colours. XVIII. Conditions of the harmony of colours. XIX. Adaptation of colours, etc. XX. Art. XXI. Harmony of colours. XXII. Practical directions and indications. XXIII. Tints derived from two complementary colours. XXIV. Colouring for the production of a combined effect. XXV. Colouring derived from more than two tints.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Hirschfield*, C. F., and W. N. *Barnard*: Elements of Heat Power Engineering. 8vo. Chapman and Hall. London. 1913. Net 21s.

Mayer, Dr. K.: Beiträge zur Theorie der Kolbenpumpen. [Aus: "Die Fördertechnik."] 4. Tl. (IV u. S. 71—102 m. Fig.) Lex. 8°. Wittenberg. A. Ziemsen. 1913. M. 1.75.

Patchell, W. H.: Application of Electric Power to Mines and Heavy Industries. 8vo, pp. 350. Constable. London. 1913. Net 10s. 6d.

IIA. *Wilson*, F. H.: Coal; its Origin, Method of Working, Preparation for the Market. Cr. 8vo. pp. 140. I. Pitman. London. 1913. Net 1s. 6d.

Recktenwald, J.: Die Bekämpfung des gefährlichen Kohlenstaubes. [Aus: "Berg- u. hüttenmänn. Rundschau."] (8 S.) gr. 8°. Kattowitz. Gebr. Böhm. 1912. 60 Pf.

Schömburg, W.: Verwendung des Teeröls f. Kraftmaschinenzwecke u. industrielle Feuerungsanlagen. [Aus: "Berg- u. hüttenmänn Rundschau."] (17 S. m. 2 Fig.) gr. 8°. Kattowitz. Gebr. Böhm. 1912. M. 1.

V. *Copeland*, M. T.: The cotton manufacturing industry of the United States; awarded the David A. Wells prize for the year 1911–12 and published from the income of the David A. Wells fund. Cambridge, Mass., Harvard Univ. c. 1912. 12+415 p. (7 p. bibl.) O. (Harvard economic studies.) 1913. $2.

VII. *Doelter*, C.: Ueber einige neue Färbungsversuche durch Radiumstrahlung. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (6 S.) gr. 8°. Wien, A. Hölder. 1912. 30 Pf.

Rutherford, Prof. E., u. Miss H. *Robinson*: Wärmeentwicklung durch Radium u. Radiumemanation. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (26 S.) gr. 8°. Wien, A. Hölder. 1912. 95 Pf.

Thaller, R.: Ueber das Radium E. (Aus dem physikal. Institut der k. k. Universität in Innsbruck.) [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (18 S. m. 7 Fig.) gr. 8°. Wien, A. Hölder. 1912. 85 Pf.

Doelter, C., u. E. *Dittler*: Ueber einige Mineralsynthesen. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (18 s.) gr. 8°. Wien, A. Hölder. 1912. 52 Pf.

Donath, Prof. E., u. A. *Indra*: Die Oxydation des Ammoniaks zu Salpetersäure u. salpetriger Säure. [Aus: "Sammlg. chem. u. chem.-techn. Vortr."] (110 S. m. 10 Abbildgn.) Lex. 8°. Stuttgart, F. Enke. 1913. M. 4.50.

VIII. *Schmidt*, R.: Der Poterieguss u. seine formmaschinenmässige Herstellung. (16 S. m. 15 Abbildgn.) Lex. 8°. Berlin, J. Springer. 1913. M. 1.

IX. *Campanella*, G.: Costruzioni in cemento armato. 2 vol. Napoli. 8°. 1913. Lire 20.

Cochran, J.: A Treatise on Cement Specifications. 8vo. Constable. London. 1913. Net 6s.

Danusso, A.: Beitrag zur Berechnung der kreuzweise bewehrten Eisenbetonplatten u. deren Aufnahmeträger. Bearb. nach den Veröffentlichgn. des Verf. in der Zeitschrift "Il cemento" (Heft 1—10, Jahrg. 1911), von H. v. Bronneck. (XI, 114 S. m. 22 Abbildgn.) Lex. 8°. Berlin, W. Ernst & Sohn. 1913. Cloth M. 6.50.

Jones, B. E., Ed.: Reinforced Concrete. A Complete Treatise of the Practice and Theory of Modern Construction in Concrete Steel. 4to, pp. 418. Cassell. London. 1913. Net 15s.

Thullie, Prof. M. v.: Weitere Versuche m. exzentrisch belasteten Eisenbetonsäulen. (IV, 80 S. m. 56 Abbildgn. u. 2 Taf.) Lex. 8°. Wien, F. Deuticke. 1912. M. 7.

X. *Bergwerke u. Hütten Deutschland's*: Jahrbuch der gesamten Montan- u. Hütten-Industrie Deutschlands. 10. Jahrg. 1912/13 m. e. Lebensabriss u. Bildnis v. A. Thyssen. 2 Bde. (XIX, 314, 152, 446, 135 u. XV, 314, 152, 291 u. 107 S. m. Abbildgn. u. Taf.) 8°. Berlin, H. Meusser. 1913. Cloth M. 15.

Hudson, O. F.: Iron and Steel. An Introductory Text-Book for Engineers and Metallurgists, with a section on Corrosion by G. D. Bengough. 8vo, pp. 184. Constable. London. 1913. Net 6s.

Lewis, J. V.: Determinative Mineralogy with Tables. Cr. 8vo. Chapman & Hall. London. 1913. Net 6s. 6d.

Schmidt, R.: Die moderne Gussputzerei m. besond. Berücksicht. des Sandstrahlgebläses. (16 S. m. 6 Fig.) Lex. 8°. Berlin, J. Springer. 1913. M. 1.

Wien, W.: Zur Theorie der elektrischen Leitung in Metallen. [Aus: "Sitzungsber. d. preuss. Akad. d. Wiss."] (S. 184—200 m. Fig.) Lex. 8°. Berlin, G. Reimer. 1913. M. 1.

XII. *Schaal*, J.: Die moderne Toiletteseifen-Fabrikation unter besond. Berücksicht der Fabrikations-Schwierigkeiten u. deren Beseitigung. Nebst e. Abschnitt üb. medizin. Seifen u. e. Anh. üb. Betriebskontrolle u. Kalkulation. (VII, 319 S. m. 47 Fig.) gr. 8°. Augsburg, Verlag f. chem. Industrie. 1913. Cloth M. 8.

XVI. *Houtermans*, E.: Ueber angebliche Beziehungen zwischen der Salpetersäureassimilation u. der Manganabscheidung in der Pflanze. (Aus. dem pflanzenphysiolog. Institute der k. k. Universität in Wien.) [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (31 S. m. 2 farb. Taf.) gr. 8°. Wien, A. Hölder. 1912. M. 1.30.

XVII. *Feitler*, Prof. S.: Technologie der Landwirtschaftlichen Industrien. 1. Teil. Die Zuckerfabrikation. Kurzgefasstes Lehrbuch f. Studierende, Beaamte und Praktiker. (VIII. 182 S. m. 75 Abbildgn.) Gr. 8°. Wien, A. Hölder. 1913. Cloth M. 4.80.

XVIII. *Marescalchi*, A.: L'analisi del vino e la ricerca delle sofisticazioni: mosti, filtrati, vini. Casale Monferrato, 16°. fig., p. ix, 268. 1913. Lire 4.

Vandone, E.: Manuale del liquorista: prontuario completo di liquoreria, contenente 2500 formule per la fabbricazione degli idrolati, alcoolati, essenze, estratti, liquori, sciroppi, cocktail. Casale Monferrato, 16°. p. xi, 328. 1913. Lire 5.

XIXA. *Grafe*, Dr. V.: Untersuchungen üb. die Herkunft des Kaffeols. (Aus dem pflanzenphysiolog. Institute der k. k. Universität in Wien.) [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (18 S.) gr. 8°. Wien, A. Hölder. 1912. 52 Pf.

Lebensmittelgewerbe, Das. Ein Handbuch f. Nahrungsmittelchemiker, Vertreter v. Gewerbe u. Handel, Apotheker-Ärzte, Tierärzte, Verwaltungsbeamte u. Richter. Hrsg. von Prof. K. v. Buchka. Mit zahlreichen Taf. u. Abbildgn. (In ca. 30 Lfgn.) I. Bd. 1. Lfg. (S. 1—48.) Lex. 8°. Leipzig, Akadem. Verlagsgesellschaft. 1913. M. 2.

XIXB. *Grassberger*, Prof. R.: Die Desinfektion in Theorie u. Paxis f. Ärzte. Chemiker u. Ingenieure. (VIII, 315 S. m. 94 Abbildgn.) Lex. 8°. Leipzig, S. Hirzel. 1913. Cloth M. 13.50.

Greene, A. M. : The Elements of Heating and Ventilation. Svo. Chapman and Hall. London. 1913. Net 10s. 6d.

Wolfmann, J. : Die Gefahren des Leuchtgases als Licht- u. Heizquelle in Wohnräumen. Beiträge zur Hygiene der Gasbeleuchtg. m. besond. Berücksicht. der Ausführgn. des Herrn Albrecht u. anderer Gasfachmänner. (27 S.) gr. 8°. Berlin, F. Siemenroth. 1913. M. 1.

XX. *Dieterich*, E. : Neues pharmazeutisches Manual. 11., verm. Aufl. Hrsg. v. Dr. K. Dieterich. (VIII, 776 S. m. 148 Fig.) gr. 8°. Berlin, J. Springer. 1913. Cloth M. 20.

Haskins, H. D. : Organic chemistry; including certain portions of physical chemistry for medical, pharmaceutical, and biological students; with practical exercises. 2d ed. N.Y., Wiley. c. 430 p. figs. 12°. 1913. $2.

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Mann, H. : Die moderne Parfümerie. Eine Anweisg. u. Sammlg. v. Vorschriften zur Herstellg. sämtl. Parfümerien u. Kosmetika unter besond. Berücksicht. der künstl. Riechstoffe, nebst e. Anh. üb. die Parfümierg. der Toiletteseifen. Unter Mitwirkg. v. Fachkollegen hrsg. 3. verm. u. verb. Aufl. (VIII, 609 S.) gr. 8°. Augsburg, Verlag f. chem. Industrie. 1912. Cloth M. 13.50.

Rockwood, E. W. : An introduction to chemical analysis for students of medicine, pharmacy and dentistry. 4th rev. ed.; with 20 illustrations. Phil., Blakiston. c. 15+247 p. il. 8°. 1913. $1.50.

Sodemann, R. : Unsere Arzneimittel gemeinverständlich dargestellt. (VIII, 648 u. XXVIII S.) 8°. Lüneburg, H. Rathmacher. 1913. Cloth M. 6.

XXIII. *Biltz*, H. : Qualitative Analyse anorganischer Substanzen. 4. Aufl. (III, 64 S. m. 8 Fig.) gr. 8°. Leipzig, Veit & Co. 1913. Cloth M. 2.40.

Testing materials; International Association for. Vienna. Proceedings Jan. 10, 1913. Vol. 2, No. 14, 8vo, swd. Spon. London. 1913. 1s.

XXIV. *Grossmann*, J. : The Elements of Chemical Engineering. 2nd edition, revised. Cr. 8vo. pp. 160. C. Griffin. London. 1913. Net 3s. 6d.

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Jahresbericht üb. die Fortschritte der Chemie u. verwandten Teile anderer Wissenschaften. Begründet v. J. Liebig u. H. Kopp, hrsg. v. J. Tröger u. E. Baur. Für 1909. 13. Heft. (X. u. Register S. 1889—2176.) gr. 8°. Braunschweig, F. Vieweg & Sohn. 1913. M. 15. (1909 complete: M. 159).

Scientific American Reference Book, 1913. Cr. 8vo. Spon. London. 1913. Net 7s. 6d.

Year Book on the Scientific and Learned Societies of Great Britain and Ireland, 1912. Compiled from Official Sources. 8vo, pp. 382. C. Griffin. London. 1913. 7s. 6d.

[*] Dissertations.

[Prices vary, ranging from two to three shillings.]

III. *Klingenberg*, K. L. : Ueber den 2-Anthrachinonaldehyd. Berlin-Charlottenburg. 1912. 51 S. 8°.

Miller, P. Ch. : Ueber Carboxylierung einiger fettaromatischer Kohlenwasserstoffe mittels Oxalylchlorid. Berlin. 1912. 39 S. 8°.

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VII. *Carter*, F. E. : Ueber die Verbrennung von Wasserstoff mit Sauerstoff. Karlsruhe. 1912. 21 S. m. 5 Textfig. u. 1 Taf. 8°.

Greeff, M. : Ueber die Bildungstemperaturen des Kalziumkarbids. Hannover. 1912. 42 S. m. 3 Tab. u. 8 Skizzen. 8°.

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Schlumberger, E. : Ueber die statische Bestimmung des Ammoniakgleichgewichtes in der Nähe von 500° C. Karlsruhe. 1912. 43 S. m. 3 Fig. 8°.

Schröder, K. : Studien über die Mitwirkung des Luftsauerstoffes bei der Oxydation der Oxalsäure durch höhere Manganoxyde. Giessen. 1912. 29 S. 4°.

X. *Gellert*, O. : Eisen und Alteisen in ihren technischen u. wirtschaftlichen Beziehungen. Dresden. 1912. 78 S. 8°.

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Kühnel, R. : Das Verhalten gehärteter u. angelassener untereutektischer Stähle. Berlin-Charlottenburg. 1913. 54 S. m. 37 Textfig. 4°.

Markgraf, H. : Experimentelle Untersuchungen über die Verwendung von Braunkohle im Martinbetrieb. Breslau (Techn. Hochsch.). 1912. 20 S. m. 12 Fig. 4°.

Schade, M. : Ueber die Polarisation bei der elektrolytischen Nickelabscheidung. Dresden. 1912. 76 S. m. 16 Taf. 8°.

Theobald, W. : Die Herstellung des Blattmetalls in Altertum und Neuzeit. Hannover. 1912. VIII, 121 S. 8°.

XI. *Reichinstein*, D. : Die chemische Polarisation der umkehrbaren elektrolytischen Elektrode. Zürich. 1911. 23 S. m. 13 Fig. 4°.

Reitlinger, O. : Versuche über den Einfluss der Ueberlagerung von Wechselstrom auf die Gleichstromelektrolyse. Giessen. 1912. 33 S. 8°.

XII. *Miller*, P. : Ueber partielle Verseifung von Triglyceriden. München (Techn. Hochsch.). 1912. 52 S. 8°.

XVII. *Bloch*, L. Fr. : Studien über Rotationsdispersion und Mutarotation der Zuckerarten in Wasser, Pyridin und Ameisensäure. Erlangen. 1912. 72 S. 8°.

XVIII. *Carlson*, T. : Ueber d. Zersetzung v. Asparagin durch Bakterien in Gegenwart v. freiem Sauerstoff. Berlin. 1912. 13 S. m. 1 Fig. 8°.

XXIII. *Müller*, F. : Ueber die Technik der Probenahme und die Analysenmethoden zur genauen Bestimmung kleiner Mengen von schwefliger Säure und Schwefelsäure in Abgasen. Dresden. 1912. 71 S. m. 4 Fig. 8°.

Renner, O. : Ueber die Bestimmung des Fluors. Dresden. 1912. 84 S. 8°.

Stiegler, H. : Ueber eine neue Methode der Rohfaserbestimmung. München (Techn. Hochsch.). 101 S. m. 6 Abb. 8°.

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[*] Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

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Official Notices.

ANNUAL GENERAL MEETING, 1913.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Arts Theatre of the University of Liverpool on Wednesday, July 16th, 1913. A programme of the proceedings will be issued later.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir William Crookes, O.M., F.R.S., has been nominated to the office of President under By-law 20; Sir Hugh Bell, Bart., Prof. W. Hodgson Ellis, and Sir Richard Garton have been nominated Vice-Presidents under By-law 21, and Prof. Marston T. Bogert has been nominated a Vice-President under By-law 20. Mr. Thos. Tyrer and Dr. J. Lewkowitsch have been re-appointed Hon. Treasurer and Hon. Foreign Secretary respectively.

Members are hereby invited to nominate, on or before May 23rd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid, shall receive notice thereof from the Secretary, and shall not be submitted for election.

ELECTIONS OF VICE-PRESIDENT AND ORDINARY MEMBER OF COUNCIL.

Mr. Julian L. Baker has been elected a Vice-President, and Mr. W. J. Atkinson Butterfield an Ordinary Member of Council under By-law 32.

Charles G. Cresswell,
Secretary.

Canadian Section.

Meeting held at Kingston on Friday, February 28th, 1913.

PROF. W. L. GOODWIN IN THE CHAIR.

THE PROBLEM OF THE WASTE LIQUOR FROM SULPHITE PULP MILLS.

BY PROF. W. O. WALKER.

(School of Mining, Queen's University, Kingston.)

This is a subject which one naturally hesitates to present to an audience because the presentation must necessarily consist, for the most part, of an enumeration of a lengthy list of futile attempts at solving the problem. However, some encouragement is secured when one considers the importance of this subject, especially since it is becoming one of the largest sources of waste in Canada. The problem dates back to the beginning of the sulphite pulp industry, and has assumed such acute proportions in some countries that legislation has been enacted with regard to the disposal of this waste and mills have had to be shut down. That condition of affairs has not yet arrived in Canada, mainly on account of its large rivers and sparse population. Since for every ton of pulp produced an equal weight of wood goes into solution, an enormous quantity of organic material is wasted when pulp mills turn out from fifty to several hundred tons of pulp per day. The U.S. Geological Survey estimates that there are more than a thousand million pounds of this organic matter annually discharged into the streams of the United States.

The waste liquor is usually discharged into rivers, and on account of its great volume and high content of organic material there it becomes a source of pollution, renders the water injurious to health, unfit for boiler purposes, and injurious to fish or other life. It causes in many cases the development of algæ, and in the smaller rivers the stream beds are sometimes completely choked with them. Under certain conditions these sulphite wastes develop large quantities of sulphuretted hydrogen, entailing a rapid loss of dissolved oxygen and the death of all animal and plant life in the stream.

There are three different types of waste from the sulphite paper industry: (1) digester liquor and waste water; (2) screen or filter press water: (3) condenser water. The first two are objectionable, the strong digester liquor being the more so.

Composition of the digester liquor.—As it comes from the digesters it is a dark reddish-brown liquid of variable specific gravity about 1·05. It has a peculiar, not unpleasant odour, due to bodies of a terpene nature. By evaporation of the liquor a syrup is obtained which, on further evaporation, changes to a glue-like mass. The dried residue is about 10 to 12 per cent. of the weight of the original liquor. This residue on ignition gives about 12 per cent. of ash, chiefly sulphates of calcium and magnesium. The other 88 per cent. is organic material.

The following substances have been shown to be present in the liquor:—

1. A small quantity of sulphurous acid.
2. A very small quantity of sulphuric acid.
3. As the chief constituent, an organic sulphur compound containing calcium, probably a calcium and magnesium lignin sulphonate.
4. Small quantities of pentoses and pentosans.
5. Mannose, dextrose, and galactose in very small amounts.
6. Free furfural.
7. Traces of vanillin, or a vanillin-like body.
8. Small quantity of a terpene-like substance.
9. Small quantity of free sulphur.

The chief constituent of this liquor may be precipitated by alcohol. It comes down as a dark, gummy mass which becomes brittle by drying. It may also be obtained by concentrating the liquor to a suitable degree, and then salting it out by means of sodium chloride or magnesium sulphate. Concentrated mineral acids precipitate it, as does also lead acetate. The purification of the precipitate is very difficult since it dissolves, apparently, only in water and dilute alcohol, from which it does not crystallize. It yields brominated and chlorinated derivatives, it contains an active carbonyl group and methyl groups, and is a strong reducing agent. The sulphur has been shown by McRae of this University to be in the form of a sulphonic group. This substance, no doubt, is the soluble reaction product from the calcium and magnesium bisulphites on the complex of groups in combination with the cellulose in the ligno-celluloses. These groups are commonly designated as lignin or lignone. Their leading characteristics are those of di-ketones, or more particularly, quinones. The lignone complex is a body of much higher carbon content than cellulose (44 per cent.). The soluble by-products which are, in effect, the lignones in combination with the bisulphite residues, have been separated in various derivative forms and analysed. The empirical formula of $C_{24}H_{24}(CH_3)_2SO_{12}$ has been established for the product precipitated from the waste liquor by hydrochloric acid. The formula of $C_{24}H_{24}(CH_3)_2O_{10}$ has been given to the parent lignone complex.

Our knowledge of the structural relations existing in the lignone group is very limited. What knowledge we have has been gathered from decomposition reactions which are extraordinarily complex and difficult of interpretation. Without entering into particulars in regard to the characteristics of these decompositions with various reagents, it may be stated that they indicate the presence in the lignone complex of hydrocarbon nuclei of very small dimensions together with a high proportion of CO groups alternating in periods of short dimensions with the hydrocarbon groups. Furfural derivatives appear to be present. The presence of CH_3 groups is indicated, as well as a low proportion of OH groups. Apart from these facts the structure is as yet unknown.

Methods proposed for disposal of the waste.—In most plants some treatment is given to the waste before it is discharged into the stream. This consists usually in the removal of the fibre and a partial recovery of the sulphur, or merely neutralisation. A large works in Germany is attempting the disposal of its wastes by cooling and neutralising them, and then discharging them into the city sewers, where the wastes mixed with the domestic sewage are treated on underdrained areas of sandy soils. Another method tried is to cause the liquors to enter sink holes, and mingle with the ground water. This is possible, of course, only where geological conditions are favourable. The substance resulting from the evaporation can be burned in suitable furnaces, and it is claimed that the calorific value is slightly greater than the heat required to evaporate the liquor, the cost of evaporation averaging about 82 cents per 1000 gallons. A number of patents have been taken out for the recovery of sulphur, but the recovery is incomplete since most of the sulphur is combined organically. A process for the destructive distillation of the residue has been patented, but the yield of useful products is too low for economical development. The yield of oxalic acid by fusing the residue with caustic potash has also been found too low. By adding a solution of gelatin to the liquor, a compound has been precipitated, which, when dissolved in weak alkali, has been employed for engine-sizing paper. The sodium salt of ligninsulphonic acid has been produced and employed as a reducing agent in chrome mordanting wool to replace tartaric and lactic acids. The concentrated liquor has been used as an adhesive in foundries for core making. A slag meal rich in phosphorus has been added to the concentrated liquor and used in fertilising land. It is claimed that this renders the phosphorus available as plant food. Patents have been granted for processes involving the use of the liquor for tanning purposes. It has been found that 28 per cent. of the solids is removed by hide powder, but this does not necessarily prove the presence of tannin. It has been found that the liquor in itself is not suitable for tanning, but it is being used at present in conjunction with tanning extracts, and serves the purpose of a filler for the leather.

Mr. R. T. Mohan investigated the subject of tanning at this University, and found that the addition of lactic acid to the liquor improved the tanning properties. He tried the effect of the addition of sulphites and acids on ordinary hemlock bark liquor, finding that they caused swelling, bleaching, and hardening of the leather. He also tried the effect of an addition of sulphites to waste sulphite liquor and found swelling, hardening, and bleaching to occur. He removed the lime and found very little difference in quality of the leather. Removal of the gummy matters destroyed all tanning property, further the gums when redissolved would not tan. However, the addition of lactic acid improved the tanning markedly. During this work it was noticed that according to the different percentages of acid in the liquor, the leathers varied from hard and bleached to black and flabby. Experiments were carried out to determine what relation of tannin to acid was best to produce leather of a good colour and texture. It was found that each acid has a factor for each tanning extract. With bark liquors the best ratio was found to be 0·8 (tans 8°, acid 10) for lactic acid. For sulphite liquors the ratio was 1. For equal parts of sulphite liquor (spruce) and quebracho, the ratio was 0·4. From this it would seem, therefore, that for heavy leather, when acidity of liquor is needed, more uniform and reliable results could be obtained by the proper control of the ratio of acid to tannin in the first half-dozen vat liquors at least. The concentrated liquor has been used to some extent as a binder in coal dust briquetting. It has not proved to be a success, however, partly because of the high percentage of ash, and the fact that the material is not waterproof. It has even been used in combination with molasses and straw as a cattle food.

Most of the uses that have been proposed have been abandoned, either on account of the cost, or of unsuitability for the purposes intended. During the winter of 1910–11 an investigation into the possible use of the liquor for laying the dust of roads was carried on at this University by Mr. R. T. Mohan. Small sample roads were constructed in imitation of the common macadam road. A layer of road dust was placed on top. Three such roads were treated, one with ordinary road oil, another with the same quantity of concentrated (4 : 1) waste liquor, and the third with road oil, followed by waste liquor. These roads were treated with water at intervals of a few days for a period of four months, using a total of ten inches of water, the most at any one time being 2½ inches. These figures correspond closely to the total and maximum rainfall in Ontario during May, June, July, August, and September. The result was that the oil on the first road was practically all washed away, while the second road that was treated with the liquor, and the third road treated with liquor and oil, still presented a hard surface, which after being broken and dried showed very little dust, and did not have the disagreeable odour given off from the oil-treated road. This experiment gives promise of the material finding use in the treatment of roads. The cost, especially in the neighbourhood of pulp mills, should not be prohibitive. Phelps, of the U.S. Geological Survey, carried on a series of experiments to determine if condensation products could be obtained by treating the liquor with aromatic amines. These experiments were based on the assumption that aldehyde groups are present in the organic part of the liquor. He found that, of the amines tried, those retaining the NH_2 group gave bright red products, and those in which substitution had taken place in the NH_2 group gave brown or black compounds. Attempts to diazotise these products failed. When nitrated they gave different coloured products depending upon the amine used. Some of these substances were brilliant dyes. These reactions were carried out without purifying the original amine condensation products. Phelps failed to purify these as he was unable to prevent their decomposition. McRae, of this University, succeeded in preventing this decomposition in the case of aniline by treatment with bromine.

He also showed that substitution had taken place in the amino group of the amine molecule, thus indicating the presence of a free carbonyl group in the original molecule. Phelps obtained a yellow dyestuff by treating the liquor with nitric acid. He failed to learn the structure of this body. It was found that the dyestuff could not be manufactured economically.

Perhaps the most promising method for utilising the liquor is that of the production of alcohol from it. This is being carried out to a considerable extent in Sweden. It has been calculated that nearly two per cent. of the organic material of the liquor is fermentable by yeast. The process consists essentially as follows: The acid of the liquor is nearly neutralised with lime, the liquor is then aerated, and the lime sludge, consisting of calcium sulphate and part of the organic matter, is removed. The clear liquid is now treated with a special yeast cultivated for the purpose, and a weak current of air is blown through the liquid during the fermenting period. The fermentation is completed after four to six days. Upon distillation 1·2 volumes per cent. of alcohol is obtained. The raw alcohol contains cymol, methyl alcohol, acetone, and acetaldehyde as impurities. There is considerable doubt in regard to the market for the large amount of such a grade of alcohol that could be made from such a tremendous supply of raw material. Further, since only about two per cent. of the organic material is utilised, the process does not completely solve the problem of its disposal.

Suggestions for research.—In spite of the fact that a tremendous amount of work has been done on the subject, the problem still remains for the most part unsolved. It is to be noted that most of the investigation work that has been carried on in the past has not been for the purpose of determining the actual structural relations existing in the molecule of the main constituent of the organic substance of the waste liquor. This accounts, no doubt, for the meagre knowledge we possess of this substance. We can scarcely hope to make much advancement in the utilisation of this substance until we know more about its composition. What we need is more purely scientific investigation into the structure of the main organic substance. It is true that such an investigation is beset with great difficulties owing to the inertness of the substance towards solvents. Attempts should be made toward recovery of the sulphur (on the understanding that it is in the form of a sulphonic group).

At present this seems to be a chemical impossibility. If such could be accomplished, however, the cost of the production of pulp would be considerably reduced. The work on the amine condensation products should be extended with the purpose of solving their structure, as well as for working up useful substances from them.

Further work might be done to try to increase the amount of fermentable material for the production of alcohol. The subject of its use in the treatment of roads should be investigated more fully and on existing roads. Its possible use as a binding material should be tried out with a larger number of materials. In connection with this, a method for making it waterproof would be a great help. A patent has lately been granted for obtaining hydrocarbons of formula C_5H_8, and multiples thereof, from carbohydrates. As the liquor contains carbohydrates, it should be possible to obtain turpentine and consequently rubber from the liquor. This should be investigated more fully. In fact, it might well form the subject of a research to be undertaken by the Canadian Government in connection with the conservation of our natural resources.

London Section.

Meeting held at Burlington House on Monday, June 3rd, 1912.

MR. E. GRANT HOOPER IN THE CHAIR.

STUDIES ON OXIDATION.—(*a*) THE NATURE OF THE PROCESS. (*b*) PASSIVE METALS. (*c*) HIGHER METALLIC OXIDES. (*d*) OXIDATION BY PERMANGANATE. (*e*) OXIDATION OF CARBON.

BY PROF. H. E. ARMSTRONG AND R. T. COLGATE.

1. In the essay presented by one of us to this Section in 1905,[1] it is pointed out that the inquiry into the mechanics of fire cannot well be regarded as otherwise than co-extensive with that into oxidation phenomena generally, including those which attend vital changes. The importance of the subject is in no wise diminished in the interval, indeed oxydases are now attracting much attention; the corrosion of metals also seems to be a never-ending topic of discussion; most important of all, the internal combustion engine has suddenly taken possession of the field and the coal strike not only brought the importance of fuel more closely home to the dull brains of the general public but the strike of taxicab drivers has led it even to think furiously about petrol and the value of liquid fuel; lastly, though engineers were convinced that what they did not know about firing boilers was not worth knowing, a chemist who has been guided by the pure light of reason derived from a carefully conducted experimental inquiry has been able to increase, in no small measure, the efficiency of an appliance which must always remain the mainstay of industry in regions where no water power is available.

Nevertheless, the process of oxidation seems to be taboo, as it is undiscussed in the text-books—so complete is the disregard of fundamentals in our academic circles. The ionic mythology is still the subject of popular worship and students of chemistry are content to have their beliefs dictated to them: it is time that they were led to "wake up" and think for themselves.

If we are ever to arrive at an understanding on the moot question of the corrosion of metals and many other cognate subjects, the knowledge hardly won by the efforts of generations of workers must be made available and must be made use of in some better way than is now customary. We are accumulating vast stores of information but are doing little or nothing to codify it—to sift the many tares from the little wheat; each poor beginner has to go through the weary process for himself of making up his mind what small proportion of the statements printed in his books he shall believe, what small proportion is worth remembering. It is true that experience can only be gained; yet more might be done to facilitate the acquisition not of knowledge merely but of judgment—to facilitate the development of some degree of critical power.

What chemists need chiefly is not new knowledge but that the knowledge we have should be sifted, coordinated and critically examined in order that it may be made science. At present, we are too often rank empiricists and have little sense of proportion; far too much of our science is but pseudo-science.

It is from this point of view that we venture to bring the subject of the activities of fire-air again under the notice of the Society.

2. In the present communication, we desire as before to advocate the general thesis that in all cases of oxidation, whether by means of gaseous oxygen or of any of the numerous other oxidising agents at our disposal, the action takes place *within a system* in which oxidising agent and oxidised substance are linked together by an electrolyte, when and whenever but only when such a system is constituted—as in the formation of water, for example:—

$$\underset{\text{Electrolyte}}{\begin{array}{c}\mathrm{H}\\ \dot{\mathrm{H}}\end{array} + \begin{array}{c}\mathrm{HO{\cdot}HX{\cdot}H}\\ \mathrm{HO{\cdot}HX{\cdot}H}\end{array}} + \begin{array}{c}\mathrm{O}\\ \dot{\mathrm{O}}\end{array} = \begin{array}{c}\mathrm{HOH}\\ \mathrm{HOH}\end{array} + \begin{array}{c}\mathrm{HX}\\ \mathrm{HX}\end{array} + \begin{array}{c}\mathrm{HO}\\ \dot{\mathrm{HO}}\end{array}$$

Only an imperceptible amount of the electrolyte may be present but present it must be if any action whatsoever is to take place. No other interpretation is possible apparently, if the process be regarded from an electrolytic point of view—the only point of view from which chemical phenomena can be regarded that has any philosophical or rational foundation.

3. According to our thesis, hydrogen peroxide is a necessary product of the initial change, whenever oxygen is used; it may easily escape notice, however, because, in its turn, it either becomes the oxidising agent or is decomposed.

Although only traces of the peroxide can be detected when hydrogen is burnt in the ordinary way, a high percentage is produced by the action of the "silent" discharge on a mixture of hydrogen and oxygen cooled by liquid air.[2]

M. Traube's observation that hydrogen peroxide is formed when dilute sulphuric acid is electrolysed by reduction of the oxygen present in the solution at the cathode has been confirmed recently by F. Fischer and O. Priess,[3] who have shown that when the oxygen is under pressure the yield of the peroxide is much larger, the hydrogen being practically all peroxidised when the electrolysis is effected in presence of oxygen under 100 atmospheres pressure.

4. As Traube has shown, the production of the peroxide when zinc dissolves in presence of oxygen is easily demonstrated. Following his directions, we have repeatedly obtained at least 75 per cent. of the possible amount.

Using cadmium, we have obtained 85 per cent. of the amount that should be formed if the conversion were complete.

In the case of aluminium, we have succeeded only by using an amalgam of the metal. To prepare the amalgam, 5—10 grms. of mercury was placed in a small test tube drawn out in the middle and closed by a cork carrying tubes permitting the introduction and exit of carbon dioxide. The tube having been filled with the gas and the mercury boiled, the cork was quickly removed, a small quantity of aluminium dropped in and the cork replaced; on boiling the mercury, the aluminium was dissolved. The tube was then sealed off at the constriction.

The tube containing the aluminium was dropped into the flask containing alkali, oxygen and about 50 grms. of mercury and the mixture violently shaken.

Then a further quantity was treated similarly. Success depends on the introduction of small quantities of metal at a time (0·006—0·01 grm.). In each of two experiments in which about 0·068 grm. of aluminium was used, nearly 30 per cent. of the calculated amount of hydrogen peroxide was formed.

5. By using substances such as indigo white and hydrazobenzene, $C_6H_5.NH.NH.C_6H_5$, it is easy to show both that the calculated amount of oxygen is absorbed and that the peroxide formed contains the whole of this oxygen.[4]

The apparatus used by Manchot and Herzog in oxidising indigo-white is shown in Fig. 1. It consists of a flask fitted with a dropping funnel and T-piece, one arm of the latter being connected to a Hempel burette, the other to the top of the funnel.

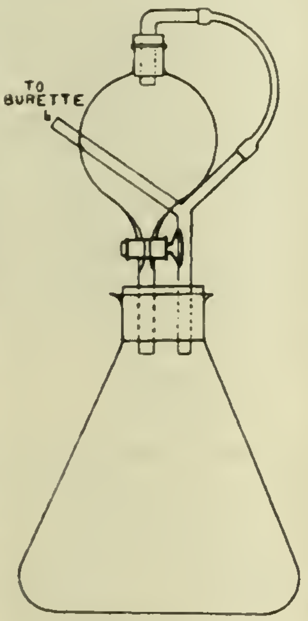


Fig 1.

By means of this side connexion, it is possible to admit liquid to the flask from the funnel during or at the end of the oxidation without opening the apparatus or altering the volume of gas within it.

The indigo-white is oxidised in presence of baryta (50 c.c. of a saturated solution) and when the action is complete a mixture of lead dioxide and sulphuric acid is run in from the funnel.

The volume of oxygen absorbed during oxidation is found, in every case, to be equal to the volume evolved after the admission of the mixture of acid and lead dioxide, showing that the peroxide which is formed contains the whole of the absorbed oxygen.

The oxidation of hydrazobenzene may be carried out in an alcoholic solution in presence of sodium ethylate. One molecule of oxygen is absorbed for every molecule of hydrazobenzene oxidised. The formation of hydrogen peroxide is rendered obvious by the separation of sodium peroxide from the alcoholic solution.

6. It will be seen on reference to the equation in § 2, that primarily there is no direct interaction of hydrogen and oxygen but that the oxygen functions as *depolariser*, each molecule serving only to condition the "hydroxylation" of the particular molecule of hydrogen with which it happens to be in circuit through the agency of the electrolyte.

It is remarkable how little the function of the depolariser is appreciated. The manner in which it acts may be demonstrated in various ways.

The annexed diagram (Fig. 2) represents a voltaic cell in which the positive metal zinc can be coupled with a relatively negative metal such as copper or platinum in an electrolyte such as diluted sulphuric acid. It is worth while to have such a diagram constantly in mind. When the circuit is closed by joining the zinc with the copper, a current flows, the acid is electrolysed and hydrogen is evolved at the negative copper surface, the negative radicle of the acid combining with the equivalent amount of zinc at the positive surface, the current flowing through the electrolyte with the hydrogen from the zinc *anode* to the copper *cathode*. In this case, the hydrogen set free is remote from the metal, and only apparently displaced by the zinc. The conventional equation: $SO_4H_2+Zn=SO_4Zn+H_2$ is, in fact, merely a "statistical" statement, indicating, in algebraic form, the nature of agents and resultants and the proportions in which they interact but in no way expressive of the nature of the process.

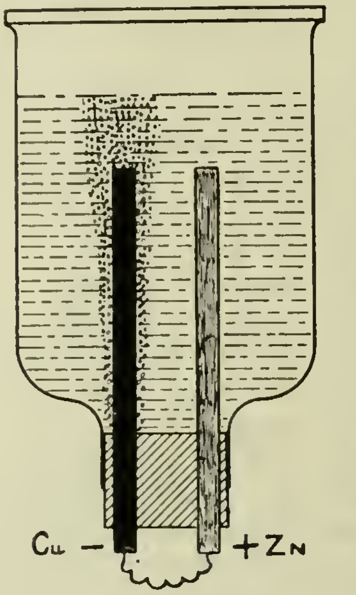
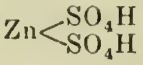


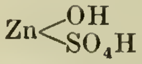
Fig 2.

7. In earlier days, it was customary to speak of the metal "decomposing" the *water* to form zinc oxide, which then *combined with the acid*, forming the zinc sulphate; then, it became customary to think of *the acid as acted upon directly by the metal*; but in these days of ethical looseness, scientific as well as social, suicide is looked upon as the normal course for molecules to pursue on entering solution and their wandering ions are supposed to have no regard for the sanctity of the marriage tie: though the morals of students are still being perverted by the preaching of this doctrine of free love, signs are not wanting that its popularity is waning and that science may be in advance of society in recovering its moral tone.

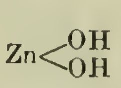
Probably, the ultimate conclusion will be that zinc sulphate exists in solution not as $ZnSO_4$ but as $HO.Zn.SO_4H$ (more or less hydrated) and that a mean of the views held in the early and middle periods is to be taken as the more likely course of change: that is to say, that both water and acid are concerned in the changes. Moreover, there can be little doubt that sulphuric acid, as a rule, acts as a monobasic acid—as $(HSO_4)H$, not as $(SO_4)H_2$; and that in dilute solutions especially the two negative radicles or ions of the electrolyte derived respectively from the acid and the water, HSO_4 and HO, are both active.[5] It is, therefore, conceivable that the three compounds



$\mathrm{Zn}{<}\begin{matrix}\mathrm{SO_4H}\\ \mathrm{SO_4H}\end{matrix}$



$\mathrm{Zn}{<}\begin{matrix}\mathrm{OH}\\ \mathrm{SO_4H}\end{matrix}$



$\mathrm{Zn}{<}\begin{matrix}\mathrm{OH}\\ \mathrm{OH}\end{matrix}$

may all be formed initially at the metallic surface; probably the one thing that is never thus formed is $ZnSO_4$.

8. The rate at which a metal is dissolved is "governed" by the well-known "law" $C=\frac{E}{R}$. That is to say, the current or amount of chemical change is proportional to the electromotive force—the intensity of the chemical effect—in the circuit and inversely proportional to the electrical resistance. No action can take place unless E have a positive value.

9. When zinc is opposed simply to another metal, C varies somewhat—chiefly because R varies owing to the deposition of hydrogen on the negative surface: in other words, the negative surface becomes polarised.

To cancel this effect, various depolarisers have been introduced—for example, copper sulphate, nitrous-nitric acid, chromic acid and lead peroxide (the last in the case of the lead accumulator, so-called). All these are "reduced" by hydrogen. But the depolariser not only prevents the deposition of hydrogen and the consequent increase of resistance; in all cases, its reduction is a source of energy and it serves to raise the electromotive force developed in the system.

In the case of the Daniell cell, in which zinc in zinc sulphate is opposed to copper in cupric sulphate, depolarisation is effected by the displacement of copper from the cupric sulphate and on account of the energy thus thrown into the circuit, the Daniell cell has a greater electromotive force than the simple zinc-sulphuric-acid-copper cell.

10. Although copper is not dissolved by dilute sulphuric acid, its heat of dissolution may be calculated by deducting from the sum of the heat of formation of cupric oxide and the heat of dissolution of this oxide in dilute sulphuric acid the heat of formation of water, since :—

$$CuO + H_2SO_4 = CuSO_4 + H_2O.$$

The value arrived at is about − 12,000 calories. The thermal disturbance attending the displacement of copper from cupric sulphate by hydrogen is therefore + 12,000 calories.

The heat of formation of water at 18° being about 68,000 calories, the dissolution of copper in dilute sulphuric acid is attended theoretically with a thermal disturbance of 68,000—12,000 = 56,000 calories—so that an E.M.F. considerably over a volt (56/46 = 1·2) is developed in a copper-sulphuric acid-oxygen couple.

11. The assisted dissolution of the metal in a dilute acid, at a distance from the depolariser, may be effectively demonstrated by arranging two vessels in the manner shown in Fig. 3, using nitrous-nitric acid as depolariser.

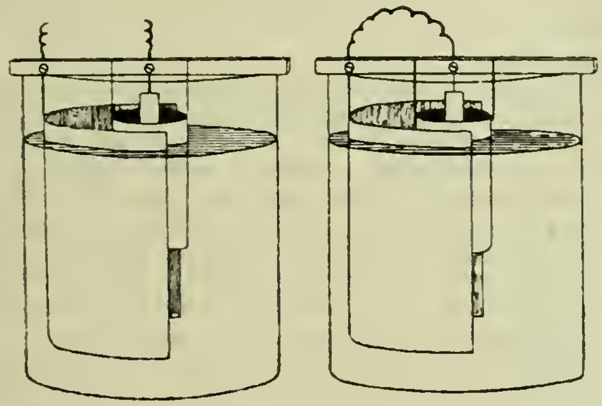


Fig. 3.

The cells contain dilute sulphuric acid. A rounded sheet of copper is suspended in the acid in each cell, also a small porous pot containing fuming nitric acid. A small piece of platinum foil dips into the fuming acid. In one of the cells, the copper and platinum are connected as shewn, otherwise the two are similar.

Although in the cell in which the poles are not connected no blue colour is noticeable in the sulphuric acid during several hours (*i.e.*, until the acid reaches the copper by diffusion), in the other a blue colour is quite distinctly obvious near the surface of the copper within a few minutes and the copper dissolves rapidly.

In the latter instance, when the circuit is completed the copper is enabled to dissolve in the dilute acid by the depolarizing action of the nitrous-nitric acid, this substance furnishing by its reduction the energy necessary for the interaction.

12. The heat of dissolution of copper in nitric acid being a negative value, copper is not dissolved by nitric acid. The validity of this conclusion has been demonstrated over and over again, notably by Veley; but Veley has contended[6] that nitrous acid, not nitric acid, is the actual solvent of the metal—hence the behaviour of copper towards ordinary nitric acid, which always contains nitrous acid as an impurity.

The heat of dissolution of copper in nitrous acid cannot be calculated, as the necessary data are wanting; but as it is a weak acid in comparison with nitric, there is no reason to suppose that it would function as a solvent of metals which are not dissolved by the latter. As nitrous acid cannot be used in a pure state, experiments cannot decide such an issue and the decision must be based on "theory."

Veley has based his argument on the fact that not only is copper insoluble in nitric acid which has been deprived of nitrous compounds by passing air through it but also in acid from which these compounds have been removed *by the addition of an oxidising agent* such as hydrogen peroxide.

13. But in proving this, he has proved too much. On the theoretical grounds stated above, the presence of an oxidising agent should directly determine, not prevent, the dissolution of the metal. It is impossible to place nitric acid in a category apart from all other acids. Even the weakest organic acids dissolve copper in presence of oxygen and other depolarising agents and it is customary to prepare copper sulphate on a large scale by subjecting the metal to the conjoint influence of air and sulphuric acid. Some other explanation, therefore, than that put forward by Veley, is required to account for the inactivity of nitric acid in presence of oxidising agents. As the removal of exceptions is often of more value in proving a rule than the discovery of new instances of its operation, we have subjected Veley's observation to critical examination.

Using purified nitric acid (30 per cent.), he added hydrogen peroxide in so small a proportion that only one part was present in 2,140 parts of the acid. A copper sphere, weighing 9·919 grms., which was rotated rapidly in this acid at 28°·5—29° C. during 78 minutes lost only 0·0015 grm. At 32° during 28 minutes the loss was 0·0085 grm. As the peroxide was then used up, about twice as much was added as at first: the sphere then lost only 0·003 grm. during 60 minutes. Potassium chlorate had a similar retarding effect; permanganate was less effective, more copper dissolving.

On passing air into nitric acid in which a copper sphere was rotated, the amount dissolved during 52 minutes was only 0·0048 grm. When the same sphere was placed in the same acid and carbon dioxide was passed in during the experiment, the loss in weight during the same period was 0·32 grm. These amounts of copper are in the proportion of 1 : 64 : 6. A point to be noticed in connexion with Veley's experiments is that when the metal was kept still and the acid was not stirred, action soon set in and the copper was dissolved freely.

14. As there was no reason to suppose—apart from differences conditioned by differences in strength—that nitric acid would differ as an acid from other acids, we commenced our experiments by endeavouring to ascertain whether other acids were similarly affected by hydrogen peroxide and other oxidants. It was soon apparent that they were and that the behaviour noticed by Veley was in no way peculiar to nitric acid—it was no longer necessary therefore to regard nitrous acid as a factor in the problem: obviously, the oxidant acted in some way as a protecting agent while undergoing decomposition.

15. In our first series of experiments, using electrotype copper and a solution containing 20 per cent. of sulphuric acid to which hydrogen peroxide had been added, no change was obvious at the surface of the metal but this was gradually dissolved, the rate of dissolution being proportional to the concentration of the peroxide and the amount dissolved equivalent to the amount of peroxide used.

Copper dissolved.	Hydrogen peroxide used.	Hydrogen peroxide equivalent to copper dissolved.
grm.	grm.	grm.
0·778	0·0417	0·0419
0·1506	0·0809	0·812
0·2166	0·1166	0·1167
0·2765	0·1456	0·1493
0·3578	0·1940	0·1900

16. When, however, some copper turnings which happened to be at hand were placed in the acid-peroxide mixture, it was noticed that they were at once blackened. It was then found that common commercial sheet copper behaved in a similar way, the surface soon becoming covered with a velvet-black deposit which could be rubbed off with the finger. The black substance was insoluble in dilute sulphuric acid but at once disappeared on adding hydrogen peroxide. It was soon discovered that blackening only occurred when the concentration of the peroxide was low.

The Broughton Copper Company were so kind as to send us a series of strips of their best coppers containing only very minute amounts of impurity—none of these blackened in the acid peroxide mixture; in fact, the blackening only appears on the really impure metal.

17. When the blackened strip of metal is washed to remove acid and then plunged into a solution of peroxide of hydrogen, effervescence takes place owing to the escape of oxygen and the black coating disappears; the plate then has a bronze hue quite unlike the colour proper to copper. On now plunging the plate into acid after washing it, the bronze appearance gives way to that of copper, some copper dissolving: the solution contains hydrogen peroxide, as on pouring it into a solution of titanic acid the characteristic yellow colour at once appears.

18. All who have watched the dissolution and electrodeposition of copper when a current is passed between copper plates in dilute sulphuric acid must have noticed that blackening often takes place at the anode. When the demonstration described in §10 is carried out, it is generally noticeable that the copper plate becomes more or less darkened, if ordinary copper sheet be used.

On passing a current between a platinum cathode and an anode of common copper immersed in sulphuric acid, the copper at once darkens; as a rule, the current remains steady. On diminishing the resistance, so as to increase the current density, the current mounts up to a certain value and then suddenly drops—the plate is polarised; but the polarisation soon comes to an end and the current rises again, only to fall once more—at the same time, the black deposit either peels off the plate or becomes so loose that it is easily removed with a brush. The coating thus removed, however, is not a definite substance but a mixture of the black "oxide" with metallic copper.

It is material that when the current is first passed between the plates and is kept low, the copper plate becomes coated with the black deposit and the metal dissolves steadily; a solution of the salt is seen to form at its surface and to flow down the plate. As the current is increased and approaches the polarising value, a crystalline film spreads slowly over the whole plate and the salt appears to crystallise out on it even while it is in the solution: at this moment oxygen is evolved in small quantity. Obviously, the solution is highly concentrated at the electrode surface, whatever the concentration of the solution as a whole may be.

The formation of the deposit depends largely upon the current density and the concentration of the acid. If a weak acid be used, a much higher current can be passed without polarising the plate than if the acid be concentrated. Polarisation appears to set in at a definite current density in each particular concentration.

We failed at first in obtaining any black deposit on anodes of copper containing minimal amounts of impurity, whenever the experiment was made by switching on the current to electrodes already placed in the acid. When, however, the circuit was completed by just dipping the anode into the solution and then lowering it gradually, the black deposit was always obtained, whatever the quality of the copper.

19. It appears probable that the black deposit is not a primary product but is formed by the decomposition, at the surface of the plate, of some persalt and that this decomposition is promoted, in the case of the commercial copper, by the impurities present in the metal. Impure copper is at once blackened on immersing it in sulphuric acid containing persulphuric acid free from hydrogen peroxide. Unfortunately, we have not yet been able to obtain the black substance in sufficient quantity to determine its composition. The quantity that can be rubbed off from a plate that has been immersed in a mixture of sulphuric acid and hydrogen peroxide is very small; and as it appears to change on exposure to air, by the time that any appreciable amount has been collected some of it has already undergone change.

Passive Iron.

20. All who have read the correspondence between Schönbein and Faraday, in 1836, on a peculiar condition of iron[7] are aware of the remarkable observations made by these two philosophers on the conditions which determine the passivity of the metal in nitric acid. The conclusion arrived at by Faraday in explanation of the phenomenon was stated by him with absolute clearness in the following passage:—

"My strong impression is that the surface of the iron is oxidised or that the superficial particles of the metal are in such relation to the oxygen of the electrolyte as to be equivalent to an oxidation; and that having thus their affinity for oxygen satisfied and not being dissolved by the acid under the circumstances, there is no renewal of the metallic surface, no reiteration of the attraction of successive particles of the iron on the elements of successive portions of the electrolyte and therefore not those successive chemical actions by which the electric current can be continued."

21. The behaviour of iron towards a mixture of sulphuric acid and hydrogen peroxide is precisely similar to that of copper; if the concentration of the peroxide be not too high, a black coating is formed. If this be washed free from acid and then brought into contact with fresh peroxide, it is converted into what appears to be ordinary rust, oxygen being evolved.

Cobalt behaves similarly.

Nickel and also silver do not change in appearance but condition a rapid evolution of oxygen from the mixture of acid peroxide.

22. When a current is passed between a platinum cathode and an iron anode in sulphuric acid, as the iron dissolves the plate is gradually coated with a black deposit but when the coating has reached a certain stage it begins to disappear, usually from one corner, gas bubbles forming at the surface of the plate; at the moment when the deposit appears to be entirely removed and the plate has assumed a metallic aspect once more, polarisation is complete; then the iron no longer dissolves and oxygen is given off freely so long as the current is uninterrupted.

23. If the "passive plate" be lifted out of the solution or even if the current be cut off during a few seconds, the passivity disappears but is soon regained on passing the current: this is also true of copper. But the deposit on copper does not dissolve as that on iron does, apparently because it springs away from the plate and fresh copper is exposed; on this account the copper never becomes passive. In the case of iron, we are inclined to attribute the formation of the deposit of black oxide (for it can scarcely be of any other nature) to secondary action, as in the case of copper.

24. When a nickel anode is plunged into sulphuric acid, not the slightest deposit can be noticed but the plate almost immediately becomes passive and oxygen is given off from its surface.

There can be little doubt that the oscillatory variations in the activity of chromium and other metals in acids such as Ostwald, Bredig and others have observed and studied, are due to alternate formation and reduction of "protecting" layers at the metallic surface.

Discrimination of Oxides by Trillat's Agent.

25. It has been pointed out by Trillat[8] that if the derivative of diphenylmethane which is formed by the interaction of formic aldehyde and dimethylaniline, $CH_2(C_6H_4NMe_2)_2$, be subjected to the action of either lead peroxide or manganese peroxide or cobalt peroxide, in presence of acetic acid, it is oxidised and converted into the corresponding carbinol; as the salts of this compound with weak acids are blue, the occurrence of the change is indicated by the appearance of a blue colour in the solution.

Perhaps a way of applying the test which is better than that recommended by Trillat is to use a solution of the base in citric acid, as advocated by Carney.[9]

Hydrogen peroxide and peroxides which give this oxide on treatment with acid act differently on Trillat's agent, converting it into a colourless oxidation product.

It therefore appears to afford a means of distinguishing oxides of the lead peroxide type from those of the hydrogen peroxide type.

26. Lead peroxide, the black oxides of cobalt and nickel produced by the action of an alkaline hypochlorite on cobalt and nickel salts, as well as the oxide formed on heating a mixture of praseodymia and neodymia in

oxygen, all give a blue colour when added to Trillat's agent. None of these oxides is soluble in diluted sulphuric acid. They all decompose a solution of hydrogen peroxide. Lead peroxide apparently remains unchanged but the other oxides are reduced and become soluble in acid after treatment with the peroxide.

It is noteworthy that lead monoxide continuously decomposes hydrogen peroxide without itself appearing to undergo change.

27. The black substance formed on copper and iron as an anodic deposit or when these metals are submitted to the action of a mixture of dilute sulphuric acid and hydrogen peroxide has no action on Trillat's agent and is insoluble in acid; as already pointed out, it is reduced by hydrogen peroxide and converted into a bronze-coloured substance which appears to belong to the class of ordinary peroxides. This substance is possibly a cuprous peroxide, as what appears to be a cupric peroxide is formed by the action of hydrogen peroxide on cupric hydroxide. This latter substance resembles in behaviour the peroxide formed from mercuric oxide and hydrogen peroxide. Both these oxides are slowly decomposed by hydrogen peroxide; neither of them has any action on Trillat's agent.

The black anodic deposit formed on silver in dilute sulphuric acid gives a strong blue colour with Trillat's agent; it acts explosively on hydrogen peroxide and is itself reduced to silver.

Lastly, it may be mentioned that Trillat's agent is a test for ferrous salts, as it is at once coloured blue by a freshly-made mixture of a ferrous salt with hydrogen peroxide. It is also coloured blue by persulphates.

28. A very thin film of an "oxide" such as we have obtained on iron would serve to protect the metal and render it passive; but the impression we have gained is that more often than not the passivity is conditioned chiefly by the state of the electrolyte at the anode—that, as Faraday expresses it, the superficial particles of the metal are in such relation to the oxygen of the electrolyte as to be equivalent to an oxidation. Any variation of the current seems to produce an alteration in the polarization.

29. Nitric acid is peculiar on account of the readiness with which this gives rise to "nitrous" compounds which may act either as oxidising or as reducing agents. It is obvious that in Veley's experiments, though copper was very slowly dissolved, some action went on at the surface, as the hydrogen peroxide was gradually destroyed. Probably a "peroxide" is formed and reversibly decomposed.

Oxidising Agents.

30. It is customary to formulate oxidising agents as acting directly but it is to be supposed that their behaviour is precisely similar to that of oxygen—in other words, that the oxidising agent acts primarily as depolariser, the immediately effective hydroxylating agent being the OH ion liberated from the electrolyte at the positive surface of the oxidised material.

The "fate" of the oxidising agent is less easily determined, as we are not yet aware how precisely these behave on reduction. The only observations on record of which we are aware are those of V. Meyer and several of his students.[10]

31. These observers have found that when either hydrogen or carbon monoxide is shaken with an acidified solution of potassium permanganate, the gas is oxidised and an amount of oxygen liberated equivalent to about half the volume of the absorbed gas: if neutral or alkaline permanganate be used, the gas is absorbed without any corresponding separation of oxygen.

A small amount of oxygen is given off on merely agitating the acidified solution of permanganate; strange to say, this evolution of oxygen soon reaches a limit, though if the solution be allowed to stand quietly, the decomposition takes place continuously, a far larger amount of oxygen being given off; nevertheless the action does not appear to be reversible.

32. Victor Meyer rejected the explanation that the oxygen is derived from hydrogen peroxide, on the ground that it is given off not only when hydrogen is used but also when carbonic oxide is oxidised.

But the view taken by us involves the conclusion that hydrogen peroxide would be produced whatever substance were oxidised.

Assuming this to be the case, it is clear, however, that the hydrogen peroxide which is formed undergoes decomposition catalytically, not at the expense of permanganic acid, as in the latter instance the volume of oxygen obtained would be equal to that of the hydrogen or carbonic oxide oxidised.

33. Our own observations, needless to say, confirm those of Victor Meyer and his co-workers.

In one experiment in which 106 c.c. of hydrogen were shaken with an acid solution of permanganate, the amount of oxygen finally obtained at the end of 17 hours was 52·8 c.c. A series of experiments were made in which the percentage of oxygen relatively to hydrogen present at various times was determined with the following results:—

Hours.	Oxygen.	Hydrogen.
	per cent.	per cent.
1	14·46	85·54
3	41·51	58·49
5	60·65	39·35
7	76·95	23·05
17	96·86	3·14

34. It is strange that we should understand so little of the behaviour of so familiar and prized an oxidising agent as permanganate.

Morse, Hopkins and Walker[11] have shown that whilst solutions of permanganate which are free from suspended dioxide are stable, in presence of the latter decomposition takes place somewhat readily, three-fifths of the active oxygen of the permanganate being liberated in the manner expressed by the statistical statement:—

$$2HMnO_4 + xMnO_2 = H_2O + (x+2)MnO_2 + {}^3/_2O_2$$

The ratio of oxygen to manganese in the precipitated oxide remains normal (2 : 1) so long as there is unreduced permanganate present; in the absence of the latter, the peroxide loses oxygen even at ordinary temperatures.

On the assumption that permanganic acid is a per-acid, its decomposition in presence of the dioxide may be represented in the following manner:—

$$\begin{array}{l} MnO_2.OOH \\ MnO_2.OOH \end{array} + \begin{array}{l} H \\ H \end{array} \quad \begin{array}{c} \cdot\ \cdot\ \cdot\ \cdot \\ \cdot\ \cdot\ \cdot\ \cdot \end{array} \quad \begin{array}{l} OH \\ OH \end{array} + (MnO_2) =$$

$$\text{(Electrolyte)}$$

$$\begin{array}{l} MnO_2 \\ MnO_2 \end{array} + \begin{array}{l} HOOH \\ HOOH \end{array} \quad \cdot\ \cdot\ \cdot\ \cdot \quad HO.OH + (MnO_2)$$

The three molecular proportions of hydrogen peroxide thus formed would give rise to one and a half molecular proportions of oxygen when decomposed catalytically by the manganese peroxide.

The observation made by Morse, Hopkins and Walker that the ratio of oxygen to manganese in the "peroxide" at once falls below 2 : 1 when there is no unreduced permanganate present affords a by no means improbable explanation of Victor Meyer's observations of the instability of an undisturbed solution of permanganate. In such a case, it would often happen that the permanganate would be exhausted here and there and consequently there would be an opportunity for the peroxide to undergo reduction locally, in the manner observed by Morse and his co-workers: it is probable that the reduction of permanganate is conditioned more readily, if not entirely, by an oxide lower than manganese peroxide and therefore if the formation of such an oxide were in any way promoted, the extent to which the permanganate underwent decomposition would also be increased. A similar explanation may be given of the influence of oxygen in retarding the separation of oxygen from permanganate: it is not improbable that oxygen is more attracted than hydrogen by the active "oxygen-surface" of the permanganate molecule and that consequently the permanganate would be more stable in its presence. It is well-known that excess of oxygen may retard combustion.[12]

35. It has recently been argued by Wieland[13] that carbonic oxide on combustion does not give rise primarily to the dioxide and hydrogen peroxide but is initially converted, when the slightly moist gas is burnt, into formic acid, which is then resolved into carbon dioxide and hydrogen, this latter being reburnt to water. Wieland's reason for this assumption is that when carbonic oxide is agitated with palladium black, in presence of water but in absence of oxygen, it is converted into carbon dioxide and hydrogen and that a small amount of formic acid may be detected in the solution. He assumes that the palladium first conditions the addition of water to the carbon monoxide and then determines the resolution of the formic acid into carbon dioxide and alcohol.

It is far more likely that palladium acts in virtue of its special power of absorbing hydrogen and that it primarily determines the formation of carbonic acid and hydrogen, thus:—

$$CO.OH_2 + \begin{matrix}OH\\OH\end{matrix} \quad \begin{matrix}\cdot\ \cdot\ \cdot\ \cdot\\ \cdot\ \cdot\ \cdot\ \cdot\end{matrix} \quad \begin{matrix}H\\H\end{matrix} + (Pd)_x =$$

$$CO(OH)_2 + H_2O \quad \cdot\ \cdot\ \cdot\ \cdot \quad H_2(Pd)_x$$

It is also far more likely that the formic acid is formed by the reduction of carbonic acid by palladium-hydrogen than that it is produced by the association of water with carbonic oxide under the influence of the metal. Wieland has himself given numerous illustration of the power palladium has of acting as a dehydrogenising agent.

36. Wieland has applied his view to the explanation of the oxidation of alcohols to aldehydes and of these latter to acids which is conditioned by the finely divided platinum metals. He considers that in both cases, the compound is dehydrogenised and that the hydrogen then undergoes combustion, the metal being thus freed to act once more in determining the separation of hydrogen.

But if regarded from the point of view of Traube's hypothesis of which we are advocates the phenomena are normal oxidation phenomena, whether it be supposed that the primary action involves only the hydrogenation of the metal and that the hydrogen is oxidised subsequently or whether it be assumed that oxygen acts primarily at the metallic surface and that the action is comparable with that which takes place in a Daniell's cell, for example. All depends probably on the affinity of the metallic surfaces used relatively to oxygen and hydrogen under the conditions of the experiment. Thus:—

$$Pd_x \begin{matrix}H\\H\end{matrix} + \begin{matrix}HO\ ..\ H\\HO\ ..\ H\end{matrix} + \begin{matrix}O\\O\end{matrix} Pd_y =$$

$$xPd + \begin{matrix}H_2O\ ..\ HO\\H_2O\ ..\ HO\end{matrix} + yPd$$

$$R{\cdot}C \left\{\begin{matrix}H\\H\\OH\end{matrix}\right. + \begin{matrix}HO\ ..\ H\\ \\HO\ ..\ H\end{matrix} + xPd =$$

$$R{\cdot}C \left\{\begin{matrix}H\\OH\\OH\end{matrix}\right. + OH_2 + H_2Pd_x$$

$$R{\cdot}C \left\{\begin{matrix}H\\H\\OH\end{matrix}\right. + \begin{matrix}HO\ ..\ H\\ \\HO\ ..\ H\end{matrix} + \begin{matrix}O\\ \\O\end{matrix} Pd_y =$$

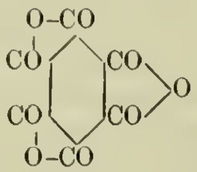
$$R{\cdot}C \left\{\begin{matrix}H\\OH\\OH\end{matrix}\right. + H_2O_2 + yPd.$$

The fact that hydroquinone and methylene blue may be substituted for oxygen as depolarizing (dehydrogenising) agents, on which Wieland relies, proves nothing in particular with regard to the nature of the process.

Oxidation of Carbon.

37. Experiments have been described recently by Rhead and Wheeler[14] showing that amorphous carbon will absorb oxygen in considerable quantity without giving rise to gaseous products and that when the oxygenated material is heated the monoxide and dioxide of carbon are both formed. One of us long ago contended that the oxidation must be gradual and that the combustion of carbon must be a very complex process.[15]

It is interesting that Meyer and Steiner[16] have recently described the oxide $C_{12}O_9$ obtained by dehydrating mellitic acid:—

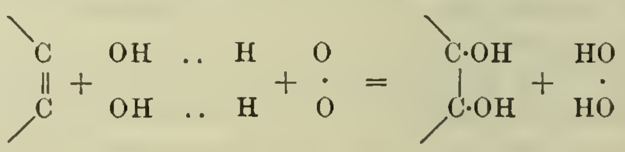


This compound separates as colourless crystals from boiling benzoyl chloride; it is very stable and can be volatilised in vacuo. Obviously, such a substance will give both oxides of carbon as thermoschists. The initial products of the oxidation of carbon must be of an even more complex character on account of the great complexity of the carbon molecule.

Now that facts such as these are demonstrated, the discussion, whether the monoxide or the dioxide is the initial product of combustion has no longer even academic interest.

38. It appears to us that nothing is to be gained by assuming that oxygen molecules enter the carbon molecule directly nor by postulating the formation in the first instance, of "a loosely formed physico-chemical complex" of carbon and oxygen. It is surprising that Rhead and Wheeler discuss the subject without taking any notice of previous discussions of the "theory" of combustion and that they disregard H. B. Baker's observations on the influence of moisture on the combustion of carbon. Their attitude is a justification of the protest made at the outset of this communication and is proof that it is impossible for chemists at present to think clearly on these subjects.

It may be pointed out that the molecules of amorphous carbon must be oxidised initially in the manner in which ethenoid hydrocarbons are oxidised. One by one, each ethenoid junction would be hydroxylated, thus:—



Summary.

In the present communication, the general thesis is advocated that, in every case of oxidation, interaction between the oxidizing and oxidized substance is only possible in presence of an electrolyte; it is argued that there is no immediate, direct combination between the oxidizing agent and the oxidized substance but that the oxygen of the former acts merely as depolarizer, thereby conditioning the hydroxylation of the latter more or less at a distance. Hydrogen peroxide has been shown to be the primary product of many such interactions; whether it be always formed is still open to question.

Usually the conditions of experiment are such as to determine the immediate decomposition of the hydrogen peroxide which is formed initially; it is therefore not surprising that the peroxide has not been detected in many instances.

The number of cases in which hydrogen peroxide has been isolated, however, is now considerable, and the results show that its detection is possible only if favourable experimental conditions are secured.

The problem of the corrosion of metals is far from being solved in all its details and it is obvious that much valuable information may yet be obtained by a systematic study of the effect of oxidizing agents in general in promoting the dissolution of metals by acids.

The peculiar behaviour of some metals in presence of hydrogen peroxide and acids, when functioning as anodes, dealt with in this communication, is a proof that the higher unstable oxidation products of the metals are products of consequence; it is to be expected that further inquiry in this direction will serve to elucidate the phenomena of passivity and also the periodic changes attending the dissolution of metals.

The examples quoted will serve to show that much remains to be learnt before the behaviour of so familiar an oxidizing agent as potassic permanganate and of oxidizing agents generally is fully understood.

We would insist that if an acceptable generalisation is to be arrived at regarding the phenomena of oxidation in general, the fate of the oxidizing agent and the precise manner in which it parts with its oxygen to the oxidizable substance must be elucidated. Progress is not possible so long as we are content to take into account only the initial and final stages in the process of oxidation.

The inquiry will be continued in the various directions foreshadowed.

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Newcastle Section.

Meeting held at Armstrong College, on Wednesday, February 19th, 1913.

MR. T. W. LOVIBOND IN THE CHAIR.

THE "AGGLUTINATING POWER" OF COALS.

BY J. T. DUNN, D.SC., F.I.C.

When a coal which does not coke, or which cokes badly, is mixed with a good coking coal, and the mixture is carbonised, the good coking coal is able to bind the carbonised residue of the non-coking coal, and a coke is the result; of greater or less coherence according to the relative proportions of the two coals in the mixture, and the intensity of the binding properties of the coking coal. Such mixtures are frequently made, on the Continent more especially, and one of the valuable and desirable characteristics of a coking coal is consequently that it should possess in a high degree this binding or "agglutinating power," so that as small a quantity of it as possible may be needed to bind a given quantity of the carbonised residue of the poorer coal into a coke of fair mechanical quality.

In the "Comptes rendus" for 1895 M. Campredon published a method for the approximate measurement of this characteristic of coals, which consisted in carbonising in platinum or porcelain crucibles mixtures of the coal with different proportions of inert material, and ascertaining the maximum proportion of the inert material which could thus be bound into a coherent mass. For his inert material Campredon used sand; and his method has been in more or less general use from 1895 to the present day.

Whilst it does on the whole enable one to classify coals roughly as to their coking properties, the method gives in many cases very anomalous results; and I have found in especial that a coal containing a very high percentage of ash has frequently shown a higher agglutinating power than a coal of the same origin containing less ash and obviously more desirable as a coking coal. Direct experiment shows that this is due to the partial fluxing of the sand by the ash of the coal, so that the coherence of the button was not due to the strength of the coke properly so called, but to the strength of the silicious framework formed by the partial fusion of the ash and sand.

I have found that very much more consistent results are yielded, and very much closer gradation is attained, by substituting for the sand a good anthracite. The coal to be tested is passed through a half-millimetre sieve; and the anthracite is powdered and sifted to pass a millimetre mesh and be retained by a half-millimetre mesh. Varying proportions of coal and anthracite are mixed, and 10 grms. of each mixture are coked in covered porcelain crucibles in the usual way over a burner. The mixture which turns out of the crucible just coherent, but can be crushed to powder by the exertion of a very slight pressure, is taken as the measure of the "agglutinating power."

Discussion.

Professor P. B. **Bedson** agreed that it was desirable that some substance akin to coal should be used instead of quartz, but suggested that anthracites differed in composition; could not some form of artificially prepared carbon be employed?

Mr. G. **Weyman** suggested that retort carbon might prove to be a suitable diluent for the coal, as there was no difficulty in getting supplies containing less than 0·5 per cent. of ash.

Mr. H. **Dunford Smith** said that he too had found Campredon's method at times very unsatisfactory. The sand used was too coarse. It was quite right that the size should be specified both maximum and minimum, but with regard to the coal the maximum size only could be specified and as a consequence when mixed with the sand some of the minutest particles of the coal tended towards the bottom of the crucible whilst the coarse sand went to the top.

Another defect was that the time of coking the mixture had a very marked effect upon the nature of the agglutinated mass. The same mixture coked 30 or even 15 seconds too long gave a much less coherent coke than it would have done earlier. Then again the measurement of coherence by means of the pressure of the fingers was somewhat loose. Could not some definite mechanical means be adopted to measure this?

He rather doubted whether the partial fluxing of the ash of the coal with the sand had much effect on the agglutinating power of the coal, since the above-mentioned sources of error were quite enough to cloak the fluxing of the sand and ash.

As regards the anthracite, would it not be better to specify its maximum ash and volatile constituents? He did not approve of the suggestion to coke the mass over a Bunsen burner, but preferred Campredon's method of coking in a muffle.

The following was a translation of an extract from the specification of a Continental State Railway:—

"Small bituminous coals, otherwise coking coals. . . . These coals will have to be suitable for locomotive grates, mixed in a certain proportion with less bituminous coals.

"They must be such as to give an agglutinated coke when mixed with an inert material (quartz) in the proportion of 70 per cent. quartz and 30 per cent. coal.

"A close mixture made up in the above proportions, finely ground, heated bright red, until complete disappearance of volatile matters in a porcelain crucible and in a reducing atmosphere, will have to agglutinate in a mass which must be firm or at least must not fall into dust under the pressure of the fingers.

"Previous to the placing of the mixture into the muffle the latter will have been brought to the desired temperature."

This method differed from Campredon's: (1) in the fineness of the quartz and sand, both being nearly as fine as flour—unless some definite size were given this might easily cause analysts in different places to find different results. (2) The coking in a reducing atmosphere. This was a decided step in the right direction and could easily be managed by placing the small crucible containing the mixture to be coked in a larger crucible and packing all round with small fragments of charcoal.

This did away with any vitiation of the results by removing the opportunity of oxidation of the thin film of agglutinant. He would like to see a standard method adopted embodying the best features of the above and would suggest that Dr. Dunn might alone, or in conjunction with a small committee of the Section, formulate a method.

His own suggestions would be: (1) Coal to be very fine, to be passed through a fine sieve of definite size. (2) Inert material (quartz or anthracite or other material) to be finer than Campredon's material and to be of a definite size. (3) Adoption of a uniform method of heating, *i.e.*, muffle or Bunsen. (The temperature of coking should also be studied.) (4) Coking in a reducing atmosphere. (5) Some more definite means of measuring the coherence of coke—it had been suggested that a weight of 2 kilos. should be gently placed upon the button and the crushing power would be much more uniformly measured by this way than by pressure of the fingers. (6) To consider whether the results should be expressed in percentage or in times the weight of coal.

Dr. DUNN, in replying, said he had not tried retort carbon, though he recognised that it was a material that could probably be obtained of very uniform composition and constant properties; in using anthracite he had had in his mind the facts that it was a substance of similar nature to the coals of poor coking quality which it would be sought in actual practice to bind, and that high-grade anthracites probably differed little in volatile matter, ash, and physical properties from one another. Perhaps, however, it would be well to specify a particular anthracite, and in this respect standardise the test as far as practicable. There was no doubt that when sand was used the ash of the coal was an important factor, for he had over and over again found that by adding to a coal a quantity of its own ash its apparent agglutinating power, as tested by sand, was increased. He had not found that the time of coking, with anthracite as inert material, at least, had much effect on the result; even such differences as between 12 and 20 minutes produced no sensible effect. He thought that perhaps Mr. Smith's experience in this respect arose from the use of a muffle. The Bunsen burner surrounded the crucible with a reducing, or at least non-oxidising atmosphere, whilst the atmosphere in the muffle was as a rule strongly oxidising. No doubt a reducing atmosphere was desirable for the test, but it was questionable whether the additional labour and the additional coking required to attain the requisite temperature, involved in Mr. Smith's suggestion of packing in charcoal, were remunerative. It must be remembered that we were not measuring here a quantity susceptible of accurate numerical determination, but seeking an approximate measure of the behaviour of a coal on the industrial scale under conditions which no laboratory test could exactly imitate. One circumstance mentioned by Mr. Smith was undoubtedly of importance, namely the size of the particles. Anthracite was not so dense as sand, and the tendency to irregular distribution would hence be less with anthracite than with sand, but apart from that the hardness of the coke seemed to depend greatly on the size of the particles both of coking and of non-coking constituent of the mixture; he was experimenting further on this, and at the moment was inclined to suggest that both constituents should be graded between a millimetre and half-millimetre sieve. As to the mode of application of pressure, he had found with anthracite that testing with the finger was quite sufficient for distinction. He would be very willing to experiment on the various suggestions that had been made, and report to a future meeting. With reference to the Chairman's remarks on the variations in results of determinations of volatile matter caused by variations in gas pressure, if the dimensions of the flame were adjusted for each experiment in the way suggested by the Coal-Analysis Committee of the American Chemical Society, the difficulty would be overcome, and concordant determinations obtained.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, March 19th, 1913.

MR. S. R. TROTMAN IN THE CHAIR.

THE QUANTITATIVE DETERMINATION OF THE FALLING OF SKIN IN THE PUERING OR BATING PROCESS. PART II.

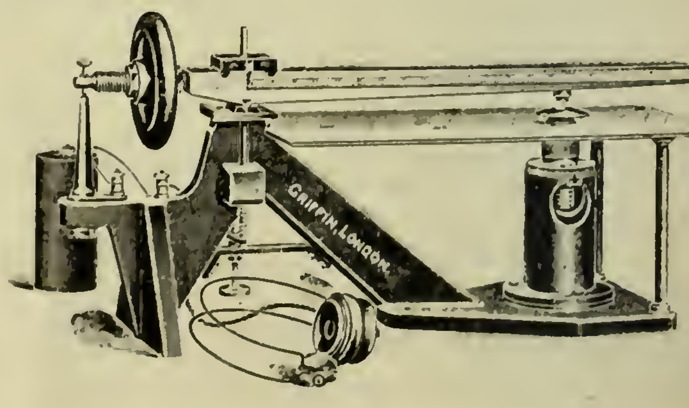
BY JOSEPH T. WOOD, HENRY J. S. SAND, AND DOUGLAS J. LAW.

In a former paper (this Journ., March 15th, 1912) we gave an account of an apparatus which we may describe as a puerometer for the measurement of the amount of depletion which skins undergo in the process of puering. It is illustrated in Fig. 1.

In the present paper we give some of the results obtained by means of the apparatus and also some considerations of the best way of expressing these results.

In carrying out the tests, it was found desirable to examine first of all the condition of the skin before entering the puer liquor, and in this way the apparatus proved of great use in showing the degree of plumping the skins had received during the liming or preparatory processes, and of equal use for this purpose as for the original purpose for which it was designed.

FIG. 1.



What we determine is the amount of compression undergone by the skin under a certain load which must be so chosen that it does not cause rupture. There was however no danger of this in any of our experiments. In our apparatus the load is distributed over a section of one square centimetre, the diameter of the circular jaws being 1·128 cm. The machine thus indicates directly the specific load or stress p undergone by the skin. The latter is compressed from its original thickness l_1 to a new thickness l_2, the relative compression thus being

$$\lambda = \frac{l_1 - l_2}{l_1}$$

We propose to refer to the number E, defined by the equation

$$E = \frac{p}{\lambda}$$

as the average resistance of the skin to compression under the stress p. It may be taken as a measure of the firmness of the skin.*

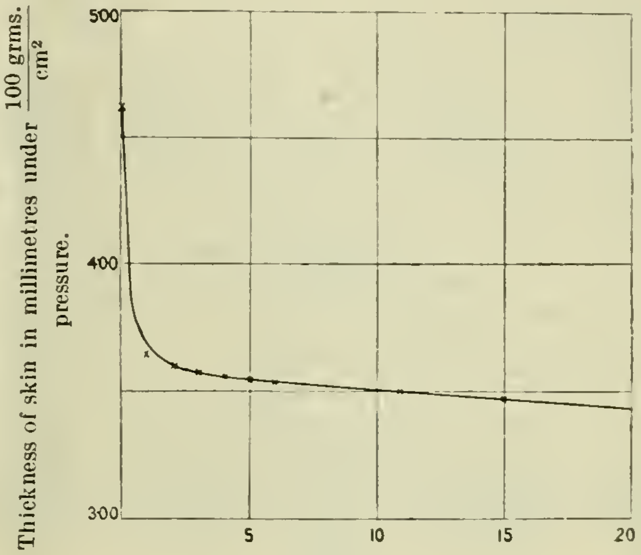
When a skin is subjected to successive increasing loads, and the load removed each time, it is found that even under a very small load it does not as a rule entirely recover its original thickness, but that a certain amount of set or permanent compression takes place. The difference between the total and the permanent compression is the elastic compression, and we propose to measure the resilience of the skin by the percentage ratio of the elastic to the total compression.

To understand what takes place during the compression of wet skin in our apparatus we may consider the skin to be of the nature of a sponge, the walls of which have varying degrees of firmness, elasticity, and thickness according as the skin is in the limed, the delimed, or the puered condition. The volume compressibility is probably negligible in all cases, but a certain portion of the skin substance always flows under pressure beyond the jaws of the machine. The principal effect of putting pressure on the skin is to diminish the size of the interstices or cavities in it with concomitant expulsion of water. The rôle played by the water as such is only to slow down the process of compression: it should not affect the final equilibrium. As the skin is perfectly wet, and, whether examined under water or not, must be considered completely surrounded by water, the surfaces of contact between water and skin-fibre are not affected to any appreciable extent by the experiments, and so capillarity plays practically no part in them. It is obvious that the size of the jaws will be of the very greatest importance in determining the time taken to attain equilibrium, since with large jaws there is little opportunity for the water to escape along the edges. Besides, the flowing of the skin as such will probably be hindered to so great an extent by large jaws that it is doubtful whether, even with the proportionately heavier loads required to produce the same stresses, as great compression will be obtained with large as with small jaws. The size of the jaws should therefore be specifically stated in experiments on the compression of skin. Professor Procter has suggested to us that the flow of water from the skin might be very greatly facilitated by placing a circular disc of it between pieces of porous tile in a tube under water, and that the flow of skin substance might in this way be inhibited. We propose to revert to this suggestion in our future experiments.

In the experiments we have carried out with the skin in air, we have usually allowed three minutes for each reading. Fig. II. shows diagrammatically the effect of time on the compression of a limed skin. It will be seen that after three minutes over 90 per cent. of the final compression at 20 minutes was reached. A much larger period than twenty minutes cannot be taken, owing to the gradual drying of the skin.

When the pressure is released from the skin, elasticity will tend to restore it to its former shape and thickness. If this is done in air it will result in very greatly increasing the surfaces of contact between water (wet skin fibre) and air, and will therefore be very much opposed by forces of capillarity. In order to avoid this, the experiments must be carried out under water. We therefore now perform all our experiments on resiliency under water. In compression experiments it is also advantageous to work in this manner, as the flow from the skin is thereby facilitated and surface effects generally eliminated. The final results are however not affected appreciably. We take this opportunity of expressing our great indebtedness to Professor Procter, at whose suggestion we first carried out experiments under water.

Fig. 2.



We have also carried out experiments with 20 per cent. gelatin. Here there is no expression of water, and as the volume compressibility of gelatin is quite negligible the diminution of thickness is completely compensated by bulging out at the sides. Owing to the absence of pores, the gelatin, as was to be expected, is very considerably firmer than any of our skins under the pressures we have employed. It is also almost completely resilient, and the value of E approaches constancy as with a perfectly elastic body. As in similar experiments on the elasticity of other substances, it is not to be expected that the size of the jaws will very appreciably affect the relation between compression and specific load. We have found that the results are very greatly improved by allowing the gelatin to set between the jaws of the machine: all errors due to uneven contact of the jaws which are very noticeable under small compression thus disappear. We have also found that the firmness of the gelatin very appreciably increases for s[illegible] time after setting. Thus a 20 per cent. gelatin jelly gave a value of 1070 grams per sq. cm. for E immediately after setting, but 18 hours after setting a value of 1790 was obtained under similar conditions. Table 1 shows the behaviour of two different jellies set between the dies of our machine. After each compression, the load was released and the resulting thickness l_3 measured. The resilience R was then calculated.

The experiments on gelatin are interesting, as affording an indication of the probable behaviour of the "jelly water" in a skin to which its elasticity is probably mainly due. As is known, the experiments of Hardy, Bütschli, and others have shown that a gelatin jelly consists of two distinct phases, the one richer, the other poorer in gelatin. According to the "emulsoid" theory, each of these phases in its turn is a very fine emulsion of two distinct liquids; elastic deformation would thus be equivalent to the deformation of the spherical drops of the emulsion. These would recover their shape after removal of the stress owing to the forces of capillarity. A similar explanation would hold for the behaviour of the jelly-water in a skin.

Our experiments on the compression of skins have yielded the interesting result that above loads of about 100 grams per sq. cm. the values of E are approximately linear functions of the stresses, *i.e.*, E can be approximately expressed as a function of the load p by an equation of the form

$$E = ap + b$$

in which a and b are constants. Tables 2 to 11 contain the results of numerous experiments on limed, puered, and delimed skins, and Fig. III. represents these same results graphically. At lower pressures than 100 grams per sq. cm. the values of E usually fall off more rapidly than corresponds to the simple linear relation. If however we accept the view that these results are vitiated by imperfect contact of the jaws—a view which derives some support from the experiments on gelatin described above, and also from the fact that results more nearly approximating to the linear relation are obtained in experiments carried out under water—we may then by a simple process of extrapolation calculate values of E corresponding to very small loads. Thus the constant b, which is the value of E corresponding to a zero load, may be easily found from our experiments, *e.g.*, by subtracting the difference between the values of E at 200 and 100 grms. per sq. cm. load from the value of E at 100 grms. per sq. cm. We may call the value so found the firmness of the skin under zero load, or perhaps—if we adopt the view that the skin approaches a state of true elasticity at very small loads—the modulus of elasticity of the skin. The other constant, a, characterising the behaviour of the skin, may be readily found from our experiments, *e.g.*, by dividing the difference between E at 200 and E at 100 grms. per sq. cm. by 100. We may say that for a limed sheep-skin E measured under a load of 100 grms. per sq. cm. approximates to a little more than 400 grms. per sq. cm., for a well-puered sheep-skin under the same conditions to 170 grms. per sq. cm. For a delimed sheepskin, E measured under these conditions is usually slightly lower than for a puered skin. The values of b for a puered sheep-skin usually vary between about 20 and 60 grms. per sq. cm. according to the amount of puering the skin has undergone, for a limed skin they usually lie between 200 and 400 grms. per sq. cm., and for a delimed skin between 50 and 100 grms. per sq. cm.

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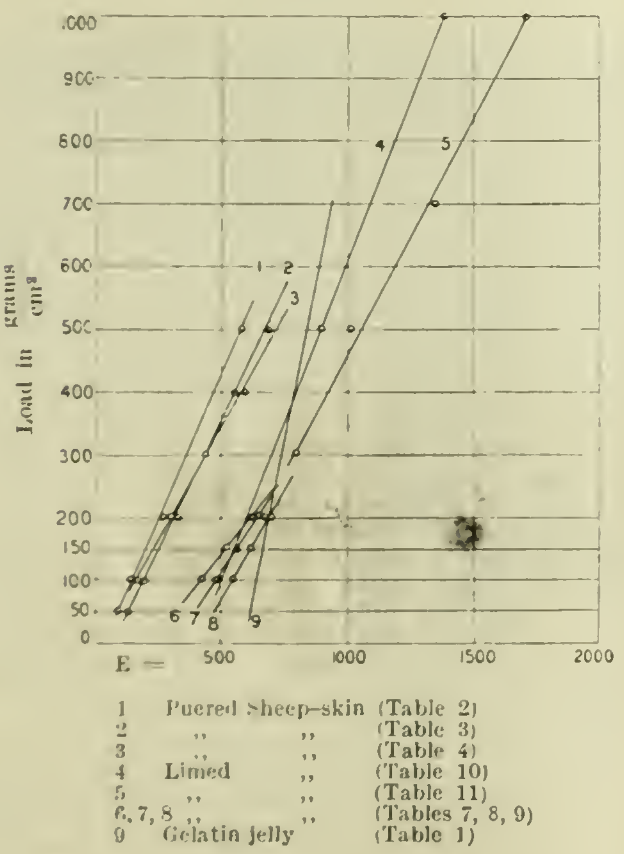
* If the skin were perfectly elastic E would be the modulus of elasticity.

Fig. 3.



Professor Procter has suggested to us that the compression of the skin may be determined by a law to the effect that the amount of interfibrillary water expelled by each increase of pressure will approximate to a uniform proportion (percentage) of the remaining volume of water. In addition to this, there will be a certain amount of compression due to the deformation of the skin substance and depending on the jelly water, and this compression will probably be simply proportional to the load. These assumptions lead to the equation

$$l = f + a e^{-C_1 p} - C_2 p$$

in which l is the thickness of the skin under the pressure p, f is the volume of fibre substance plus jelly-water per unit surface of skin under zero load, a the volume of the interfibrillary water under the same conditions, a + f thus the thickness of the skin under zero load, e = 2·718 the base of the natural logarithms, and C_1 and C_2 constants governing respectively the compression due to the expulsion of interfibrillary water and to the deformation of the skin substance. It is very doubtful, however, whether an equation of the above form will express the results obtained by us so far, as well as the empirical relation enunciated above.

The resiliency of the skin was always determined under water as explained above. For this purpose a small brass capsule was prepared which could be mounted on the lower jaw of our machine and into which an auxiliary jaw of 1 sq. cm. surface protruded. Table 12 expresses the results obtained. It will be seen that, measured under these conditions, the resiliency of puered roan is about 20 per cent., that of a limed sheep-skin between 70 and 80 per cent., and that of a delimed sheepskin also about 20 per cent.

The behaviour of delimed skins, which, as explained above, are slightly less firm than puered, under a pressure of 100 grms. per sq. cm. caused us some surprise. To further elucidate this matter we have carried out the following experiments. By the examination of eight different skins first in the delimed and then in the puered condition we have found that the water-content in both stages of manufacture is practically identical: thus in one case we obtained for delimed skin 83·9 per cent., for puered skin 84·2 per cent. water. That the ash-content of a skin increases during puering and is greater than that of a well-delimed skin has already been stated in Wood: The Puering, Bating, etc., of Skins, p. 38.

On soaking the delimed and puered skins in 96 per cent. alcohol for 2 days and again making a test the values obtained were, for 100 $\frac{\text{gr.}}{\text{cm}^2}$

Delimed skin E=490

Puered skin E=251

which is the proportionate difference we expected between the two skins.

With regard to the differences in the results obtained for different parts of the same skin, we find that the variations are very much of the same order as those found for the breaking strain of leather by Professor Paessler,* and this fact must be borne in mind in using the method. The simplest way is to take samples from the neck and butt of the skin. The thickness found will enable one to judge if the piece taken is about the average. Pieces too thick or too thin should be rejected. In practice it is well-nigh impossible to give attention to each individual skin. If therefore two skins are taken, one representing the firmest and the other the softest, the comparison of the figures obtained is very often of great use.

In conclusion we wish to draw attention once more to the original object of the research, which was to devise a method for expressing *numerically* the amount of depletion undergone by skins in the puering process, so as to make records for future reference and comparison.

TABLE I.

Twenty per cent. (about) gelatin jelly set between dies of machine (2-minute intervals).

p	l_1	l_2	l_3	$\lambda = \frac{l_1 - l_2}{l_1}$	$E = \frac{p}{\lambda}$	Resiliency R
						per cent.
10	3·39	3·37	3·40	0·0089	1125	100
20	3·39	3·34	3·40	0·0149	1340	100
50	3·39	3·25	3·39	0·0415	1210	100
100	3·39	3·12	3·37	0·0800	1250	93
200	3·39	2·92	3·34	0·1390	1440	90
300	3·39	2·69	3.23	0·2060	1450	77

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* Ueber Reissfestigkeit bei Riemenleder. Collegium, 1909, 45, etc.

Twenty per cent. gelatin jelly (another sample of gelatin).

p	l_1	l_2	l_3	$\lambda=\frac{l_1-l_2}{l_1}$	$E=\frac{p}{\lambda}$	Resiliency R
						per cent.
10	4·24	4·18	4·25	0·0142	705	100
20	4·24	4·11	4·24	0·0307	650	100
50	4·24	3·89	4·24	0·0825	610	100
100	4·24	3·39	4·20	0·200	500	95
200	4·24	3·00	—	0·294	680	—
300	4·24	2·52	3·91	0·405	740	81

Table 2.

Puered sheep-skin.

Load in grms. cm^2	l_1	l_2	λ	E
0	2·710	2·710		
5	2·710	2·155	0·205	24·5
10	2·710	1·950	0·280	35·8
15	2·710	1·700	0·373	40·3
20	2·710	1·305	0·518	28·6
25	2·710	1·250	0·539	46·5
30	2·710	1·185	0·566	53·0
40	2·710	1·125	0·585	68·5
50	2·710	1·070	0·605	83·0
60	2·710	1·015	0·625	96·2
70	2·710	0·980	0·638	110
80	2·710	0·920	0·660	122
90	2·710	0·875	0·677	134
100	2·710	0·795	0·706	142
200	2·710	0·645	0·762	263
500	2·710	0·360	0·867	578

Table 3.

Roan puered in artificial bate.
Original thickness l=2·64.

p	l_2	λ	E
0	2·64		
5	2·25	0·1734	28·83
10	2·02	0·2348	42·59
15	1·84	0·3030	49·51
20	1·71	0·3523	56·78
30	1·60	0·3940	76·15
50	1·46	0·4470	111·9
75	1·33	0·4963	151·1
100	1·24	0·5304	188·5
200	1·01	0·6176	323·8
300	0·92	0·6516	460·5
400	0·82	0·6896	580·1
500	0·69	0·7388	677·0

Table 4.

Roan puered.
Original thickness l, = 2·56 m.m.

p	l_2	λ	E
0	2·56		
5	1·98	0·2265	22·08
10	1·74	0·3203	31·22
15	1·56	0·3906	38·41
20	1·44	0·4376	45·71
30	1·34	0·4766	62·95
50	1·16	0·5470	91·41
75	1·06	0·5860	128·00
100	0·98	0·6173	162·00
200	0·85	0·6680	299·4
300	0·70	0·7267	428·7
400	0·47	0·8165	490·0

Table 5.

Puered roan.

p	l_1	l_2	l_3	λ	E	R (resiliency)
						per cent.
50	2·46	1·59	1·69	0·355	141	11·5
100	2·46	1·32	1·40	0·460	217	7·4
200	2·46	1·17	—	0·520	385	—
300	2·46	1·07	—	0·564	530	—
100	1·88	1·13	1·23	0·400	250	13·4

Table 6.

Limed sheep-skin.

Load in grms. cm^2	l_1	l_2	λ	E
0	4·475	4·475		
5	4·475	4·305	0·0380	132
10	4·475	4·255	0·0492	205
15	4·475	4·185	0·0684	220
20	4·475	4·095	0·0849	236
25	4·475	3·985	0·109	230
30	4·475	3·900	0·128	235
40	4·475	3·760	0·160	250
50	4·475	3·615	0·192	260
60	4·475	3·535	0·210	286
70	4·475	3·445	0·230	305
80	4·475	3·385	0·243	330
90	4·475	3·300	0·262	344
100	4·475	3·215	0·282	355
200	4·475	2·635	0·411	487
500	4·475	1·955	0·563	890
1000	4·475	1·255	0·719	1400

Tables 7, 8, 9.

Limed sheep-skin.

p	l_1	l_2	λ	E
100	3·91	2·98	0·238	420
150	3·91	2·78	0·289	519
200	3·91	2·56	0·319	625

p	l_1	l_2	λ	E
100	2·33	1·90	0·184	542
150	2·33	1·76	0·244	613
200	2·33	1·66	0·287	695

p	l_1	l_2	λ	E
100	5·98	4·71	0·212	471
150	5·98	4·37	0·269	557
200	5·98	4·09	0·316	635

Table 10.

Limed sheep-skin, a different portion taken for each pressure.

p	l_1	l_2	l_3 (thickness on removing load)	R (resiliency)	λ	E
				per cent.		
20	4·80	4·30	4·59	58·0	0·104	193
30	4·36	3·90	4·18	60·8	0·105	286
40	4·93	4·24	4·64	58·0	0·140	353
50	4·88	4·09	4·66	72·1	0·162	310
60	5·04	4·11	4·67	60·2	0·184	308
70	4·77	3·87	4·40	58·9	0·190	372
80	4·82	3·58	4·23	52·4	0·258	315
90	4·65	3·44	4·04	49·6	0·260	345
100	4·48	3·41	4·04	58·8	0·240	420
200	4·42	2·99	3·69	49·0	0·325	620
500	5·46	2·38	3·03	21·1	0·565	890
1000	4·89	1·34	1·68	9·6	0·725	1380

Table 11.

Limed sheep-skin, all pressures on same portion.

p	l_1	l_2	l_3	R	λ	E
				per cent.		
20	3·61	3·27	3·45	52·3	0·093	216
50	3·61	3·09	3·38	55·7	0·144	481
100	3·61	2·85	3·27	55·0	0·210	637
200	3·61	2·49	3·02	47·5	0·310	839
300	3·61	2·25	2·80	40·5	0·376	1176
500	3·61	1·81	2·32	28·4	0·497	1414
700	3·61	1·72	2·22	26·5	0·521	2700
1000	3·61	1·48	1·82	31·0	0·590	3000

Table 12.

Limed sheep-skin, under lime-water.

p	l_1	l_2	l_3	λ	E	R
						per cent.
100	3·13	2·26	2·87	0·278	360	70
100	3·34	2·39	3·20	0·285	350	85

Puered sheep-skin, under water.

p	l_1	l_2	l_3	λ	E	R
						per cent.
100	1·79	0·76	1·06	0·575	174	29
100	1·79	0·77	0·95	0·570	175	17·4

Delimed sheep-skin, under water.

p	l_1	l_2	l_3	λ	E	R
100	2·52	1·50	1·82	0·572	174	15·8
100	1·79	0·91	1·15	0·490	205	27·3

Discussion.

Mr. S. R. Trotman suggested that the authors' method of testing might prove useful in the examination of glue and gelatin, which at present were generally judged by the percentage of water they were capable of absorbing.

Mr. C. E. B. Merriman inquired what would be the result of the tests if carried out in a vacuum.

Mr. J. H. Dunford pointed out that different mechanical tests for glue often yielded different results. Thus he had known cases where a glue which was found stronger than another by the shot test gave a weaker joint than the other.

Mr. J. M. Wilkie inquired what was the percentage error of the tests.

Mr. S. J. Pentecost inquired what was the effect of oil and grease on the mechanical properties of the skin.

Mr. J. T. Wood, in reply, said that beyond causing rapid evaporation of the water contained in it the effect of placing a puered skin in a vacuum would be slight. He had, however, suggested puering in vacuo, as this would be favourable to the depletion of the skin. It was not possible to obtain exact duplicates of any test, since the test must necessarily be made on different parts of the skin. Adjacent pieces did not differ more than a few per cent., the third figure of E being unreliable. Natural fat in a sheep-skin in some cases added much to its thickness, and care must be taken in selecting test pieces where the fat was normal. In a puered skin the fat was set free and the effect was negligible.

Yorkshire Section.

Meeting held at the Hotel Metropole, Leeds, on Monday, March 10th, 1913.

PROF. A. G. GREEN IN THE CHAIR.

RAG FLOCK AND THE CHLORINE STANDARD OF PURITY.

BY F. W. RICHARDSON AND A. JAFFÉ.

The use of unwashed rags for the manufacture of flock has caused disquiet for years past, and the Local Government Board has at last taken action in the shape of the Rag Flock Act of 1911. It seems scarcely credible that flock made from filthy rags, the remnants of "cast-off clothing and strips of old carpet, which may have been picked out from refuse heaps," to use Dr. A. Newsholme's words, should, without any cleansing other than a mere shaking, furnish flock for the stuffing of mattresses and cushions.

Professor Nuttall and Dr. Graham Smith have wisely decided that "it would be impracticable to establish a bacteriological standard of purity" (L.G.B. Report on Rag Flock, New Series, No. 27, 1910, pp. 27 to 29.) Ordinary road dust teems with microbes, many of these of the *coli* species, and it is not so much this dust but filth from the human person which one wishes to detect in rag flock.

In the Draft Regulations of the Local Government Board, Section 1 (1) of the Rag Flock Act, 1911, we read :—

"Article 1. Flock shall be deemed to conform to the standard of cleanliness for the purposes of Subsection (1) of Section (1) of the Act when the amount of soluble chlorine, in the form of chlorides removed by thorough washing with distilled water at a temperature not exceeding 25° centigrade from not less than 40 grammes of a well-mixed sample of flock, does not exceed 30 parts of chlorine in 100,000 parts of the flock."

The chlorine standard is based upon the fact that human urine and perspiration contain considerable amounts of chlorides. This fact is shown in the following analyses.

50 grms. of a well washed and dried rag-flock were mixed with 5 c.c. of urine. A woollen vest previously soaked in perspiration, caused by vigorous exercise, was taken for a comparison based upon the chlorine figure.

Parts in 100,000 parts of material :—

	Urine-stained flock.	Perspiration-soiled vest.
Chlorine	90·8	90·8
Phosphorus pentoxide	25·5	0·43
Soluble organic nitrogen	125·4	21·8
Free nitrogen as ammonia	20·6	1·14

These data give rise to several interesting considerations : (1) $3\frac{1}{3}$ c.c. of urine in 100 grms. of flock would furnish the maximum amount of soluble chlorides permitted by the Rag Flock Act. This seems a large proportion of impurity ; but the Act probably allows for an amount of chlorine due to other sources.

(2) One part of chlorine in urine is associated with ·28 part of phosphorus pentoxide.

(3) Perspiration contains very little phosphate.

(4) Soluble organic nitrogen shows a higher figure than the chlorine in fresh urine-soiled flock.

The following figures show the percentage of ash and sandy matter in a selected number of rag-flocks compared with the chlorine standard :—

	Chlorine.	Ash.	Sand, etc.
M.	9·1	6·1	2·6
N.	31·4	5·5	0·8
O.	17·1	4·4	0·3
P.	110·0	4·2	1·5
Q.	59·5	2·6	1·1
R.	19·8	2·8	0·6

Here the flock with the smallest amount of chlorine contains the largest percentage of mineral matters. The amount of earthy substances in flock is thus no guide to the quantity of organic filth present.

We are informed that garments soiled with fæces are converted into rags for flock making. Fæces show very little chlorine, and the chlorine standard would thus allow such flock to pass muster. In the case of rag flock we are dealing with decomposed human excreta. The nitrogenous constituents of the urine, perspiration, fæces and pus (for even bandages from wounds are made into flock) will have suffered still further degradation, through the activity of micro-organisms. The following figures show what a large amount of decomposition has taken place, also how rash it would be to assume that all soluble nitrogen and chlorine in flock is of human origin; even a well washed top, straight from the sheep's back and ready for lubrication with oil, shows considerable amounts of chlorine and nitrogen:—

Rag flock and chlorine comparisons.—Parts per 100,000.

	Chlorine.	Total nitrogen.	Free ammonia (N).	Alb. ammonia (N).
(1)	314	138·0	82·5	41·1
(2)	306·5	115·2	49·4	16·5
(3)	250·0	107·0	82·4	12·4
(4)	125·0	50·3	16·5	20·6
(5)	122	31·4	9·8	12·3
(6)	59·5	23·5	11·5	4·9
(7)	28·4	22·4	14·8	6·6
(8)	19·8	21·3	8·2	3·3
(9) Pure wool tops	22·7	14·6	6·6	2·5

While in freshly urinated flock the nitrogen as ammonia is only one-seventh of the total nitrogen, in some of these it constitutes more than half.

We suggest the estimation of total soluble nitrogen as follows:—Macerate 50 grms. of the flock with successive amounts of water, until the strained liquid measures one litre. Filter upon a dry filter and use the filtrate for the operations hereafter mentioned. A large amount of vigorous washing and pressure is necessary to remove the great bulk, say 95 per cent., of the chlorides from rag-flocks. Make 250 c.c. (corresponding to 12½ grms. of flock) acid with sulphuric acid and boil down for the estimation of total nitrogen by Kjeldahl. 10 c.c. form a convenient quantity when largely diluted, for the estimation of the free and saline ammonia by the Wanklyn method, also for the albuminoid ammonia if deemed necessary.

Methods for estimation of chlorine.

The filtrate from ordinary flock is too dark and impure to admit of the direct estimation of chlorine with $N/10$ silver nitrate. 2·2 c.c. of $N/10$ silver nitrate if required for 500 c.c. of the 5 per cent. decoction would represent the maximum amount of chlorine. We evaporate to dryness 500 c.c. of the filtrate, representing 25 grms. of the flock accordingly, with 1 c.c. of a 10 per cent. solution of sodium carbonate, ignite, take up with water, filter, and use the filtrate for the chlorine estimation. The Volhard silver and sulphocyanate method is the best for this purpose, as the decomposition occurs in the presence of excess of nitric acid.

The following figures give useful comparisons and furnish parts of chlorine in 100,000 parts of rag flock.

	Volumetric		Gravimetric.
	N/10 silver nitrate and chromate.	Volhard's thiocyanate etc.	
	parts.	parts.	parts.
(1)	122·0	—	117·0
(2)	59·5	—	55·3
(3)	53·9	—	51·5
(4)	31·2	—	31·6
(5)	19·8	—	18·2
(6)	110·3	—	108·6
(7)	14·2	13·75	—
(8)	19·9	18·20	—
(9)	17·0	15·20	—

We have been surprised to find soluble chlorides in material presumably free from such bodies; thus a clean wool top showed 22·7 parts of chlorine in 100,000 parts of sample.

The following are some typical illustrations:—

	Chlorine. (grav.)	Free ammonia nitrogen.	Alb. ammonia nitrogen.	Organic nitrogen.	Total nitrogen.
	parts.	parts.	parts.	parts.	parts.
Cotton seed flock	95·0	16·5	16·5	20·5	37·0
Best wool flock	75·0	16·5	3·3	5·9	19·8
Good wool flock	41·6	12·4	2·5	5·6	18·0
White serge	12·8	6·6	4·1	9·1	15·7
White wool flock	35·6	6·6	2·5	8·0	14·6

The cotton seed flock shows over three times the maximum amount of chlorine and the total nitrogen would also indicate a similarly excessive amount of impurity. Why a pure clean looking white wool flock should also yield excessive chlorides is a problem we have not yet solved. The only sample which passes muster is the white serge, and the total soluble nitrogen in this sample is peculiarly large.

Here are some examples:—

	Chlorine.	Total nitrogen.	Free nitrogen.	Alb. nitrogen.
I. Carpet flock ..	39·7	34·7	12·3	13·2
J. Carpet flock .	181·4	128·0	20·6	30·6
K. Carpet rags..	14·2	16·8	3·3	7·4
L. Carpet strips .	85·1	101·0	25·5	24·8

J and L would certainly seem to be filthy when judged both by chlorine and nitrogen.

Hypochlorite bleaching and carbonising by hydrochloric acid gas are also possible sources of high chlorine in carpet material.

In a recent number of the "Cabinet Maker," (Jan. 4, 1913, p. 11), W. Bacon said that "chlorine was freely used in manufacture, and was not a sign of dirt." He also accounts for it in new material as due to chlorine largely used for fixing colours and threads in weaving.

Thus the chlorine factor may not indicate organic dirt, but only harmless chemical substances in certain flocks. We have included carpet flock in our paper, despite a recent decision of the Shoreditch Magistrate that a flock made from carpet waste was not rag flock. Carpets can furnish rags just as well as clothing and may contain the same impurities. If there is any possibility of the Court of King's Bench upholding such a judgment we also concur that the Rag Flock Act will have to be amended.

The following analyses may be of interest :—

Milling flocks.

	Chlorine.	Total nitrogen.	Free ammonia nitrogen.	Alb. ammonia nitrogen.
A. Millings	14·2	14·2	6·6	2·47
B. Dark millings	125·0	31·2	9·2	12·40
C. Dark millings, scoured ..	17·0	22·4	4·9	8·20
X. Thread raisings after scouring ..	17·0	10·1	5·8	1·65

Presumably milling flocks should be largely free from impurities; but those who have seen the concentrated dirty fluid with which they are mixed as they fall from the machine will readily understand how serious pollution is possible. A sample must have been washed while B represents the crude and impure article.

Finishing flocks, etc.

	Chlorine.	Nitrogen.		
		Total.	Free.	Alb.
D. Mixture cuttings	17·0	10·0	4·1	2·5
E. Grey raisings (dry bed flocks).....	19·8	11·2	4·1	4·1
F. Beatings	17·0	18·4	13·2	3·3
G. Beatings.....	11·3	14·5	8·2	2·4
H. Mungo rags .	132·0	20·5	11·5	4·1

We propose determinations of three data :—(1) Chlorine: (2) Soluble nitrogen; (3) Phosphorus pentoxide.

To estimate the phosphorus pentoxide, the residue from the evaporation at 100° C. must be oxidised, not charred, as charring causes a serious loss of phosphorus. The molybdate process should be used in such a manner as to give a precipitate of fairly average composition, a precipitate which can be collected on a dried and weighed filter.

A flock yielding a high chlorine and low nitrogen with little or no phosphorus might be allowed to pass as reasonably free from human excrement. Further and fuller investigations are necessary before a satisfactory standard of purity or a maximum of animal impurity can be fixed.

FLOCKS AND THE CHLORINE STANDARD OF PURITY FOR RAG FLOCKS.

BY HOWARD PRIESTMAN.

Flocks, other than rag flocks, are composed of the fibres that are removed from cloth of various kinds, in the processes of cloth finishing. The fibres are very short: few, if any, averaging half an inch in length. They may be classified under three main heads :—

1. Those from the scouring and milling processes.
2. Those from the raising and thread raising processes.
3. Those from the cropping process.

Flocks from the scouring and milling of pieces composed of long fibred wools are of the highest value, because some of them are good enough to be suitable for blending with wool for the production of Cheviot yarns and goods. They consist for the most part of fibres rubbed from the surface of the cloth, whilst cloth is going wet and soapy over and through the rollers of the two processes named.

On the other hand, flocks of this class which come from cloths composed largely of shoddy or mungo, are naturally dirty, because mungo and shoddy are never washed prior to finishing; and in addition to the dirt in the rags as they come to the factory, mungo and shoddy fabrics contain a very high percentage of black oil, which is added to them in the pile, before they go through the rag machine or "devil." This machine pulls them thread from thread and fibre from fibre. A certain amount of dust and dirt is shaken from them before oiling, but from the first process until they are made into cloth, almost all the dirt and grease goes forward from one process to the next. This means that all cloth wholly or largely composed of shoddy and mungo contains a heavy percentage of foreign matter, including chlorides, and that it will all be washed out in the scouring and milling processes. This filthy residue must of necessity permeate all the soapy water used in the machines, and consequently all the waste or flock which has fallen to the bottom of the machines and is there saturated again and again. For this reason real flocks from woollen fabrics may be quite undesirably dirty, although the cloth itself will be perfectly clean, after it is scoured and rinsed, as it is rinsed, with liberal applications of pure water, to remove the soap.

These flocks are, so far, outside the scope of the Act and may be sold with apparent impunity, although they may contain above the standard allowance of chlorine. Some of these flocks are washed and dried before they are sold.

2. Raising flocks are composed of fibres brushed or combed from the surface of the cleansed piece, in the process of raising of a nap on the surface of the cloth, by the action of the spines of the teazles. There are generally three, and sometimes more than three, separate raising processes in the finishing of a single piece. They are thread raising, wet raising, and dry raising. The flocks from them may be sold separately or they may be blended.

Anyone intimately acquainted with the trade would expect to find that the fibres in these flocks had come away, not in groups, but one by one, and this is approximately the case. In the flocks there are few pieces of yarn to be found. Bits of broken teazles abound, but otherwise the dry, clean and springy product is remarkably uniform in its composition prior to being rolled.

Raising flocks, like milling flocks, are sometimes sufficiently long to be used for blending in the production of low-class yarns, but many of them doubtless find their way into the upholstering trade and they are quite unlikely to contain objectionable impurities.

3. Cropping flocks are the fibres which are first brushed up on the face of the cloth and then removed by shearing or cutting with a circular knife. They are necessarily very short, sometimes a lot will not average one-eighth of an inch in length.

They should be quite clean, but their length makes them unfit for textile purposes, and they are said to go largely to the paper trade; though they, like all other wool flocks, doubtless find their way into upholstery stuffing as well.

These flocks, like those from the raising process, contain few pieces of yarn, and when any such occur they will be fairly numerous; as, for instance, when the tail of a piece kicks up as it passes under the knife and is cut to shreds in the twinkling of an eye. It is possible also that a piece has been mended on the face, and in that case the loose ends of yarn would naturally be shorn off close to the surface. But in either of these cases the pieces of thread would be easy to tell; they would not be disintegrated and they would have at least one clean cut end.

So much may be said of flocks which are left outside the Act. Why they are left outside is a problem that does not concern us here, though it is a problem of extraordinary interest; and why the chlorine standard should be applied to "*Flocks manufactured from rags*" and not to other flocks, not manufactured from rags but made filthy by human excrement in a previous incarnation, is an equal mystery. That is to say, wool flocks made utterly filthy by one user of a mattress may be, and sometimes are, sold back to a flock maker and by him blended with others to be sold again as new. They are neither washed nor otherwise properly cleansed. Such a transaction would not be in any way contrary to law, for these are not rag flocks.

Let us see what rag flocks are, and why they are worse than real flocks? or why they are supposed to be so. To answer even this simple question we are driven to analyse the meaning of the two words "manufactured" and "rags." In the heavy woollen district, "rags" are such pieces of cloth as come back to the manufacturer to be pulled to pieces and made again into yarn. They are pieces of cloth that are unfit, owing to size or shape or condition, to be used for making into clothes or carpets or curtains or flags or furniture. Seeing that this Act had special reference to the heavy woollen district, it is hard to imagine how any definition other than this can be given of the word rags.

Purists may contend that rags must consist of cloth in a torn or ragged condition, that untorn clothes are not rags, and that tailors' clippings are not rags. The Act has already been interpreted in this way in London by a stipendiary magistrate. It is an unfortunate definition, for it can only mean that no clothes except such as are actually worn into holes are rags within the meaning of the Act. If this be so it only remains to cut out the frayed places from any garments and it ceases to be rag. It may be as dirty as you like but it is not rag, and is therefore exempt from the Act. Again, tailors' clippings have never been worn and are therefore not rags according to this argument, but many of them are thrown out into the ashmiddens, from which they are picked by itinerant rag gatherers. They are filthy beyond all description, but if the word rag is only to apply to worn and frayed clothing any one is at liberty to make *all* tailor's clippings into flock without the least reference to its cleanliness or the reverse.

It is the object of this paper to point out that most invidious distinctions have been drawn between different classes of materials whether they are clean or dirty. Of the dirtiness of many there is no doubt, but it is interesting also to note that many materials as clean as the best scouring can make them, are condemned simply because they contain chlorine. Presumably those who drew up this extraordinary law were entirely ignorant of the processes of the trade; for clean carpets contain an excess of chlorine which is applied to fix the various dyes, and chlorine is used in baths of considerable density to denude wool of its scales and thereby make it, to all intents and purposes, unshrinkable. This process is applied to large quantities of the highest classes of knitted underwear, and also to the best white serges and other like goods, that are likely to need washing.

It has not yet been determined whether it is possible to remove all the chlorine from such goods by any commercial process, that will leave the fabric uninjured, but it is clear from a sample tested that ordinary washing does not remove all chlorine from within the fibre, because the cloth in question would quickly have rotted if the hypochlorite had not been efficiently washed out. It is also clear that very well washed cloths contain about half as much chlorine as would condemn them if they were made into flock, and it cannot reasonably be doubted that many unshrinkable fabrics of pure worsted, that have escaped drastic washing, will contain over the standard of chlorine prescribed by the Act.

And what is true of pure white serge is true to a greater extent of the cleanest unused carpets. They contain almost three times the amount of chlorine allowed by law. The chlorine is used to fix the dyes, and we are therefore face to face with this extraordinary paradox, that flocks prepared from clean carpet and the like will be condemned under the Act and persons in possession of them will be mulcted in heavy damages. On the other hand, under the interpretation that "rags" within the meaning of the Act are necessarily torn or frayed flocks made from the filthiest of tailor's clippings and will go free; together with all dirty flocks coming from the scouring and milling machine of the heavy woollen district because they are not "manufactured" from rags at all.

So much for the inconsistencies that occur in the use of the word "rags" in the Act. It now only remains to consider what is meant by the word to manufacture. Shoddy and flocks (which are largely used as the raw material for certain woollen yarns) are described by the Government as partly manufactured. Some one must decide if these articles are manufactured within the meaning of the Act, for in the ordinary acceptance of the term they are not manufactured. On the other hand, it is clear that some dictionary definitions of the word to manufacture would include all flocks. For example, it would be difficult to say that the manufacture of flocks was "a particular form of productive industry," seeing that every pound of flocks produced means one pound less of cloth. On the other hand, if it be held that "to produce by labour or mechanical process" is to manufacture, then all flocks are manufactured and all that come even as a by-product from shoddy cloth or from cloth largely composed of shoddy are "manufactured from rags" and are "rag flock" within the meaning of the Act. It does not matter in the least how many processes intervene in their conversion from rags to flock. They may be ground, shaken, and put through the flock machine or they may be ground garneted, carded, scribbled, spun, woven, and milled, and they have once been rags. They may have been through three manufacturing processes or through seven. It ought not to matter, and in that case all flocks from the heavy woollen district are rag flocks within the meaning of the Act, and if they contain above 30 parts per 100,000 of chlorine they stand condemned whether they are free from animal excretions or they are not.

The whole position is anomalous, and the foolishness of the position becomes apparent when it is realised that the deletion of the word "rag" would solve the whole complexed problem. Why should real flocks be allowed to contain more objectionable matter of any kind than flocks made from rags?

NOTE ON SOLUBLE CHLORIDES IN WOOL AND "WOOL" FLOCKS.

BY WILLIAM MCD. MACKEY AND JAMES MILLER.

The following samples have been supplied to us by a well-known Leeds firm, who guarantee that the flocks have been manufactured from material which in no case has been worn since leaving the manufacturer's hands.

Soluble chlorides stated in terms of chlorine, parts per 100,000.

No. 1.	East India wool	301
No. 2.	"Best white woollen flocks"	40
No. 3.	"Fine raising flocks"	60
No. 4.	"Fine milling flocks"	6
No. 5.	"Fine blue milling flocks"	40
No. 6.	"Grey milling flocks"	18
No. 7.	"Brushing flocks"	18
No. 8.	"Coarse milling flocks"	80
No. 9.	"Brown grey rug milling flocks"	4
No. 10.	"Red rug milling and raising flocks"	6
No. 11.	"White blanket flocks"	28
No. 12.	"Carpet flocks"	6
No. 13.	"Dark cutting flocks"	12

DISCUSSION.

Prof. A. G. **Green** said that the legislation obviously did not meet the technical facts of the case. The difficulties were very great and he thought that if the help of technical men had been called in, better results might have been obtained. Reliance on the chlorine value alone was quite erroneous. Chlorine could be introduced from several sources which were not detrimental to health. Wool might contain chlorine in the form of hydrochloric acid and also under certain conditions in organic combination. In the carbonising of rags hydrochloric acid was used. Large quantities of chlorine were thus introduced, part of which remained in the wool. This chlorine was remarkably firmly fixed and could not be washed out by water alone. The rags if made from shoddy might have passed through this process more than once. Hydrochloric acid could even be taken up by wool from solutions containing only salt if an organic acid were present. Those conditions existed while the wool was still on the sheep's back. Referring to dyes he pointed out that although salt was frequently employed in dyeing cotton it was not much used in dyeing wool and the probability of its introduction in this way was rather remote. He did not see how the suds produced in scouring cloth made from rags could carry down chlorine as had been suggested, although the flock might contain chlorine fixed upon it in a previous state of existence. The chlorine test alone was obviously quite fallacious. The determination of soluble nitrogen compounds might lead to error as the wool substance itself could give rise to such compounds. That figure alone was also not a safe guide. It seemed to him that a high content of chlorine accompanied by phosphates might serve as an indication of organic contamination. If the amount of sodium were estimated at the same time and the combined chlorine deducted from the total chlorine the organic chlorine could thus be allowed for. He was surprised to hear of difficulty in extracting, as he thought soluble chlorides would be easily extracted by water.

Mr. J. B. Wilkinson drew attention to the introduction of chlorine in the scouring process. Ammonium chloride and common salt had been largely used, especially in the past, to keep colours insoluble and yet get cloth clean. Often the colour of a single thread out of a large number must be protected and chlorine compounds were used to a large extent for the purpose. Most colouring matters were insoluble in salt solutions. Then again the unshrinkable process, especially for woollen underwear, had come largely into use within this last few years, and chlorine compounds formed a very important part of the process—also another factor must be noted where low woollen goods were treated with zinc and magnesium chlorides for weighting purposes. All these had their effect in leaving chlorine on the fibre in some form or other.

Mr. W. McD. Mackey suggested that the chlorides in the water used for washing the flock in the mill should be taken into account in a prosecution; thus flock after washing might hold say half its weight of water, and if we assume an extreme case of the water containing 60 parts of chlorine per 100,000 this would give 30 parts of chlorine per 100,000 in the flock. He did not consider churning of the flock when treating a sample for testing necessary. His experience was that standing half an hour with frequent stirring, as suggested by Dr. Garrett in his report, was all that was needed, and that indeed the stirring need not be frequent. He and Mr. Miller had made comparative experiments on the point. Nor was it necessary to wash the chlorides out of the sample; all that was required was to give the sample an adequate treatment with distilled water, and having got the soluble chlorides into solution to take an aliquot portion (without filtration) for the test. He found it easy to titrate without further treatment in the great majority of cases. Eight drops of a five per cent. solution of potassium chromate added to 50 c.c. solution (representing five grams of the flock) usually gave a predominating yellow tint that allowed of titration with a weak silver nitrate solution (1 c.c. equals 0·001 grm. of chlorine). Samples could at least be sorted by such a titration. Say a first 0·5 c.c. gave no change and a second 0·5 c.c. gave a change, the titration could be repeated to get the exact number; if a third 0·5 c.c. was necessary in the first titration it showed that the sample was near the border line and more elaborate treatment was necessary (100 c.c. evaporated with sodium carbonate, charred, etc., as mentioned by Mr. Richardson). He thought the Act was in the right direction. It was a rapid test and on the whole an adequate test, and in the interest of manufacturers the test must be simple and easily applied. The origin of the rags must be taken into account along with the analytical result. New material, such as carpet clippings, did not require to come within the Act, nor was the Act aimed at such. The vessel that Mr. Miller and he had used in extracting flock consisted of a cylindrical glass vessel with means of drawing the water off at the bottom.

Mr. W. E. Clarke said there had been a great outcry against low-class bedding, and the Rag Flock Act was the outcome of agitation. The reason the Act did not apply to flocks other than rag flocks was because the Local Government Board had endeavoured to get rid of human impurities, to which rags were subject, while new woollen flocks, not having been worn, were free from such matter. Woollen flocks were as clean as new blankets, new flannel or new cloth, because they came from those textile fabrics during the last processes of manufacture. He understood that in these cases chlorine did not indicate corrupt matter. He explained that new carpet cuttings and new tailor's cuttings, though new and clean, were rags and as such came within the Act, but carpet waste and thrums never having been woven into a fabric were exempt. He suggested a conference between flock manufacturers and this association.

Dr. H. Ingle said that in one sample of flocks he had found by washing with water 71 parts per 100,000. He then tested the flocks—25 grms. in a 500 c.c. flask with $N/50$ potash, allowed to stand 24 hours, then filtered off the flocks, squeezed them and several times washed them with the filtrate. Then, after acidifying the filtrate and titrating against silver nitrate, using potassium chromate (10 per cent. solution) as spot indicator, he found 270 parts of chlorine per 100,000, or nearly four times that yielded to water. He suggested two explanations. The oily nature of the flocks might retard the action of the water on the chlorides present, and further the dilute alkaline liquor might react with some of the eosines or basic dyestuffs or the mordants and assistants used.

Prof. A. G. Green thought it very improbable that grease would retain soluble chlorides, and basic dyestuffs were not likely to be used.

Dr. Ingle continued that the increased yield of chlorine might be due to the action of the weak alkali upon the chlorinated wool fibre produced by the "carbonization" processes used in shoddy mills. He agreed that probably the best method was to determine the chlorine and sodium in the flocks, as that would give a clue as to the cause of the filth present, although even then the sodium might well result from the soaps used in scouring.

Mr. W. Lowson suggested the use of Brearley and Ibbotson's lead molybdate method for estimating phosphorus. This determination could be made very rapidly and accurately. Owing to the relatively large weight of precipitate obtained compared with the amount of phosphorus to be estimated the method was a very delicate one and small quantities of phosphorus might thus be readily determined. Referring to the varying amounts of chlorine obtained by the authors when using different methods of estimation, he asked whether, in the use of Volhard's method, precautions had been taken to prevent the action of the thiocyanate solution on the precipitated silver chloride.

Dr. L. L. Lloyd considered the analytical data relied upon so far to be quite useless. Professor Green had mentioned the fixation of hydrochloric acid upon wool that was produced by the action of salt or most inorganic chlorides and an organic acid. A very important point was that when such wool was dried, some of the hydrochloric acid might be extracted by cold or warm water. That was perfectly true even when the wool had been washed with water until chlorides were practically no longer present in the washings. Again, wool reacted with a strong solution of salts, and particularly with salt or chlorides, with production of a wool acid-substance and a wool alkali-substance. The wool alkali-substance was more soluble in water than wool acid-substance, and it was most probable that the wool-alkali substance would lead to false interpretations if the albuminoidal ammonia were considered as being derived from filth. Again, wool that had been chromed gave, after drying, a fairly large amount of water soluble matter, which would again increase the amount of albuminoidal ammonia. If a cutting was not a rag, then there were many chlorine compounds used for finishing purposes that should be estimated and allowance made for their chlorine content. Such bodies as zinc, barium, magnesium and calcium chlorides were not detrimental from a hygienic standpoint, and in some cases might be advantageous as disinfectants. It appeared from the data given that the phosphorus would be the most satisfactory. A good method for the estimation of phosphorus in organic compounds was to mix the compound with twelve to fourteen times its weight of sodium peroxide in a nickel crucible, and heat gently until decomposition began, in some cases the mixture might be fired by touching with a piece of red hot iron wire. The reaction was complete immediately after combustion. The melt was treated when cold with water, and the phosphorus estimated gravimetrically. This method had been found to give quantitative results with pure organic compounds and also with albuminous bodies. The phosphorus could be estimated upon the whole of the material or upon the aqueous extract. A very important point would be the detection of pathogenic bacteria.

Mr. W. McD. Mackey contended that a cutting was not a rag within the meaning of the Act. The Act referred to rags that had been worn.

Mr. Howard Priestman said that the wording of the Act should be altered, since tailors' clippings and other material which had not actually been worn but thrown out on to refuse heaps might easily get into the flocks.

Obituary.

JOHN HERON.

John Heron was born in Bandon, Co. Cork, on May 8th, 1850. After studying engineering at Queen's College, Cork, and gaining the degree of B.E. in 1871, he decided to take up chemistry, came to London, and entered as a student at the Royal College of Chemistry under the late Sir Edward Frankland. For a few months in 1876 he was in charge of a guncotton factory in Wales, but soon gave this up to join Dr. Horace Brown as second chemist at Worthington's Brewery, Burton-on-Trent. After about seven years with Brown, during which time they did valuable pioneer work in the chemistry of starch and in the study of enzyme action, Heron went, in 1883, for a couple of years as Chemist to the Anglo-Bavarian Brewery at Shepton Mallet, and was then for 10 years chemist at the Invert Sugar Works of Messrs. Garton, Hill and Co. in London. From 1895 till his death on March 29th, Heron was in practice in London as Brewing Chemist and Consultant. Always keenly interested in the science of his subject, Heron was an active investigator in brewing and sugar chemistry, and published a large number of papers on these subjects, including some valuable ones contributed to this Society on the use of the polariscope in brewing and malting work. An original member of our Society, he freely gave his services for its work:—he was Hon. Secretary of the London Section from 1892 to 1898, a Vice-President from 1898 to 1900, and a member of the Publication Committee from 1888 to 1910. He was one of the founders of the Laboratory Club, served on its first Committee, was the last President of the Club, in 1887, and the first President of the Institute of Brewing when the Club developed into that Institute in 1890, and had since then been closely and actively interested in the Institute. In 1876 he married Miss Emily Clarke, of Hove, who survives him, and he leaves a family of three sons and seven daughters. Heron was a man of genial character and great ability, and exercised an important influence for good on the Brewing Industry.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Furnaces. W. Sillery, Glasgow. Eng. Pat. 4163, Feb. 19, 1912.

The furnace has a travelling grate, the chains or other supporting members carrying the fire-bars being suspended in a catenary curve, and driven from the rear of the furnace in such a manner that the travel of the grate is in the same direction as the flow of the gases of combustion.—H. H.

Furnaces. A. Leinveber, Chemnitz, Saxony. Eng. Pat. 13,986, June 15, 1912.

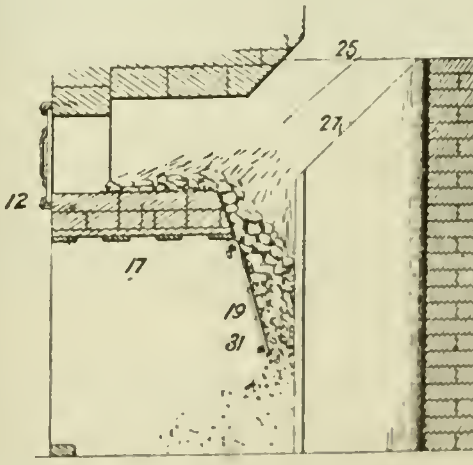
To avoid the premature burning through of the arch of the hearth of furnaces of the regenerative type, *e.g.* Siemens-Martin furnaces, the furnace arch is made to extend upwards over the front of the arch of the air passages, which are directed steeply downwards. The furnace arch has thus a convex shape above the hearth, and a concave shape at the ends over the arch of the air passages.—T. St.

Steam evaporators. D. A. Quiggin, Liverpool. Eng Pat. 5587, March 5, 1912.

In evaporators in which vapour is rapidly generated and carries with it considerable quantities of the finely divided liquid, the separation of the vapour and liquid particles is effected by causing them to pass through an arrangement of volute-shaped baffles, so that they pass centrifugally from the centre line of the apparatus to the periphery. During the passage through the spaces between the baffles, the rubbing action causes the separation of the entrained liquid particles. The latter flow down the baffle-plates to the partition or "deck," which supports them and are thence returned through a pipe to the boiling liquid below.—W. H. C.

Kiln. J. Ruston, Athens, Ohio. U.S. Pat 1,055,233, March 4, 1913.

The fuel for heating the kiln is introduced through the door, 12, on to the coking plate, 17, and is burnt in the fire-box, 31, formed between the grate, 19, and the semicircular baffle-wall, 27. The heated products of combustion



pass through the channel, 25, into the heating flues of the kiln.—W. H. C.

Evaporator. O. Mantius. Assignor to Zaremba Co., Chicago, Ill. U.S. Pat. 1,054,926, March 4, 1913.

The claim is for a vertical tubular evaporator the length of which is three times the diameter and which is provided with a set of tubes in the lower part, which are at least half the length of the outer casing. A baffle is arranged between the tubes to ensure continuous contact between the heating medium and the tubes, and a return flow pipe is provided on the opposite side to the baffle.—W. H. C.

Drying plant for macaroni, vermicelli, and the like, as well as for pulpy and liquid substances; Method and apparatus for the construction of ——. W. P. Thompson, Liverpool. From Trockenschrank- und Maschinenbau-Industrie Friedrichshafen W. G. Mader und Co., Friedrichshafen a. B., Germany. Eng. Pat. 14,430, June 20, 1912.

The drying chamber and the supports to carry the material to be dried are formed of porous asbestos plates, on which a film of aluminium or gold has been electrolytically deposited.—W. H. C.

Dry kiln. E. A. Rummler, Winnetka, Ill., Assignor to The Wenborne-Karpen Dryer Co. U.S. Pat. 1,055,359, March 11, 1913.

A drying kiln is provided with a partition at one side adapted to form an air circulating duct communicating at top and bottom with the drying chamber. The air is circulated by means of heating coils in the air duct and cooling coils spread across the top of the drying chamber in such a manner that the hot air entering the top of the drying chamber from the air duct is cooled evenly and caused to descend in a uniform stream upon the materials to be dried.—H. H.

Dryer. W. E. Prindle, Manitowoc, Wis. U.S. Pat. 1,056,121, March 18, 1913.

A horizontal drum rotatably mounted on rollers, is provided at the front end with a suitable feeding device and is connected with the source of a supply of heated air. The dried material is discharged from the other end of the drum, which is also provided with an internal concentric tube, extending from the discharge end of the outer drum, where it is in communication with an exhaust fan, to an intermediate point between the ends of the outer drum. The inner tube which serves as an exit for the heated air, is provided with baffles to force the heated air into contact with the walls, so that the heat may act on the material passing along the outer tube.—W. H. C.

Cooling towers. G. Harrison, London. From A. and F. Hamon Frères, Brussels. Eng. Pat. 15,074, June 27, 1912.

Water and like cooling towers of the type in which a vertical air draught conduit is situated in the centre of a system of laths composing the tower, are provided with baffles opposite the air inlets at the bottom to prevent the air from passing right through the lower part of the tower during violent gusts of wind.—H. H.

Gases and vapours; Separating liquid particles from ——. P. Graefe, Mallnitz, Germany. Eng. Pat. 15,353, July 1, 1912.

The moist gases are passed over a series of plain and slotted plates, arranged alternately, the slotted plates having projecting tongues which act as baffles and collect the moisture.—H. H.

Heating vessels such as are used for instance for distilling purposes; Method of and apparatus for uniformly ——. Sudfeldt und Co., Melle, Germay. Eng. Pat. 25,711, Nov. 8, 1912. Under Int. Conv., Nov. 8, 1911.

The process consists in employing as a heating agent a mixture of air and steam which has been raised to the desired temperature by preheating if necessary and then compressing either by a steam jet blower or by a compressor. For example, a temperature of more than 200° C. may be attained by preheating air to a temperature of 150° C. and compressing it by a superheated steam jet to a pressure of 2½ atmospheres. The temperature is regulated by regulating the pressure at which the heating agent escapes by means of a valve.—H. H.

Separating liquids and solids; Process of ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 1,055,254, March 4, 1913.

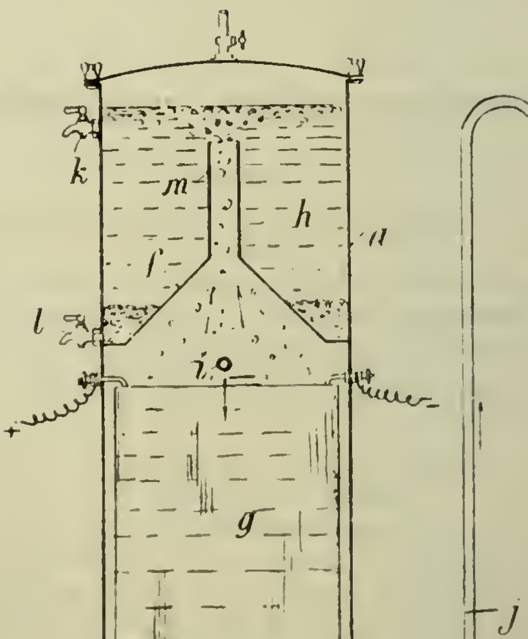
A long layer of settled solids below a body of liquid is formed by centrifugal or other suitable means. The solids are moved towards and discharged from one end of the layer, the point of discharge being above the level of the clear liquid. The clear liquid is discharged from the opposite end of the apparatus, and fresh material to be separated is introduced at a point midway between the ends.—W. H. C.

Solids from liquid solutions; Apparatus for separating ——. L. C. Trent, Los Angeles, Cal. U.S. Pat. 1,056,233, March 18, 1913.

The apparatus consists of a stationary tank for receiving the mixture to be treated and within which a centrifugal separator, having a bottom feed open to the tank is mounted. The mixture passes upwards into the centrifugal and the solids, which are thrown by the centrifugal force to the periphery, are discharged, whilst the clear liquid is drawn from the centre of the centrifugal, through the hollow shaft, by a vacuum pump and discharged into a launder.—W. H. C.

Separation of the constituents of mixtures; Method and apparatus for automatically effecting the —— [*and for purifying water*]. J. Mason and J. Roussel. Fr. Pat. 448,019, Sept. 6, 1912.

The mixture to be separated is introduced, along with a suitable liquid, through the pipe, *i*, into the vessel, *a*, which is divided into an upper and lower chamber by the conical partition, *f*. The lighter constituent rises through the funnel and tube, *m*, into the upper chamber, *h*, where it either settles or floats, and is drawn off by one of the taps, *k* or *l*. The heavier constituent passes downwards and is discharged with the liquid through the pipe, *j*. The difference in density of the components of the mixture may be increased by causing the particles of one of the constituents to be surrounded or enveloped by a film



of gas, produced by suitable chemical or physical means. The apparatus may also be used for the purification or sterilisation of water, in which case electrodes, *g*, are provided and connected with a source of current. The gas resulting from the electrolysis attaches itself to the particles of the separated impurities, which are floated into the upper chamber and separated.—W. H. C.

Liquids from solid materials; Apparatus for removing ——. I. Blount, Brooklyn, N.Y. U.S. Pat. 1,056,495, Mar. 18, 1913.

The apparatus comprises a conical chamber having an inner perforated wall spaced at a small distance from the outer wall, an inlet chamber at the top communicating with the inner space, and a removable discharge plate at the bottom equal in area to the whole width of the chamber and fitted with an inner perforated partition. The liquid to be treated is admitted at the top together with steam and flows away through outlet pipes connected with the lower part of the chamber and with the discharge plate, while the solid materials remain in the inner perforated chamber and are compressed therein by the steam pressure.—H. H.

Impregnating solid or nearly solid materials [leather] with other substances; Process for ——. A. R. Bullock. Fr. Pat. 448,191, Aug. 12, 1912.

The rate at which the impregnating substance penetrates the material being treated is greatly increased by subjecting both to the action of a magnetic field, the intensity of which can be varied.—W. H. C.

Vacuum; Process for the production and maintenance of a high —— especially in metal vessels for the storage and transport of liquefied gases. Heylandt-Ges. m. b. H. Ger. Pat. 255,860, Nov. 5, 1910.

The use of charcoal as an absorbing medium for the production of high vacua is known (see Eng. Pat. 13,638 of 1904; this J., 1905, 793). According to the present patent magnesium carbonate is used instead of charcoal. It is stated to possess an appreciably greater absorptive power than the latter.—A. S.

Drying or treating solid materials by air or gases; Apparatus and process for ——. J. Liddle, Glasgow. From The Mark Process Co., Phœnix, Arizona, U.S.A. Eng. Pat. 6533, March 16, 1912.

See Fr. Pat. 441,990 of 1912; this J., 1912, 909.—T. F. B.

Drying vegetable and mineral substances; Band-press for ——. H. Brune and H. Horst, Frankfort, Assignors to E. Abresch, Neustadt on Hardt, Germany. U.S. Pat. 1,055,384, March 11, 1913.

See Fr. Pat. 434,085 of 1911; this J., 1912, 217.—T. F. B.

Evaporators; Means for removing salt deposits from the walls of ——. G. A. Riemer. Stassfurt, Germany. Eng. Pat. 11,909, May 20, 1912.

See Fr. Pat. 444,411 of 1912; this J., 1912, 1112.—T. F. B.

Concentrating apparatus. P. Kestner, Lille, France. Eng. Pat. 21,548, Sept. 21, 1912. Under Int. Conv., Sept. 22, 1911.

See Fr. Pat. 447,710 of 1912; this J., 1913, 276.—T. F. B.

Evaporation, concentration, and distillation; Process of ——. W. Anderson, Helensburgh, and J. Meikle, Glasgow. U.S. Pat. 1,056,877, March 25, 1913.

See Eng. Pat. 14,285 of 1911; this J., 1912, 909.—T. F. B.

Filter-presses; Plates for ——. R. Haag, Stuttgart, Germany. Eng. Pat. 14,429, June 20, 1912. Under Int. Conv., Oct. 10, 1911.

See Ger. Pat. 248,613 of 1911; this J., 1912, 910.—T. F. B.

Filter. F. and F. P. Candy, Westminster. U.S. Pat. 1,057,328, March 25, 1913.

See Eng. Pat. 22,955 of 1911; this J., 1912, 896.—T. F. B.

Filter. F. P. J. Grenet, Bellevue, Assignor to Soc. Anon. du Filtre Chamberland, Système Pasteur, Paris. U.S. Pat. 1,057,823, April 1, 1913.

See Eng. Pat. 16,270 of 1911; this J., 1911, 1331.—T. F. B.

Ammonia; Method of condensing —— [for refrigeration, etc.]. L. Block, Mamaroneck, N.Y. U.S. Pat. 1,056,144, March 18, 1913.

See Fr. Pat. 444,688 of 1912; this J., 1912, 1113.—T. F. B.

Separating materials; Apparatus for magnetically ——. S. Brück, Berlin. U.S. Pat. 1,056,318, March 18, 1913.

See Eng. Pat. 11,898 of 1911; this J., 1911, 1457.—T. F. B.

Adding reagents to liquids or mixing liquids; Apparatus for ——. M. Deacon and W. Gore, London. U.S. Pat. 1,056,780, March 25, 1913.

See Eng. Pat. 11,251 of 1911; this J., 1912, 576.—T. F. B.

Agitating and conveying settled stiff masses, such as starch, clay, or the like; Apparatus for ——. V. Taschl, Wessely on March, Austria-Hungary. U.S. Pat. 1,057,685, April 1, 1913.

See Fr. Pat. 446,008 of 1912; this J., 1913, 125.—T. F. B.

Classification of fine powders; Apparatus for ——. G. H. J. Monnet, Stolberg, Germany, Assignor to Soc. Anon. des. Manuf. des Glaces et Prod. Chimiques de Saint Gobain, Chauny et Circy, France. U.S. Pat. 1,057,870, April 1, 1913.

See Eng. Pat. 2830 of 1911; this J., 1911, 732.—T. F. B.

Separation of substances by passing them through a thickness of froth; Process for the ——. R. Jaffé. Fr. Pat. 448,818, Sept. 28, 1912.

See Ger. Pat. 255,531 of 1911; this J., 1913, 351.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Sulphuric acid for refining petroleum; Examination of ——. F. Schulz. Chem. Rev. Fett Ind., 1913, 20, 82—84.

A refining test affords the best mean of ascertaining the suitability of a sample of sulphuric acid for refining crude petroleum and lubricating oils:—An addition of 1 c.c. of the acid is made to 100 grms. of well-refined petroleum oil in a 150 c.c. flask, which is then closed and vigorously shaken for 15 minutes. After standing for an hour the oil is decanted into another flask, shaken with about 2 grms. of dry calcium hydroxide, and filtered, and the filtrate compared colourimetrically with the same oil before this treatment. The difference in colour may be expressed numerically by matching it with 98 to 99 c.c. of water into which a 0·1 per cent. solution of potassium chromate is introduced drop by drop. From 0·3 to 2·5 c.c. (= 0·0003 to 0·0025 per cent. of K_2CrO_4) are usually required. Of the usual impurities in commercial sulphuric acid, nitrogen oxides and selenious acid have a strong discolouring influence upon petroleum oil, but no such effect could be observed with sodium sulphate, ammonium sulphate, lead sulphate, arsenic pentoxide (0·1 per cent.) and hydrochloric acid, whilst the influence of ferric sulphate was doubtful. The discolouration caused by nitrogen oxides is due to partial nitration, whilst the selenium oxide effects oxidation. Commercial sulphuric acid which had caused discolourations in the refinery was found to contain from 0·02 to 0·04 per cent. of oxides of nitrogen.

In the case of acid containing selenium the yellow discolouration of the petroleum oil increases with the quantity of acid used for the refining, but when an acid contains only slight traces of oxides of nitrogen the colour of the petroleum oil may be improved by increasing the proportion of acid or by using acid of higher concentration. Selenium is determined by stirring 10 grms. of the acid with 90 c.c. of water, and filtering the separated lead sulphate from the cooled mixture. The filtrate is then treated with 10 c.c. of strong hydrochloric acid and 6 grms. of sodium sulphite and heated for a few hours on the water-bath. The selenium, which separates quantitatively as a red precipitate, is collected in a Gooch's crucible, washed with water, dried at 105° C., and weighed. Nitrous acid is best detected by Ilosvay's reagent, which is prepared by dissolving 0·1 grm. of α-naphthylamine in 100 c.c. of boiling water, adding 5 c.c. of glacial acetic acid and a solution of 1 grm. of sulphanilic acid in 100 c.c. of water, together with a little zinc dust, shaking the mixture, and rapidly filtering it into a flask which is kept well closed. For a colourimetric determination 2 grms. of sodium nitrite (about 90 per cent. $NaNO_2$) are dissolved in 100 c.c. of water, and 1 c.c. of the solution added to 99 grms. of pure sulphuric acid. The acid will then contain 0·01 per cent. of N_2O_3 and will keep unchanged for a long time. The comparison is made by adding 5 grms. of solid sodium acetate to each of two portions of 40 c.c. of water, then 1 c.c. of the reagent and 1 c.c. of the acid under examination to the first flask and 1 c.c. of the standard acid to the second flask. The contents must be kept at the same temperature, and the colourations compared after 30 minutes.—C. A. M.

Steam coal; Standard specification for ——. J. Gas Lighting, 1913, **122**, 116.

SPECIFICATIONS for steam coal, of which the following is an abstract, have recently been approved by Committees representing the principal London firms of coal contractors and the Associated Municipal Electrical Engineers of Greater London. Two alternative specifications are given, A for "named" coal, or coal of a particular description, and B for coal guaranteed to have definite qualities as a fuel for steam-raising purposes. The table of standards for guaranteed coals is given below :—

	Calorific value.	Moisture.	Small coal through mesh of:			
			½ in.	⅜ in.	¼ in.	$\frac{3}{16}$n.
	B.T.U.	per cent.	per cent.	per cent.	per cent.	per cent.
A. Durham and Yorkshire coals (bituminous) :—						
Washed double nuts	13,250	8	—	—	15	—
Washed single nuts	13,000	9	—	17·5	—	—
Washed peas	12,750	10	—	—	20	—
B. Scotch washed coals (bituminous) :—						
Washed double nuts	12,750	10	15	—	—	—
Washed single nuts	12,500	11	—	20	—	—
Washed peas	12,000	13	—	—	—	20
C. Welsh washed coals (semi-bituminous and pseudo-anthracitic) :—						
Washed large nuts	14,300	5	15	—	—	—
Washed small nuts	13,900	6	—	20	—	—
Washed peas	13,350	6	—	—	—	20
D. Durham and Yorkshire dry screened coats (bituminous) :—						
Double nuts	12,750	5	17·5	—	—	—
Single nuts	12,500	6	—	25	—	—
Peas	12,250	6	—	—	25	—
E. Derby and Notts. dry screened coals (bituminous) :—						
Double nuts	12,250	9	15	—	—	—
Double screened small nuts	12,000	9	—	20	—	—
Pea nuts	11,500	10	—	—	—	20
F. Leicester-Warwick and South Staffs. dry screened coals (bituminous) :—						
Double nuts	12,000	10	15	—	—	—
Double screened small nuts	11,750	10	—	20	—	—
Pea nuts	11,250	12	—	—	—	20

Bonus and penalty. No variation of the contract price shall be made for any variation from the standard not exceeding one-twentieth, up or down, of the figures given in the table. If the calorific value (determined in a Mahler bomb calorimeter with coal dried for 1 hour at 220° F. or 104·4° C.) exceed or be less than the standard value, the price per ton shall be increased or decreased in the same percentage ratio, and the purchaser shall have the right to reject the consignment if the calorific value be more than 7½ per cent. below the standard. If the moisture (determined by air-drying and exposing to a temperature of 220° F., or 104·4° C., for 1 hour) be less than, or exceed, the standard value, the weight of coal to be paid for shall be increased beyond, or decreased below, the quantity actually weighed by a percentage equal to the percentage decrease, or increase, of moisture; the purchaser shall have the right to reject the consignment if the total moisture exceed 1½ times the standard value. If the percentage of small coal (determined with sieves of square mesh with openings "in the clear" to the sizes given) be less than, or exceed, the standard, the weight of coal to be paid for shall be increased beyond, or decreased below, the quantity weighed by a percentage equal to one-quarter of the percentage decrease or increase (taken on the bulk and not on the standard) of small coal; the purchaser shall have the right to reject the consignment if the proportion of small coal exceed 25 per cent. by weight (on the bulk). The percentage of sulphur reckoned on the coal "as received" must not exceed 2 per cent.—A. S.

Petroleum oil; Edeleanu's process of refining —— by means of sulphur dioxide. C. Engler and L. Ubbelohde. Z. angew. Chem., 1913, **26**, 177—181.

THE authors have tested Edeleanu's method of refining petroleum with liquid sulphur dioxide (see this J., 1910, 143; also Eng. Pat. 11,140 and Ger. Pat. 216,459 of 1908; this J., 1908, 974; 1910, 144) both in the laboratory and and on the industrial scale. In the large-scale tests, the petroleum distillate to be refined was first dried by means of a fused mass of 1 part of calcium chloride and 4 parts of ordinary salt, then pumped into a cooling chamber, some of its heat being abstracted on the way by passing through pipes in contact with previously chilled refined oil. At the same time the liquid sulphur dioxide was chilled in a similar manner and conveyed to another cooling chamber. As soon as both oil and reagent had been cooled to about − 10° C. the oil was run into a mixing chamber and the necessary quantity of liquid sulphur dioxide (1·3 : 1) made to flow in a state of fine division over its surface. In this way the oil became saturated with the sulphur dioxide without the need of mechanical agitation. The lower layer consisting of the sulphur dioxide extract was then drawn off into an evaporation vessel, whilst the upper refined portion was drawn off into another chamber. The sulphur dioxide was evaporated from both portions by means of steam coils, and was condensed again and returned to the liquefied gas reservoir. The refined oil then only contained about 0·2 per cent. and the extract about 0·4 per cent. of sulphur dioxide, and this could be easily washed out of both with water. A plant for treating 62 tons of oil per day could easily be managed by three workmen and the total cost of refining 100 kilos. of petroleum oil would amount to M. 0·436 (2·6d. per cwt.) The refined oil obtained by the process had invariably a lower sp. gr. than the original distillate, that of the extract being correspondingly higher. The refined portion from crude distillates of every kind was nearly colourless, any faint yellow colour being readily removed by a slight subsequent refining with 0·5 per cent. of sulphuric acid. Oil thus refined would burn with a strong white flame without any tendency to smoke, and was equal in these respects to the best lamp oils. The extract, on the other hand, was yellow to brown in colour and could not be burned in lamps. The following results illustrate the differences in the products obtained from Bustenari oil by this process and by the ordinary method of refining with sulphuric acid :—

Properties.	Original distillate.	Lamp oil obtained by ordinary refining.	Lamp oil obtained by SO_2 process.		Extract.
			Without refining.	After subsequent refining.	
Sp. gr. ...	0·8200	0·8195	0·8030	0·8028	0·8650
Flash-point	27·0° C.	27·5° C.	28° C.	28° C.	—
Sulphur, %	0·052	0·016	—	0·008	0·042
Yield on crude oil, %	33·0	32·8	24·7	24·5	25·0 (calculated on distillate)

Photometric tests also showed that the lamp oil refined by the new process was superior to that refined by the ordinary method, and that it was nearly equal in intensity of light to the best American oils. Since the extract consisted, in the main, of unsaturated hydrocarbons, homologous compounds to benzene, etc., it could be used in the preparation of substitutes for oil of turpentine, and especially for such purposes as oils rich in unsaturated hydrocarbons (*e.g.* oils from Borneo and Texas) are used. In fact, these extracts would be more suitable than the natural oils mentioned, as solvents for many resins. The constituents boiling above 200° C. could not be used for this purpose, but might be utilised as lubricants and gas oils, whilst the tar obtained in the latter process would contain a considerable quantity of the lower aromatic hydrocarbons, which would increase its value under certain conditions.—C. A. M.

Petroleum oil; Toxicity of the gases formed in the distillation of——. A Scheller and K. Stauss. Petroleum, 1913, 8, 849—850.

A fatal case of poisoning, which took place when a still containing the residue from a distillation of petroleum oil was being repaired, was found to be due to the presence of carbon monoxide. Experiments were therefore made to determine the composition of the gases formed in a vacuum still at different stages of the distillation of petroleum oil residues, and the following results were obtained :—

	Shortly after the beginning of distillation.	After about 1 hour.	After distillation of about a third of the oil.	Shortly before the end of the distillation.
	per cent.	per cent.	per cent.	per cent.
Carbon dioxide..	3·5	6·0	3·0	2·5
Unsaturated hydrocarbons .	3·5	12·0	3·5	16·5
Carbon monoxide	16·0	8·5	16·5	10·0
Saturated hydrocarbons	77·0	73·5	77·0	71·0

No oxygen or hydrogen was present in any of the samples, but there were traces of organic sulphur compounds and from 0·6 to 0·7 per cent. of hydrogen sulphide. The proportion of carbon monoxide in the gases varied with the origin of the residue. Thus, for example, the following average results were obtained in the distillation of residues under the same conditions :—From Policiori residue, 8·0; from Bustenari residue, 3·7; Campina residue (containing paraffin wax), 2·6; and from Moreni residue, 1·1 per cent. of carbon monoxide. In other respects the gases had a similar qualitative composition, and contained no hydrogen or oxygen. The carbon monoxide and dioxide appear to be derived mainly from the decomposition of the esters of the acids in the residue. Thus on extracting a residue with alkali hydroxide solution and subsequently drying and distilling it, no trace of carbon monoxide or dioxide was found in the gases. In like manner, unrefined heavy machine oil yielded these gases on distillation, whereas after refining they were not detected. Even when all air was expelled (by means of benzine vapour) from the retort, carbon monoxide and dioxide were found in the distillation gases. On the other hand, atmospheric oxygen might play a part, as was shown by the fact that when air was admitted from time to time into a flask in which a refined machine oil was being distilled, the evolved gases contained carbon monoxide and dioxide, whereas these gases were not produced when the oil was distilled in the usual way. But since the gases never contained any appreciable quantity of nitrogen and no hydrogen (from the decomposition of the methane), the formation of the carbon monoxide and dioxide was attributed to the decomposition of the acids mentioned above.—C. A. M.

Motor spirit; The future of——. V. B. Lewes. Chem. World, 1913, 2, 111—113.

The imports of petrol into this country have increased from 18 million galls. in 1905 to 80 million galls. in 1912, whilst the world's production of crude oil has only increased from 28·5 to 50 million tons. The principal sources of the petrol imported in 1912 were the Dutch East Indies and America, which sent to this country 46 and 16 million galls. respectively. The surplus available for export from America is decreasing, and the excess of demand over supply has raised the price of crude oil at the oil-fields. Methods are available for increasing the yield of petrol from the crude oil. By compressing the gas which escapes from the oil wells, a light spirit is recovered which may be mixed with the fractions of higher boiling point. The specific gravity of petrol used for motor spirit is now 0·720 or higher, as compared with 0·680 when the supply was greater than the demand. The heavier fractions of crude oil may be converted into light oils by distillation in contact with catalytic agents such as nickel, or by "cracking." One process in use consists in spraying "solar oil" (a heavy fraction from American petroleum) with water into long iron retorts packed with iron filings and heated to 600° C.. and condensing fractionally the vapours obtained; 100 galls. of "solar oil" yield 39 galls. of petrol, 13 galls. of solvent spirit and 13 galls. of "varnish." Crude oil, however. cannot be a lasting source of supply of motor spirit. The quantity of motor spirit (benzol, etc.) available from gas-works in this country at present is only 50,000 galls. per annum. whilst 8 million galls. of benzol are recovered in coke-oven plants which only treat 42 per cent. of the coal used for making metallurgical coke. The Scotch shale-oil industry yields about 600,000 galls. of motor spirit per annum. The motor spirit of the future will probably be alcohol, in admixture with about 10 per cent. of benzol.—A. T. L.

Studies on oxidation. Armstrong and Colgate. *See* London Section, p. 391.

The agglutinating power of coals. Dunn. *See* Newcastle Section, p. 397.

Gasworks pitch industries and cancer. Ross and others. *See* III.

Patents.

Compressed fuel. L. J. Thomas, Hoylake, Cheshire, and A. Hannay, Liverpool. Eng. Pat. 9065, April 17, 1912.

Briquettes are made of anthracite "duff" (small grains and powder), 95 to 97 per cent., and an adhesive mixture consisting of 7 parts by bulk of maize or equivalent flour, 1 part of powdered or small asbestos and 2 parts of powdered pitch or bitumen.—A. T. L.

Fuel briquettes, ovoids, and the like; Manufacture of —— from waste products. A. D. Furse, Beckenham, Kent. Eng. Pat. 18,736, Aug. 15, 1912.

In the process for making fuel briquettes from town refuse, etc., described in Eng. Pat. 21,192 of 1911 (this J., 1912, 275), the small particles of incombustible substances such as dust, ashes, etc., are separated from the vegetable and other moist material in a rotary cylindrical screen or perforated drum having pivoted within it beaters or vibrators actuated by gravity, which cause vibration as it rotates. To prevent damage to the screen, striking plates are provided against which the beaters come in contact as they fall.—H. H.

Fuel; Manufacture of agglomerated ——. L. Martel. Fr. Pat. 448,604, Sept. 23, 1912.

Briquettes are made with about 7 per cent. of a binder containing dry pitch, 5 parts, tar, 1 part, and asphaltic calcareous material, 1 part.—A. T. L.

Coke-oven heat; Apparatus for utilising ——. E. C. Morgan, Chicago, Ill., Assignor to Titlow Waste Heat Power Co., Uniontown, Pa. U.S. Pats. 1,054,859 and 1,054,860, Mar. 4, 1913.

(1). A steam-generator is mounted above each coking chamber, and is connected with the steam-main by a swivel joint so that it can be moved aside in a horizontal arc to give access to the coking chamber. Each steam-generator has a central vertical heating flue which, when the generator is in position, forms a continuous flue with the central opening in the top of the oven. (2). A steam-generator having vertical heating flues is carried on a truck on rails on the top of the oven, so that it is can be brought over the central opening of the oven or moved to one side. The generator is fitted with flexible steam and water pipes leading to the fixed steam and water mains.—A. T. L.

Retort coke-oven. C. H. Hughes, Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 1,055,536, Mar. 11, 1913.

A retort coke-oven having horizontal heating flues is provided with a pair of regenerators located below the oven and parallel thereto, and with two waste gas flues and an intermediate air flue located below the regenerators. Each waste gas flue is connected with one regenerator while the air flue is connected with both, and interconnected valves are provided so that the connections between the regenerators and the flues are shifted synchronously.
—H. H.

Coke; Quenching of ——, in receptacles open at the top. Ofenbau-Ges. m. b. H. Fr. Pat. 447,749, June 19, 1912. Under Int. Conv., June 21 and 23, 1911.

The receptacles for the coke are constructed so that the water is admitted at the bottom and is allowed to rise until the coke is covered, the water being then run off. The water is admitted through louvres formed by overlapping plates. The lower part of the receptacle is conical and is closed by horizontal doors or covers. These doors are withdrawn horizontally for discharging, and in replacing the doors, the continued movement of the controlling member, when the door is beneath the opening, moves a wedge beneath the door so as to hold it tightly in place. The controlling member acts on this wedge through a spring so that the vertical pressure is applied gradually. The door bears against a replaceable frame having a seating edge of V-section.—A. T. L.

Chamber ovens for the production of coke and gas; Method of heating regenerative ——. Bunzlauer Werke Lengersdorf und Co. Ger. Pat. 254,121, Oct. 28, 1910.

The oven is heated by several parallel currents of heating gases, the groups of vertical flues being connected in such a manner, that the paths of the different currents are of equal length. The heating flues are so arranged that the ascending currents of heating gases in one group are between the ascending and descending currents respectively of another group.—A. S.

Shaft furnace, with external and internal heating, for the coking and gasification of coal. J. Lütz. Ger. Pat. 255,907, May 18, 1912. Addition to Ger. Pat. 250,576 (see this J., 1912, 1172; also Ger. Pat. 252,154, this J., 1913, 77).

A heat-exchanging device for preheating the air supply to the inner heating flues is disposed in the central part of the furnace.—A. S.

Coke oven; Regenerative —— for alternate heating with coke-oven gas or low-grade gas [e.g. blast-furnace gas], with two regenerators each for air and gas. Dr. C. Otto und Co., Ges. m. b. H. Ger. Pat. 256,023, March 3, 1912.

The air-regenerators are disposed on one side and the gas-regenerators on the other side of the oven, so that they can alternately be placed in communication with the same air- or gas-distributing main respectively. In each of the upper horizontal conduits there is a movable division wall, so that varying proportions of the waste heat can be supplied to the air- or gas-regenerators. By means of suitable dampers the oven can be heated either by a low-grade gas, such as blast-furnace gas, or by coke-oven gas, or a suitable mixture of the two.—A. S.

Back-lighting in combustible gaseous mixtures; Prevention of ——. W. A. Bone, Leeds, Yorks, and C. D. McCourt, London. Eng. Pat. 6738, Mar. 19, 1912.

In the process of surface combustion (see Eng. Pat. 29,430 of 1909, this J., 1910, 1448) a combustible mixture is supplied at a speed greater than the speed of back-ignition to a bed of refractory material in which combustion takes place. In order to check the backward progress of the flame, if the speed of supply accidentally falls, the supply pipe is interrupted by an air-tight casing containing a diaphragm of porous refractory material through which the gas must pass. When the flame reaches this point, combustion takes place in the surface layers of the diaphragm, and the flame is not propagated further along the supply pipe. The heat of the combustion at this point may fuse a wire and so close a valve in the supply pipe and sound an electric bell. The porous diaphragm is constructed as described in Eng. Pat. 25,808 of 1909 (this J., 1910, 1448). The invention may also be applied to steam-boilers fired by surface-combustion as described in Eng. Pat. 4362 of 1910 (this J., 1911, 406).—A. T. L.

Propagation of flames along conduits carrying combustible mixtures; Prevention of backward ——. A. C. Ionides, jun., London. Eng. Pat. 12,346, May 24, 1912.

The conduit is provided with a section in which the gas is spread into a thin layer such that a flame passing through it would be cooled and extinguished. This layer must be not more than $\frac{1}{16}$ in. for a mixture of petrol vapour and air, or $\frac{1}{50}$ in. for a mixture of coal-gas and air. Further, this narrow passage meets the conduit at right-angles so that the flame undergoes a sudden change in direction, and in order to prevent undue resistance the narrow passage is at all points of equal sectional area to the conduit.—A. T. L.

Propagation of a flame along a conduit conveying combustible gaseous mixture; Means for preventing the backward ——. A. C. Ionides, jun., London. Eng. Pat. 14,717, June 24, 1912.

The apparatus comprises a liquid-seal, preferably of castor oil, the current of gaseous mixture passing down a vertical pipe which is open at its lower end and dips into the liquid. A valve mounted on a vertical spindle and immersed in the liquid is arranged beneath the open end of the dip pipe. On the occurrence of a back-fire, the pressure in the outlet compartment of the liquid-seal device forces liquid up the inlet pipe and closes the valve. A spring catch holds the valve closed and the valve when closed in this manner is sealed with liquid at both sides —A. T. L.

Gas producers. P. A. J. Cousin, Loos-lez-Lille, France. Eng. Pat. 23,256, Oct. 11, 1912. Under Int. Conv., Oct. 17, 1911.

The producer is arranged above an inverted conical water-trough and the fuel column rests on the bottom of this trough. The air-blast is admitted through a central conical tuyère which is covered by the water. By this arrangement, the clinkers are rendered spongy and easily breakable, so that they readily descend into the ash-pit and can be removed by a conveyor. The casing of the producer dips into the water so as to form a seal for certain pressures. A deeper seal is formed for higher pressures by a movable annular bell which dips into the water trough and into an annular trough formed on the outside of the producer casing. The tuyère for the blast is fitted with interchangeable caps having apertures at different heights, so that the blast can be admitted at different levels below the surface of the water. A draught is maintained when the producer is shut down by means of a small air-inlet pipe above the level of the water.—A. T. L.

Suction gas producers; Open hearth ——. Sir K. I. Crossley and F. Fielden, Manchester. Eng. Pat. 26,127, Nov. 14, 1912.

The producer has a stepped circular fire-grate, open all round to the atmosphere. The grate comprises a number of annular plates arranged one above the other, resting on brackets on the columns which support the producer, the smallest plate being at the bottom. These plates have flanges at the edges and may also have grooves or channels formed in the upper surface. Water is run directly on to the uppermost plate of the grate, and any water not evaporated there passes to the next lower plate.—A. T. L.

Gas producers. Sir K. I. Crossley and F. Fielden, Manchester. Eng. Pat. 26,128, Nov. 14, 1912.

An automatic ash-ejector for producers using pit-head slack or other fuel containing much ash, comprises a reciprocating table placed below the conical grate and worked at a regular but adjustable speed. One-half of the basket-shaped conical grate is extended downwards to the surface of the reciprocating table to act as a scraper and prevent the ash being carried back with the table on its return movement, and an auxiliary scraper is fixed behind this half of the grate so as to remove any ash falling through the grate-bars behind the first-mentioned scraper. —A. T. L.

Gas; Process of making ——. W. G. Laird, Washington, D.C., Assignor to The Improved Equipment Co., New York. U.S. Pat. 1,055,334, March 11, 1913.

Finely divided gas-making material, suspended in a non-oxidising gaseous medium, is subjected to radiant heat by being passed between heated walls, in a chamber. A whirling motion is imparted to the mixture by introducing at various points, jets of heated gas, which are directed along the heated walls transversely to the direction taken by the mixture.—W. H. C.

Gas; Process of manufacturing ——. M. W. Murray, Assignor to C. H. Rosenblatt, New York. U.S. Pat. 1,056,045, March 18, 1913.

Steam impregnated with a finely divided hydrocarbon is passed through hollow electrodes into the interior of an electric arc, which is maintained between electrodes. The steam is decomposed and the hydrocarbon gasified, and the resulting gas is caused to pass from the chamber which surrounds the electrodes through a water seal. —W. H. C.

Gas producers. Farnham's Patents, Ltd. Fr. Pat. 448,454, Sept. 12, 1912.

The producer, which can be worked by suction or by pressure, is of the underfeed type and comprises a main body portion lined with fire-brick and a short lower portion formed by an annular steam-generator. The fuel column is supported on a horizontal grate of diameter equal to that of the producer, and this grate can be raised and lowered by means of gearing driven from an electric motor. To charge the producer when in operation, the grate is raised as far as the top of the steam-generator, and horizontal plates are inserted between the main and lower portions of the producer so as to form a temporary support for the fuel. The grate is then lowered and the charge of fresh fuel is fed on to it, the horizontal plates being then withdrawn.—A. T. L.

Blast-furnace gas: Process for increasing the calorific power of ——. W. Zimmermann. Fr. Pat. 448,555, Sept. 20, 1912.

The gas is admitted above the column of coke in a coke-oven. The carbon dioxide in the blast-furnace gas is reduced by the incandescent coke and by the hydrogen in the coke-oven gas, whereby a gas rich in carbon monoxide is obtained, suitable for heating furnaces or for the production of motive power. The coke-oven gas is cooled, and the yield of by-products is therefore increased. —A. T. L.

Gas producer. F. Heller. Ger. Pat. 256,727, March 29, 1912.

By the introduction of steam in the clinkering zone of a gas producer, a loss of heat is caused in other parts of the producer traversed by the gases. In order to make up for this loss of heat, one or more additional supplies of air are provided, the additional air inlets being arranged at that zone of the producer where the endothermic processes causing the loss of heat occur.—A. S.

Acetylene storage tank. J. H. James, Pittsburgh, Pa., Assignor to Searchlight Gas Co., Chicago, Ill. U.S. Pat. 1,055,915, Mar. 11, 1913.

The tank is filled with the pith of plants of the order *Gramineæ* together with infusorial earth, a binder, and a solvent for acetylene gas.—A. T. L.

Gases; Separation of hydrogen sulphide from ——. K. Burkheiser. Fr. Pat. 448,728, Sept. 11, 1912. Under Int. Conv., Sept. 12 and 26, 1911.

The hydrogen sulphide is absorbed by a solution of alkali, and the alkali is recovered by treating the sulphide with hydrated iron oxide. The process may also be carried out by passing the gas through a washer which is supplied with a solution of alkali and an emulsion of hydrated iron oxide at the same time. The alkali may consist merely of the ammonia present in the gas, the washer being placed immediately after the tar-separator. The spent oxide is separated from the alkali by filtration, and may be used to furnish sulphur dioxide or trioxide for the ammonia scrubbers. In order to prevent the formation of insoluble ferrocyanides, sulphur is added to the alkaline solution, whereby polysulphides are formed and the cyanogen is absorbed in the form of thiocyanate. —A. T. L.

Gas washer. L. Smulders & Co., Maschinenfabrik Jaffa. Ger. Pat. 253,810, Jan. 4, 1911.

The washer comprises a rotating drum provided inside with suitable packing material. On the central shaft is a bucket-wheel which takes up the washing liquid from the lower part of the drum and distributes it over the packing material. On the hub of the shaft there are also guiding plates by which the descending washing liquid is directed inwards on to the packing material in the lower half of the drum.—A. S.

Ammonia from coal distillation gases; Process for the recovery of ——. C. Still. Ger. Pat. 255,432, Dec. 4, 1910.

Two saturators are used, the first for the cooled gases and the second for the vapours evolved on distilling the gas liquor. The whole of the acid required for the absorption of the total ammonia is introduced into the second saturator, and the acid solution from this saturator is led into the first. In this way solid ammonium sulphate is separated only in the first saturator.—A. S.

Coal distillation gases; Process for the simultaneous separation of hydrogen sulphide, ammonia, and cyanogen from crude ——. L. Bergfeld. Ger. Pat. 255,593, Aug. 24, 1910.

The purifying material consists of dehydrated copper sulphate or a mixture of salts, *e.g.*, alkaline-earth sulphates or chlorides, which combine with ammonia but not with hydrogen sulphide, with metallic oxides capable of combining with hydrogen sulphide. It is treated with ammonia gas before use. The reaction which takes place is of the type: $H_2S+NH_3+CaSO_4.NH_3=CaS+(NH_4)_2SO_4$. At the same time some sulphurous acid (which is fixed by the purifying material) and sulphur are also formed according to the equation: $SO_3+H_2S=H_2O+SO_2+S$. When the purifying material is exhausted, it is heated, with regulated access of air, whereupon the following reaction occurs:—

$$CaS+(NH_4)_2SO_4+3O=CaSO_4+SO_2+H_2O+2NH_3.$$

Ammonium sulphite with 1 mol. of water of crystallisation, is deposited in the receiver, and in presence of air is rapidly oxidised to ammonium sulphate with gentle warming. Cyanogen in the crude gas is fixed by the purifying material as cuprous ammonium cyanide, which during revivification yields ammonia and carbon dioxide, any thiocyanate giving ammonia, carbon dioxide, and sulphur dioxide. After passing the purifying material the coal gas may be further purified by leading it over alkali- or alkaline earth sulphides, and if necessary over sodium-amalgam.—A. S.

Mineral oil; Conversion of —— into volatile spirit. The New Oil Refining Process, Ltd., London, and R. G. Neilson, Glasgow. Eng. Pat. 28,460, Dec. 18, 1911.

Oil and water in the proportion of about 3 to 1, both in the liquid state, are introduced into a chamber which is kept at a temperature of 1000° to 1200° F. (538°—649° C.), this chamber being packed with a refractory metal, alloy or material, such as carbide of iron, copper, aluminium or an alloy thereof, bauxite, broken brick, coke, charcoal, or aluminium oxide. Air is excluded from the chamber. The resulting vapours are condensed, and the product is rectified. In a modification, the oil is introduced as a vapour and the water is introduced in the liquid state. Eng. Pat. 13,675 of 1908 (this J., 1909, 133) is referred to. —A. T. L.

[Mineral] oils soluble in water; Process for manufacturing ——. A. J. Boult, London. From Chem. Fabrik Westend, Charlottenburg, Germany. Eng. Pat. 6825, March 19, 1912.

See U.S. Pat. 1,042,915 of 1912; this J., 1912, 1173. The viscosity of the products may be increased by admixture with alkali or alkaline-earth hydroxides or carbonates.—T. F. B.

Gasolene; Manufacture of ——. W. M. Burton, Chicago, Ill., Assignor to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,049,667, Jan. 7, 1913.

Liquid paraffins from petroleum distillation having a boiling point of 500° F. (260° C.) and over are converted into low-boiling products of the same series by distilling off the volatile constituents at a temperature of from 650° to 850° F. (343°—454° C.) and a pressure of from 4 to 5 atmospheres, and condensing at a similar pressure. Accumulations of gas in the condensed products are released from time to time.—H. H.

"Natural-gas gasolene"; Process of refining ——. W. O. Snelling, Assignor to American Gasol Co., Pittsburgh, Pa. U.S. Pat. 1,056,845, Mar. 25, 1913.

The gasolene is distilled and the vapour, under a pressure of at least 2 atmospheres, is passed through a series of condensers, each of which is kept at a temperature just below the boiling point (at that pressure) of the fraction to be condensed.—A. T. L.

Paraffin compositions; Apparatus for expressing the fluids out of —— and separating the scale therefrom. J. Hansen, Texas City, Tex. U.S. Pat. 1,054,839, Mar. 4, 1913.

An apparatus for separating wax, etc., from paraffin distillates consists of a series of narrow cylindrical chambers each having an inner perforated tube fitted with a screen and straining cloth through which the distillate is forced. A worm shaft for removing the solid material passes through the chambers.—H. H.

Asphalt [Asphaltum]; Process of producing ——. W. M. Burton, Chicago, Ill., Assignor to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,055,707, Mar. 11, 1913.

The liquid portions of paraffin distillates having a boiling point of upwards of 500° F. (260° C.) are distilled at a temperature of from 650° to 850° F. (343°—454° C.) under a pressure of from 4 to 5 atmospheres maintained by means of the volatile constituents until the volume of the liquid has been reduced to about 40 or 50 per cent. of its original volume. The liquid residue is then drawn off and subjected to a temperature of from 500° to 700° F. (260°—371° C.) under substantially atmospheric pressure in an inert atmosphere until the major portion has been distilled off. The asphaltic residue is finally allowed to cool.—H. H.

Asphalt [Asphaltum]; Process of making ——. R. C. Dundas, Los Angeles, Cal., Assignor to Dundas Engineering Co. U.S. Pat. 1,056,980, Mar. 25, 1913.

Crude petroleum is caused to flow by gravity over a series of undulating plates in a vacuum chamber, the apparatus being heated so that the lighter products are evenly expelled and the liquid gradually thickened, and the liquid is then allowed to fall in thin streams over a series of baffles in a second vacuum chamber, so as to liberate the "nascent vapours."—A. T. L.

Petroleum, Apparatus for refining ——. F. W. Holmes and E. C. Blasdell, Pittsburgh, Pa. U.S. Pat. 1,055,747, Mar. 11, 1913.

The crude petroleum enters the still through a series of jackets acting as condensers for the vapours from the still. The pipes for the vapours progressively decrease in size, and traps are provided between each successive pair of condensers, by means of which the condensed distillate can be drawn off according to its specific gravity. —H. H.

Elaterite; Process and apparatus for treating ——. J. C. Ross, Colorado Springs, Colo., Assignor to The Hydro Carbon Co. U.S. Pats. 1,057,093 and 1,057,094, Mar. 25, 1913.

(1) The crude hydrocarbon is ground and mixed with liquid hydrocarbons, and the mixture is allowed to fall freely through a chamber lined with refractory material. A flame is established near the top of this chamber, so that the hydrocarbon is ignited and continues to burn as it falls. The hydrocarbon is allowed to fall until it burns itself out. (2) The crude hydrocarbon is ground and mixed with liquid fuel, and the mixture is fed on to a moving surface such as the surface of a rotating drum, on which it is ignited and allowed to burn freely until it burns itself out, the residue being continuously removed. —A. T. L.

Petroleum and petroleum residues; Treating ——. J. A. Dubbs, Los Angeles, Cal. U.S. Pat. 1,057,227, Mar. 25, 1913.

Petroleum or its residues are heated until the lighter constituents have been expelled, and then blown with air and steam in regulated quantities so as to obtain an asphaltic product. Either air or steam may be admitted first, followed in either case by a blast of mixed air and steam. The quantities of air and steam are varied in order to obtain harder or softer products.—A. T. L.

Petroleum; Apparatus for use in connection with the refining of ——. C. I. Robinson, West New Brighton, N.Y., Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 1,057,395, Mar. 25, 1913.

A still for crude petroleum is provided with two gas-outlet mains, one of which leads to a condenser and thence to a burner. The hydrogen sulphide in the gases which pass through the condenser is burned to sulphur dioxide and suitable apparatus is provided for converting the sulphur dioxide into sulphuric acid. The other gas outlet from the still is used when it is not desired to utilise the sulphur in the gas.—A. T. L.

Mineral oils, wax, tar, and similar substances; Process of treating ——. M. Melamid and L. Grötzinger. First Addition, dated Sept. 30, 1912, to Fr. Pat. 443,650, May 10, 1912 (this J., 1912, 977).

The method of purifying oils, etc., by means of phosphoric acid or a mixture of this acid with pyrophosphoric and phosphorous acids described in the chief patent, is stated to be particularly effective if carried out at temperatures of from 300° to 400° C. In an example, a mixture of 1000 kilos. of crude petroleum with 100 kilos. of phosphoric acid, or with 65 kilos. of this acid, 10 kilos. of pyrophosphoric acid, and 2 kilos. of phosphorous acid, is heated to 350°—400° C., and the purified oils either distilled off in the usual way or separated from the residue by decantation after standing. From the residue is extracted about 20 per cent. of a substitute for oil of turpentine, while the remainder forms a pale and inodorous resinous body. —H. H.

Naphtha, mineral oils, paraffin, and ceresine; Process for treating distillation products of ——. G. Petroff. Fr. Pat. 448,207, Aug. 31, 1912.

A process for purifying mineral oils consists in treating them in the usual manner with concentrated or fuming sulphuric acid, separating the acid layer, and washing the product with alcohol, acetone, or a similar solvent, either pure or mixed with water, before finally treating with alkali. The treatment with alcohol, etc., removes the sulphonic acids which cause the formation of an emulsion when the acid-treated oil is shaken with alkali without such treatment, so that the purification is quicker and more complete. The sulphonic acids may be recovered as a by-product. In an example, 400 kilos. of 40 per cent. alcohol are used for treating 10,000 kilos. of mineral oil.—H. H.

Oils; Process and apparatus for refining ——. R. A. Dorrès. Fr. Pat. 448,658, Dec. 1, 1911.

The process consists in passing a mixture of the oil vapour and superheated steam through a series of condensers maintained at successively reduced temperatures and pressures by means of which solid bodies and the heavier liquid fractions are removed in succession.—H. H.

Bituminous minerals; Apparatus for the utilisation of ——. H. Schillbach. Ger. Pat. 255,812, April 27, 1909.

The material is heated in a retort to drive off the volatile matter, and the non-volatile solid residue falls from the retort into a furnace, the gases from which circulate around the retort. The retort is provided at the bottom with a funnel fitted with a grating, through which the melted bitumen flows into an outlet pipe.—A. S.

Fuel; Process for the production of a weatherproof carbonaceous —— *of permanent shape and for rendering innocuous the sulphur contained in the coal.* E. Pollacsek, Florence, Italy. Eng. Pat. 8865, April 15, 1912.

See Fr. Pat. 442,556 of 1912; this J., 1912, 913.—T. F. B.

Gas retorts; Means for heating vertical ——. H. J. Toogood, Assignor to R. Dempster and Sons, Ltd., Elland. U.S. Pat. 1,055,837, March 11, 1913.

See Eng. Pat. 16,825 of 1911; this J., 1912, 805.—T. F. B

Water-gas; Means for the manufacture of carburetted ——. L. D. Carroll, Richmond, Va., Assignor to A. G. Glasgow, Richmond, Va., and Westminster. U.S. Pat. 1,055,317, March 11, 1913.

See Eng. Pat. 28,763 of 1910; this J., 1911, 1303.—T. F. B.

Process for increasing the stability of finely-divided calcium carbide. Fr. Pat. 448,077. *See* VII.

Utilisation of the waste of manufacture of calcium carbide. Fr. Pat. 448,078. *See* VII.

Manufacture of alkali sulphides. Fr. Pat. 448,927. *See* VII.

Detectors of combustible gases. Eng. Pats. 27,281 of 1911. 1469 and 15,677 of 1912, and 3002, 4003, and 4004 of 1913. *See* XXIII.

Apparatus for automatically analysing a gas or gaseous mixture volumetrically and recording the same. Eng. Pat. 5039. *See* XXIII.

Apparatus for analysing gases. Eng. Pat. 11,679. *See* XXIII.

Calorimeter. U.S. Pat. 1,055,699. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Wood, peat, and other substances; Apparatus for distilling ——. A. R. Tattersall, London, and A. P. J. Archbold, Barking. Eng. Pat. 5343, March 2, 1912.

A self-contained metal retort for distilling wood, etc., consists of a cylindrical metal body surrounded by a metal jacket and having charging doors at the sides, a fire-box at the bottom, and flues passing through the centre of the retort. The products of distillation are led to the condensers through the jacket space, and when two or more retorts are used in conjunction, the distillation products from the retorts which are being heated are passed through the jackets of those which are being charged, so that the material therein becomes dried and pre-heated before being distilled.—H. H.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 11,792, May 17, 1912.

The steadiness of arcs of the flaming or luminous type is increased if the electrode contains a cyanide or a material containing the cyanogen group. It has been found that the objection due to the poisonous nature of the gases given off by cyanides can be avoided by using metallic cyanamides. In one example, electrodes are formed by mixing in a finely-divided condition calcium cyanamide 150 parts, titanium oxide 250 parts, cryolite 150 parts, and carbon 800 parts. A suitable binding material such as pitch is added, and the mixture squirted and baked in the usual manner.—H. H.

Filaments ; Method of manufacturing electric incandescent lamp ——. E. M. Bailey, Leeds, and H. F. McDowell, Harrogate. Eng. Pat. 20 621, Sept. 10, 1912.

A FILAMENT combining the advantages of carbon and metallic filaments is formed from an ordinary carbon filament of fine sectional area by immersing it in a constantly agitated solution of hydrocarbon liquids and refractory oxides and passing a high tension current through the filament. An exterior sheathing of fine carbon and refractory oxide particles is thus deposited upon the filament. (Refererce is directed to Pats. 5790 of 1891, 3213 and 16,534 of 1896, 8434 of 1900, and 8891 and 14,898 of 1905 ; this J., 1901, 977 ; 1906, 527, 918.)—H. H.

Incandescence mantles of artificial silk ; Manufacture of ——. F. Wirth. Ger. Pat. 254,496, July 21, 1911.

AFTER the mantle has been impregnated and the thorium precipitated as hydroxide in known manner, the cerium is converted into compounds of a higher stage of oxidation by treatment with a basic or neutral solution of compounds capable of absorbing oxygen from the air. Alkaline pyrogallate or sodium hydrosulphite solution, or a solution of tannin in pyridine are mentioned as suitable for the purpose. The precipitation of the thorium as hydroxide may in some cases be effected by the same reagent. If a solution of tannin in pyridine be used, no subsequent washing is needed.—A. S.

Electrode [for arc lamps]. G. W. Elmen, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,057,046, March 25, 1913.

SEE Eng. Pat. 21,510 of 1906 ; this J., 1907, 1132.—T. F. B.

Incandescent mantles for gas-lighting ; Manufacture of ——. A. H. Williams, Hyde Park, South Australia. U.S. Pat. 1,057,312, March 25, 1913.

SEE Fr. Pat. 415,980 of 1910 ; this J., 1910, 1294.—T. F. B.

Preparation of metals and metallic oxides in a finely-divided condition. Ger. Pat. 256,962. *See* VII.

III.—TAR AND TAR PRODUCTS.

Coal tar, tar oils and pitch ; The supply of ——. W. J. A. Butterfield. Surveyor and Mun. and County Eng., 1913, **43**, 390.

THE development of sources of tar, the output of which could be varied to meet variations in demand, would have a steadying effect on prices. Low-temperature carbonisation, with production of semi-coke, tar and ammonium sulphate is discussed from this point of view. For commercial success there must be a plentiful supply of cheap bituminous slack, and a ready market for the semi-coke near the distillation plant, since the cost of transport is greater than that of coal on account of the greater bulk per ton. To compensate for the greater bulk, the semi-coke must offer some advantage to the consumer such as freedom from smoke, or smaller cost per ton. As compared with gas-works practice, the yield of coke per ton of coal is greater, and the yield of gas only one-half to one-third. The gas could probably be used at the plant. The yield of ammonium sulphate is considerably greater than in gas-works though less than in a producer plant. The yield of tar and oil is greater than in gas-works or in producers, and the tar gives more fuel oil and motor spirit but less pitch, and all these products are of better quality. The yield of pitch per ton of coal is however greater than in gas-works.—A. T. L.

Gas-works pitch industries and cancer. H. C. Ross and J. W. Cropper. With observations by W. J. A. Butterfield. The John Howard McFadden Researches, Pamphlet, 1912, 1—48 ; also Brit. Med. J., March 8, 1913.

IT has long been known that workmen engaged in the distillation of gas-works tar and the preparation of briquettes from the pitch are subject to warts and epitheliomatous cancer, whereas the pitch from blast-furnaces does not produce these results. Starting from the hypothesis that two of the factors inducing cancer are : (1) rapidly proliferating cells on a chronically injured surface ; and (2) abnormal migration of those cells into the neighbouring tissue, the authors have attempted to isolate from the gas-works tar and pitch the substances producing these effects. The method was that discovered by them in 1908 of subjecting white blood cells to the action of various substances for 10 minutes at 37° C. Those substances which caused cell proliferation by division, were termed *auxetics*, whilst those producing amœboid movements in the cells when acting in the presence of *auxetics* were termed *kinetics*. About 31 compounds (including creatinine, xanthine, methylamine and leucine) which acted as *auxetics* were discovered, whilst the *kinetics* included cadaverine, choline, and atropine. In testing the different tars and pitches for these bodies, 1 per cent. aqueous extracts were used, and it was found that while gasworks tar and pitch contained both *auxetics* and *kinetics*, blast-furnace pitch contained no *kinetics* and only a small amount of *auxetics*. It was proved that by washing the pitch with water the dangerous principles were removed ; but this would not be practicable since it would interfere with the binding properties of the pitch. Distillation of the tar at higher temperatures did not eliminate the *auxetics* and *kinetics* below 360° C., and pitch heated to that temperature was useless. Washing the tar with twice its volume of water at 100° to 200° F. (38°—93° C.) removed these bodies, but objection has been taken by the distillers to this proposal owing to the difficulty and expense of subsequently separating the water from the tar. Experiments with 10 per cent. aqueous extracts of different kinds of coal have shown that the soft or bituminous kinds are those which produce the dangerous tar and pitch, whilst the Scottish splint and many hard kinds of coal are much more free from the dangerous principles. This difference is also borne out by the occurrence of the diseases among the workmen. This is one of the factors which may explain the pathological difference between the blast-furnace tar and pitch and that obtained from the gas-works (from bituminous coal). Another possible explanation is that the tar from blast-furnaces passes over at a lower temperature than gasworks tar. Another remedy suggested is that the gasworks should mix with the highly bituminous coal a percentage of harder and less bituminous coal. This would probably lead to a great reduction in the occurrence of pathological conditions among the workers in briquette works and tar distilleries.
—C. A. M.

PATENTS.

1-Chloro-2-amino-5-naphthol-7-sulphonic acid ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,151, June 17, 1912.

2-NAPHTHYLAMINE-5.7-DISULPHONIC acid is converted into an arylsulpho compound by treatment with an aromatic sulphochloride ; the compound thus obtained is chlorinated, the sulphonic group in the 5-position is replaced by a hydroxyl group by fusion with an alkali hydroxide, and finally the arylsulpho-group is eliminated by treatment with sulphuric acid.—T. F. B.

Anthraquinone-α-carboxylic acids and their derivatives ; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 448,512, Sept 19, 1912. Under Int. Conv., April 16, 1912.

α-METHYLANTHRAQUINONE and its derivatives are converted into the corresponding carboxylic acids by oxidation by means of chlorine in presence of nitrobenzene, at high temperatures. Example : One part of 1-chloro-4-methylanthraquinone (from phthalic anhydride and *p*-chlorotoluene) is dissolved in 5—10 parts of nitrobenzene, and chlorine is passed into the solution heated to 160°—170° C. When a portion mixed with sodium carbonate and treated with steam, yields a clear solution, the whole mixture is cooled : the greater portion of the acid separates on cooling, and the remainder is obtained by removing the nitrobenzene from the mother liquor by means of steam. The product consists of pure 1-chloro-anthraquinone-4-carboxylic acid, of m. pt. 229°—230° C.—T. F. B.

Chloranil (tetrachloro-p-benzoquinone) free from trichloroquinone ; Process for preparing ——. R. Kempf and H. Moehrke. Ger. Pat. 256,034, July 28, 1911.

Chloranil free from trichloroquinone is obtained by the action of *aqua regia* on phenol or a chlorophenol. Besides oxalic acid, some nitro-compounds are formed as by-products, *e.g.*, 2.4-dinitro-6-chlorophenol, but further action of *aqua regia* replaces the nitro groups by chlorine. —T. F. B.

Sulphazones ; Process for preparing ——. M. Claass. Ger. Pat. 256,342, April 19, 1912.

o-Nitroarylthioglycollic acids or their nucleus-substitution products, or the benzoketodihydro-*p*-thiazines obtained by treating them with acid reducing agents, are oxidised by means of potassium permanganate at the ordinary temperature, and, in the case of the products obtained direct from the thioglycollic acids, the ring-formation is effected by treatment with acid reducing agents. The products may be used as azo dyestuff components. The oxidation with permanganate gives much higher yields than when hydrogen peroxide is used (see this J., 1912, 379).—T. F. B.

1-Methyl-2.3-dihydroxybenzene (isohomocatechol) ; Process for preparing ——. Saccharinfabr. A.-G. vorm. Fahlberg, List und Co. Ger. Pat. 256,345, March 24, 1912.

A salt of 3-chloro-2-hydroxy-1-methylbenzene-5-sulphonic acid is heated with an alkali hydroxide at 160°—180° C., and the sulpho-group is eliminated from the resulting 1-methyl-2.3-dihydroxybenzene-5-sulphonic acid.—T.F.B.

α-Amino-, α-alkylamino-, α-arylamino-, and β-amino-anthraquinones or their derivatives from anthraquinonesulphonic acids ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 256,515, July 5, 1911.

By treating β-anthraquinonesulphonic acid with ammonia or α-anthraquinonesulphonic acids with ammonia or an amine, in presence of an oxidising agent such as manganese dioxide, copper oxide, bichromate, arsenic acid, or silver oxide, the corresponding amino-anthraquinone or its substitution product is obtained in a very pure condition and in almost theoretical quantity. It is stated that the presence of the oxidising agent prevents entirely the occurrence of secondary reactions.—T. F. B.

Anthraquinone from anthracene ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,623, Jan. 12, 1911.

In order to avoid the presence of free nitric acid in the conversion of anthracene into anthraquinone by means of a mixture of air and nitrogen peroxide, the anthracene is mixed with zinc dust, litharge, or other substance which will combine with or decompose nitric acid ; an inert substance, such as pumice stone or glass wool, and a small quantity of molybdenum dioxide may also be present. It is stated that a very pure product is obtained in almost theoretical yield.—T. F. B.

Selenocyanides of the anthraquinone series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 256,667, Jan. 25, 1912.

The diazoselenocyanides, prepared from diazoanthraquinones, are heated in aqueous suspension, without the addition of copper or other catalyst ; nitrogen is eliminated and the anthraquinoneselenocyanide, $C_{14}H_7O_2.SeCN$, is produced. Treatment with alcoholic soda or potash converts the new compounds into the corresponding selenophenols.—T. F. B.

Aminothiophen (thiophenine) or the double salt of its hydrochloride with stannic chloride ; Process for preparing ——. W. Steinkopf and G. Lützkendorf. Ger. Pat. 257,462, Feb. 21, 1912.

Nitrothiophen may be reduced to aminothiophen by means of tin or stannous chloride and aqueous hydrochloric acid at a temperature of about 40°—45° C. The aminothiophen is obtained in the form of a double salt of its hydrochloride with stannic chloride, the yield being about 68 per cent. of the calculated yield.—T. F. B.

Anthraquinone-α-carboxylic acid and its derivatives ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 22,840, Oct. 7, 1912. Under Int. Conv., April 16, 1912.

See Fr. Pat. 448,512 of 1912 ; preceding.—T. F. B.

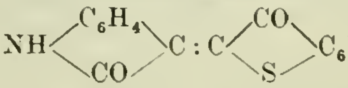
Isatin compounds ; Manufacture of [dichloro- and chlorobromo] ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7768, March 30, 1912.

See Ger. Pats. 225,772. 225,773, 225,774, and 225,775 of 1912 ; this J., 1913, 355.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

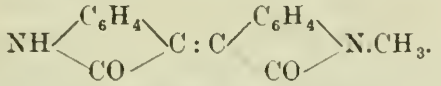
Indigoid series ; Syntheses in the ——. A. Wahl and P. Bagard. Comptes rend., 1913, **156**, 898—901.

In an attempt to prepare a compound analogous to iso-indigo (see this J., 1909, 420, 831), in which one of the NH-groups was replaced by sulphur, oxindole was condensed with diketo-2.3-dihydrothionaphthene (thio-isatin) ; a compound was obtained which was considered provisionally as the compound desired, but on further examination proved to be identical with a product obtained by Kalle und Co. (Ger. Pat. 241,327), *viz.*, Thioindigo Scarlet,



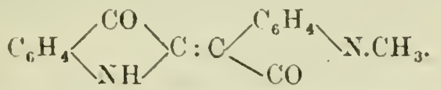
$$NH<\genfrac{}{}{0pt}{}{C_6H_4}{CO}>C:C<\genfrac{}{}{0pt}{}{CO}{S}>C_6H_4.$$

In order to test if the cause of this different reaction was due to the absence of a mobile hydrogen atom in the thioisatin, oxindole was condensed with methyl-1-isatin ; a brown crystalline substance was obtained, possessing no tinctorial properties, and having the characteristics of a methyl-1-iso-indigo,



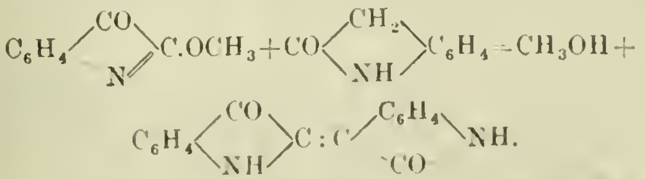
$$NH<\genfrac{}{}{0pt}{}{C_6H_4}{CO}>C:C<\genfrac{}{}{0pt}{}{C_6H_4}{CO}>N.CH_3.$$

Thus methylisatin behaves like isatin. An isomeride, methyl-1-indirubin,



$$C_6H_4<\genfrac{}{}{0pt}{}{CO}{NH}>C:C<\genfrac{}{}{0pt}{}{C_6H_4}{CO}>N.CH_3.$$

was also prepared by condensing indoxylic acid with methyl-1-isatin. As a further proof that the difference in behaviour of isatin and thioisatin was not due to the mobile hydrogen, O-methylisatin was condensed with oxindole ; when the reaction took place in acetic acid containing aqueous hydrochloric acid, iso-indigo was produced, the methoxy group being eliminated, but when the condensation was effected in anhydrous media, indirubin was obtained very readily, with a yield of 50 per cent., thus,



$$C_6H_4\genfrac{}{}{0pt}{}{CO}{N}\!>C.OCH_3+CO<\genfrac{}{}{0pt}{}{CH_2}{NH}>C_6H_4=CH_3OH+$$
$$C_6H_4<\genfrac{}{}{0pt}{}{CO}{NH}>C:C<\genfrac{}{}{0pt}{}{C_6H_4}{CO}>NH.$$

—T. F. B.

Nitroanilines ; Quinonoid salts of ——. A. G. Green and F. M. Rowe. Chem. Soc. Proc. 1913, **29**, 66.

The authors subjected solutions of various nitroamines in dry benzene to the action of sodium ethoxide. Deep orange to red precipitates were obtained with the following compounds : *o*-nitroaniline, *p*-nitroaniline, *p*-nitroethylaniline, 2 : 4′-dinitroaniline. 2 : 4 : 6-trinitroaniline (picramide), 2-nitro-*p*-toluidine, 6-nitro-*m*-toluidine, 4-nitro-*m*-toluidine, 4-chloro-2-nitroaniline, 3-chloro-2-nitroaniline, 3-chloro-4-nitroaniline, 2-nitro-*p*-phenylenediamine, 2-nitro-

4-acetyl-*p*-phenylenediamine. The following nitroamines gave no precipitates, and exhibited no change of colour: *m*-nitroaniline, 5-nitro-*o*-toluidine, 3-nitro-*o*-toluidine, 5-nitro-*o*-4-xylidine, and also the *o*-, *m*-, and *p*-nitro-derivatives of dimethylaniline. It would therefore appear that all primary and secondary ortho- and para-nitroamines give rise to deeply coloured quinonoid salts under the conditions employed, but that no such reaction occurs in the meta-series. Analysis of the products supports the general formula $NH:X:NO_2Na$. In the case of *p*-nitroaniline, two "chromoisomeric" salts were obtained, namely, a red labile form and an orange stable form. The tendency of nitroamines to form quinonoid salts is further exemplified by the properties of nitro-*p*-phenylenediamine. This compound crystallises from water in bluish-red needles, with a dark green reflex, but dissolves in non-ionising solvents with a yellow colour. In the solid state and in its aqueous and alcoholic solutions, which are red, it probably possesses the constitution of an internal quinonoid salt, $\underline{NH_3.C_6H_3(:NH):NO_2}$. Thus, a sharp distinction is found between the *o*- and *p*-nitroanilines on the one hand, and *m*-nitroaniline on the other.

Patents.

Compounds of the anthraquinone series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8509, April 10, 1912.

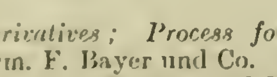
A series of products, which can be used as vat dyestuffs or for the production of vat dyestuffs, can be obtained by oxidising 1-arylaminoanthraquinones or their homologues or derivatives, in which the *p*-position to the imino-group in the aryl nucleus is occupied by hydrogen. Especially valuable are the products obtained by oxidising arylaminoanthraquinones containing a carboxyl group in an *o*-position to the imino group, either in the aryl or in the anthraquinonyl nucleus; these products can be treated with condensing agents and converted into anthraquinone-acridone dyestuffs. Analogous products are obtained by treating anthraquinone-acridones with oxidising agents. For example, the product obtained by treating 1-phenylaminoanthraquinone with manganese dioxide in presence of sulphuric acid, dyes cotton violet shades from the hydrosulphite vat. Again, the acridone obtained by heating with sulphuric acid the oxidation product from 1-anilino-anthraquinone-2-carboxylic acid, dyes cotton reddish-brown shades from the vat.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9267, April 19, 1912.

Sulphonic or carboxylic acids of amino-trisazo compounds of the benzene or naphthalene series, containing an amino group but no free hydroxyl group, are converted into the symmetrical diarylurea compounds by treatment with phosgene or its equivalent, such as perchloromethyl formate or hexachlorodimethyl carbonate. The products dye unmordanted cotton brown shades very fast to light. The preparation of the product from diazotised aminoazobenzenedisulphonic acid, *m*-toluidine, and phosgene is described in detail.—T. F. B.

Anthraquinone derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Sept. 13, 1912, to Fr. Pat. 432,279, July 17, 1911. Under Int. Conv., Sept. 18, 1911. (See Ger. Pat. 238,981 of 1910; this J., 1911, 1306.)

Anthraquinone-thiazoles, analogous to the anthraquinone-iminazoles described in the principal patent, are obtained by the action of certain condensing agents on the *o*-aminoanthraquinone-mercaptans. Thus, a yellow crystalline thiazole is obtained by boiling a mixture of 1-aminoanthraquinone-2-mercaptan-sodium with acetic anhydride. Thiazole-mercaptan,

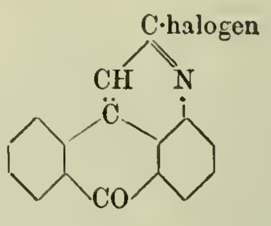


$$C_{11}H_6O_2\left\langle\begin{matrix}N\\S\end{matrix}\right\rangle C.SH,$$

is obtained from aminoanthraquinone-mercaptan and carbon bisulphide, whilst 4-benzoylaminoanthraquinone-1.2-thiazole (which dyes cotton bright orange shades from the hydrosulphite vat) is obtained from 1.4-diaminoanthraquinone-2-mercaptan and benzoyl chloride.—T. F. B.

Anthracene derivatives containing nitrogen; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 256,297, Nov. 21, 1911.

Aromatic amines or aminoanthraquinones are condensed with the α-halogen-1(N).9-pyridanthrones of the general formula,



The products are useful for the preparation of dyestuffs.
—T. F. B.

Vat dyestuffs of the anthraquinone series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,617, May 28, 1912.

Di- or polyhalogen-benzenes and their derivatives are condensed with two or more mols. of an aminoanthraquinone or a derivative thereof, and the products are treated with aluminium chloride. *Example:* One part of the condensation product from *p*-dichlorobenzene and two mols. of α-aminoanthraquinone is heated with 5 parts of anhydrous aluminium chloride at 150°—160° C., with constant stirring, until the mass has become a thin liquid; the cooled melt is boiled with dilute hydrochloric acid. From the red hydrosulphite vat cotton is dyed very fast brown-violet shades.—T. F. B.

Disazo dyestuffs for cotton; Diazotisable ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 448,581, Sept. 21, 1912. Under Int. Conv., Dec. 1, 1911.

A new series of disazo dyestuffs is obtained by combining a symmetrical 3.3′-diaminodiarylurea with equimolecular proportions of two different diazo compounds, one of which is derived from a basic amino-compound and the other from an aminoarylsulphonic or carboxylic acid. Thus, the dyestuff obtained by combining the diazo compound from 207 parts of 3-chloro-aniline-6-sulphonic acid with 242 parts of 3.3′-diaminodiphenylurea in acid solution, and combining this in neutral solution with the diazo compound from 127 parts of 2-chloro-aniline, dyes cotton orange shades, which may be changed to full claret shades by diazotisation and development with β-naphthol.
—T. F. B.

Vegetable colouring matters; Method of producing ——. G. T. Onsager. Fr. Pat. 448,609, Sept. 24, 1912.

Mosses, lichens, woods, or parts of plants containing colouring matters are boiled with an alkaline solution, and the filtered liquid is evaporated almost to dryness, mixed with a mordant, and allowed to stand until solid. The product may be dissolved in water and used for dyeing, or mixed with an oil extracted from "a plant of the rose family" and used as a paint.—T. F. B.

N-Alkylcarbazolemonosulphonic acids; Process for preparing ——. L. Cassella und Co. Ger. Pat. 256,718, Feb. 16, 1912.

When N-alkylcarbazoles are treated with less than the quantity of sulphuric acid calculated for complete monosulphonation, at a high temperature, the new N-alkylcarbazolemonosulphonic acids are produced: the free acids, as well as their sodium salts, are easily soluble in water, the barium and calcium salts sparingly so. When the products are condensed with *p*-nitrosophenol, indophenols are formed from which blue to grey sulphide dyestuffs may be prepared. On fusing with alkali hydroxides, the N-alkylcarbazolesulphonic acids are converted into monohydroxy-N-alkylcarbazoles.—T. F. B.

Vat dyestuffs of the anthraquinone series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,626, June 25, 1911. Addition to Ger. Pat. 243,586.

The 4-amino-3-halogenanthraquinone-acridones, obtained by treating 4-amino-3-halogenanthraquinonylanthranilic acids with condensing (dehydrating) agents, dye blue shades from vats prepared with alkali carbonates, and green shades from those made with alkali hydroxides. —T. F. B.

Vat dyestuffs of the anthraquinone series. Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,761, April 2, 1912.

Anthraquinone-dihydrazines (*e.g.*, the 1.5-, 1.8-, and 2.6-compounds) or their derivatives are condensed with aromatic hydroxy- or polyhydroxy-aldehydes or ketones or their substitution products. Unlike the monohydrazones, the products are not decomposed by reduction, and can be converted into vats, which have great affinity for cotton fibre.—T. F. B.

Dyestuffs or dyestuff solutions; Process for preparing yellow to brownish-red ——. M. Lange. Ger. Pat. 256,762, April 18, 1912.

Acetaldehyde is allowed to react with aminoacetic acid or a homologue thereof, preferably in solution. It is advisable to carry out the reaction in presence of a quantity of alkali hydroxide or carbonate insufficient to combine with the whole of the aminoacetic acid. The dyestuff is analogous to, and probably identical with, that present in "white" wines.—T. F. B.

Indigoid colouring matters; Manufacture of derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8510, April 10, 1912.

See Fr. Pat. 443,418 of 1912; this J., 1912, 979.—T. F. B.

Anthracene colouring-matters and process of making them. M. H. Isler, Mannheim, and P. Nawiasky, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,057,243, March 25, 1913.

See Ger. Pat. 236,857 of 1910; this J., 1911, 1048.—T.F.B.

Polyazo dyes. H. Schweitzer and A. Zart, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Re-issue No. 13,550, April 1, 1913, of U.S. Pat. 1,038,209, Sept. 10, 1912.

See Eng. Pat. 9433 of 1911; this J., 1912, 182.—T. F. B.

Wool azo dye. L. Hesse, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,054,348, Feb. 25, 1913.

See Ger. Pat. 253,933 of 1911; this J., 1913, 79.—T. F. B.

Trisazo dyes; Black ——. A. Blank and C. Heidenreich, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,056,493, March 18, 1913.

See Eng. Pat. 20,608 of 1911; this J., 1912, 978.—T. F. B.

Diazotised nitranilines; Producing stable solutions of ——. R. Fischer, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,057,137, March 25, 1913.

See Fr. Pat. 439,535 of 1912; this J., 1912, 712.—T. F. B.

Mordant [phthalein] dyestuffs and process of making same; Yellow to red, and orange-red to bluish-red ——. E. Bodmer and C. de la Harpe, Assignors to Dye Works formerly L. Durand, Huguenin, und Co., Basle, Switzerland. U.S. Pats. 1,055,864 and 1,055,885, March 11, 1913.

See Ger. Pat. 245,231 of 1911; this J., 1912, 484.—T. F. B.

Indigo; Mode of manufacturing a new synthetic ——. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,057,886, April 1, 1913.

See Ger. Pat. 239,339 of 1910; this J., 1911, 1372.—T. F. B.

Indigo; Process of manufacturing finely divided colloid-like ——. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,057,887, April 1, 1913.

See Fr. Pat. 445,803 of 1912; this J., 1912, 1174.—T. F. B.

Indigo; Synthetic —— *in a new form and process of making same.* A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pats. 1,058,019 and 1,058,020, April 1, 1913.

See Eng. Pats. 18,761 and 20,324 of 1910; this J., 1911, 1047, 1110.—T. F. B.

Indigo; Dry colloid-like —— *and process of making same.* A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,058,021, April 1, 1913.

See Fr. Pat. 445,850 of 1912; this J., 1912, 1174.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Studies on ——. E. G. Parker. J. Phys. Chem., 1913, 17, 219—229.

The author gives reasons for regarding some modification of Lange's method (potassium hydroxide at a high temperature) as the most suitable means for determining the percentage of normal cellulose in surgical cotton wool or similar materials. The method as originally described is, however, defective owing to the continuous concentration of the alkali. This defect may be remedied by working under a reflux condenser. The method adopted by the author is as follows: 0·5—2·0 grm. of the air-dry material (surgical cotton) is placed in a 500 c.c. Jena flask with round bottom with 50 c.c. of potassium hydroxide solution; the flask is connected with a reflux condenser and heated in a paraffin bath at 130°—140° C. At the end of the time found to be necessary for the treatment, the flask is allowed to cool to 70°—80° C. and the contents are washed out into a beaker. The residue of cellulose is collected in a Gooch crucible, washed, acidified, again washed with dilute alkali, water, alcohol, and ether, then dried to constant weight. The main difficulty is due to serious bumping, which may be mitigated first by weighing out the sample in a compact mass and secondly by passing a long glass rod down the condenser so that its end rests on the sample of cotton, holding it down at the centre of the bottom of the flask. The reaction is characterised by a definite constant limit, beyond which further treatment, even for several hours produces no appreciable effect on the result. Hence it is presumed to effect a sharp separation of the modified or non-cellulose constituents of the sample from the true normal cellulose. The time required to reach this limit depends on the concentration of the alkali and is longer with higher concentrations. Thus, with 20 per cent. potash lye a constant yield was reached only after 15 hours' boiling, with 10 per cent. the same point was reached after 6 hours, whilst with 1·25 grms. of pure potassium hydroxide in 50 c.c. of water the limit was almost reached in 3 hours. With the type of cotton employed the yield of normal cellulose obtained was about 92·5 per cent. on the sample containing 3·3 per cent. of moisture. Cellulose re-precipitated from cuprammonium solution and oxycellulose gave indefinite and low results, showing that these substances behave very differently from the original cotton; other types of cellulose have not yet been investigated. —J. F. B.

The problem of the waste liquor from sulphite pulp mills. W. O. Walker. *See* Canadian Section, p. 389.

Rag flocks and the chlorine standard of purity. Richardson and Jaffé. *Also* Priestman. *Soluble chlorides in wool and wool flocks.* Mackey and Miller. *See* Yorkshire Section, pp. 402—407.

Patents.

Artificial threads; Manufacture of —— [from algin]. L. Sarason. Fr. Pat. 448,429, Sept. 18, 1912.

Alginic acid, preferably in the form of aqueous solutions of alkali alginates containing about 10 per cent. of solid matter, is squirted through fine orifices into coagulating baths containing metallic salts and acids, and the resulting filaments are dried under tension.—J. F. B.

Silk floss and waste, cocoons and silk threads and fabrics; Process and apparatus for the electrolytic treatment [degumming] of ——. Baudot et Cie. Fr. Pat. 448,735, Dec. 4, 1911.

While the material is being passed through two degumming baths containing hot sodium carbonate solution at different temperatures, it is subjected to electrolysis, to saponify the fats and loosen the gummy matters, and it is subsequently passed through a washing machine in which it is subjected to intermittent agitation to remove the impurities disaggregated by the electric current. The apparatus consists of two vats arranged in series, having perforated false bottoms and endless bands, armed with teeth, for conveying the material and to act as a diaphragm between the positive electrodes, situated above, and the false bottom which serves as a negative electrode. From these the material passes through presses into a washing vat in which it is propelled over a perforated plate by jets of water, directed obliquely against the material from above and below the plate.—J. F. B.

Wool; Process for treating —— with bisulphite solutions at high temperatures. E. Elsaesser. Ger. Pat. 256,851, May 3, 1912. Addition to Ger. Pat. 233,210 (see Fr. Pat. 418,082; this J., 1911, 20).

Wool which has been saturated with bisulphite solution at the ordinary or increased temperature, is passed under tension through a steam chamber, in which it is treated with (preferably) superheated steam; it is finally treated with an emulsion of wool grease.—T. F. B.

Agave and similar plants; Process for utilising the waste produced in obtaining fibres from the leaves of the ——. H. J. Boeken. Ger. Pat. 254,836, Dec. 28, 1910.

The semi-liquid or pasty waste, before decomposition sets in, is separated into a liquid portion and a solid residue. The waste contains more than 95 per cent. of the original leaf substance, and acids (oxalic acid, etc.) and fats and waxes (similar to carnauba wax) may be separated from it.—A. S.

Artificial silk filaments; Preparation of —— from cuprammonium solutions of cellulose, using caustic alkali as precipitant. Hanauer Kunstseidenfabrik A.-G. Ger. Pat. 255,549, Oct. 14, 1911.

The cellulose solution is warmed before leading it into the precipitating bath, which may be either cold or warm. —A. S.

Broom; Process for obtaining fine fibres, for spinning, from ——. R. Sütterlin. Ger. Pat. 256,470, March 27, 1912.

The broom is boiled under pressure with a dilute (3—5 per cent.) solution of sodium carbonate, disintegrated by rapidly rotating rollers provided with pointed teeth, the separated fibres freed from bark by beating or crushing, washed, dried, stored for at least 10 days in a hot moist atmosphere, and then pressed into balls.—A. S.

Nitrocellulose and celluloid solutions; Precipitation of ——. H. Wertheim, Vienna. Eng. Pat. 6268, March 13, 1912.

The nitrocellulose or celluloid is dissolved in spirit and acetone, and the precipitant, such as water, added in quantities at first small but gradually and constantly increasing, the material being precipitated in a pulverulent condition.—B. N.

Cellulose esters and their transformation products; Manufacture of ——. H. Dreyfus. Seventh Addition, dated Sept. 16, 1912, to Fr. Pat. 432,046, July 5, 1911 (this J., 1912, 24, 225, 329, 1119; 1913, 283).

When it is desired at any stage to modify the solubility of the product by the ulterior action of an acid or other constituent of the acetylating mixture, sufficient water, or a slight excess, is added to neutralise the action of the quantity of acetic anhydride still present, thus interrupting the acetylation reaction without interfering with the modification reaction. Instead of water, other substances may be used which would combine with and neutralise the residual acetic anhydride. The proportion of water employed in the acetylating mixture may be varied to suit the requirements of condensing agents other than sulphuric acid which may be used. It is the action of the condensing agent in conjunction with the water which governs the ulterior reaction modifying the solubility of the ester produced in the acetylation reaction.—J. F. B.

Cellulose ethers and their derivatives; Manufacture of ——. L. Lillienfeld. Fr. Pat. 447,974, July 17, 1912. Under Int. Conv., March 16, 1912.

Ethers of cellulose or modified cellulose are prepared by substituting one or more of the hydroxyl hydrogen atoms of the cellulose by an alcoholic radical. Cellulose, preferably so modified as to be soluble in alkalis, is treated with an alkyl ester of an inorganic acid in the presence of a base. Example: Cellulose soluble in alkali is prepared by regeneration from a solution of ordinary or modified cellulose, *e.g.*, from viscose, or from zinc chloride or cuprammonium cellulose solutions. To 1200 parts of a solution of such cellulose, containing 100 parts of cellulose and 100 parts of caustic soda, are added 100 parts of a 30 per cent. caustic soda lye; the liquid is heated moderately and 100—200 parts of diethyl sulphate are gradually added. The mixture is further heated for ½—2 hours on the water-bath, and, after cooling, 300—600 parts of dry powdered caustic soda are added with stirring. The mixture is again heated and treated again with 300 to 1300 parts of diethyl sulphate in small portions at a time. The cellulose ether separates, the liquid is diluted, acidified, and the product is collected. The ether thus prepared is insoluble in cold water, but soluble in a large number of organic solvents, and shows on analysis a composition corresponding to a pentaethyl cellulose ether (on the C_{12} basis). According to the conditions employed and the proportions of the reagents, a range of ethyl cellulose ethers may be obtained of various degrees of etherification and showing various degrees of solubility, some of them being soluble in cold water but coagulated on heating.—J. F. B.

Cellulose esters; Preparation of ——. A. Wohl. Fr. Pat. 448,072, Sept. 7, 1912. Under Int. Conv., Sept. 11, 1911.

In preparing cellulose acetate or other organic esters of cellulose, the cellulose is first steeped in glacial acetic acid or other organic liquid which is miscible with water, *e.g.*, formic acid or acetone, or a mixture of such liquids. The cellulose is then pressed until the weight is about

1·2 times the original weight, and the moist fibre is introduced into the anhydrous esterifying reagent. It is stated that in this way uniformity of penetration and reaction is ensured by the elimination of the hygroscopic moisture and substitution of a miscible liquid. If desired, a small proportion of a catalytic agent may be added to the acetic acid.—J. F. B.

Fatty acid anhydrides or chlorides; Manufacture of —— particularly for the manufacture of cellulose esters. H. Dreyfus. Fr. Pat. 448,342, Sept. 16, 1912.

In the manufacture of cellulose acetate considerable quantities of acetic acid may be recovered for future use. This acid is either partially neutralised, or else mixed with metallic acetates, and treated with reagents capable of producing acetic anhydride, such as sulphur chloride, sulphuryl chloride, chlorine and sulphur, chlorine and sulphur dioxide, salts of chlorosulphonic acid, halogen compounds of phosphorus, etc. The reagents may be employed in such proportions that a mixture of acetic anhydride and acetic acid results, suitable for re-employment as an acetylating agent, either directly or after fractional distillation. If the metallic acetate be omitted, similar mixtures of acetyl chloride and acetic acid may be obtained for the same purpose.—J. F. B.

Celluloid; Process for preparing masses resembling ——. H. Stein. Ger. Pat. 254,992, Nov. 30, 1911.

Casein is heated with aqueous ammonia and a solution of rubber in carbon bisulphide, glycerin is added, and the paste is mixed with a gelatin solution containing tannin and a solution of rosin in ammonia; the whole is spread on plates and treated with formaldehyde.—T. F. B.

Celluloid; Process for preparing masses resembling ——. F. Lehmann and J. Stocker. Ger. Pat. 255,953, June 2, 1911.

When agar-agar or other colloid obtained from seaweed, is treated with chromic acid, either alone or in presence of a colloid of animal origin, products similar to celluloid are obtained.—T. F. B.

Acetylcellulose; Preparation of shaped masses, films, tulle, etc., from —— which do not become brittle. Knoll und Co. Ger. Pat. 255,704, Sept. 13, 1911.

The acetylcellulose solution shortly before being worked up into films or the like, and with or without admixture of filling materials, such as collodion-cotton, is mixed with a quantity of a salt, *e.g.* zinc chloride, exceeding 15 per cent. of the quantity of acetylcellulose. The products (films, etc.) are kept for a long time at a moderate temperature to allow of the gradual evaporation of the acetic acid before they are washed with water or other washing agent. *Example.* 100 grms. of acetylcellulose solution, prepared for example as described in Ger. Pat. 196,730 or 203,178, are mixed with 1 grm. of collodion-cotton and 5 grms. of zinc chloride, and formed into films. The latter are stored for about three months at about 30° C. and are then washed.—A. S.

Wood pulp; Method for producing ——. W. Denso, Forst, and B. Jirotka, Berlin, Germany. Eng. Pat. 26,824, Nov. 30, 1911.

Wood is cut across the grain into four-cornered flakes of 1—2 sq. ins. in size and the product so prepared is brought between the faces of two stones moving in opposite directions to each other, steam being introduced with the wood between the stones in such a manner that the high temperature of the grinding paste will have a favourable effect on the opening of the wood fibres.—J. F. B.

Wood-pulp; Process for the production of mechanical ——. G. C. Howard, Seattle, Wash. U.S. Pat. 1,057,151, March 25, 1913.

Fibrous vegetable material is treated in a series of grinding mills, each of which is adapted to grind material of progressively diminishing size; the partially ground material is passed from each mill through a classifier adapted to sort the crushed material into two sizes, the coarser grade being returned to the mill in which it was insufficiently ground, and the finer grade being passed on to receive similar selective treatment in the next mill.—O. R.

Humus-like substances from sulphite cellulose lyes; Process for obtaining ——. Stora Kopparbergs Bergslags Aktiebolag. Ger. Pat. 256,964, March 11, 1911.

After the manufacture of alcohol from sulphite liquor or similar waste lyes from the treatment of cellulosic materials with acids, the residual liquor is treated with a basic substance, such as lime, to recover the humic substances; the amount of lime may be only sufficient to produce a feebly alkaline solution, in which case its action may be intensified by passing air through the mixture, after addition of a small quantity of an oxygen-carrier, such as a manganese salt. The products may be used as fuel.
—T. F. B.

Soda-cellulose manufacture; Process for regenerating the boiling-lyes from ——. R. Adam. Ger. Pat. 257,124, June 20, 1911.

The humic substances in the lyes are precipitated by suitably regulating the temperature and pressure, aided by addition of metallic oxides or their compounds, especially those of the alkaline-earth or iron group, which form more or less insoluble hydroxides with water. The most economical precipitants are obtained by roasting such minerals as will give rise to the oxides or mixtures of oxides mentioned.—T. F. B.

Printing inks capable of being destroyed by chemical treatment when the printed paper is pulped for re-manufacture. Lefranc et Cie. Fr. Pat. 448,616, Nov. 30, 1911.

Since papers printed with carbon inks cannot be purified satisfactorily for the re-manufacture of white papers, it is proposed to employ special printing inks in which the black pigment used is either ferroso-ferric oxide or a compound obtained by the action of tanning bark extracts on ferrous sulphate. Such pigments are incorporated with a medium composed of resin or mineral oils and rosin, or of boiled linseed oil. For the destruction of these inks when the paper is re-pulped, the material is bleached with an acid solution of a hypochlorite, chlorine gas, hydrochloric or oxalic acid, the action of which reagents readily yields a perfectly white pulp.—J. F. B.

Paper with a high content of loading material; Manufacture of ——. F. Günther. Ger. Pat. 256,093, July 21, 1911.

The loading material (china clay, barytes, or the like) is introduced between two webs of paper while they are still damp, and the two webs are then couched together.
—A. S.

Fabric or cloth treated with rubber or the like. A. H. Henderson, Baltimore, U.S.A. Eng. Pat. 6791, March 19, 1912.

See U.S. Pat. 1,020,499 of 1912; this J., 1912, 446.—T. F. B.

Fabrics and paper: Process for rendering —— "solid" and impervious. N. Hornstein and B. Chapiro, Paris. Eng. Pat. 7555, March 28, 1912. Under Int. Conv., May 26, 1911.

See Fr. Pat. 441,496 of 1911; this J., 1912, 917.—T. F. B.

Porous material for the grinding members of Hollander and other beating engines, paper- or wood-pulp mills and like grinding plant for paper-pulp, cell-substance, cellulose, and the like; Process for the manufacture of a ——. H. Helin, Skarblacka, and C. F. Södervall, Kilsmo, Sweden. Eng. Pat. 26,867, Nov. 22, 1912.

See Fr. Pat. 447,558 of 1912; this J., 1913, 284.—T. F. B.

Cellulose solutions; Production of viscous ——. E. Bronnert, Niedermorschweiler, Assignor to Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. U.S. Pat. 1,055,513, March 11, 1913.

SEE Eng. Pat. 309 of 1911; this J., 1911, 484.—T. F. B.

Corks; Process of coating —— *with resisting neutral layers.* L. Pink, Berlin, Assignor to Dutch Holding Co., New York. U.S. Pat. 1,056,446, March 18, 1913.

SEE Eng. Pat. 2455 of 1911; this J., 1911, 1376.—T. F. B.

Corks; Treatment of ——. L. Pink, Berlin, Assignor to Dutch Holding Co., New York. U.S. Pat. 1,056,447, March 18, 1913.

SEE Ger. Pat. 240,563 of 1911; this J., 1912, 67.—T. F. B.

Manufacture of alkali sulphides. Fr. Pat. 448,927. *See* VII.

Method of impregnating wood [with waste sulphite liquor]. U.S. Pat. 1,057,211. *See* IX.

Impregnated wood and method of preparing the same. U.S. Pat. 1,057,319. *See* IX.

Explosive [from waste lyes from cellulose manufacture] and method of manufacturing the same. Eng. Pat. 29,696. *See* XXII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Reserve printing on Paranitraniline Red; Plain and coloured ——. Webank and Levasseur. Sealed note No. 1310, of Dec. 23, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1913, **83**, 54—56.

THE cloth, prepared with β-naphthol, is printed with a paste composed of ferrous sulphate, a small quantity of tartaric acid, and a thickening of starch and British gum. It is then dried, steamed, and developed in the ordinary way. Coloured reserves are obtained by adding to the paste, for instance, Brilliant Green, Auramine, Methylene Violet 6B or Methylene Blue, and a little acetic acid. No tannin is required for the fixing of these basic dyestuffs. The report states that, compared with stannous chloride, ferrous sulphate should be cheaper and less harmful to the fabric, but would have the disadvantage of necessitating souring to remove iron. Comparative trials showed that it gave a poorer white than potassium sulphite or stannous chloride. In any case reserve processes have now been superseded by the formaldehydesulphoxylate discharge method.—J. B.

Metallic powders; Printing ——. J. Stephan. Sealed note No. 1287, of Sept. 7, 1901. Report thereon by M. Battegay. Bull. Soc. Ind. Mulhouse, 1913, **83**, 56—60.

THE metallic powder is printed along with formaldehyde and ammonia and a thickening which consists of a solution of glue and resorcinol. The material is then dried and steamed for an hour under pressure. The process is based on an observation of the author that a solution of glue or gelatin can be kept fluid by the addition of a soluble phenol. The report refers to sealed note No. 2213 of Nov. 26, 1912, J. Heilmann & Cie., H. Wagner, and M. Battegay, in which it is suggested to print metallic powders along with a mixture of "Sericose" (acetylcellulose), phenol, and formaldehyde together with a little sodium acetate or ammonia. In this case fixation is due to the condensation of the formaldehyde and phenol to form a synthetic resin. It seems probable that in the process of sealed note 1287, fixation is to some extent due to the condensation of the formaldehyde with the resorcinol as well as with the gelatin.—J. B.

PATENTS.

Bleaching apparatus. V. Jaeggle, Erste Trautenauer Maschinenfabrik und Eisengiesserei, Trautenau, Bohemia. Eng. Pat. 25,822, Nov. 11, 1912. Under Int. Conv., Feb. 9, 1912.

FOR the purpose of avoiding injurious fumes, provision is made for (1) a fan exhaust which acts through holes placed round the top of the vat and just above the level of the liquor, (2) the delivery of liquor from the circulating pump through holes at a sufficient distance below the level of the liquor to prevent frothing.—J. B.

Bleaching fibres by means of hydrogen peroxide; Process for ——. H. Siebold. Ger. Pat. 256,997, May 11, 1909.

THE goods to be bleached are immersed in a dilute solution of hydrogen peroxide, wrung out, and then passed through a vessel in which they come in contact with ammonia gas. The bleaching action is stated to be very rapid.—T. F. B.

Yarn mercerising machine. P. Hahn, Niederlahnstein, Germany. Eng. Pat. 21,539, Sept. 21, 1912.

THE unit of the machine consists of a pair of rollers the one vertically above the other in the same plane, over which the hank of yarn is placed by hand. The upper roller is caused to move upwards by means of a lever acting on a cam shaft and the yarn is thus stretched. While the yarn is under tension and the rollers are revolving at the same time, a box-shaped vessel is caused to move vertically upwards until the yarn is completely enclosed. Caustic lye is now run into the box and the yarn thoroughly impregnated. When this operation is completed the lye-box is emptied, lowered again from the rollers, and caused to move horizontally until a second compartment, similar to and attached to the first box, comes under the yarn. This is the washing box, and it is raised vertically until the yarn is enclosed, when the water is turned on. The washing water is run away and the box lowered as in the first operation. The upper (movable) roller then falls a little and the yarn ceases to be under tension. It is then removed by hand, a fresh hank put on, and the whole cycle of operations repeated. The machine consists of a series of such units in two rows, back to back, and the cam mechanism required to raise and lower the boxes, open the valves, and operate the tension rollers is worked by a main shaft and a counter shaft, the system being so arranged that each unit follows a little behind the next one in the cycle of operations in order that one attendant can operate a large machine.—J. B.

Dyeing hanks of wool, cotton, or silk and the like; Apparatus for ——. L. Gillet, Suippes, France. Eng. Pat. 8679, April 12, 1912.

THE hanks during the dyeing operation rest on hollow carriers formed with openings or slits from which the dye-liquor flows, so that the hanks can neither spread nor press together but have every portion uniformly dyed. The bottom of the dyeing trough is fitted with semicircular guards of graduated diameter, arranged "step-wise" at different heights from the bottom, to ensure the smooth circulation of the liquid.—B. N.

Laundry and dyeing purposes; Method of employing colouring matters for ——. G. E. Heyl, London. Eng Pat. 1088 of 1913, date of appl., Oct. 22, 1912.

THE colouring matter is spread evenly between two sheets of absorbent paper which are made to adhere by means of an adhesive. After drying the sheet is perforated like a sheet of postage stamps so that predetermined quantities of the dye can be removed as desired.—J. B.

Colouring of material: Process for the ——. L. Schulhof New York, Assignor to The American Diamalt Co., Cincinnati, Ohio. U.S. Pat. 1,051,456, Jan. 28, 1913.

VAT, sulphur and other insoluble dyestuffs, which are usually dyed in the reduced state, are rendered soluble by means of alkali and maltose, the presence of diastase being an advantage. Maltose is also used as an addition to vats prepared by means of hydrosulphite or other agents which quickly lose their solvent and reducing properties, it being claimed that the fixation of dyes from such vats can thereby be more easily controlled. —J. B.

Dyeing machine. J. M. Payne, Phœnix, and G. G. Wallace, Girard, Ala., Assignors to Perfection Dyeing Machine Co., Columbus, Ga. U.S. Pat. 1,057,265, March 25, 1913.

A machine for dyeing warps on the beam. The beam is detachably mounted in a closed tank within an open vat which has a well or sink in its floor. The beam is hollow and has one end closed, while at the other end is provided means for forcing the dye liquor from the well into the inside of the beam and thence through the yarn. —J. B.

Dyeing, bleaching, etc., textiles in the form in which they come from the spinning machine. P. J. Grandsire Fils. Fr. Pat. 448,248, July 31, 1912.

A method of dyeing cops, etc., on cardboard tubes instead of on the usual perforated spindles. The bobbin, preferably of the type obtained from the "continuous" or Mule-Jenny machines is put on a solid skewer and fixed vertically between two horizontal perforated plates, the perforations in the plates which hold the bobbins being made cup-shaped and fitting on the shoulder of the bobbin to make a tight joint. Liquor pumped from the chamber outside the plates is thus forced to travel through the material wound on the bobbin before it reaches the inner chamber and is exhausted. The usual cycle of operations is thus carried out continuously.—J. B.

Dyeing and rendering impermeable; Process of ——. P. Germain. Fr. Pat. 448,928, Dec. 9, 1911.

Ultramarine is rendered soluble by boiling with a mixture of three parts of water and one part of glycerin, and a solution of nitrated hydrocellulose in methylethylketone is added. Fabrics impregnated with this mixture resist soap, "chemick," sodium carbonate and light. If a drying oil and a suitable siccative are added, the mixture obtained is suitable for waterproofing balloon coverings, tents, etc.—J. B.

Skins, hairs, feathers, etc.; Process for producing fast dyeings on ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 256,794, May 2, 1912. Addition to Ger. Pat. 250,462.

2·6-Diaminophenol and its derivatives substituted in the *p*-position are used in place of the 2.5-diaminocresol specified in the chief patent (see Fr. Pat. 438,476; this J., 1912, 638). Fast olive to brown shades are produced. —T. F. B.

Printing textile fabrics. The Calico Printers' Assoc., Ltd., Manchester, and W. Browning, Accrington. Eng. Pat. 15,018, June 28, 1912.

Paper of sufficient strength and porosity is used in place of the usual back cloth.—J. B.

Brown shades capable of being reserved or discharged; Production of —— on the fibre. Badische Anilin und Soda Fabrik. Fr. Pat. 447,991, Sept. 2, 1912. Under Int. Conv., Feb. 13 and July 5, 1912.

The goods are padded or printed with a solution of *o*-dianisidine in an organic acid, or a mixture of a mineral acid and an organic acid in which the latter predominates, together with sodium chlorate and preferably a catalyst, for example ferrous sulphate or potassium ferrocyanide. After drying and steaming in the Mather and Platt, a brown similar to Manganese Bronze is produced. Reserve effects can be obtained by previously printing a reducing agent with or without the addition of a colouring matter. Discharging by chlorate gives an orange-brown, by hydrosulphite-formaldehyde an olive-green. The shade of brown can be modified by adding to the padding mixture quantities of ferrocyanide much beyond that required merely for catalysis, brighter and more orange-brown tones being thus obtained.—J. B.

Preparing glycollic acid compounds. Ger. Pat. 256,858. *See* XX.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Bauxites; Analysis of ——. E. Martin. Monit. Scient., 1913, 3, 232—236.

A quantity of the substance in fine powder is dried at at 100°—105° C., and the loss on ignition determined. 1 grm. is then treated with 15 c.c. of nitrohydrochloric acid and 30 c.c. of sulphuric acid (1 : 1), and evaporated until sulphuric acid vapours are evolved and a quantity of solid sulphates separates, cooled, 50 c.c. of water are added, and the flask is again heated until all the soluble salts are dissolved. First method.—*Silica.*—The solution is filtered into a 500 c.c. measuring-flask, the residue thoroughly washed with hot water, the filter ignited in a platinum crucible, and in the residue the silica is determined. *Titanic acid.*—250 c.c. of the solution in a flask of 1 litre or more capacity are just neutralised by ammonia, any slight permanent precipitate being re-dissolved by a drop of dilute sulphuric acid. Then 2 c.c. of sulphuric acid (1 : 1) are added, the solution is diluted to at least 500 c.c., and boiled; 10 c.c. of saturated solution of sodium bisulphite are now added, and the boiling continued for some time, the loss by evaporation being made up. A little more bisulphite is added, the flask is corked, allowed to cool in an inclined position, the clear liquid decanted off, the precipitate of titanic acid rinsed on to a filter, washed, ignited, and weighed. *Ferric oxide.*—The liquid deprived of titanic acid is oxidised with bromine, the bromine boiled off, the iron precipitated by ammonia, the precipitate washed, re-dissolved in sulphuric acid (30 c.c. of 1 : 1 acid), the solution reduced by zinc and titrated with permanganate. *Alumina* by difference. Second method.—*Ferric oxide.*—The solution (without filtering off the silica) is titrated at boiling temperature with standard stannous chloride solution (using a burette with a twice bent capillary tube, the horizontal portion about 15 mm. long) until the yellow colour disappears. The stannous solution is standardised before each series of titrations by means of ferric chloride solution. *Silica, lime, and ferric oxide* are next determined. *Titanic acid.*—250 c.c. are just neutralised as before, boiled to complete expulsion of hydrogen sulphide, then sodium bisulphite added and the process completed as in the first method. *Alumina*, as before, by difference. *Rapid method.*—The iron and silica having been determined as in the second method, the liquid is made up without removing the tin. The titanic acid is then determined in 500 c.c. colourimetrically by means of hydrogen peroxide; and the lime in a separate portion after removing iron and alumina.—J. T. D.

Uranium solutions; Radiations from ——, and determination of uranium by a radioactive method. L. Michiels. Bull. Soc. Chim. Belg., 1913, 27, 69—80.

The author describes experiments with solutions of potassium-uranyl sulphate and uranyl nitrate which show that the radioactivity of such solutions, as measured by the speed with which the charged leaf of an electroscope falls, varies directly with the concentration, except in the case of uranyl nitrate solutions of high concentration (above 20 per cent. U.), for which the activity increases less rapidly than the concentration. This variation from direct proportionality appears to be due to the high density of the more concentrated solutions, for if solutions of different uranium content but brought to the same density by addition of ferric chloride be compared, the activity is found to be directly proportional to the uranium content. It is possible to base on these results an accurate method for the determination of uranium in presence of non-radioactive metals.—A. S.

Radioactive disintegration products ; Chemical nature of some ——. A. Fleck. Chem. Soc. Trans., 1913, **103**, 381—399.

The author finds that uranium-X and radio-actinium are chemically similar to, and non-separable from, thorium ; mesothorium-2 is non-separable from actinium ; thorium-B is non-separable from lead ; radium-B and actinium-B are very similar to lead and probably non-separable from it ; thorium-C, radium-C, and actinium-C are very closely allied to bismuth, and probably non separable from it ; radium E is chemically identical with bismuth. Direct measurement of the development of radium-F from radium-E has confirmed the view that there is only one product (radium-E) between radio-lead and polonium. (See also this J., 1913, 287.)—A. S.

Hydrogen peroxide ; Influence of some organic acids on the decomposition of ——. C. Porlezza and G. Norzi. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 238—245.

Various substances have been recommended as additions to solutions of hydrogen peroxide in order to retard the decomposition of the same. The authors have compared the efficiencies of a number of organic acids for this purpose. In order to obtain comparable results in a relatively short time, a small quantity of manganous sulphate was added to the hydrogen peroxide in order to accelerate its decomposition. The hydrogen peroxide solution used contained about 0·02 grm.-mol. per litre (0·68 grm. per litre), and the results of the experiments (all carried out at 25° C.), given in tables and curves, show that the decomposition is greatly retarded by addition of benzoic, hippuric, oxalic, or uric acid, especially, by the three first-mentioned acids.—A. S.

Chlorine and hydrogen ; The interaction of ——. *The influence of mass.* D. L. Chapman and L. K. Underhill. Chem. Soc. Proc., 1913, **29**, 75.

The authors have determined the sensitiveness to light of mixtures containing chlorine, oxygen, and hydrogen, the object having been to find the variation in the rate of formation of hydrogen chloride when the concentrations of the chlorine and oxygen were kept constant and that of the hydrogen varied. The concentration of the oxygen was small in comparison with that of the chlorine. It was found that as the concentration of the hydrogen was increased from zero, the sensitiveness increased at first very rapidly, attained a maximum value, and then gradually fell. Thus, a mixture which contained 50 per cent. of hydrogen was only twice as sensitive as one which contained only 3 per cent., whilst the sensitiveness of a gas consisting of 100 per cent. of hydrogen was less than that of a mixture containing 50 per cent., in the ratio of 7 to 10. The above results demonstrate conclusively that the rate of formation of hydrogen chloride is not under ordinary conditions proportional to the number of impacts per second between pairs of molecules of hydrogen and chlorine. The results of the authors are in agreement with the view that by the action of light a comparatively unstable form of chlorine is produced, and that this, in the presence of a sufficient quantity of hydrogen, is almost entirely converted into hydrogen chloride, whereas in the presence of a deficiency of hydrogen it reverts largely to ordinary chlorine.

Examination of sulphuric acid for petroleum refining. Schulz. *See* IIA.

Ferrous sulphate monohydrate and its use in volumetric analysis. Florentin. *See* XXIII.

Studies on oxidation. Armstrong and Colgate. *See* London Section, p. 391.

PATENTS.

Sulphurous and the like gases from industrial and other furnaces ; Process of recovering and treating ——. D. Peniakoff, Brussels. Eng. Pat. 21,476, Sept. 20, 1912.

Gases containing small quantites of sulphur oxides (or of these oxides together with such impurities as hydrogen chloride or carbon monoxide, which render the gases useless in sulphuric acid manufacture) are placed, whilst still hot and possibly mixed with air, in contact with bauxite or its ferruginous residues or with other substances having similar physical and chemical properties, the purifying material being preferably made to move in a direction opposite to that of the heated gases ; this renders the gases harmless and brings about fixation of the contained sulphur in the form of aluminium and iron sulphates. The product may be gradually exhausted or lixiviated with water, and the concentrated solutions of more or less pure aluminium or iron sulphate thus obtained, made to yield marketable salts, or it may be heated in closed vessels so as to give sulphuric acid and revivify the purifying material.—F. Sodn.

Sulphuric acid ; Manufacture of ——. N. L. Heinz, La Salle, Ill. U.S. Pat. 1,057,149, Mar. 25, 1913.

In the manufacture of sulphuric acid by the chamber process, the current of steam, nitrous and sulphurous gases is mixed with such regulated quantities of air, introduced at such different points and at such times, as to maintain a uniform pressure and movement of the gases in the chambers, the quantity of air admitted containing an amount of oxygen equal to that consumed by the reacting gases.—O. R.

Alkali hydroxides ; Process for the direct preparation of —— *from alkali chlorides.* J. Kersten. Ger. Pat. 255,688, Oct. 31, 1911.

A dilute solution of the alkali chloride is heated with lead hydroxide, whereby it is converted almost quantitatively into the corresponding hydroxide. The basic lead chloride also formed can be easily reconverted into lead hydroxide by means of nitric acid and ammonia, ammonium nitrate being obtained as a by-product in addition to hydrochloric acid.—A. S.

Ammonia and hydrocyanic acid from calcium cyanamide ; Manufacture of ——. E. E. Naef, Clydach. Eng. Pat. 14,412, June 20, 1912.

Calcium cyanamide (nitrolim) is treated, at a fairly high temperature (*e.g.*, 500°—700°C.) and at ordinary or higher pressure, with a current of dry hydrogen, either alone or mixed with carbon dioxide, or nitrogen or carbon monoxide, or a mixture of these.—F. Sodn.

Cyanogen [*and ammonia*] ; *Process of obtaining* —— *starting with gases derived from vinasse or analogous substances.* Deutsche Gold- und Silber-Scheide Anstalt, vorm. Rössler. Fr. Pat. 448,722, Sept. 5, 1912.

Gaseous mixtures containing nitrogen, obtained by heating vinasse or analogous substances, are taken direct from the calcining or distilling apparatus to superheaters which are lined with refractory material, preferably of an acid character (such as Dinas bricks), the speed of the gases in the superheater being made sufficiently great to prevent catalysis.—F. Sodn.

Ammonia ; Manufacture of —— *from nitrogenous carbon compounds.* F. Schreiber. Ger. Pat. 257,188, June 2, 1911.

Organic nitrogenous compounds are caused to interact with contact masses containing hydrated iron oxide at temperatures below red heat, *e.g.*, 200° C. It is stated that by this method the nitrogen of solid organic nitrogenous compounds, which on destructive distillation is converted into ammonia only to the extent of about one-fifth, is almost completely converted into ammonia. In a similar manner, up to 80 per cent. of the nitrogen of pyridine and cyanogen salts is converted into ammonia.—A. S.

Ammonium sulphate; Process for obtaining ——. P. Fritzsche. Ger. Pat. 256,400, Feb. 17, 1912.

Alumina is treated with sulphurous acid, the basic or acid aluminium sulphite so produced is oxidised to aluminium sulphate, and the latter is treated with gases or vapours containing ammonia. The aluminium sulphite is preferably produced in solutions containing ammonium sulphite or sulphate, in presence of which it is more easily oxidised. The process may be combined with the purification of coal gas by means of aluminium sulphite (see Eng. Pat. 25,454 of 1911; this J., 1913, 24).—A. S.

Oxides of nitrogen; Apparatus for carrying out gas reactions particularly for the production of —— *in the electric arc.* W. Kochmann, Berlin. U.S. Pat. 1,055,331, Mar. 11, 1913.

The apparatus consists of a furnace containing a number of electrodes of the same polarity and a single electrode of opposite polarity; the latter has a prominent spot from which the arcs proceed, thereby rendering its effective surface smaller than the sum of the effective surfaces of the opposed electrodes, so that the arcs are caused to touch one another forming a cone, and the energy to be concentrated in the direction of the effective surface of the single electrode. The single electrode is preferably made in the form of a water-cooled expansion nozzle, adapted to be covered by the cone of arcs, and a conical water-cooled central plug, axially adjustable in the nozzle, is adapted to regulate the free passage therein, and to serve as an electrode. The electrodes and cooling surfaces may include a catalyst favourable to the reaction.
—F. Sodn.

(1) *Stannic chloride; Manufacture of* ——. (2) *Method of producing hydrates of stannic chloride.* W. F. Doerflinger, New York, Assignor to Niagara Alkali Co. U.S. Pats. 1,055,617 and 1,055,727, March 11, 1913.

(1) Chlorine is passed over liquid anhydrous stannic chloride, under such conditions that the moisture in the gas combines with the stannic chloride to form a specifically heavier hydrate which sinks out of contact with the chlorine, and the dried chlorine is then made to combine with tin, so as to produce stannic chloride, part of which is used to treat the chlorine entering the process, the rest being treated with metallic tin, in order to remove dissolved chlorine. The moist chlorine is preferably passed in a tortuous path over a flowing body of the anhydrous liquid, at a temperature below 80° C., so as to be below the melting point of hydrated stannic chloride, and it is advantageous to remove the heat of reaction independently from the interior and exterior of the body of tin in contact with the dry gas, the gases escaping from the reaction being cooled, so as to condense the contained stannic chloride. (2) Stannic chloride is hydrated by adding water in the form of ice (so as to dissipate part of the heat of reaction), and the resulting hydrate is melted and conducted from the apparatus.—F. Sodn.

Lead hydrate [hydroxide]; [Electrolytic] Method of producing ——. *Method of recovering lead and silver.* T. G. Timby, Chicago, Ill. U.S. Pats. 1,056,382 and 1,056,383, March 18, 1913.

(1) A cast anode of lead sulphide ore is electrolysed in a neutral aqueous solution of an alkali nitrate, such as sodium nitrate, by a current of low potential, and in the presence of a cathode in a cloth envelope. The hydroxide is precipitated in the electrolytic cell by the reaction of the ingredients of the bath. (2) Silver and lead are recovered from ore by electrolysing in a bath, containing a suitable electrolyte, and a cast argentiferous lead-bearing ore anode in a filtering screen. The silver is precipitated within the screen by a halogen salt of an alkali metal, and the lead, liberated by the electrolysis of the anode, is collected.—B. N.

Salt; Process for the manufacture of ——. S. M. Lillie Philadelphia, Pa. U.S. Pat. 1,056,558, Mar. 18, 1913.

The process is described as carried out in a multiple effect apparatus, in which the impurities are concentrated and transferred gradually from the last vessel of the series to the first, the salt crystals produced being transferred in the opposite direction and finally precipitated in a settling chamber.—F. Sodn.

Rock salt or sodium chloride containing iron; Process for melting —— *so as to yield a white product on solidifying* P. Adler. Ger. Pat. 256,249, Sept. 22, 1911.

The salt, before or after melting is treated with a quantity of an alkali ortho-, meta-, or pyrophosphate, or other colourless (white) phosphate, or phosphoric acid, sufficient to give a white product on solidifying.—A. S.

Calcium carbide; Process for increasing the stability of finely divided —— *towards air.* F. Morani. Fr. Pat. 448,077, Sept. 9, 1912. Under Int. Conv., Oct. 16, 1911.

The particles of carbide are coated with a thin layer of carbon by agitating them at a suitable temperature in the presence of carbon monoxide or carbon dioxide, or of a suitable mixture containing these gases, which should be as dry as possible.—F. Sodn.

Calcium carbide; Process for the utilisation of the waste of manufacture of ——. Soc. Italiana per il Carburo di Calcio. Fr. Pat. 448,078, Sept. 9, 1912. Under Int. Conv., Oct. 16, 1911.

The smaller particles produced in the crushing of calcium carbide are rendered serviceable (*e.g.*, for making acetylene) by coating them with a thin protective layer of calcium cyanamide, thus rendering them more resistant towards atmospheric moisture. To this end, the carbide is introduced into suitable vessels in which an atmosphere of air and nitrogen (or a mixture of nitrogen and an inert gas) is maintained, the particles being given such a motion that they come rapidly and uniformly into contact with the walls which are strongly heated.—F. Sodn.

Magnesia; Process of extracting —— *from natural or artificial solutions.* J. J. T. Schloesing. Fr. Pat. 448,370, Nov. 23, 1911.

Solutions of magnesium chloride, or of magnesium and other salts capable of yielding magnesium chloride by double decomposition, especially mother liquors from salt-pits, are treated with powdered magnesia in such manner as to cause the whole to become solid (the dissolved magnesium being precipitated along with that added, as oxychloride), and the product is broken up, dried, and calcined, so as to give hydrochloric acid and, after washing with water, a residue of almost pure magnesia.—F. Sodn.

Alkali sulphides; Process of manufacture of ——. H. Gouthière et Cie. and P. Ducancel. Fr. Pat. 448,927, Dec. 9, 1911.

A mixture of peat or analogous material (such as, lignite, coal dust, sawdust, etc.) and sulphur-containing residues, from the decyaniding of spent gas-purifying material or from the manufacture of Chardonnet silk, or powdered sulphur (preferably mixed with calcium sulphate) is subjected to destructive distillation, and the liquor, containing ammonium sulphide and carbonate, and residue (which consists principally of calcium sulphide and quicklime), thus obtained, are distilled together, so as to give an ammoniacal solution of ammonium sulphide and a residue of calcium carbonate. The washing of the original distillation gases is preferably effected by an alkaline liquor, and, by a suitable choice of alkali and of the sulphate added, sodium or potassium sulphide or an alkaline earth sulphide may be prepared by the process.
—F. Sodn.

Potassium salts; Apparatus for dissolving ——. Gebr. Burgdorf. Ger. Pat. 256,196, May 20, 1911. Addition to Ger. Pat. 238,255.

The apparatus described in the chief patent is modified in that the loose receptacle for the crude potassium salts is provided with one or more outlets on one or on both of its long sides, together with a transverse partition, preferably removable, just behind each outlet or each pair of outlets. The flow of the liquid is retarded by the partitions and by means of the outlets, solutions of varying concentration can be withdrawn from different parts of the apparatus.—A. S.

Silicic acid; Preparation of —— from alkali silicate solutions and carbon dioxide. J. L. Seyboth. Ger. Pat. 256,803, March 28, 1912.

Silicic acid in the form of a very fine powder is obtained by spraying an alkali silicate solution, treating the spray with a current of carbon dioxide, separating the precipitated silicic acid from the alkali bicarbonate solution, and drying it. Special claim is made for the use of the exhaust gas from a carbon dioxide liquefying installation for precipitating and drying the silicic acid.—A. S.

Metals and metallic oxides in a finely divided condition; Preparation of ——. H. Kast. Ger. Pat. 256,962, Dec. 25, 1910.

The metal salts of aromatic nitro-acids, such as the mono-, di-, and tri-nitro-compounds of phenol, cresol, xylenol, resorcinol, or their homologues, isomerides, or substitution products, are heated, with or without access of air, until the metals or their oxides separate in a voluminous form. In order to moderate the violence of combustion of the compounds, they may be diluted with inert substances or mixed with oils, fats, higher hydrocarbons, tar, or resinous substances. They may also be mixed with suitable substances, such as the oxides, hydroxides, or salts of alkali, alkaline-earth, earthy, or heavy metals and with suitable binding materials, and formed into compact porous masses. The process may be applied to the manufacture of incandescence mantles.—A. S.

Separating mixed gases [hydrogen and oxygen from the decomposition of water vapour]. W. T. Hoofnagle, Glen Ridge, N.J. U.S. Pat. 1,056,026, March 18, 1913.

The mixture of gases resulting from the decomposition of water vapour is passed first through a condenser and then through porous tubes, encased in jackets, the space between the tube and the jacket being connected with a vacuum pump.—W. H. C.

Separating mixed liquefied gases [air]; Process of ——. A. C. Morrison, Chicago, Ill. U.S. Pat. 1,056,043, March 18, 1913.

The liquefied air which is to be separated into two portions containing respectively a higher and a lower oxygen content than the original mixture, is placed in contact with a number of pieces of paramagnetic metal and then subjected to a magnetic field, whilst at the same time the liquefied mixture is heated to a temperature above the boiling point of the more volatile and less magnetic component, nitrogen.—W. H. C.

Nitrogen from air; Process of extracting ——. E. M. Wiley, Adams, Ind. U.S. Pat. 1,056,244, March 18, 1913.

The proportion of nitrogen to oxygen in air is progressively reduced by systematic treatment in a series of units, each of which comprises a high- and a low-pressure tank, through which a circulation of water is set up, a separate circulation being maintained in each unit. Air is directed, under pressure, into the high-pressure tank of the first unit and is partly absorbed by the circulating water which, becoming saturated with air, passes into the corresponding low-pressure tank. The gases, thus separated from the water and containing a smaller proportion of nitrogen than the original air, are directed into the high-pressure tank of the second unit, in which the proportion of nitrogen is still further reduced, and so on. The excess air from the high-pressure tank of each unit is returned to the high-pressure tank of the next preceding unit, and that from the first unit is utilised in actuating the pumping means employed.—F. Sodn.

Barium oxide; Manufacture of ——. Chem. Fabr. Grünau, Landshoff und Meyer A.-G., and W. Kirchner, Grünau, Germany. Eng. Pat. 6176, March 12, 1912.

See Fr. Pat. 441,565 of 1912; this J., 1912, 922. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 3628 of 1890. —T. F. B.

Alkaline hydroxides; Process of producing —— directly from alkaline chlorides. J. Kersten, Delbruck, Germany. Eng. Pat. 22,717, Oct. 5, 1912.

See Ger. Pat. 255,688 of 1911; preceding.—T. F. B.

Arsenate of lead; Method of production of ——. F. Kaufler, Vienna, and A. Chwala, Milan, Italy. U.S. Pat. 1,056,340, March 18, 1913.

See Eng. Pat. 10,017 of 1912; this J., 1912, 722.—T. F. B.

Nitrous vapours or oxides of nitrogen diluted in indifferent gases; Process of recovering ——. P. A. Guye, Geneva. U.S. Pat. 1,057,052, March 25, 1913.

See Fr. Pat. 441,022 of 1910; this J., 1911, 541.—T. F. B.

Oxygen bath. L. Sarason, Berlin, and E. Franke, Grünau, Germany. U.S. Pat. 1,057,281, March 25, 1913.

See Fr. Pat. 405,644 of 1909; this J., 1910, 425.—T. F. B.

Separation of hydrogen sulphide from gases. Fr. Pat 448,728. *See* IIa.

Erratum.

This J., 1913, p. 361, col. 2, l. 12 from top, *for* "used" *read* "fused," and delete the inverted *f* in l. 11.

VIII.—GLASS; CERAMICS.

Quartz glasses; Devitrification of ——. R. Rieke and K. Endell. Silikat-Zeits., 1913, 1, 6—12. (See also this J., 1912, 983 and 1913, 234.)

All kinds of quartz glass devitrify and become crystalline on long heating at a high temperature. The resulting product is cristobalite, and the degree of devitrification may be ascertained by density determinations, the specific gravity of silica being 2·21 and of cristobalite, 2·33. The extent of the change is dependent on temperature, time and surface. Under 1200° C. it requires many hours to become apparent; towards 1685° C., the melting point of cristobalite, it is nearly proportional to the length of heating. The least tendency to crystallisation is shown by quartz glasses which are quite clear and transparent and free from bubbles. Surface impurities held in suspension conduce to devitrification. The phenomenon is prejudicial as it causes brittleness and permeability to gases, the transformation from silica to cristobalite being accompanied by a contraction of 5 per cent. in volume. At 230° C., in cooling, β-crystobalite, the regular crystalline form, changes into the α-variety, which accentuates devitrification.—H. H. S.

Underglaze colours; Influence of titanic acid in ——. A. Berge. Sprechsaal, 1913, **46**, 206—208.

The colour produced by a stain depends to some extent on the other constituents reacting on the chief colouring oxide. Cobalt, for example, gives a deep dark-blue with silica, and a sky-blue with alumina. The tints are further affected by the presence of zinc oxide, phosphoric acid, etc. The intimate mixture of the component oxides of a stain may be made by fine grinding, by precipitation of the hydroxides, by melting together of sulphates in their water of crystallisation, or by Pukall's "suction method (see this J., 1912, 434) in which soluble salts of colouring oxides are absorbed by kaolin, etc., and then calcined and ground. Titanic acid is recommended as a carrier for other colouring oxides. Trials were fired in majolica, stoneware and porcelain kilns, of rutile thus used with the oxides of uranium, cobalt, iron, nickel, copper, manganese, chromium, molybdenum and tungsten. A wide range of colours was obtained from yellow to blue-black. The best results for underglaze by the use of titanic acid alone were obtained at cone 7—9 for olive-green, brown and yellow tints.—H. H. S.

Asbestos-porcelain; its employment in the filtration of alimentary liquids and of serums. Hinard. *See* XIXb.

Patents.

Glass gathering furnaces. H. L. Dixon, Knoxville, Pa., and A. L. Schram, Hillsboro, Ill., U.S.A. Eng. Pats. 27,742 and 27,743, Dec. 2, 1912. Under Int. Conv., Dec. 15, 1911, and March 22, 1912.

A stationary glass-gathering tank, which may be fed by any suitable connection with a tank furnace, is surmounted by a furnace of which at least a portion is rotatable, whereby the glass in the tank is made accessible to a gathering hood and tool which are also rotating relatively to the glass. The gathering device may be carried by the movable portion of the furnace, which is accordingly fitted with a recess.—H. H. S.

Quartz glass articles; Method of manufacturing transparent ——. F. Wolf-Burckhardt, Biebrich on the Rhine, Germany. Eng. Pat. 2150, Jan. 27, 1913. Under Int. Conv., Jan. 26, 1912.

Amorphous silica (*e.g.*, geyserite) is fused and shaped in known manner, and the opaque outer layers are then removed by mechanical means (such as a sand blast), with or without chemical treatment, after which the mass may be further worked into the required shape.
—F. Sodn.

[*Brick*] *Kiln.* E. Cole, London. Eng. Pat. 25,860, Nov. 11, 1912.

The kiln is of the tunnel type in which two sets of rails are employed. It is provided with a number of furnaces on each side, and also with a perforated pipe which extends longitudinally through the centre of the burning chamber, and serves as a burner for gas or oil. It is supported on a continuous wall, at a height just above the platforms of the trolleys on which the bricks are stacked. Hot gases from the burning chamber of the kiln are conveyed to a drying chamber in which green bricks are dried. The floor on which the rails are laid is sloped downwards from the entrance to the exit of the kiln to facilitate the passage of the moving trolleys through the kiln, the platforms of the trolleys, however, being kept horizontal. The kiln is provided with sliding fireproof doors, which consist of a skeleton framework of metal, filled in with fireclay or firebricks. The moving platforms are mounted upon rollers, which run over the rails. The platforms consist of metal plates covered with fireclay, and fit close to the side of the kiln and to the wall which supports the central longitudinal burners, thus protecting the rollers and rails from the heat of the burning chamber.—W. C. H.

Enamelled utensils: Method of removing the enamel from useless ——. G. Spitz, Brünn, Austria-Hungary, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,055,678, March 11, 1913.

See Fr. Pat. 370,986 of 1906; this J., 1907, 257.—T. F. B.

IX.—BUILDING MATERIALS.

Mortars and concretes mixed with asphaltic oils. A. Taylor and T. Sanborn. Proc. Amer. Soc. Civil Eng., 1913, 39, 355—363.

The authors subjected Page's statements concerning oil-mixed concrete (this J., 1911, 1213; 1912, 925) to a thorough investigation, and drew the following conclusions with regard to asphaltic oils: (1) Oil-mixed concrete containing 5, 10, or 15 per cent. of oil is more permeable under pressures of 20—60 lb. per sq. in. than ordinary concrete, and oil-mixed mortar containing 10 per cent. of oil is more permeable than plain mortar under pressures of 10—20 lb. per sq. in. (2) Oil-mixed mortars containing up to 25 per cent. of oil show slightly less absorption of water than plain mortar, except that with the most viscous oils the mortar becomes more absorptive, and absorption is not an index of the permeability. The absorption decreases with the increase in the quantity of oil. (3) Both the tensile and the crushing strengths of oil-mixed mortars are considerably less than those of plain mortars, the strengths decreasing with increasing quantities of oil, and the progressive deterioration with increase of oil being more marked in the case of crushing than of tensile strengths. (4) The strength decreases with the viscosity of the oils, and with the most viscous oils it requires considerably more water to keep a mixture at normal consistence than is required in the fluid oil mixtures. (5) The relative decrease in strength with increasing quantities of oil in mortars is less in 50 than in 28 days. (See also this J., 1913, 86.)—O. R.

Portland cement; Adsorption and volume changes of ——. Knothe. Tonind.-Zeit., 1913, 37, 535—538.

Referring to White's observations of the volume changes of set cement under various conditions (this J., 1912, 130), the author quotes Jesser's conclusions (Oesterr. Verein der Zementfabrikanten, Mar. 26, 1912) that the phenomena are due to adsorption. When set cement is brought into an atmosphere of definite humidity and at constant temperature, a state of equilibrium is set up between the water-content of the cement and the water-content of the air, water being given up by the cement or adsorbed by it, according as is required by the state of equilibrium holding good for the particular system in respect of humidity and temperature. Adsorption of water by cement is accompanied by expansion and loss of water is accompanied by contraction. Ferro-concrete is much less susceptible to volume changes than ordinary concrete, owing to the absorption by the included iron of part of the stresses and strains, which are set up at the surface of the concrete.—O. R.

Determination of calcium as tungstate. Saint-Sernin. *See* XXIII.

Patents.

Woods; Treatment of —— with sulphur. C. Haunz and W. Oliver, London. Eng. Pat. 1076, Aug. 12, 1912

Wood, having been freed from resinous and like matter by a known process such as digestion under pressure or vacuum in an alkaline solution, and thereby having been converted into a highly porous cellulose body, is dried and immersed in a bath of sulphur maintained at 115°—125° C. —a temperature which keeps the sulphur molten whilst retaining its light colour. The resulting surface is hard, smooth, and light, and ready for direct polishing, varnishing, or painting.—H. H. S.

Wood; Process of preserving —— and products thereof. C. Ellis, Larchmont, New York. Assignor to Copper Oil Products Co., New York. U.S. Pat. 1,054,756, March 4, 1913.

Wood is preserved by impregnating it with a composition made by dissolving a toxic mineral body, such as a copper compound, in a liquid but viscous asphaltic petroleum residuum.—W. C. H.

Wood and products thereof: Method of impregnating —— [*with waste sulphite liquor*]. L. H. Baekeland, Yonkers, N.Y., Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 1,057,211, March 25, 1913.

A "fibrocellular body" is treated with waste sulphite liquor under the action of heat and pressure.—O. R.

Impregnated wood and method of preparing the same. L. H. Baekeland, Yonkers, N.Y., Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 1,057,319, March 25, 1913.

The pores of wood are impregnated with mineral salts and with the solid constituents of sulphite waste liquor. —O. R.

Wood ; Process for the preservation of ——. F. Bub. Ger. Pat. 254,212, March 8, 1911.

The wood is impregnated first with a solution of the calcium salts of sulphonic acids of aromatic hydrocarbons (naphthalene, anthracene, etc.) or of mixtures of the same, and then with a solution of metallic fluorides.—A. S.

Wood parasites ; Process for destroying —— and preventing the appearance of the same. M. Leger. Ger. Pat. 256,151, Feb. 23, 1912.

The wood is impregnated with a solution of alkali-zinc aluminate.—A. S.

Plaster bricks and conglomerates ; Process of manufacture of ——. E. Leduc. Fr. Pat. 448,255, Nov. 20, 1911.

The plaster, or mixture of plaster and inert materials, such as sand, etc., is made into a liquid paste with water, the excess of which is removed by mechanical pressure or other means before the mass is moulded into the required objects.—W. C. H.

Mortars ; Process for the calcination of materials used for the manufacture of ——. G. Von Staszewski. Fr. Pat. 448,718, Sept. 2, 1912. Under Int. Conv., Sept. 2, 1911.

Claim is made for the use of the tubular rotary kiln, described in Ger. Pat. 207,881 of May 16, 1907, for calcining materials which can be used for compounding mortars, such as marls with low percentages of lime, clay, etc. These materials have been found very valuable for making mortar that has to resist the action of sea-water.—W. C. H.

Stone ; Process for the manufacture of artificial ——. Deutsche Konit-Ges. m. b. H. Fr. Pat. 448,720, Sept. 4, 1912.

Materials, such as finely divided cinders, mixed with fine mineral fibres, with or without the addition of a similar colouring substance, are formed into a paste with some agglutinant that is easily gasifiable, such as oil in solution. This paste is subjected to moderate compression in a closed mould, which, however, is not tight, but can be tightened as the pressure increases. The paste is heated, compressed, re-heated, and finally cooled rapidly after another compression.—W. C. H.

Blast-furnace slag ; Granulation of —— for use in making cement. C. Walter, Beckum, Germany. Eng. Pat. 6462, March 15, 1912.

See Fr. Pat. 440,737 of 1912 ; this J., 1912, 819.—T. F. B.

Kiln for drying lumber. Lumber-drier. A. D. Linn, Grand Rapids, Mich. U.S. Pats. 1,055,338 and 1,055,339, March 11, 1913.

See Eng. Pat. 24,193 of 1909 ; this J., 1910, 1384.—T. F. B.

Organic materials [wood, etc.] ; Process of preserving ——. H. Monseur, Angleur-lez-Liège, Belgium. U.S. Pat. 1,057,076, March 25, 1913.

See Fr. Pat. 435,732 of 1911 ; this J., 1912, 388.—T. F. B.

Woods ; Process of artificially staining ——. K. K. Schmidt and M. Kleinstück, Dresden, Germany. U.S. Pat. 1,057,284, March 25, 1913.

See Fr. Pat. 425,085 of 1911 ; this J., 1911, 896.—T. F. B.

Mixing binding agents and other substances with granular material ; Method of ——. E. Sprenger, Goldach, Switzerland. U. S. Pat. 1,057,590, April 1, 1913.

See Eng. Pat. 13,899 of 1911 ; this J., 1912, 643.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ; An electrolytic theory of the corrosion of ——. B. Lambert. Faraday Soc., April 4, 1913. [Advance proof.]

The author has already shown (this J., 1912, 777) that to effect the rusting of iron, water and oxygen are the only essentials. He supports the electrolytic theory of corrosion and attributes the formation of rust to combination of the ferrous ions with the hydroxyl ions. (See also this J., 1910, 1456.)—W. E. F. P.

Rust ; Formation of —— under paint films. E. Liebreich and F. Spitzer. Z. Elektrochem., 1913, **19**, 295—301.

In continuation of their previous work (this J., 1912, 190 and 936) the authors have investigated further the electrical conditions in a paint film on iron. By using compressed rods of the various pigments (zinc oxide, white lead, red lead, and ferric oxide) in connection with a normal calomel electrode, they have made it clear that there is a true difference of potential between pigment and iron in dilute solution, which is not to be accounted for by the presence of gas in the pigment or by differences of concentration at the electrodes. Measurements of the electrical resistance of paint films show that the resistance must be mainly attributed to the oil, but that it is not so great, when the conditions are considered, as to preclude the passage of a current in the circuit, pigment | solution | iron. The authors also give an electro-chemical explanation of the fact that in a moist atmosphere an increase in the number of coats of paint increases the susceptibility to corrosion, except in the case of the special paint containing alkali.—W. H. P.

Platinum assay ; Sources of error in the ——. L. St. Rainer. Oesterr. Zeits. Berg.- u. Hüttenw., 1913, **61**, 141—147, 155—160.

Sources of error in the sulphuric acid parting are :—(1) The conversion of any lead remaining in the button into lead sulphate. (2) The solution of some platinum if the cornet crumbles to fine powder. To avoid this, the ratio of gold to platinum should be at least 10 to 1. (3) The retention of silver. With regard to this last source of error, it is shown by diagrams and microphotographs that as the button cools on the cupel, and when an alloy of 75 per cent. Ag with 25 per cent. Pt begins to solidify, the first crystals to separate contain 45 per cent. Pt, and sink to the bottom. It is these crystals rich in platinum which cannot be parted with sulphuric acid and retain the silver with the platinum-gold. By annealing the button, however, sufficient diffusion of the metals can easily be induced, to ensure that the crystals richest in platinum shall contain not less than 65 per cent. Ag. Parting of the silver with sulphuric acid is then complete. As a complete method of assay, the author recommends the following procedure, which should be carried out in duplicate :—0·250 grm. of the alloy (0·500 grm. if low in platinum) is inquarted with so much fine gold and fine silver, that the ratio Pt : Au : Ag = 1 : 10 : 30, and cupelled with lead. The cupellation is carried out chiefly at 900° C., and finished at 1200° C. A check of fine silver is cupelled at the same time. The cupels are drawn to the front of the muffle and allowed to stand for 10 minutes at 800° C., and are then removed. The button after being allowed to cool on the cupel is weighed, and the weight corrected for added gold and silver, and cupel loss. The button is then rolled into a cornet and boiled for 30 minutes with sulphuric acid of 1·84 sp. gr. After cooling, the acid is poured off, fresh acid is added, and the boiling repeated for another 30 minutes. The cornet is washed with dilute sulphuric acid, and then three times with distilled water. Any lead sulphate is removed by digesting with ammonium acetate, and the residue is washed, dried, annealed and weighed. The weight, corrected for added gold, gives the weight of gold plus platinum in the sample taken. The

cornet is then inquarted with three times its weight of silver, (Pt : Ag is thus 1 : 33), wrapped in lead and cupelled. The button is rolled and parted with nitric acid in the usual way. The remaining gold still contains a little platinum, and is therefore again inquarted with three times its weight of silver, cupelled, and parted. The residue now consists of pure gold. The method is stated to give results correct to 1 part in 1000. Tungsten, which with gold and copper is frequently added to platinum, does not interfere, but is oxidised away during cupellation.
—T. St.

β-Gold. M. Hanriot and F. Raoult. Bull. Soc. Chim., 1913, **13**, 260—265.

Finely divided annealed gold is found to be appreciably attacked by boiling nitric acid (0·076 grm. of metal being dissolved from 5 grms. of gold by 100 c.c. of monohydrated acid in 2 hours), and brown gold (this J., 1911, 89, 216) is soluble to a yet greater extent (1·540 grms. being dissolved under the given conditions). Brown gold is likewise dissolved more readily than yellow gold by a solution of auric chloride in the presence of hydrochloric acid, giving a solution which on cooling yields a crystalline deposit of metallic gold. A study of the magnetic susceptibilities of the original brown gold, the crystalline gold obtained by solution, and the residual gold leads to the conclusion that, from brown gold, which is regarded as a mixture of α- and β-gold, pure β-gold (crystalline gold) may be prepared by treatment with a solution of gold chloride, α- gold being left as a residue.—F. Sodn.

Zinc retort residues; Working up of ——. Lindt. Metall u. Erz, 1913, **10**, 347.

Zinc retort residues containing: Zn 3·8, Pb 0·56, Fe 18·9, S 4·73 per cent., and Ag 1·33 oz. per ton were washed, ground up, and then passed through a magnetic separator, care being taken that the non-magnetic particles adhering to the magnetic portion were washed away. The non-magnetic part was then re-ground to 0·5 to 0·75 mm. in size and again separated. It was found that the magnetic portion consisting of 26 per cent. contained: Zn 3·8, Pb 0·16, Fe 59·6, S 3·65 per cent., Ag 3·96 oz. per ton, while the 74 per cent. of non-magnetic material contained: Zn 3·8, Pb 0·71, Fe 4·60, S 5·12 per cent., Ag 0·55 oz. per ton. Suitable methods are indicated for extracting the silver from these products.—A. H. C.

Lead-baths; Action of added substances in electrolytic ——. F. C. Mathers and O. R. Overman. Chem.-Zeit., 1913, **37**, 341—344.

The authors have investigated the influence on the nature of lead deposited electrolytically, of a very large number of substances when these are added to the bath in small quantities. The best results were given by the following substances, which are arranged in their order of effectiveness:—Oil of cloves, peptones, phlorizine, and gum guaiacum. In a lead perchlorate bath about 165 grms. of oil of cloves are required for each metric ton of lead. The only relationship which could be found to exist between chemical composition and effect on the lead deposit is that the substances which are favourable to a good deposit all contain hydroxyl.—T. St.

Lead in couples and alloyed with other metals; Solubility of —— in water. A. Scala. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 155—162.

Strips of lead and another metal (zinc, tin, copper) were immersed in distilled water and connected above the containing vessel by a piece of thick copper wire; in one set the strips were both placed in the same vessel, whilst in another set, they were placed in separate vessels, communicating with one another by a siphon; control tests were made with similar strips not joined together. The results obtained indicate that the solubility of lead in water at the ordinary temperature is not increased by placing it in electrical connection with other metals. Some experiments were also made with lead-tin alloys containing respectively 90, 80 and 50 per cent. Pb. The results show that the alloys must be regarded as distinct entities, and cannot be looked upon as series of galvanic couples of the component metals.—A. S.

Mineral production of the United Kingdom in 1912. Board of Trade J., April 10, 1913. [T.R.]

The following tables show the output of coal and certain other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Acts (the returns from quarries under the Quarries Act are not yet available) during the year 1912, with comparative figures for the preceding year.

I.—Output of Minerals under the Coal Mines Acts.

——	1911.	1912.
	Tons.	Tons.
Barium (compounds)	8,940	4,712
Coal	271,878,124	260,567,552
Clay and shale, other than fire-clay and oil shale	404,223	405,425
Fire-clay	2,482,846	2,279,059
Igneous rocks	444	268
Iron pyrites	8,466	8,442
Ironstone	7,886,898	6,744,258
Limestone	17,149	12,009
Oil shale	3,116,803	3,184,826
Sandstone (including "Ganister"*)	138,339	152,156

* The quantity of ganister obtained was 132,107 tons in 1911, and 136,880 tons in 1912.

II.—Output of certain Minerals under the Metalliferous Mines Regulation Acts.

——	1911.	1912.
	Tons.	Tons.
Barium (compounds)	33,610	38,055
Clay and shale	128,470	123,279
Copper ore and copper precipitate	3,244	1,912
Fluorspar	31,587	28.691
Gold ore	2,752	170
Gypsum	233,732	243,811
Igneous rocks	59,461	61,117
Iron ore	1,823,795	1,672,988
Lead ore	23,864	25,323
Limestone*	404,705	343,424
Manganese ore	4,987	4,170
Rock salt	200,620	218,055
Sandstone†	98,482	98,158
Slate	110,608	101,648
Tin ore, dressed‡	6,618	6,817
Zinc ore	17,652	17,704

* Including 2,515 tons of calcspar in 1911 and 1,432 tons in 1912.

† Including 566 tons of ganister in 1911.

‡ In addition, 408 tons of undressed tin ore were obtained in 1912.

The above figures do not in all cases represent the total production of the minerals for the year. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, etc., are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal and for the ores of copper, lead, and zinc are, however, substantially complete.

Analysis of bauxite. Martin. *See* VII.

Studies on oxidation. Armstrong and Colgate. *See* London Section, p. 391.

Patents.

Iron; Electrolytic refining of ——. G. Tischenko, St. Petersburg. Eng. Pat. 5855, March 8, 1912.

The anode is in the form of a vertical centrally arranged cylinder with perforated walls, and is surrounded by a double-walled cathode, the annular space, through which steam is passed, being sealed; or the cathode may be a centrally-disposed sealed cylinder, and the anode a surrounding double-walled cylinder open at the top, the wall in front of the cathode being perforated. The anode in both cases is lined with lead. The electrodes are so arranged that either may be separately raised out of the electrolytic bath without disturbing the other.—B. N.

Steel; An improved high speed tool ——. Stahlwerk Becker Akt.-Ges., Krefeld-Willich, Germany. Eng. Pat. 27,838, Dec. 3, 1912. Under Int. Conv., Aug. 9, 1912.

THE addition of up to 15 per cent. Co to high speed tool steels of the usual compositions, is stated to yield a steel capable of cutting at higher temperatures, and one which retains its cutting properties for a considerably greater length of time. The following composition is given as an example: C 0·70, Cr 5, W 18, V 1, Mo 0·75, and Co about 4 per cent. The vanadium and molybdenum may either or both be omitted.—T. ST.

Steel; Art of manufacturing cement ——. G. H. Benjamin, New York. U.S. Pat. 1,054,817, March 4, 1913.

PUDDLE bars are subjected to the heating and vibratory effects of a transmitted polyphase current of electricity, and simultaneously to the action of a gaseous hydrocarbon. The latter is brought into contact with the highly heated iron under pressure, and under conditions such that atmospheric air is excluded.—T. ST.

Metals [steel]; Method of treating [refining] ——. A. J. Rossi and W. F. Meredith, Niagara Falls, N.J., Assignors to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,056,125, March 18, 1913.

THE metal (steel) is purified by adding to it whilst in a molten condition, a compound consisting of a similar metal agglomerated with titanium carbide.—W. H. C.

Steel or iron sheets; Method of oxidising ——. J. E. Carnahan and A. J. Maskrey, Canton, Ohio. U.S. Pat. 1,056,627, March 18, 1913.

THE sheets are pickled and annealed, and after cooling, are separated. They are then re-packed, one by one, in the reverse order, and oxidised by heating and steaming in an annealing box. The sheets are then cold rolled, re-packed in the reverse order, and the oxidising process is repeated. Finally, the sheets may be again cold rolled.—T. ST.

[Iron.] Ores and metals; Process of desulphurising ——. A. E. Greene, Chicago, Ill., Assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. U.S. Pat. 1,056,900, March 25, 1913.

IN a process for eliminating sulphur from pig iron and from "iron compounds containing sulphur," a mixture of the material with a lime compound or slag and a reducing agent is heated in an electric furnace to a temperature sufficient to effect the removal of the sulphur as calcium sulphide: in the case of pig iron the temperature employed is approximately 1350° C.—W. E. F. P.

Steel; Manufacture of ——. J. Fattelay dit Victor. Fr. Pat. 448,188, Sept. 12, 1912. Under Int. Conv., Sept. 16, 1911, and May 22, 1912.

THE iron is melted in a crucible provided with a tuyère opening below the surface of the metal. Oxygen, or air enriched with oxygen, is blown through the molten iron until the carbon is removed, and any desired additions are then made. The object of the invention is to provide a rapid means of making steel on a small scale without a large outlay.—T. ST.

Cast iron; Refractory and resistant —— and its method of manufacture. L. Martin. Fr. Pat. 448,697, Sept. 26, 1912.

A CHARGE composed of scrap iron, hæmatite, and scrap steel or nails, in suitable proportions, is melted in a cupola. The charge is arranged in layers divided by layers of coke, and heated to 1300° to 1400° C. From time to time a lump of chalk is added. The molten metal is run off into a ladle, in which, contained in a packet and covered with a layer of charcoal powder, is the following mixture:—(1), titanium or ferrotitanium, equivalent to 150 grms. of titanium for 100 kilos. of the charge; (2), 50 per cent. ferrosilicon to the amount of 1 per cent. of the charge; (3), 80 per cent. ferromanganese to the amount of 2 per cent. of the charge. The metal is stated to give homogeneous castings free from blow-holes, and to be very resistant to shock and high temperatures.—T. ST.

Ferrochromium; Process of treating crude ——, and producing solid ingots. J. T. Morehead New York, and J. B. Huffard, Ferris, W. Va., Assignors to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 1,057,078, March 25, 1913.

To the molten ferrochromium, while protected from oxidation, ferrosilicon is added in such quantity as to effect the reduction of oxides and the removal of occluded gases and ensure the presence of silicon in the purified alloy; the latter is subsequently cast in the usual manner. —W. E. F. P.

Chromium; Process for increasing the yield of —— in the aluminothermic production of carbon-free ferrochromium from chrome-iron ore. T. Goldschmidt A.-G., Essen-on-the-Ruhr, Germany. Eng. Pat. 18,671, Aug. 14, 1912. Under Int. Conv., July 5, 1912.

IT is claimed that by the addition of chromic oxide to the mixture of chrome-iron ore and aluminium (or other reducing metal) in the aluminothermic method of producing ferrochromium, a higher yield of the chromium contained in the chrome-iron ore is obtained, and at the same time, ferrochromium of a uniform composition can be produced. A mixture of 60 parts of chromic oxide to 300 of chrome-iron ore has given good results. By giving the mixture used for the aluminothermic reaction a moderate preheating (preferably to red heat) the yield is further increased.—T. ST.

Furnaces; Metallurgical ——. J. E. Greenawalt, Denver, Colo., U.S.A. Eng. Pat. 28,441, Dec. 10, 1912.

AN improved design of the furnace described in Eng. Pat. 14,805 of 1912 (this J., 1913, 239). Ore is placed on a grid in a sintering pan, and ignited from above downwards by means of a downward current of air, ignition being brought about by means of a current of oil, gas, or finely powdered charcoal, injected through nozzles into a hood which is temporarily placed over the pan. The hood is made to run on rails and is suitably balanced, whereby it can easily be raised and lowered over the several pans comprising a plant. In the present construction the pan is practically 12 ft. long, 7 ft. wide, and 2 ft. deep, and the crown of the ignition hood is only about 6 in. above the surface of the charge. The shallowness of the hood is an important practical feature, as providing more satisfactory ignition of the charge. The roof of the hood consists of an outer shell with large perforations, and an inner cast-iron lining with small (½ in.) perforations. The air supporting combustion is drawn through the perforations, and the air-jacket between the outer sheet and the lining keeps the outer sheet cool. A torch hole with a swinging plate is provided to allow of the injected fuel being ignited.—T. ST.

[Blast-] Furnace. F. J. Zippler, Avalon, Pa. U.S. Pat. 1,055,589, Mar. 11, 1913.

A FURNACE is provided with an outer annular blast chamber and an inner annular chamber fitted with blocks forming tuyères, the blast pipes between the two chambers being staggered relatively to the tuyères so that the blast flows in a tortuous passage. Means are provided for opening and closing the tuyères successively.—H. H.

Ore and the like; Method of and apparatus for concentrating ——. G. S. A. Appelqvist, and E. O. E. Tyden, Stockholm, Sweden. Eng. Pat. 402, Jan. 6, 1913.

A MIXTURE of the ore and water is treated with gasified oil, tar, or fat, and then passes to a large settling hopper shaped like an inverted cone. The oil adheres selectively to the metalliferous particles, which are thereby caused to float to the surface, and run out by way of a spout, whilst the rock sinks to the bottom and is drawn off through a drain. In one form of apparatus, a powerful stream of water from a pump draws the ore from a hopper, and the gasified oil from a retort, simultaneously into a small mixing hopper by injector action. In another form, intended for larger production, the ore feeds itself, the gas is introduced by injector action by means of a stream of water, and as a mixing agent, a powerful stream of water is driven independently into the hopper by means of a pump.—T. St.

Ores; Process for treating ——. C. Schick, Siegen, Germany. U.S. Pat. 1,055,495, March 11, 1913.

Ore slimes are mixed with a chlorine derivative of benzol and a nitrogen derivative of benzol. The mixture, after agitation, is subjected to the action of an acid bath, and the whole allowed to settle.—T. St.

Platinum and osmium; Alloy of ——. F. Zimmermann, Assignor to Baker and Co., Newark, N.J. U.S. Pat. 1,055,119, March 4, 1913.

The alloys contain refined Pt less than 0·5 and refined Os 30 per cent.—T. St.

Precious metals; Process of extracting —— from their ores. S. Williams, San Francisco, Cal. U.S. Pat. 1,056,311, March 18, 1913.

The ore in a finely divided state is agitated in the presence of mercury with a solution formed of potassium sulphate 1, potassium double superphosphate 1, and water 24 parts.—T. St.

Gold; White alloy of —— and method of manufacture. Dr. Richter und Co. Fr. Pat. 448,407, Sept. 17, 1912.

Claim is made for replacing, more or less, a metal of the platinum group by a metal of the iron-nickel group in the preparation of white gold alloys, with the object of making a less costly alloy which shall yet be soft enough to work. The alloy to be added to the gold is composed of: Pt or Pd 0·5 to 20, Ni 70 to 94, and Cu 4 to 30 atomic proportions.—T. St.

Zinc and manganese; Electrolytic recovery of ——. A. G. French, Nelson, British Columbia. U.S. Pats. 1,055,157 and 1,055,158, March 4, 1913.

(1) For the recovery of pure metallic zinc and manganese dioxide, an electric current of from $2\frac{1}{2}$ to $4\frac{1}{2}$ volts is passed from a lead anode to a zinc cathode immersed in an aqueous solution of zinc sulphate, manganese sulphate and normal sodium sulphate. The electrolyte after being acted upon is continuously delivered to the leaching tank from which the original supply was obtained, and is continuously replaced in the electrolytic tank by a supply drawn from the same leaching tank. (2) The electrolyte, after being acted upon, and before delivery to the leaching tank, is treated with sulphur dioxide or a solution of sulphurous acid in order to convert the manganese dioxide suspended therein into manganese sulphate.—B. N.

Metals; Process for welding dissimilar ——. F. W. Rogers, Assignor to Malleable Iron Range Co., Beaver Dam, Wis. U.S. Pat. 1,056,061, March 18, 1913.

The sheets of different metals to be welded, and a sheet of a metal possessing physical properties different from at least one of the metals, are all fixed together, the last-mentioned sheet being an outside one. The three contacting metals are then subjected to a welding heat sufficient to cause an integral weld between the three metals, the interposed metal freely fluxing with the other metals at the point of weld. The interposed metal should possess non-corrosive properties. In welding an iron or steel plate to a copper plate, a plate of Monel metal is used, the copper being interposed between this and the iron or steel.—T. St.

Ore-roaster. G. A. Stanton, Placerville, Cal. U.S. Pat. 1,056,376, March 18, 1913.

The floor of the ore roaster consists of a number of overlapping sections, the front edge of each section being overlapped by the rear edge of the section immediately in front. The sections are thus individually inclined. Each section consists of a heat-resisting block, supported by a metallic plate which has an upturned flange along its lower edge. The flange is partially embedded in the block, and stops short of the upper surface of the block. Near, and parallel to the upper edge of each section is an angle iron strip, which is secured to the plate and is embedded in the block.—T. St.

Tin-plate scrap; Method of stripping ——. J. M. Calmels. Fr. Pat. 448,044, Sept. 7, 1912.

The scrap is suspended (preferably in a rotating perforated drum) in a bath of hydrochloric acid, into which a current of gaseous hydrochloric acid is passed. The speed of the gas current is regulated so that the temperature of the bath is maintained at 20° to 25° C. The solution of the tin is complete in from 10 to 15 minutes, when the stripped scrap is removed, washed free from tin chloride, and dried. It is stated that only traces of iron are dissolved, as under the given conditions, any bare iron surface becomes immediately coated with a protective layer of ferrous chloride.—T. St.

Tungsten, molybdenum, and similar refractory metals or their alloys; Manufacture of articles composed of ——. P. Schwarzkopf, S. Burgstaller, and Wolfram Laboratorium P. Schwarzkopf G. m. b. H. Fr. Pat. 448,229, June 13, 1912.

The articles are shaped under pressure from the metal powders containing oxide, the powders being as fine and dense as possible. Reduction and agglutination is then brought about by heating to 1500° to 1600° C. in a current of a reducing gas such as hydrogen. The intensity of reduction may be controlled by the addition of oxygen or water vapour to the reducing gas, provided always the partial pressure of oxygen in the gas is lower than that in the powder. The process is continuous, the articles being fed through the furnace in the opposite direction to that of the gas current, so that complete reduction is ensured. To counteract brittleness due to the formation of large crystals by exposure of the article to a high temperature, the original powder is mixed with a substance that will lower the vapour pressure of the metals forming the powder. Uranium or uranium oxide may be used for the purpose.—T. St.

Metalliferous dust; Method of briquetting —— by means of organic agglutinants soluble in water. Gewerkschaft Pionier. Fr. Pat. 448,276, Sept. 13. 1912. Under Int. Conv., Sept. 15, 1911.

The solution of agglutinant is mixed with the dust, roasted ores, etc., as these leave roasting furnaces, etc., and while they are still in the hot state. The heat contained in the solid material serves to evaporate the excess of moisture in the agglutinant to such an extent that the briquettes are ready to be utilised or transported immediately after compression.—T. St.

Nickel alloy very resistant to chemicals and which can be mechanically worked. W. and R. Borchers. Ger. Pat. 256,361, Aug. 20, 1912. Addition to Ger. Pat. 255,919, June 21, 1912.

In the nickel-chromium-silver alloy described in the chief patent (this J., 1913, 295). the nickel may be partly replaced by an equal quantity of cobalt and the silver partly or completely by a somewhat greater, but not more than the double, quantity of copper.—A. S.

Steel ingots; Process of treating ——. B. Talbot, Woodburn, Darlington. U.S. Pat. 1,055,831, March 11, 1913.

See Eng. Pat. 6391 of 1912; this J., 1913, 238.—T. F. B.

Furnace : Electric ——for melting and liquefying ferro-alloys. W. Schemmann and J. Broun, Assignors to Rombacher Hüttenwerke, Rombach, Germany. U.S. Pat. 1,056,456, March 18, 1913.

See Fr. Pat. 434,120 of 1911 ; this J., 1912, 236.—T. F. B.

Electrolytic processes [recovery of iron and cobalt from solutions]. C. J. Reed, Philadelphia. U.S.Pats. 1,055,652 and 1,055,653, March 11, 1913.

See Eng. Pat. 9612 of 1912 ; this J., 1912, 781.—T. F. B.

Copper : Process for refining ——. W. S. Rockey and H. Eldridge, New York. Eng. Pat. 12,168, May 22, 1912.

See U.S. Pat. 1,027,769 of 1912; this J., 1912, 592.—T.F.B.

Furnace for roasting ores ; Multiple-floor ——. R. Scherfenberg, Berlin. U.S. Pat. 1,057,584, April 1, 1913.

See Fr. Pat. 437,565 of 1911 ; this J., 1912, 543.—T. F. B.

Zinc and the like ; Production of ——. A. B. Pescatore, London. U.S. Pat. 1,057,878, April 1, 1913.

See Eng. Pat. 29,839 of 1911 ; this J., 1911, 1456.—T. F. B.

Furnaces. Eng. Pat. 13,986. *See* I.

Process for increasing the calorific power of blast-furnace gas. Fr. Pat. 448,555. *See* IIa.

[Electrolytic] method of producing lead hydrate [hydroxide] and of recovering lead and silver. U.S. Pats. 1,056,382 and 1,056,383. *See* VII.

Preparation of metals and metallic oxides in a finely-divided condition. Ger. Pat. 256,962. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Furnace ; Electric induction heater or ——. A. Helfenstein, Vienna. Eng. Pat. 14,164, June 17, 1912. Under Int. Conv., June 16, 1911.

The furnace casing (forming the outer limit of the furnace) is connected up wholly or partially as a length of conductor in the secondary current circuit, in such a manner that it forms with the heated conductor a loop as free as possible from self-induction.—B. N.

Reduction-furnace ; Electrical ——. H. H. Noble, San Francisco, Cal. U.S. Pat. 1,057,082, Mar. 25, 1913.

A number of arch covers disposed transversely are supported by the side walls of the furnace to which the end walls of an outlet stack are united by base blocks situated between the ends of the arch covers. The latter are connected with the side walls of the stack and provided with openings for the electrodes.—W. E. F. P.

Resistance brick applicable in the construction of electric radiation furnaces. M. Sauvageon. Fr. Pat. 448,618, Dec. 1, 1911.

The resistance brick is suitable for the construction of walls and roofs of electric furnaces, each of its faces destined to form part of the wall being dressed with a layer of appropriate thickness of glass or enamel, or of a material which is a bad conductor of electricity. The brick itself, which is homogeneous in structure and conductive of electricity, is composed of a base of glass obtained by intimately mixing, in suitable proportions, powdered glass with bodies such as carbon, graphite, etc., and a binder such as tar or refractory earth.—B. N.

Furnaces or heaters ; Electric —— with great yield. G. Bruandet. Fr. Pat. 448,699, Feb. 13, 1912.

The system of electric furnaces or heaters, which have a great coefficient of efficiency, may be applied to cases where the materials to be treated are bad conductors of electricity, in which cases the walls of the reaction chambers, in the form of tubes, constitute the resister itself. These chambers may be brought into action separately, or may be united electrically between themselves according to any possible groupings. If the material to be treated is a liquid, it is made to traverse the tubes, which are grouped electrically in a suitable manner to secure the proper voltage and amperage. The system may be applied to materials which are good conductors of electricity, by the employment of additional resisters. —B. N.

Colloidal and finely sub-divided substances ; [Electrolytically] Separating ——. G. B. Schwerin, Frankfort-on-the-Maine, Germany. Eng. Pat. 24,666, Oct. 28, 1912. Under Int. Conv., Aug. 22, 1912. Addition to Eng. Pat. 14,369 of 1912 (this J., 1913, 241).

The substances are separated both according to their difference of potential and the difference of size of particle, by operating with diaphragms of different porosity, and also by making the diaphragms of two or more materials of different and selected potential.—B. N.

Arcs ; Method and apparatus for producing long electrical ——. F. H. A. Wielgolaski, Christiania, Norway. U.S. Pat. 1,054,886, March 4, 1913.

The arc is produced between electrodes at one end of a furnace space, and a wide thin magnetic field is formed between the electrodes, whereby the arc is longitudinally stretched in the space into a long U-shaped form. The flux lines pass between the legs of the arc substantially perpendicularly to the plane of the arc, the field being extended in width in the direction of the length of the space and the arc. Gas is passed into the field in a direction away from the electrodes.—B. N.

Electrode for producing arcs. G. Wagener, Schlebusch-Manfort, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 1,055,003 and 1,055,295, March 4, 1913.

(1) The improved electrode, for the production and maintenance of arcs in the carrying out of gas reactions, comprises a metallic core, cooled artificially, by means of which the arc is first formed, and a surrounding body of cement, or non-volatile refractory earth, which does not combine chemically with the metallic core, but is permanently associated therewith in the maintenance of the arc. The surrounding sheath is not normally conductive, but becomes so when heated, and after being raised in temperature has a greater affinity for the arc than the cooled metallic core ; the sheath therefore serves to maintain the arc, and causes the latter to assume different positions thereon, thereby reducing the wear of the electrode to a minimum. A gas reaction chamber surrounds the electrode, and has ports for the admission of air into the arc space. (2) The surrounding sheath of cement projects beyond the metallic core, and may be in the form of a surrounding conical wall with a cup-shaped recess in its narrowest end, the diameter of the recess being substantially greater than the diameter of the metallic electrode ; the latter projects through the base of the cup to a height less than the height of the surrounding wall, from the rim of which the arc springs after heating.—B. N.

Gases and vapours ; Electrical treatment of ——. W. T. Hoofnagle. Fr. Pat. 448,519, Sept. 19, 1912.

A mass of gas or vapour is aspirated by means of a pump between electrodes in a chamber in which a partial vacuum has been produced, and an electrical discharge is passed through the gas during the time that it is motionless. The gas after treatment is extracted from the chamber before the treatment of the following charge in order to prevent admixture of treated and untreated gas. Steam may be decomposed, and the resulting gases afterwards separated, or mixed gases may be made to combine and the resulting products collected in a convenient reservoir. Several chambers may be employed from which the gases are extracted in turn. Two exhausted chambers may be connected respectively with the opposite sides of the cylinder of a pump, with arrangements so that with the movements of the piston the electric circuits are closed alternately. On the compression side of the pump, means may be provided for separating the gases, such as hydrogen and oxygen, by diffusion, with a condenser interposed between the electrical arrangements and the separators. The latter may consist of a principal tube receiving the mixed gases, this tube having one or more branches or chambers; the tube and its branches have porous walls and are surrounded by envelopes, an aspirating pump being attached to the porous tube. The gas diffusing through the walls of the first tube is aspirated by a pump, and passed on to the first branch. Here it is again subjected to diffusion, and from the outer envelope it is aspirated by a pump and passed on to the following branch. To facilitate diffusion, each porous tube is furnished with a helical rib on its inner surface, inside which fits a solid core. The gas is thus driven spirally through the tube against the inner surface; a pressure is maintained in each outer envelope slightly less than in the inside of the porous tubes. —B. N.

Electrolysing streaming electrolytes. J. G. Paulin, Landskrona, Sweden. U.S. Pat. 1,056,118, March 18, 1913.

The electrodes are arranged in such a manner that the current density is the same in all parts of a cross-section of the electrolyte, and the latter is caused to move as a whole with an automatically-controlled speed, in a direction determined by the direction of the electric current. The anode and cathode chambers are separated by double porous partitions, enclosing an intermediate space, and a somewhat lower pressure is maintained in this space. The fresh electrolyte is supplied to one of the chambers, and the solution of the product formed at this electrode is made to flow towards and past the other electrode.—B. N.

Cell; Electrolytic —— and method of maintaining the efficiency thereof. W. M. Jewell, Assignor to Chloride Process Co., Chicago, Ill. U.S. Pat. 1,056,181, March 18, 1913.

The cell is of the horizontal type, containing an electrolyte composed of anode and cathode liquors kept separate in layers by the difference in their specific gravities, the cathode liquor being the lighter. Electrodes are placed in the respective electrolytes, and means are provided, *e.g.*, such as a gas-conduit, between the electrodes for collecting and removing the gases liberated at the anode. —B. N.

Ozoniser; Tubular ——. M. P. Otto. Fr. Pat. 448,580, Sept. 21, 1912.

Two concentric tubes are arranged to act as dielectrics, the electrical discharge being passed through the annular space formed between them. One of the tubes is cooled directly by a current of water, and the second tube is cooled by radiation. The gas to be ozonised enters chambers at the extremities of the dielectric tubes, traverses the annular space, and then passes through holes near the middle of the outer dielectric tube into an intermediate chamber of aspiration, the walls of which are suitably protected by non-oxidisable material. Several tubular elements may be grouped together in the same case.—B. N.

Furnace; Electric resistance ——. L. Ubbelohde, Karlsruhe, Germany. Eng. Pat. 9203, April 18, 1912.

See Fr. Pat. 438,642 of 1912; this J., 1912, 649.—T. F. B.

Furnace; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 1,057,239, March 25, 1913.

See Eng. Pat. 29,126 of 1911; this J., 1912, 592.—T. F. B.

Furnace; Revolving electrical —— with resistances arranged diametrically. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,057,286, March 25, 1913.

See Addition of Aug. 4, 1911, to Fr. Pat. 430,553 of 1910; this J., 1912, 1136.—T. F. B.

Endothermic reaction of gases; [Electrical] apparatus for the ——. W. S. Lee, Charlotte, N.C., U.S.A. Eng. Pat. 23,459, Oct. 14, 1912.

See U.S. Pat. 1,051,131 of 1913; this J., 1913, 200.—T.F.B.

Galvanic cell. A. Heil, Frankfort on Maine, Germany, Assignor to C. H. and S. Stern, New York. U.S. Pat. 1,057,830, April 1, 1913.

See Fr. Pat. 419,770 of 1910; this J., 1911, 221.—T. F. B.

Apparatus for carrying out gas reactions, particularly for the production of oxides of nitrogen, in the electric arc. U.S. Pat. 1,055,331. *See* VII.

[Electrolytic] method of producing lead hydrate [hydroxide] and of recovering lead and silver. U.S. Pats. 1,056,382 and 1,056,383. *See* VII.

XII.—FATS; OILS; WAXES.

Japanese marine animal oils. M. Tsujimoto. Chem. Rev. Fett Ind., 1913, 20, 70—73.

The name "Japan fish oil" (*Japanthran*) is given in European textbooks to a mixture of various marine animal oils in which herring oil probably predominates. Among the less known Japanese fish, marine animal, and liver oils are the following:—(1) *Dolphin oil* from *Delphinus longirostris* (Gray): (*a*) The head oil is a light yellow liquid, of not unpleasant odour; it becomes semi-solid at —16° C. and yields only a trace of bromides insoluble in ether. (*b*) The blubber oil obtained by a boiling process is a reddish-yellow oil, which has a slight fishy odour, and solidifies at 0° C. (*c*) The blubber oil obtained by a roasting process is a brownish-yellow oil which becomes turbid at 5° C. Both blubber oils yield large amounts of insoluble bromides. (*d*) Refined head oil is prepared by leaving the crude oil for 12 hours at —12° C. and separating the "stearine" (about 30 per cent.). The refined oil remains quite fluid at —15° C. and does not dry when exposed in a film at 100° C. The high saponification and Reichert-Meissl values (*vide infra*) indicate the presence of valeric acid. The octobromides of fatty acids contained Br 71·52 per cent., which agreed with the composition of a mixture of the octobromide of clupanodonic acid and of an octobromide, $C_{16}H_{24}O_2Br_8$. (2) *Sea-lion oil* from *Otarias telleri* (Less.) is a yellow oil with a fishy odour. The fatty acids yielded 36·04 per cent. of a bromide insoluble in ether, which, when washed with benzene, contained Br 70·76 per cent. The oil is used for the same purposes as and usually in admixture with whale oil. (3) *Bonito oil* from *Gymnonsarda affinis* (Cantor) is generally used in admixture with other marine animal oils. Two commercial samples of unpleasant odour were dark brown and reddish-yellow in colour, and their fatty acids yielded 63·89 and 51·82 per cent. respectively of octobromides containing Br 69·12 per cent. Bonito oil is cheaper than herring oil. (4) *Tunny fish oil* from *Thunnus Schlegeli* (Steind.) is a dark brownish-re- oil of unpleasant odour. The fatty acids yielded 51·5 ped cent. of octobromide (Br=70·51 per cent.). (5) *Mackerel*r *pike oil* from *Cololabis saira* (Brevoort) is a brownish-red oil of unpleasant odour. Its fatty acids yielded 26·96 per cent. of octobromide (Br=70·64 per cent.). (6) *Mackerel oil* from *Scomber colias* (Gmel) is a reddish-yellow oil, the fatty acids of which yielded 36·18 per cent. of clupanodonic octobromide (Br=69·60 per cent.). (7) *Akajei fish oil* from *Dasyatis akajei* is extracted from the fish by roasting, each fish yielding about 1 lb. of oil. The oil solidifies at 0° C. and has an unpleasant odour. The fatty acids yielded 37·47 per cent. of clupanodonic octobromide (Br=67·31 per cent.). (8) *Cod-liver oil.* The fatty acids of two commercial samples yielded 34·4 and 36·17 per cent. of octobromide respectively (Br=70·91 and 70·41 per cent.), which approximated closely to the composition of therapic octobromide, $C_{17}H_{36}O_2Br_8$ (Br=70·93 per cent.). (9) *Suketo-tara liver oil* is derived from a species of cod, *Gadus chalcogramus* (Pall.). It becomes turbid at 0° C. and gives with sulphuric acid colour reactions similar to those of ordinary cod-liver oil. The fatty acids yielded 40·08 per cent. of octobromide (Br=71·33 per cent.). (10) *Eel oil* from *Anguilla japonica* is a light yellow oil which throws down a crystalline deposit on standing. The bromides insoluble in ether (13·97 per cent.) contained Br 67·21 per cent., and apparently consisted of a mixture of about 60 per cent. of clupanodonic octobromide and 40 per cent. of linolenic hexabromide. (11) *Snapping turtle oil* obtained from the liver of the snapping turtle, *Trionyx sinensis* (Wiegm.) is a pale yellow oil which deposits large amounts of "stearine." The fatty acids yielded 3·53 per cent. of ether-insoluble bromide, the main portion of which contained Br 63·34 per cent., and melted at 174° C. Apparently the bromide consisted of linolenic hexabromide mixed with a small quantity of octobromide.

The foregoing oils gave the following values :—

Oil.	Sp. gr. at 15° C.	Acid value.	Saponif. value.	Iodine value (Wijs.)	Reichert-Meissl value.	Refractive index at 20° C.	M. pt. of fatty acids.	Hydroxy acids.
							°C.	per cent.
Dolphin oil from head (*a*)	0·9249	2·30	279·78	24·48	112·31	1·4524	—	—
Dolphin oil from blubber (*b*)	0·9286	11·90	217·22	125·25	30·40	1·4717	—	—
Dolphin oil from blubber (*c*).........	0·9307	3·97	230·35	114·35	44·39	1·4695	—	—
Dolphin oil from head (*d*)	0·9259	0·26	277·70	25·67	—	1·4517	—	—
Sea-lion oil..........................	0·9278	0·58	189·80	156·37	—	1·4783	29·5	—
Bonito oil (1)	0·9339	15·80	184·69	208·92	—	1·4843	34·5	0·63
Bonito oil (2)	0·9293	4·36	182·64	189·45	—	1·4820	32·0	0·49
Tunny fish oil	0·9327	20·85	185·32	198·90	—	1·4837	31·0	0·62
Mackerel-pike oil	0·9223	14·47	184·74	139·81	—	1·4760	26·96	0·26
Mackerel oil	0·9301	1·72	191·63	167·43	—	1·4811	—	—
Akajei oil	0·9268	1·72	186·98	161·95	—	1·4784	32·5	—
Cod-liver oil (1)	0·9290	1·88	188·10	159·17	—	1·4792	—	—
Cod-liver oil (2)	0·9263	0·55	183·83	160·83	—	1·4797	—	—
Suketo-tara oil	0·9279	1·18	187·87	169·58	—	1·4798	31·3	—
Eel oil..............................	0·9218	0·0	200·60	107·42	—	1·4712	36·0	—
Snapping turtle oil	0·9229	0·45	195·65	121·09	—	1·4737	32·8	—

—C. A. M.

Polenske's "difference values" of fats ; Theoretical basis of ——. A. Bömer and R. Limprich. Z. Untersuch. Nahr. Genussm., 1913, 25, 367—386.

POLENSKE'S method of detecting beef and mutton fat in lard by the difference between the melting and solidification points of the fats (this J., 1907, 1149; 1908, 1119), is shown to be capable of detecting about 20 per cent. of beef fat and about 15 per cent. of mutton fat in admixture with lard. The method depends upon the different character of the glycerides of lard and the other fats, and, in the main, upon the fact that the α-palmitodistearin of lard shows a difference value of 18·4, whilst the β-palmitodistearin of beef and mutton fat has a difference value of 11·8. The difference values of the stearodipalmitins from mutton fat and lard were 12·2 and 12·4 respectively. It is essential that sufficient time should be allowed for the stable form of the glyceride to solidify completely before repeating a determination. The most insoluble glyceride of mutton and beef fat, tristearin, has a difference value of 19·7, but its amount (1 to 2 per cent.) in beef fat is not sufficient to outweigh the greater proportion of α-palmitodistearin in lard. On the other hand the relatively higher difference value of mutton fat (16·9) is probably due to the greater proportion of tristearin (about 3 per cent.). The sensitiveness of the test is not materially increased by removal of glycerides containing oleic acid.—C. A. M.

Lard ; Mixed glycerides of palmitic and stearic acids in ——. A. Bömer. Z. Untersuch. Nahr. Genussm., 1913, 25, 321—353.

PURE glycerides of saturated fatty acids were obtained by the repeated fractional crystallisation of lard from ether. No tristearin was found, and in this respect lard differs from beef and mutton fats. The most insoluble glyceride obtained was not heptadecylo-distearin as stated by Kreis and Hafner (this J., 1904. 755), but about 3 per cent. of a palmitodistearin ; and there was no proof of the occurrence of heptadecylic acid in lard. The palmitodistearin of lard differs in its m.pts. (68·5° C. and 51·5° C.) and its crystalline form from the palmitodistearin of mutton fat. The latter is apparently β-palmitodistearin, whilst the lard glyceride is α-palmitodistearin. Lard also contains about 2 per cent. of stearodipalmitin melting at 58·2° C. and 47·1° C. It has not been determined whether this is identical or isomeric with the stearodipalmitin of mutton fat.—C. A. M.

α-Distearin and β-palmitodistearin ; Synthetical preparation of ——. A. Bömer and R. Limprich. Z. Untersuch. Nahr. Genussm., 1913, 25, 354—366.

IN the preparation of α-distearin from α-dichlorhydrin and potassium stearate by Guth's method (this J., 1903, 427, 639, 1136) a considerable quantity of tristearin is simultaneously produced. The synthetical α-distearin prepared by the authors melted at 78·5° C. and did not show the phenomenon of double melting point. In like manner, when β-palmitodistearin was prepared by heating α-distearin with palmitic acid at 190°—205° C. under a pressure of 70 to 80 mm., as in Guth's method (*loc. cit.*). considerable quantities of tristearin and apparently of stearodipalmitin were also obtained. The synthetical β-palmitodistearin melted at about 63° C. and crystallised from ether in the same form as the palmitodistearin from mutton fat.—C. A. M.

PATENTS.

Copra ; Apparatus for use in drying ——. R. Bridge, Castleton. Eng. Pat. 5633, Mar. 6, 1912.

THE trucks of copra are conveyed on rails into one or more compartments provided with a door at each end, with steam pipes or other heating device, and with a fan or other means for withdrawing the moist air. In order to promote the circulation of hot air through the copra, the trucks may be fitted with perforated bottoms. Or the doors of the compartments may be made to close hermetically to permit of the use of a vacuum-drying plant.—C. A. M.

Cottonseed oil ; Process of refining crude ——. J. C. Chisholm, Dallas, Tex. U.S. Pats. 1,056,261—1,056,264, March 18, 1913.

(1) THE crude oil is treated with a substance producing an alkali soap and with an alkali silicate, by agitation at about 75° to 90° F. (24°—32° C.) until the free acid is nearly neutralised, after which it is heated and agitated with an alkali hydroxide and separated from the resulting soap-stock. (2) The substance used for neutralising the acidity of the crude oil may consist of a mixture of an alkali silicate and carbonate. After the introduction of the additional alkali hydroxide the mixture is heated to about 120°—140° F. (49°—60° C.) until the soap stock will separate readily, and the heating then continued at about 100°—120° F. (38°—49° C.) until the separation

of the precipitate is complete. (3) The oil is heated with alkali silicate until nearly neutral, and the mixture then treated with alkali hydroxide and carbonate to separate the soap stock as described in (2). (4) After the crude oil has been treated with alkali silicate or a mixture thereof with another alkaline compound, the mass is heated with an alkali hydroxide and a base wherein hydrogen has been replaced by a metal, and the soap stock precipitated as described in (2).—C. A. M.

Wax from [*candelilla*] *plants; Apparatus for extracting* ——. F. Thatcher, El Paso, Tex. U.S. Pat. 1,056,378, March 18, 1913.

The apparatus comprises a vapouriser connected by a main vapour-feed pipe with a condenser. From the latter the condensed liquid passes through solvent-feed pipes, provided with valves, to a pair of digesters. Each digester is connected with the vapouriser by a siphon-feed device, with a valved by-pass connection between the lower ends of the legs of each siphon tube. Each digester is also in connection by pipes, provided with valves, with the main vapour pipe. Below the vapouriser is a separator, the two being in communication by means of a tube provided with a valve, and the separator is provided with a coil the valved terminals of which extend out at opposite ends; the separator is also in communication with the main vapour-feed pipe. A reservoir for solvent is in communication with the vapouriser and with the main solvent-feed pipe leading from the condenser to the digester.—B. N.

Neutral fats and soaps of the free fatty acids; Process for obtaining pure —— from impure or crude fats or oils. E. Jaeschke. Ger. Pat. 254,024, Feb. 23, 1911.

The fat or oil is treated with warm alkaline sugar solution. It is stated that in the presence of sugar the soaps produced by the action of the alkali on the free fatty acids separate readily from the neutral fat. Any neutral fat carried mechanically by the separated soap can be recovered by dilution with water.—A. S.

Soap. P. Froget née L. Ducret. Fr. Pat. 448,379, Nov. 23, 1911.

A mixture in equal parts of oleic acid, caustic soda and sodium carbonate is boiled for about 30 minutes with frequent stirring, and then incorporated with about a third of its quantity of a mixture in equal quantities of glycerin, sodium or potassium oleate and palm oil, and the boiling continued for about an hour, after which the soap is cooled in suitable moulds.—C. A. M.

Soap; Manufacture and application of a new ——. R. Weiss. Fr. Pat. 448,490, Nov. 27, 1911.

A soap suitable for washing, bleaching and dressing textile fabrics is prepared from a base less alkaline than sodium or potassium hydroxide (*e.g.* ammonia and its salts), and from a fatty acid (*e.g.* palmitic or stearic acids or their glycerides) which does not change colour on exposure to air and does not affect the firmness or colour of the fibres. An addition of boric or perboric acid, borates or perborates or other per-salts or peroxides may be made to the soap during or after the saponification. —C. A. M.

Soap; Process for extracting a product specially suitable for the manufacture of —— from "sebacic acid" and more particularly the sebacic acid in whale and herring oils. S. H. Goldschmidt and C. Jorgensen. Fr. Pat. 448,517, Sept. 19, 1912.

The "sebacic acid" of whale or fish oil is treated with a solution of sodium hypochlorite containing as little sodium hydroxide as possible, or with another hypochlorite, and the resulting fatty product is separated from the aqueous solution of sodium chloride (which falls to the bottom) and is used in the manufacture of a soap, which will not have the fishy odour of the original oil. Analogous results may be obtained by treating ordinary oils or fats with a solution of a hypochlorite.—C. A. M.

Process for emulsifying fat. Eng. Pat. 4505. *See* XIXa.

Manufacture of margarine. Eng. Pat. 4508. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pine oil in oil of turpentine; Detection of ——. Utz. Chem. Rev. Fett Ind., 1913, 20, 77—79.

Leuchter's phloroglucinol reagent consists of 0·3 part of phloroglucinol, 3·0 of 96 per cent. alcohol, 7·5 of glycerin (28° B., sp. gr. 1·241), 3·75 of water, and 15·0 parts of dilute (about 15 per cent.) hydrochloric acid. Oil of turpentine gives with this reagent a light yellow colour, which becomes brown or disappears after a short time, whilst pine oil gives a rose to ruby red colouration, which darkens on standing. A second test, also devised by Leuchter, consists in treating the sample with a reagent containing 0·1 part of *o*-nitrobenzaldehyde, 3·0 of alcohol, 2·0 of water, and 1·0 of 15 per cent. sodium hydroxide solution. Oil of turpentine gives a light yellow colouration, whilst pine oil becomes yellowish brown to black. The oil, resembling pine oil, which is obtained in the manufacture of sulphite-cellulose, gives at most faint colourations in these tests, and it is therefore possible to determine to a certain extent whether this oil or a pine oil has been added to an oil of turpentine. The author has studied the variations in the reactions given by the different kinds of turpentine oil on the market. In the first test the colours of the mixtures ranged from pink (American oil) to orange (Swedish) or brown (German oil), whilst after separation the oil was colourless, cherry red, or orange, and the reagent pink, brown or dark brown. Mixtures containing 10 per cent. of pine oil gave a straw-yellow colouration, the separating oil then appearing yellow, whilst the reagent became brown. Similar variations in the colourations obtained with different kinds of oil of turpentine when tested with the second reagent were recorded. In mixtures containing 10 per cent. of pine oil, however, the first colouration was dirty straw-yellow, whilst the separating oil was pale yellow, and the reagent blackish brown. In doubtful cases it is advisable to distil part of the oil, and to apply the tests to the distillates. Comparative tests should also be made with different kinds of genuine oil of turpentine. Light camphor-oil, which is sometimes added to oil of turpentine, gives an orange colouration (oil yellow, reagent orange and afterwards brown) in the phloroglucinol test; whilst in the second test it gives a straw-yellow colouration (oil, nearly colourless and reagent black-brown). The Herzfeld reaction with sulphurous acid, and Piest's acetic anhydride reaction (this J., 1912, 239) are useful as confirmatory tests.—C. A. M.

Formation of rust under paint films. Liebreich and Spitzer. *See* X.

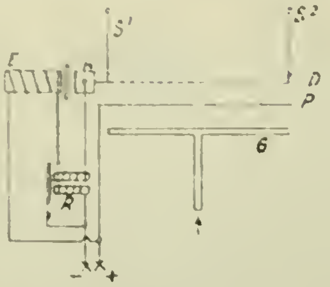
Patents.

Lead pigments. A. Hamburger, London. Eng. Pat. 2405, Jan. 30, 1912.

A solution of a lead salt, such as lead nitrate, is added to a hot, alkaline soap solution, such as a mixture of sodium carbonate, caustic soda, and sodium palmitate solutions, whereby a lead pigment and an insoluble soap are co-precipitated.—O. R.

Lampblack; Manufacture of —— from flames. B. Thieme. Ger. Pat. 256,675, Jan. 11, 1912.

The apparatus used is shown diagrammatically in the accompanying figure. A wire, P, 3 mm. thick, extends through the flame of the gas-burner, G, and is connected with the positive pole of a source of electric current of less than 1000 volts potential. The flame plays on a piece of wire gauze, D, hanging freely on the supports, S^1, S^2, and connected by way of the relay, R, with the negative pole of the source of current. The lampblack is deposited on the negative pole (wire gauze) and gradually forms a bridge between this and the wire, P, connected with the positive pole. When this is effected a weak current passes through the bridge thus formed and gradually increases in intensity until it becomes strong enough to bring the relay into action, whereupon the current circuit of the electro-magnet, E, is closed, and the iron armature, H, attached to the wire gauze is attracted to the electro-magnet with such force that the lampblack on the gauze is dislodged and falls into a receptacle below. When the bridge of lamp-black is thus destroyed, the relay, R, and hence also the electro-magnet cease to act, and the wire gauze swings back to its original position.—A. S.



Composition of matter [resinous condensation product], and process of making the same. B. B. Goldsmith, New York, U.S.A. Eng. Pat. 6363, March 14, 1912.

Hexamethylenetetramine is incorporated with a phenol in the absence or presence of a solvent, and the bodies are made to interact by the application of heat in the absence of a condensing agent. The ammonia liberated during the action is collected, and utilised for the production of a further quantity of hexamethylenetetramine.—B. N.

Phenols and formaldehyde; Process for the manufacture of condensation products of ——. F. Pollak. Fr. Pat. 447,969, June 7, 1912. Under Int. Conv., June 7, Sept. 25, and Dec. 5, 1911.

Artificial resinous bodies are prepared by the condensation of phenols with a polymerised formaldehyde of high boiling point. The water, which is produced in the first condensation, may be removed by distillation, or the first condensation product may be treated in various ways, such as with water, formaldehyde, or an acid, basic, or saline substance, and re-heated under ordinary or reduced pressure. Examples: (1) 94 parts of phenol and 25 parts of finely powdered trioxymethylene are heated with agitation to 85° C. under an upright condenser. The heat of the reaction causes the temperature to rise to 110° C. and the mixture is maintained at this temperature for some time after the violent reaction has subsided. The resulting product is dehydrated at 160°—170° C. and forms a suitable substitute for shellac. (2) 376 parts of phenol are heated to 85° C. with 80 parts of trioxymethylene, which is added in 4 successive operations, 20 parts at a time, each addition taking place after the exothermic reaction has ceased and the temperature has gone down to 100° C. The product is then filtered, cooled, and washed with water below 40° C. until the washings are nearly clear, after which the residue is heated with a little water to 130° C. with the formation of a clear, yellow, syrupy resin, easily soluble in alcohol, ether, and soda-lye. (3) 360 parts of resin, as prepared in the last example, and 190 parts of a 40 per cent. solution of formaldehyde are heated on a water-bath to 25°—40° C. at a pressure not exceeding 30 mm. of mercury, until water ceases to be distilled. The mixture is then gradually heated to 70° C. until the distillation of water again ceases, after which the temperature is raised to 88°—95° C. The product can then be poured into moulds and after a few hours the coagulated mass is hardened by heating to 135° C.—O. R.

Turpentine from crude pine-gums of various ages; Process of distilling ——. R. Dunwody, Kirkwood, Ga. U.S. Pat. 1,055,149, Mar. 4, 1913.

Turpentine and the highest grade rosin are obtained by heating the crude, resinous gum to about 240° F. (115° C.) and then gradually adding water to it.—O. R.

Varnish; Use of tannins for the preparation of ——. L. Meunier. Fr. Pat. 448,529, Nov. 27, 1911.

Mixtures of tannin extracts with substances adapted to reduce surface tension and promote oxidation, such as sodium sulphoricinate and a terpene, such as oil of turpentine, are claimed to yield rapidly-drying, fluid varnishes of great brilliancy. When applied to iron the varnish blackens and forms a coating, which acts as a preventive of rust.—O. R.

Oil varnish substitutes from animal oils; Process for the manufacture of ——. W. Kaempfe, Grossenhain, Saxony. Eng. Pat. 15,012, June 27, 1912.

See Fr. Pat. 445,565 of 1912; this J., 1913, 34.—T. F. B.

Enamel surface; Composition and process for obtaining an ——. H. Gaillard, Amiens on Somme, France. Eng. Pat. 22,316, June 11, 1912.

See Fr. Pat. 438,967 of 1912; this J., 1912, 651.—T. F. B.

Oil-paint; Composition of matter to be used as an ——. H. M. L. Wunnenberg, Klausthal, Assignor to Arota Ges. m. b. H., Hamburg, Germany. U.S. Pat. 1,057,199, March 25, 1913.

See Fr. Pat. 437,080 of 1911; this J., 1912, 444.—T. F. B.

Method of producing vegetable colouring matters. Fr. Pat. 448,609. *See* IV.

Printing inks capable of being destroyed by chemical treatment when the printed paper is pulped for re-manufacture. Fr. Pat. 448,616. *See* V.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Plantation rubber in 1912. W. Freudenberg. Gummi-Zeit., 1913, 27, 1005—1006.

The imports of raw rubber into England in 1910, 1911, and 1912 were 43,849, 45,298 and 55,023 tons respectively. The exports were 23,394, 28,562 and 36,298 tons, being respectively 53, 63, and 66 per cent. in weight, and 57, 73, and 76 per cent. in value, of the imports. The price did not vary much in 1912. In the beginning of the year fine hard Para was 4s. 4d. per lb. and plantation rubber, 4s. 10d.; at the end of the year the prices were 4s. 5d. and 4s. 4d. The highest prices were 5s. 1d. and 5s. 6d.; the lowest were 4s. 3d. and 4s. The consumption for 1911—12 was, according to Hecht, Levis and Kahn, 99,564 tons, an increase of 25,482 tons above 1910—1911. Up to 1910 the average increase was only 5 per cent. per year. The supply for 1911—1912 is estimated as 93,669 tons against 79,305 tons in 1910—1911; visible supply on 30 June, 1912, 10,181 tons against 12,563 in 1911. Grisar and Co., and others, estimate the consumption as 103,000 tons, and supply 93,000 tons. S. Figgis and Co. estimate supply and consumption for 1912 as 99,000 tons. The total export of the Malay peninsula for 1912 was 22,353 tons against 11,490 in 1911. The total from Ceylon was 6700 tons against 3200 tons in 1911; about 55 per cent. of the export from Ceylon reached London. The export from S. India was 125 tons against 42 in 1911. The area planted with rubber is estimated at about 1,085,000 acres (Malaya 430,000, Ceylon 230,000). The amount of rubber expected in 1913 is 50,000 tons plantation and 65,000 tons wild, 115,000 tons in all (the wild rubber has about 20 per cent. more moisture).—H. E. P.

Rubber; Washing of —— *at place of production.* F. Frank and E. Marckwald. Gummi-Zeit., 1913, 27, 1044.

The authors strongly recommend that rubber should be washed in the factory rather than at the place of production, and criticise data brought forward in favour of the latter procedure.—H. E. P.

Rubber solutions; Determination of the viscosity of ——. J. G. Fol. Z. Chem. Ind. Kolloide, 1913, **12**, 131—147.

After a critical review of previous work on the subject, especially that of Axelrod (this J., 1905, 1180) and of Schidrowitz and Goldsbrough (this J., 1909, 3), the author discusses the effect of varying experimental conditions on the determination of the viscosity of rubber solutions, in the light of his own results. He arrives at the following conclusions:—Ostwald's capillary viscometer is the most suitable type for rubber solutions, but the diameter of the capillary should not be too small. The viscosity is affected to a considerable extent by vigorous shaking during the preparation of the solution, and there is a notable difference in the relative viscosities of solutions prepared by the complete and partial solution respectively of the rubber. The viscosity varies also according to the time elapsing between the preparation of the solution and the determination of its viscosity. The decrease in viscosity with the time is greater in concentrated than in dilute rubber solutions. In the more concentrated solutions the viscosity diminishes perceptibly whilst successive readings are being taken, the greatest difference being between the first and second readings. With some rubber solutions the absolute viscosity of the solution, but not the relative viscosity (compared with that of benzene), decreases with the temperature. The following method for the determination of the viscosity of rubber solutions is recommended:—The rubber is cut in small pieces, dried, and samples of 1, 0·5, and 0·25 grm. respectively weighed off into bottles of brown glass. 100 c.c. of pure benzene are added to each, and the bottles are allowed to stand for 3 days, being carefully shaken twice during each day. The solutions are now filtered through glass-wool, allowed to stand for another day, and clear solutions prepared in the dark for the viscosity determinations, which are carried out at 30° C. in an Ostwald viscometer of normal dimensions. Three successive determinations are made for each solution, and the mean of the three results taken. A viscosity curve is then plotted with a standard scale (1 cm. on the x-axis = 2 units of viscosity and 1 cm. on the y-axis = 0·1 per cent. concentration). The area (in sq. cm.) between the co-ordinates, the curve, and the ordinate corresponding to 1 per cent. concentration is termed the viscosity-number and serves as a measure of comparison for different kinds of rubber.—A. S.

Patents.

Caoutchouc; Preparation of substances analogous to ——. The Diamond Rubber Co. Fr. Pat. 448,520, Sept. 19, 1912.

Caoutchouc-like substances are obtained by heating alcohols which can yield, by loss of water, hydrocarbons containing the grouping C : C.C : C. The heating may take place in presence of dehydrating or depolymerising agents or both. Dihydric alcohols may be used containing the grouping C.C.C.C. in which the hydroxyl groups are in the $\alpha\gamma$, $\beta\gamma$ or $\alpha\delta$ positions and in which alkyl groups may be present. Monohydric alcohols (α or β) may be used, and also olefinic alcohols or pinacone or homologues. Acetic anhydride is mentioned as a condensing agent.—H. E. P.

Caoutchouc; Manufacture of synthetic —— and intermediate products. H. Dreyfus. Fr. Pat. 448,711, Aug. 5, 1912.

Intermediate products for conversion into synthetic caoutchouc are made from the halogen derivatives of unsaturated hydrocarbons or substitution products or derivatives by eliminating the halogen by means of metals or salts such as cuprous chloride. When using the alkali metals halogenated aldehydes should not be employed. Chlorhydrins or homologues, isomerides or substitution products, such as ethers or esters (preferably prepared from acetylene or ethylene, *e.g.*, by the addition of halogens or halogen acids in presence of carriers such as aluminium chloride, or from alcohol or from glycerol, etc., through the butanediols) are transformed into butadiene or homologues by the elimination of halogen acid (and in some cases of water) by treatment with pyridine, etc. Polyhalogen derivatives of aliphatic, aliphatic-aromatic or cyclohydroaromatic hydrocarbons (prepared from alcohol, acetylene, etc.) are transformed into butadienes by elimination of halogen acid; chlorobutanols or butenols may be obtained as intermediate bodies. The halogen derivatives of unsaturated hydrocarbons or their homologues, isomerides and substitution products may be transformed into butadienes, and polymerising agents may be added so that caoutchoucs are obtained direct. The halogen derivatives of ketones, acids, or aldehydes or their homologues or substitution products may be reduced, *e.g.*, with sodium amalgam; some of these bodies may also be transformed into chloro-butenes or dichlorobutanes or iminoketones, etc. Mixtures of these various bodies may be employed. The halogen derivatives of hydrocarbons or their derivatives may be treated with potassium cyanide, reduced, diazotised, *e.g.*, to glycols and transformed into butadienes. Ketones or aldehydes may be treated, in presence of metals, such as magnesium, with halogenated hydrocarbons, and the products transformed into butadienes or chloro-butadienes by elimination of halogen acids or of water. Acetaldehyde may be condensed to aldol which may be reduced to glycol. By the action of condensing agents, aldehydes or derivatives may be transformed to acids, or condensed with ketones, or ketones or derivatives may be condensed to keto-alcohols, or ketones or aldehydes may be condensed with the esters of organic acids or derivatives to yield diketones or keto-aldehydes; the esters of organic acids or keto-acids may be condensed together, and all these bodies may be reduced to polyhydroxyl derivatives (glycols), or transformed into halogen derivatives and these products may be transformed into butadienes by elimination of water or halogen acid, or into chloro-butadienes, etc. Unsaturated aldehydes or ketones may be similarly treated. Aldehydes or ketones may be condensed with unsaturated hydrocarbons or their derivatives, or unsaturated hydrocarbons themselves may be condensed together. Organo-metallic compounds may be condensed by halogens or with the halogen derivatives of saturated or unsaturated hydrocarbons, *e.g.*, sodium acetylene may be treated with alkyl halides, or metal alkyls with halogen derivatives preferably of unsaturated hydrocarbons (giving products which are then oxidised to a glycol), or sodium aceto-acetic ester may be treated with halogenated hydrocarbons or derivatives (giving products which are then reduced to glycols, etc.). Various sugars (hexoses, pentoses, etc.) or derivatives and various polyhydroxyl compounds may be transformed into furane or its derivatives, by dehydrating agents. The furane nucleus may then be ruptured in various ways to yield keto-aldehydes, etc.; or reduced to butanediols, or transformed into furanidines, or transformed into butadienes by forming pyrrole or thiophene derivatives, or partially reduced to furanines yielding butadienes on reduction. The polyhydroxyl compounds may also be treated without forming furane derivatives, by reduction and elimination of water: various examples of this process are given; bodies with triple bonds may be obtained as intermediate products. The polyhydroxyl compounds may be treated with metals to give glycols, or the reaction may be effected in solution, *e.g.*, with formic acid, with or without dehydrating agents. The reduction may also be effected by enzymes, or the polyhydroxyl compounds may be halogenated. Olefine hydrocarbons or derivatives, *e.g.*, vegetable or animal oils, may be oxidised to glycols or halogenated; acids having at least one double bond, with on each side a carbon atom with hydrogen attached, and natural oils, may be used in particular. Sorbic acid and other natural polyolefinic bodies may be transformed into caoutchouc. Caoutchouc, its homologues and derviatives may be made by polymerisation with or without heating, with or without solvents or diluents, in presence of the following agents, preferably in small quantities: sodium derivatives of aniline and the like, metallic alkylates or glycerates, oxides of metals, salts of cyanamide, other organo-metallic substances, sulphur chloride and the like, or organic bodies such as guanidine, and many others, or mineral acids not causing an addition of halogen acid at the double bonds.
—H. E. P.

Elastic materials; Manufacture of ——. Z. Olsson, Hampton Hill. Eng. Pat. 26,935, Dec. 1, 1911.

Fibrous strengthening materials and/or a mixture of mineral oil and a carbohydrate, *e.g.* dextrin, are incorporated with a known mixture of gelatinous and hygroscopic materials to which have been added a hardening bichromate and opaque colouring matter to control the hardening by light (see Eng. Pat. 20,404 of 1906; this J., 1907, 1100).—H. E. P.

Elastic product. R. Legrand. Fr. Pat. 448,034, Nov. 14, 1911.

An animal or vegetable oil (*e.g.* cottonseed oil) is incorporated with resin (*e.g.* colophony) and a hypochlorite. The product is heated with finely powdered sulphur or a compound such as a polysulphide, yielding an elastic mass.—H. E. P.

Elastic products. R. Legrand. Fr. Pat. 448,531, Nov. 28, 1911.

Fibre from the kapok tree (Congo) or vegetable fibre of similar properties (*i.e.* having supple and impermeable walls containing many air-cells) is incorporated with elastic materials, to increase the elasticity and diminish the weight.—H. E. P.

Elastic and plastic substance; Manufacture of an ——. Wenjacit Ges. m. b. H. Fr. Pat. 448,330, Sept. 14, 1912

Soaps or metallic resinates, together with phenols or higher homologues, are condensed with aldehydes, ketones, aldoses or ketoses, the water of condensation being removed by evaporation. The operation may be performed under high pressure. Cellulose may be added after the condensation but before the evaporation. Albuminous bodies may be added before condensation. Rubber-like or horn-like masses are obtained.—H. E. P.

Manufacture of butadiene and its homologues. Eng. Pat. 3873. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

The quantitative determination of the falling of skin in the puering or bating process. Wood, Sand, and Law. *See* Nottingham Section, p. 398.

PATENTS.

Vegetable leather; Manufacture of ——. L. Velásquez. First Addition, dated Nov. 30, 1911, to Fr. Pat. 447,701, Nov. 4, 1911 (this J., 1913, 246).

Sodium silicate is added in varying proportions to the vegetable fibre which forms the basis of the product. —D. J. L.

Tanning skins; Method of ——. G. Durio. Fr. Pat. 448,321, Sept. 14, 1912. Under Int. Conv., March 9, 1912.

The skins, previously freed from all foreign matter and in a neutral condition, are treated at a suitable temperature with a vegetable or mineral tanning liquor, in vats to which the tanning material is supplied by means of a pipe communicating with a central reservoir, the excess of liquor being discharged in an unaltered condition by means of another pipe. Immediately after the treatment with the tan liquor, the discharge tap is closed and by opening another pipe the liquor is led to another reservoir communicating with an evaporating apparatus. Tannage is rapid and the excess of liquor undergoes no change, whilst the used liquor is only reduced in concentration without being changed by oxidation, fermentation or the addition of foreign matter.—D. J. L.

Hides and skins; Process for disinfecting —— in the tanyard. O. Röhm. Ger. Pat. 254,131, Aug. 31, 1911.

In order to prevent the action of bacteria on the hides during the processes to which they are subjected preparatory to the actual tanning, claim is made for the use as disinfectants of copper salts of which the copper is not precipitated by alkali. Cuprammonium salts and soluble complex copper salts such as copper alkali tartrate or the copper salt of glycocoll are suitable.—A. S.

Tanning extract; Preparation of a —— from purified sulphite-cellulose waste lyes and chromium salts. W. H. Philippi. Ger. Pat. 254,866, Aug. 13, 1910.

The claim is for the addition of chromium hydroxide to the extract for the purpose of neutralising any acid liberated during the tanning process.—A. S.

Iron tanning process. J. Bystron and K. Baron von Vietinghoff. Ger. Pats. 255,321, Oct. 6, 1911; 255,325, Nov. 30, 1910, and 255,326, Oct. 6, 1911.

See Eng. Pat. 13,952 of 1912; this J., 1913, 99. (1) The solution of a ferrous salt is oxidised by nitrous acid produced in the tanning bath by decomposition of a nitrite. (2) Ferric bichromate or chlorate is used as oxidising agent to produce a strongly basic ferric salt in a hide impregnated with a solution of a ferrous salt. (3) The hide is treated first with the ferric oxidising agent in conjunction with a neutral alkali salt, and is subsequently treated with a solution of a ferrous salt.—A. S.

Iron-tanned leather; Manufacture of durable ——. J. Bystron and K. Baron von Vietinghoff. Ger. Pat. 256,350, Sept. 1, 1911.

The leather, after the tanning process, is treated with solutions of neutral alkali salts. By this treatment the excess of acid iron salts, which would otherwise render the leather brittle, is removed.—A. S.

Skins; Process for hardening and waterproofing ——. K. Hartmann. Ger. Pat. 256,406, Dec. 22, 1911. Addition to Ger. Pat. 244,566.

After being hardened according to the process described in the chief patent (see Eng. Pat. 16,810 of 1911; this J., 1912, 82), the skins are coated with a rubber solution prepared by allowing rubber to swell in carbon bisulphide, then dissolving it in light coal tar oil, and adding a small quantity of linseed oil. A. S.

Leather substitute and method of making the same. Deutsche Gasglühlicht A.-G. (Auergesellschaft). Ger. Pats. 256,407 and 256,408, Oct. 12, 1911 and Feb. 2, 1912.

(1) A skin-like mass of micro-organisms, strengthened by incorporation of suitable solid substances (fabrics, cork meal) or of loading materials, is subjected to a tanning process. Before being tanned, the mass of micro-organisms is subjected to a preliminary treatment, *e.g.*, with caustic soda or sodium sulphide, in order to improve the pliability of the finished product. (2) A skin-like mass of micro-organisms is saturated with an albumin solution and then subjected to a tanning process.—A. S.

Sole leather; Process for rendering —— waterproof and durable. G. Bork. Ger. Pat. 256,580, July 8, 1911.

The leather is impregnated with a mixture of "carbolineum," rubber solution, tallow, and linseed oil, and is then dried.—A. S.

Gelatin; Apparatus for cooling liquefied solids such as —— and for cutting said solids after the same have set. M. Kind, Camden, N.J., U.S.A. Eng. Pat. 24,838, Oct. 30, 1912. Under Int. Conv., Nov. 2, 1911.

The liquid mass is poured in a continuous manner on an endless belt formed into a mould and arranged inside a closed cooler. A number of circular knives are arranged on a shaft mounted horizontally and cross-wise to the carrier device and adjustable above a carrier belt which takes the semi-solid mass from the mould belt by means of scrapers and carries it below the knives. The cross-cutting knives reciprocate in a vertical direction in vertical guides and are driven up and down by means of a crank drive, the cross-knives being balanced by a counter weight, whereby, by regulating the speed, the size of the sections into which the continuously supplied mass is cut across, may be regulated. Loose drying trays are carried on a belt and the cut mass is thrown into them behind the cutting device, the belt being moved at a greater speed than the carrier of the cutting device in order to prevent the cut pieces from adhering one to another.—D. J. L.

Casein; Treatment of —— to obtain material suitable for the manufacture of various objects of great strength. F. Lebreil and R. Desgeorge. First Addition, dated Dec. 6, 1911, to Fr. Pat. 435,239, Dec. 19, 1910 (this J., 1912, 400).

Casein for use in the process described in the chief patent is preferably prepared in the following way:—300 c.c. of commercial rennet are added to about 250 litres of skimmed milk contained in a vat and warmed to a temperature of 35° C. As soon as the coagulum commences to form, the temperature is raised rapidly to 75° C., and the mass well agitated. When a temperature of 75° C. is reached, the steam is shut off; the casein will now have a cellular structure and float on the surface of the liquid. The cellular state permits of the degree of fermentation in the subsequent treatment being followed by means of the microscope, according to the character of the product desired. The casein thus obtained is submitted to a temperature of 15° C. for about 12 hours when considerable development of acetous bacteria (*Mycoderma aceti*) will have taken place and the material is then treated with acetone. The time and temperature may be varied as the product is required more or less plastic or viscous, but care is necessary that damage to the objects does not ensue by liberation of acid from the bacterial action when they are submitted to the formaldehyde bath.
—D. J. L.

Leather; Substitute for —— and process for producing the same. Deutsche Gasglühlicht A.-G. (Auerges.), Berlin. Eng. Pat. 23,189, Oct. 10, 1912. Under Int. Conv., Oct. 11, 1911.

See Ger. Pat. 256,407 of 1911; preceding.—T. F. B.

Leather; Artificial ——. G. C. L. Forel, Lyon, France. U.S. Pat. 1,056,898, March 25, 1913.

See Fr. Pat. 407,654 of 1909; this J., 1910, 504.—T. F. B.

Skins; Treatment of ——. R. Ribot, Assignor to La Peausserie Française, Paris. U.S. Pat. 1,057,173, March 25, 1913.

See Fr. Pat. 442,062 of 1912; this J., 1912, 890.—T. F. B.

Tanning extract; Process for preparing a ——. W. H. Philippi. Fr. Pat. 448,064, Sept. 7, 1912.

See Ger. Pat. 254,866 of 1910; preceding.—T. F. B.

Leather; Process for waterproofing and toughening ——. G. Bork. Fr. Pat. 448,358, Sept. 16, 1912.

See Ger. Pat. 256,580 of 1911; preceding.—T. F. B.

Impregnating solid or nearly solid materials [leather] with other substances. Fr. Pat. 448,191. *See* I.

XVI.—SOILS; FERTILISERS.

Soil; Behaviour of acid amides in the ——. S. L. Jodidi. J. Franklin Inst., 1913, **175**, 245—258.

Acetamide and propionamide are converted into ammonia in the soil under the influence of bacteria as readily as asparagine is. The maximum percentages of ammoniacal nitrogen obtained from acetamide and propionamide were 83·4 and 75·1 respectively. As in the case of amino-acids, the rate of transformation of the acid-amide nitrogen into ammonia is greatly influenced by the chemical structure of the amide. The intensity of formation of ammonia reaches a maximum within certain limits of concentration of the amide beyond which it decreases rapidly.—E. F. A.

Citro-phosphate solutions. II. Electric conductivity of aqueous solutions of citric and phosphoric acids. III. The system: citric and phosphoric acids, sodium hydroxide and water. U. Pratolongo. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 86—89, 387—391. (See also this J., 1912, 195.)

Determinations were made of the electrical conductivity of solutions of citric and phosphoric acids, citric and arsenic acids, and citric and hydrochloric acids. The results obtained and the general form of the conductivity curves give no indication of the formation of complex ions. A physico-chemical study was also made of that portion of the quaternary system, citric and phosphoric acids, sodium hydroxide, and water, in which, according to Barillé (this J., 1908, 807), complex citrophosphates are formed. The experimental results are given in a table and curves. They show that at 20° C., in that portion of the system studied, the only solid phases are citric acid, monosodium citrate, and disodium phosphate.—A. S.

Patents.

Fertilisers; Manufacture of —— from the residues left after separating the alkali from the products obtained by the decomposition of potash-bearing silicate minerals with lime or lime compounds. Chem. Fabr. Rhenania and A. Messerschmitt. Ger. Pat. 255,910, May 24, 1911.

The residues mentioned in the title are treated with nitric acid or nitrous gases, then suspended in water to which quicklime is added until an alkaline reaction is obtained, and the soluble salts are recovered, and calcined, preferably after a further addition of lime.—A. S.

Superphosphate; Manufacture of ——. A. Binard. Ger. Pat. 257,191, Aug. 11, 1911.

The formation of the superphosphate is effected in a number of independent travelling receptacles within a covered chamber, the roof of which engages, with slight friction, with the upper edges of the receptacles. Each receptacle has a central opening in its floor, closed by a removable cylinder, and is brought in succession from the mixing device first under a travelling crane which withdraws the cylinder from the outlet opening, then between a disintegrating device above the chamber and a drying apparatus below, into which the charge falls, next again under the crane for the re-insertion of the cylinder, and finally again to the mixing device.—A. S.

Fertiliser from refuse material; Apparatus for making ——. P. B. de Rouvre, Assignor to Soc. Générale des Engrais Organiques, Paris. U.S. Pat. 1,056,837, March 25, 1913.

See Fr. Pat. 404,751 of 1909; this J., 1910, 231.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

[Sugar] Cane gum and cane fibre; Adsorptive power of ——. Adsorption-water in "ampas." L. G. L. Steuerwald. Mededeel. Proefstation Java-Suikerind., 1912, 715—736. Chem. Zentr., 1913, 1, 1286.

By following the alteration of the vapour pressure of cane gum saturated with water as the water was withdrawn, it was found that the gum does not contain chemically combined water of constitution, but only physically adsorbed water. Experiments in which samples of the gum of different water content were introduced into sugar solutions and the amount of water taken up by the gum determined, showed that, on the average, the gum adsorbs about 28 per cent. of its weight of water at the ordinary temperature. The adsorptive power of cane fibre varied between 15·4 and 28·8 per cent. in different experiments: average, 22·4 per cent. Part of the adsorbed water can be expelled from the fibre by pressing; in one experiment the water content fell from 22·4 to 16·5 per cent. by the application of a pressure of 300 atmospheres. "Mill-ampas" was found to contain adsorbed water, the quantity varying according to the pressure to which the "ampas" had been subjected.—A. S.

Sugar; Invert sugar, and methods of determining —— in the beetroot. E. Saillard. Suppl. Circ. hebd. Syndic. Sucre France, No. 1242. Jan., 1913. (Compare also this J., 1913, 38.)

According to the author, the roots sliced in any factory always contain some invert sugar, the amount depending upon the mode of preservation adopted and its duration. Owing to the presence of this invert sugar, and to the action of basic lead acetate upon it, the results for the sucrose indicated by direct polarisation according to the hot aqueous and hot digestion methods are vitiated, 1 per cent. of invert sugar increasing the dextro-rotation by 0·30—0·32 per cent. Experiments with pure solutions containing both sucrose and invert sugar showed that while basic lead acetate increases the direct reading it also diminishes the inversion reading in approximately the same proportion, so that whether or not the defecant is used, the sucrose value by the double polarisation (Clerget) method remains about the same. When in the analysis of beet juices by the double polarisation method, the direct polarisation is higher than the sucrose value from the direct and inversion readings, it must not be concluded that the dextro-rotatory substances designated under the term of "raffinose" are necessarily present, since by the action of basic lead acetate invert sugar is capable of causing such an increase in the direct polarisation. On the contrary, to show that the beet does not contain dextro-rotatory substances capable of giving any so-called "plus sugar," it has been proposed to calculate back to the beet the differences existing between the direct and double polarisation values in the case of the molasses. Assuming, *e.g.*, that this difference in the molasses is at most 3 per cent., and that 4 parts of molasses are produced to every 100 parts of roots sliced, the difference between the two sucrose values in the case of the roots will only be 0·12 per cent. It is pointed out that this position is also erroneous, because in the roots there may be present invert sugar and other substances the action of which on polarised light disappears during the process of manufacture, notably in the carbonatation stage, either entirely, or for the greater part. —J. P. O.

Water; Determination of —— in cane molasses. H. Pellet. Intern. Sugar J., 1913, **15**, 117—120.

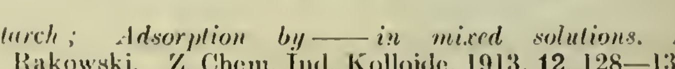
The author considers that the method for the determination of water in cane molasses proposed by Tempany and Weil (West Indian Bull., 1912, **12**, 89) is unnecessarily complicated for general adoption in sugar factory laboratories, in view of the simpler and equally accurate method of desiccation on pumice or sand in the shallow metal dishes devised by himself, controlling the operation by means of determinations made with pure sucrose. In a Pellet desiccation dish are placed 1·6—2·0 grms. of the sample, pumice or sand added, and the dish and contents re-weighed, thorough mixing being then effected with 10 c.c. of recently boiled distilled water. Parallel determinations are carried out with pure sugar, and all the dishes are heated at 103°—105° C., preferably in an electric oven, the temperature not being permitted to vary more than 1°—2° C. beyond the limit stated. At the end of an hour and a half, the control dishes containing the pure sugar are weighed, replaced in the oven, and again weighed after a further half hour, when generally no difference between the two determinations will be observed. If this be so, the dishes containing the molasses are weighed, though in order to be assured that no appreciable amount of moisture is present, heating may be prolonged for another half hour. The results obtained by different workers are stated to be quite concordant.—J. P. O.

Betaine; Preparation of —— from waste lyes from the desaccharification of molasses. K. Urban. Z. Zuckerind. in Böhm., 1913, **37**, 339—341.

The following method is simpler than those described by Stanek (this J., 1902, 560) and Andrlik (this J., 1904, 672): The concentrated lye is mixed with an equal volume of concentrated hydrochloric acid; when the mixture has cooled, the alkali chlorides precipitated are filtered off and the filtrate is evaporated. Humic substances separate during evaporation, and the pasty residue is macerated with water. The extract is decolourised with animal charcoal, and on concentration, crystallised betaine hydrochloride is obtained, the mother liquor yielding the hydrochloride of glutamic acid. In this way, a yield of betaine hydrochloride equivalent to 95·5 per cent. of the betaine in the lye was obtained. On treating the product with hydrochloric acid, any traces of alkali chloride remain undissolved, and if the filtered solution is distilled to expel hydrochloric acid and the distillation residue is re-crystallised from water, nearly chemically pure betaine hydrochloride is obtained.—L. E.

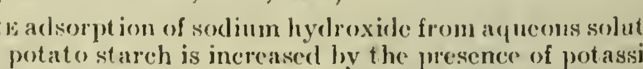
Sugar derivatives; The nomenclature of ——. J. C. Irvine. Chem. Soc. Proc., 1913, **29**, 69—70.

At present the position occupied by substituting groups in sugars is indicated by the use of Greek letters, the carbon atom next to the reducing group being termed the α-atom. Attention is now drawn to the fact that confusion arises when, in addition to the position of the substituents, the stereochemical form (α or β) of the parent sugar has also to be included in the nomenclature, and it is proposed to restrict the use of the expressions α and β, as applied to sugar derivatives, solely to the indication of the configuration of the mutarotatory forms of sugars and of derivatives, such as glucosides, which exist in two stereoisomeric modifications. It is further suggested that the carbon atoms in sugars and their derivatives should be indexed by numbers, the reducing group being termed the No. (1) position in the case of an aldose and No. (2) in the case of a ketose. The numerical system may also be applied to polyhydric alcohols, the numeration in such cases being commenced at the terminal primary alcohol group which normally oxidises to give an aldose. The application of the method is illustrated by reference to synthetical aminoglucosides, aminoglucoses, methylated sugars, and a series of mixed ethers derived from mannitol. Examples of the proposed nomenclature are shown below:



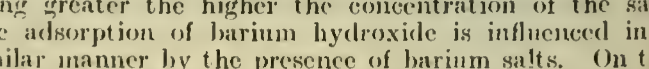
$$\mathrm{OH{\cdot}CH_2{\cdot}CH(OH){\cdot}CH{\cdot}CH(OCH_3){\cdot}CH(OCH_3){\cdot}CH{\cdot}OH}$$

2 : 3-Dimethyl-α- or β-glucose.



$$\mathrm{OCH_3{\cdot}CH_2{\cdot}CH{\cdot}CH(OH){\cdot}CH(OH){\cdot}C(OH){\cdot}CH_2{\cdot}OH}$$

6-Monomethyl-α- or β-fructose.



$$\mathrm{OH{\cdot}CH_2{\cdot}CH(OH){\cdot}CH{\cdot}CH(OH){\cdot}CH(NH_2){\cdot}CH{\cdot}OCH_3}$$

2-Amino-α or -β-methylglucoside.

Starch; Adsorption by —— in mixed solutions. A. Rakowski. Z. Chem. Ind. Kolloide, 1913, **12**, 128—130. (See also this J., 1912, 891.)

The adsorption of sodium hydroxide from aqueous solution by potato starch is increased by the presence of potassium or sodium salts of organic or inorganic acids, the effect being greater the higher the concentration of the salt. The adsorption of barium hydroxide is influenced in a similar manner by the presence of barium salts. On the other hand the slight adsorption of ammonia from its aqueous solution by starch is practically unaffected by the presence of ammonium chloride. From a solution containing barium hydroxide and sodium hydroxide, both alkalis are adsorbed, the barium hydroxide to a greater but the sodium hydroxide to a lesser extent than from separate solutions of the respective alkalis.—A. S.

Starch; Action of hydrogen peroxide and ferric chloride on ——. O. Durieux. Bull. Soc. Chim. Belg., 1913, **27**, 90—97.

The author has studied the action of hydrogen peroxide and ferric chloride on soluble starch (prepared by Fernbach's method under a pressure of 4 atmospheres). The results of the experiments are tabulated. They show that neither ferric chloride nor hydrogen peroxide alone saccharifies starch with measureable velocity at the ordinary temperature, but that appreciable saccharification takes place when both are present together. The hydrogen peroxide is completely decomposed and the quantity of reducing sugars formed varies according to the quantity of peroxide added. The decomposition of the hydrogen peroxide is accelerated catalytically by the ferric chloride. Hydrogen peroxide retards the diastatic saccharification of starch, without itself undergoing decomposition.—A. S.

Photo-sensitiveness of Fehling's solution. Leighton. *See* XXIII.

Patents.

Sugars; Process of producing fermentable ——. F. E. Gallagher, Newton, Mass., Assignor to Standard Alcohol Co., New York. U.S. Pat. 1,056,161, March 18, 1913.

Lignocellulose or other cellulosic raw material is digested by the action of steam under pressure in presence of a hydrolysing agent, until a suitable proportion has been rendered soluble. Digestion is then continued at a lower temperature and for a longer period, to increase the quantity of fermentable sugars.—L. E.

Sugars; Process of producing —— from cellulose. Process of producing fermentable sugars. F. E. Gallagher, Newton, and H. S. Mork, Boston, Mass., Assignors to Standard Alcohol Co., New York. U.S. Pats. 1,056,162 and 1,056,163, March 18, 1913.

(1) Cellulosic raw material is subjected to the hydrolysing action of sulphite liquor containing fermentable sugars resulting from a previous digestion of wood. (2) Lignocellulose is chlorinated and the product is digested by the direct action of steam under pressure in presence of sulphuric acid.—L. E.

Sugar; Process for converting wood and other substances containing cellulose, into ——. A. Classen. Fr. Pat. 448,496, Sept. 17, 1912.

The process for converting wood, etc., into sugar by treatment with sulphurous acid under conditions which permit of a partial oxidation of the sulphurous to sulphuric acid (see this J., 1901, 1008; 1902, 630), is modified, in that the oxidation is accelerated by a catalyst such as finely divided platinum or other metal, or ferric oxide. In this way the process can be effected with a smaller proportion of sulphurous acid, and at a lower temperature, and the yield of sugar is increased. Thus 100 kilos. of wood (containing 15—50 per cent. of moisture) are heated with 15—20 kilos. of a saturated solution of sulphurous acid, and the catalyst, for 30—60 minutes to 110°—135° C. in a closed vessel which is slowly rotated.—L. E.

Sugar; Process for purifying and decolourising solutions of ——. F. Tiemann. Fr. Pat. 448,842, Sept. 28, 1912. Under Int. Conv., Dec. 12, 1911.

The organic colouring matters of acid character in solutions of crude sugar are chiefly present in the form of calcium salts. According to the present invention, the sugar solution is mixed, at a moderate temperature, with a solution of an oxalate of a heavy metal such as tin, whereby the calcium is precipitated as oxalate, and the colouring matters are thrown down as insoluble lakes.
—L. E.

Beet juice; Process for removing potash and soda from raw ——. J. D. Riedel Akt.-Ges. Ger. Pat. 254,883, June 4, 1911.

The juice is treated first with aluminium sulphate and then with calcium carbonate, preferably marble, in order to separate acid substances and cell-fibres, and is afterwards filtered through "calcium-zeolite." It is stated that juice thus treated is ready for evaporation without the usual defecation process. The exhausted calcium-zeolite can be revivified by treatment with calcium chloride solution, whereby a solution of potassium chloride is obtained.—A. S.

[*Sugar.*] *Diffusion apparatus.* W. A. Raabe. Ger. Pats. 254,932 and 254,933, Sept. 9 and Nov. 1, 1911.

(1) The apparatus comprises an annular trough in which a cage, with a pivoted bottom, containing the beet slices is caused to travel. The trough is provided with an inlet and outlet for the liquid and with a discharge opening for the exhausted slices. On either side of the discharge opening are perforated inclined planes; the cage travels up one plane and when over the discharge opening, the pivoted bottom falls and the exhausted slices are discharged. A fresh charge of slices is next introduced and the cage resumes its travel. In order to render the process continuous a number of cages may be used, one behind the other, or one large cage filling the entire trough, and divided into cells by transverse perforated partitions, may be employed. (2) A device is provided for preventing the pivoted bottom of the cage from falling until the cage is entirely over the discharge opening.—A. S.

Diffusers especially for use in sugar factories. H. Raabe. Fr. Pat. 448,047, Sept. 7, 1912. Under Int. Conv., Sept. 8 and Oct. 31, 1911.

See Ger. Pats. 254,932 and 254,933 of 1911; preceding.
—T. F. B.

Drying starch; Method of and apparatus for ——. H. W. Lake, London. From Corn Products Refining Co., New York. Eng. Pat. 13,984, June 15, 1912.

See U.S. Pat. 1,035,302 of 1912; this J., 1912, 1089.
—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Maltase; Dialysis of ——. W. Kopaczewski. Comptes rend., 1913, **156**, 918—921.

This investigation was carried out with commercial taka-diastase. Solutions, filtered through filter-paper and left in the light, darkened in colour, but their hydrolytic power increased by more than 100 per cent. in 72 hours. After 24 hours' dialysis against distilled water through collodion membrane, the hydrolytic power was found to be more than doubled; on prolonging the treatment (for 96 hours) the power fell to about 180 per cent. of its original value and remained fairly constant. At the same time the reducing substances originally present in the diastase disappeared. The greater part of the total solid matter and the mineral matters, was eliminated. The alkalinity towards methyl orange, expressed as c.c. of $N/100$ sulphuric acid, diminished from 9·7 to 1·1 (for 0·2 grm. of diastase), and the electric conductivity of the solutions diminished from $81{\cdot}8\times10^{-6}$ to $11{\cdot}9\times10^{-6}$ after 96 hours' dialysis. A further quantity, but not the whole, of the substances responsible for this residual conductivity, was extracted by electric dialysis (see Dhéré, Comptes rend., 1910, **150**, 934, 993; also this J., 1910, 579), and the diastatic power diminished somewhat at the same time. It was observed that the enzyme travelled towards the negative pole. After purification by this means, the diastase was faintly acid to methyl-orange.—J. H. L.

Diastase; Action of ammonia on ——. III. T. Panzer. Z. physiol. Chem., 1913, **84**, 161—188. (See also this J., 1913, 41.)

Diastase preparations, treated with ammonia gas under conditions similar to those of the earlier experiments with hydrochloric acid (*loc. cit.*), absorbed 1·7—3·9 per cent. of ammonia. When subsequently kept in a vacuum desiccator over sulphuric acid, the whole of this increase in weight was lost again, but the preparations showed a permanent diminution in their acidity, and a slight increase in their content of nitrogen capable of reacting with formaldehyde with liberation of acid. The saccharifying power of the diastase was not diminished by the action of ammonia (the solutions of the enzyme were of course neutralised before the saccharification tests), but rather appeared to be somewhat increased. Whatever permanent chemical changes (not reversed on neutralising solutions of the diastase) the ammonia may have produced in the enzyme, and among such changes the author considers that (1) replacement of an alcoholic hydroxyl group by an amino group, and (2) interaction of ammonia with an aldehyde group, are most probable, they clearly have no effect on the diastatic action.—J. H. L.

Invertase-action; Kinetics of ——. L. Michaelis and M. L. Menten. Biochem. Zeits., 1913, **49**, 333—369.

THE authors have studied (1) the velocity of hydrolysis of sucrose by invertase during the early stages of the reaction when the influence of the reaction-products is negligible, and (2) the retardation produced by addition of dextrose, lævulose and other compounds. The investigation differs from a similar one published by Henri in 1903, in that precautions were taken to secure the optimum concentration of hydrogen ions in all the experiments, and the mutarotation of dextrose was taken into account. The authors conclude that the course of hydrolysis can be explained by application of the laws of mass action, on the following assumptions:—The sucrose combines with invertase to form a labile compound which decomposes by a unimolecular reaction, into enzyme, lævulose and dextrose, so that at any moment the rate of hydrolysis is proportional to the quantity of sucrose-invertase compound present. The hydrolytic products lævulose and dextrose (and also mannose, mannitol and glycerol, but not lactose), combine with the enzyme and thereby retard hydrolysis. On this basis the authors calculated the dissociation constants of the various sugar-invertase compounds, and derived the reaction-formula:—

$$\frac{1}{t}\left(\frac{1}{a}+\frac{1}{k_1}+\frac{1}{k_2}\right) a \log_e \frac{a}{a-x} + \frac{1}{t}\left(\frac{1}{k}-\frac{1}{k_1}-\frac{1}{k_2}\right) x = \text{const.}$$

in which a is the original amount of sucrose, x the amount decomposed in time t, and k, k_1 and k_2 the dissociation-constants of the compounds of invertase with sucrose, lævulose and dextrose. This formula is in good agreement with the experimental results. The affinity of invertase for the various substances studied, is expressed by the following affinity-constants (inverse of the dissociation-constants) of the compounds of the enzyme with these substances:—sucrose 60, lævulose 17, dextrose 11, mannose about 12, glycerol 13, mannitol 4·5, lactose and ethyl alcohol probably 0.—J. H. L.

Hop bitter substances; Choice of solvent and method of cold extraction for the determination of ——. R. Seibriger. Woch. Brau., 1913, **30**, 177—179, 196—198.

IT is found that a quantitative extraction of the bitter substances of hops can be effected by shaking 10 grms. of the finely minced sample with 250 c.c. of cold petroleum ether (boiling at 30°—50° C.) for 3—4 hours, or with 250 c.c. of cold carbon tetrachloride for 1—2 hours. The shaking is best effected in bottles (of about 400 c.c. capacity) mounted in a rotatable frame which is turned at a rate of not more than 15 revolutions per minute. One hundred c.c. of the filtered extract are treated with 80 c.c. of neutral, 96 per cent. alcohol, and then titrated with $N/10$ alcoholic potassium hydroxide; the number of c.c. of alkali required represents the percentage of bitter substances in the hops. The results obtained with cold petroleum ether are generally somewhat lower, and those obtained with cold carbon tetrachloride are somewhat higher than those obtained with boiling petroleum ether according to the method described by Lintner (this J., 1899, 178), but the differences do not exceed the limits of permissible experimental error.—L. E.

Brewing; The nitrogen question in ——. *III. The flocculation or "break" of worts and beers and its significance in brewing practice.* H. T. Brown. J. Inst. Brewing, 1913, **19**, 84—121. (See also this J., 1907, 884; 1909, 434).

IN the present paper the author discusses the substance which separates in a flocculent form from the boiled hopped wort during cooling, constituting the "break" of the wort. When a hopped wort, which has been filtered bright near the boiling point, is allowed to cool without agitation, it becomes charged with a turbidity due to the suspension of minute particles of an amorphous substance, varying in diameter from about 0·5 to 1·0 μ, according to the rapidity of cooling. These particles present the greatest difficulty in filtration, it being impossible to obtain a perfectly bright wort by centrifuging or repeated filtration. The substance which is thus precipitated from wort possesses the properties of a protein; it is stained by Coupier's Blue, is insoluble in alcohol and dilute acids, but readily soluble in caustic alkali, being reprecipitated on neutralisation. When this substance has once formed in the state of minute suspension, no treatment of the cold wort is available to bring about its flocculation, and the nature of the containing vessel, metal or other material, has no influence on its condition. It may however be re-dissolved by heating up the wort again above the critical temperature of its solubility, and may then be separated in the flocculent state by cooling under suitable conditions. The main condition which determines flocculation is mechanical agitation during a critical period of the cooling of the wort, *viz.*, between about 120° and 80° F. (49° and 27° C.). Agitation outside these limits, with rest between them, has no flocculating effect, but with suitable agitation and not too rapid cooling, the amorphous substance separates in the form of large flakes of aggregated particles ("break"), yielding a perfectly bright filtrate. In the author's experiments the agitation was performed by a current of air, but aeration plays no part in the phenomenon and any other form of mechanical agitation is equally effective. Whilst agitation is essential, it may sometimes fail to produce a perfect "break" without the co-operation of a secondary factor, as yet unknown. When the alkaline solution of the separated amorphous substance is reprecipitated by acid, the precipitate is well flocculated in the cold, but if re-precipitation be performed in presence of wort or gelatin solution, flocculation is either incomplete or absent, according to the protective effect of the colloids present. The quantity of substance precipitated from hopped wort on cooling is relatively very small, rarely exceeding 8 mgrms. per 100 c.c., equivalent to about 0·5 per cent. of the total soluble nitrogen of the wort; a further amount is deposited as finely granulated matter on standing for about 3 weeks at the ordinary temperature, and a still further small quantity separates on chilling the wort at a temperature near the freezing point. It is important to note that it is this substance which causes a "gluten turbidity" in racked beer, particularly that prepared from imperfectly "broken" wort, when stored or subjected to chill. When separated from hopped wort and purified by re-precipitation, this substance contains a little over 10 per cent. of nitrogen; it is not a pure protein but a combination of a non-coagulable malt protein with the hop-tannin, contaminated by traces of hop-resin sufficient to give it a bitter taste. From boiled, unhopped wort, an aqueous infusion of hops precipitates a similar substance containing rather more nitrogen and free from hop-resin. When this substance is present in the finely suspended form, as in an imperfectly "broken" wort, it exercises a most injurious influence on the functions of the yeast, causing "stubbornness" in conditioning and other complications indicative of "yeast-weakness." This toxic action towards yeast appears to be a mechanical or surface effect, due to the adherence of the minute particles of the suspended matter to the walls of the cells. Yeast will perform all its functions quite normally in presence of the same substance in the flocculated form. After showing the importance of agitation in obtaining a perfect "break," the author discusses the efficiency of the industrial refrigerators in this respect. The horizontal type does not afford the necessary degree of agitation, but the vertical tubular type is regarded as satisfactory. Experiments have shown that the fall of temperature between the critical limits of 120° F.—80° F. (49°—27° C.) should be spread over a period of 30 seconds. As generally designed, the vertical refrigerator is too rapid in its action, but devices are discussed whereby the cooling of the wort over this stage may be suitably prolonged to promote the "break."

As a means for assisting the break artificially, a decoction of Irish moss may be added to the wort. A proportion of about 1 in 29,000 of wort produces a coagulum enclosing the suspended matter, but if the proportion be much increased, the Irish moss may defeat its object by acting as a protective colloid. In considering the relation of this amorphous matter to the stability of beer, it is to be noted that the solubility of the protein-tannin compound is dependent on an equilibrium in which time and temperature play leading parts. The production of a good "break" is only one of the essentials for obtaining a stable beer, and at the present time chilling for a sufficient period appears to be the only means whereby the substance which causes "gluten turbidity" can be sufficiently eliminated.—J. F. B.

Cider sickness ; Further observations on ——. B. T. P. Barker. J. Inst. Brewing, 1913, **19**, 58—83.

Cider sickness of the nature previously described (this J., 1911, 915 ; 1912, 1048) is produced by a small motile bacterium probably introduced on the surface of the fruit. This organism has been studied, and the effects produced by artificial infection on sterilised cider, though varying greatly according to the composition of the latter, have confirmed its agency as the cause of the disorder ; the cells are killed by heating for 5 minutes at 55° C. In some of the experiments the type of fermentation produced by this bacterium in sterilised sweet cider closely approximated that of normal alcoholic fermentation by yeast. In other cases the ratio of carbon dioxide to alcohol fell considerably short of the normal, while in extreme cases no carbon dioxide was evolved. The quantity of carbon dioxide tends to be low with exceptionally heavy infections, likewise also with very small infections. Generally, the course of the sickness is accompanied by the formation of aldehydes, particularly acetaldehyde, to which the peculiar "sickness flavour" is definitely attributable. Sometimes, the course of the sickness is arrested by some of the products formed, possibly by formaldehyde. The characteristic "sickness turbidity" is apparently due to the combination of aldehydes with some of the tannin constituents of the cider ; both turbidity and flavour may be approximately simulated by adding acetaldehyde or formaldehyde to sterile cider. A similar flavour has been observed in sound raw apples. The sickness bacterium produces a characteristic frothing during its activity which is definitely connected in some way with the presence of aldehydes. Various treatments are discussed for the prevention or cure of the malady. Washing the fruit with disinfectants before crushing is not regarded favourably ; on the other hand, in view of the low temperature at which the organism is killed, washing with hot water at, say 60° C., should be practicable without appreciably affecting the flavour of the cider. Filtration of the juice or cider is not efficacious and the addition of salicylic acid is undesirable. A vigorous primary fermentation is beneficial in rendering the cider resistant, and sulphuring the juice after this stage is generally sufficient to preserve the cider until the early summer. Generally, the best method is to select a blend of sweet and sharp apples to bring the total acidity up to 0·7 per cent. of malic acid, which in most cases is sufficient to render the cider immune ; ciders prepared from rapidly fermenting juices are more resistant than those which ferment slowly. Early bottling and consequent accumulation of carbon dioxide also have a protective influence. Cider which has suffered from sickness may recover after some months and the turbidity may settle out. This recovery might be hastened by passing a current of carbon dioxide through the liquid until the volatile aldehydes have been eliminated, then filtering. Recovered cider shows little deterioration except its loss of sweetness.—J. F. B.

Determination of formic acid in foods. Fincke. *See* XIXa.

Asbestos-porcelain ; its employment in the filtration of alimentary liquids and of serums. Hinard. *See* XIXb.

Vapour pressures of the lower alcohols and their azeotropic mixtures with water. Part I. Ethyl alcohol. Merriman. *See* XX.

Patents.

Malt cleaning material ; Method of and apparatus for utilising ——. C. Brune, Radeberg, Germany. Eng. Pat. 9737, April 24, 1912.

Waste obtained during malting, and from malt cleaning and malt polishing machines, is shaken down an inclined stepped surface over which a current of air passes upwards. The malt grits present continue to fall, whilst the husks, culms and dust, are carried over by the current into two chambers, in the first of which the heavier particles are deposited and in the second the dust. The malt grits, which represent about 0·5 per cent. of the total quantity of malt treated, may be used for brewing, and the other products employed as fodder.—J. H. L.

Malting ; Process of ——. Mühlenbauanstalt und Maschinenfabrik vorm. Gebr. Seck. Fr. Pat. 448,736, Sept. 12, 1912.

The malting of the steeped grain is conducted on a number of stages one below another, each containing grain in a more advanced state of germination than the one next above it. Each stage is supplied with air from the one above it, so that during the later phases of germination the grain may be surrounded with air containing a high proportion of carbon dioxide, whereby respiration and consequently malting loss can be diminished.—J. H. L.

Grains ; Process for the diffusion of whole ——. F. Verbièse. Fr. Pat. 448,113, Nov. 17, 1911.

The grains, *e.g.*, maize, are steeped for 24 hours at 60°—70° C. and then treated with acid liquors in a battery of diffusers similar to those used in distilleries for the extraction of sugar from the beet by maceration ; in this way the starch is saccharified and extracted. Each diffuser is provided with a perforated false bottom sloping down towards a door by which the exhausted charge is withdrawn ; and the temperature of the contents can be regulated by injection of steam. The diffusers, each with a steeping vessel above it, are arranged in batteries and are emptied and re-charged in rotation. The diffusion liquor passes in turn through all the members of a battery, from the more to the less exhausted charges. Instead of employing special steeping vessels, placed above the diffusers, a battery of say 12 vessels may be used, of which at any one time six consecutive ones act as steeping vessels and the remainder as diffusers. In this case the saturated diffusion juice serves as steeping liquor (at 60°—70° C.) and is afterwards heated under pressure by itself to saccharify any unconverted starch or dextrin present. The advantage claimed for this process is that the juice, after neutralisation and fermentation, contains no solid matter and may be distilled in ordinary columns used for beet juices. Any acid remaining in the spent grains may be neutralised by addition of sodium carbonate, but it is best to leave the grains slightly acid as they are then less subject to putrefaction.—J. H. L.

Diastatic product : Process for producing ——. J. Takamine, New York. U.S. Pat. 1,054,324, Feb. 25, 1913.

A mixture of 100 parts of wheat bran and 60—80 parts of water is introduced into a shaking device, *e.g.*, a pneumatic malting drum, in quantity sufficient to form a layer 3—4 feet in depth. The mixture is sterilised with steam, after which the drum is rotated and a current of air passed through it until the mixture has cooled to about 30° C. Moyashi spores (see below) are then added in the proportion of about 1 part of sifted, or 7—8 parts of unsifted spores per 1500 parts of dry bran. The drum is turned sufficiently to insure mixture of the spores and moist bran, and is then left at rest, with the temperature of the mass kept at 30° C., for 16—20 hours. The temperature then begins to rise, and the drum is turned, at a rate of 1 or 2 revolutions per minute, for 40—50 hours, during which time the temperature is kept at 35°—38° C. by a current of cold, moist air. The mass of koji thus obtained is dried; the mycelial growth with which it is permeated, exhibits shorter, thicker, and more numerously branched filaments than that obtained on a stationary medium, and the diastatic power of the koji is greater. If acclimatised moyashi spores are used (see next abstract), formaldehyde, in the form of vapour or spray, may be introduced into the drum at any stage should any growth of foreign organisms be observed. If the mass is kept in the drum until the fungus sporulates, the product known as moyashi is obtained.—L. E.

Diastatic product. J. Takamine, New York. U.S. Pat. 1,054,626, Feb. 25, 1913.

Claim is made for a koji, capable of converting at least 10 times its weight of starch, very resistant to antiseptic agents, and substantially free from fungi or bacteria of comparatively low resistance to antiseptics. To obtain this product, a suitable fungus, preferably *Aspergillus oryzae*, is grown at a temperature of 28°—30° C. on moistened, sterilised wheat bran to which has been added formaldehyde in the proportion of 1 part per 3000 of moist bran. When the growth has sporulated, a portion is seeded on a fresh portion of the same medium containing the same proportion of formaldehyde, and so on for at least 4 or 5 generations. The same cycle of successive cultivations is then repeated on portions of moist bran containing 1 part of formaldehyde per 2900, and so on until the proportion of formaldehyde has been increased to 1 part per 1500 of moist bran. The final growth (7—8 parts), or the spores (1 part) separated by sifting the dried growth, are introduced upon a fresh portion of the same medium (1500 parts) to which formaldehyde (1 part or less) has been added. The culture is spread on trays to a depth of 1—3 in., and kept in an incubator at about 30° C. until the white mycelial growth is complete; the mass of koji thus obtained is dried at a temperature not exceeding 40° C., and may then be powdered. The incubator used should be well ventilated and is so devised that the air contained therein is saturated with moisture. If the growth is continued to a later stage (sporulation), moyashi is produced.—L. E.

Yeast; Process of bleaching and conserving ——. O. Hentschel, Grimma, Germany, Assignor to A. Zeckendorf, Cincinnati, Ohio. U.S. Pat. 1,056,540, March 18, 1913.

The yeast is treated with ozone and dried.—L. E.

Hops; Process and apparatus for the extraction of ——. W. Ponndorf. Fr. Pat. 448,723, Sept. 6, 1912.

The hops are introduced, together with boiling water, into a vessel with circular base, and slightly tapering walls. At the centre of the vessel, extending almost from top to bottom, is fixed a funnel, in the mouth of which a helical blade rotates. The lower, constricted parts of the funnel are perforated, and the size of the outlet at the bottom can be adjusted by a movable sleeve. After the hot liquid has been left at rest for a short time to allow the hops to steep, a rotatory motion is set up by means of stirring arms extending over the bottom of the vessel and bearing vertical projections. Owing to the slope of the walls, the rotating liquid rises at the circumference of the vessel, and flows over towards the middle, into the mouth of the funnel, down which it passes and escapes again into the outer vessel through the perforated walls and lower outlet of the funnel. The obstruction encountered by the hop cones in the funnel, ensures their disintegration and thorough extraction. After extraction is complete the liquid is allowed to come to rest, and cold water is admitted into the vessel from below, thus displacing the hot extract and removing it completely from the spent hops.—J. H. L.

Fermentation. S. H. Blichfeldt, Southall, Middlesex. Eng. Pat. 4501, Feb. 22, 1912.

For the continuous fermentation of liquids an apparatus is employed consisting of a closed cylindrical vessel having an inlet at its base and an outlet near the top; a vertical shaft with propeller blades at its lower end extends nearly to the bottom of the vessel. The liquid, charged with the necessary quantity of ferment, is filled into the vessel, and, when fermentation has proceeded to the desired degree, the propeller is rotated, causing unfermented liquid to pass into the vessel through the inlet and mix with the fermented liquid, the latter being continually discharged from the outlet.—W. P. S.

Fermenting vats. U. Deinhardt, Vieselbach, Germany. Eng. Pat. 25,275, Nov. 4, 1912.

The vat is fitted with a cooling device in the form of an inclined, stationary vessel, the ends of which project beyond the walls of the vat, and are provided with detachable covers. Ice is introduced at the upper end of the vessel, and the water formed is discharged through an outlet at the bottom.—L. E.

Alcoholic beverages; Flavourings for use in the brewing of ——. C. H. K. Gonville, Stratford, Essex. Eng. Pat. 7616, March 28, 1912.

The flavouring is prepared by adding a concentrated and clarified extract of beef to a suitable vehicle which may be a preparation of materials such as cereals, malt extract, flour, sugar, syrup, yeast or substances prepared therefrom. Thus, the vehicle may be prepared by mashing ground barley or malt at a temperature of say 160°—180° F. (71°—82° C.) and concentrating the mash to a thick syrup *in vacuo*. According to the nature of the vehicle employed, the flavouring may be added to the mash tun, to the copper, to the fermenting vat, or to the cask into which the finished beer or stout is racked.—L. E.

Filtration [Sterilising beer]. E. Zahm, Buffalo, N.Y., U.S.A. Eng. Pat. 17,569, July 29, 1912.

A vessel fitted with removable end plates and divided into an inlet and an outlet chamber by an impermeable partition has a number of filter tubes of infusorial earth in the inlet chamber. One end of each tube is closed, whilst the other is fixed to a head fitted with a hollow stem which passes through the partition. The beer, which is introduced under pressure, percolates through the walls of the tubes and passes to the outlet chamber, from whence it is discharged. The difference of pressure of the liquids in the inlet and outlet chambers is varied as the resistance of the filter varies, by a regulator; the latter comprises a diaphragm, subject on one side to the pressure of the inlet chamber and on the other to the pressure of the outlet chamber, and a valve, controlled by the diaphragm, for regulating the supply of beer to the inlet chamber. The pressure in the outlet chamber is prevented from falling by a similar device. Part of the beer to be filtered may be mixed with loose filtering material in a special container and expelled therefrom, *e.g.*, by compressed gas, into the inlet chamber; the material is uniformly deposited on the filter tubes and is subsequently removed by washing.—L. E.

Slop [Distillery]; Process of desiccating ——. C. E. Geiger, Assignor to W. E. Koop and G. W. Fiske, Louisville, Ky. U.S. Pat. 1,057,142, March 25, 1913.

The more solid portions of the slop are separated by filtration and pressing, the expressed liquid being returned to the filter. The filtrate is evaporated to a syrup and mixed, first with a filling material and then with the more solid portions of the slop which may have been previously dried; the whole is then further dried.—L. E.

Vinegar generators; Process for ensuring pure fermentation in ——. Verein der Spiritusfabrikanten in Deutschland. Ger. Pat. 254,708, Nov. 26, 1911.

In the automatic system of vinegar manufacture, a pure-culture vessel is arranged in the circuit. This vessel is supplied partly with the ordinary sterile factory mash and partly with a special nutrient solution, and the pure-culture vinegar, rich in bacteria, produced therein, is fed continuously into the vinegar generators along with the factory mash.—A. S.

Hop-extracting apparatus. J. D. Koolman and W. Ponndorf, Cassel, Germany. U.S. Pat. 1,055,475, March 11, 1913.

See Fr. Pat. 448,723 of 1912; preceding.—T. F. B.

Process of obtaining cyanogen [and ammonia] from gases derived from vinasse, etc. Fr. Pat. 448,722. *See* VII.

Producing fermentable sugars from cellulose. U.S. Pats. 1,056,161—1,056,163. *See* XVII.

XIXa.—FOODS.

Water in foods, etc.; Direct determination of —— by distillation. F. Michel. Chem.-Zeit., 1913, **37**, 353—355.

Results are recorded of an investigation of the method of determining water in foods, etc., in which the substance is mixed with a volatile, non-miscible liquid, distilled, and the volume of water measured in the distillate. A mixture of one part of toluene with 2 parts of xylene is recommended for use in the method. For the determination, about 150 c.c. of the dry mixture are placed in a flask, a weighed quantity of the substance under examination is added, a few spirals of aluminium wire are introduced, and, after the flask has been connected with a vertical condenser, the contents are distilled until water ceases to pass over into the receiver. The latter consists of a narrow graduated cylinder provided with a small funnel at the top. At the end of the distillation, any drops of water adhering to the sides of the condenser are brought into the receiver by the aid of a glass-rod or feather dipped in xylene. When the distillate has separated into two portions (it may be subjected to centrifugal action, if necessary) the volume of the aqueous layer is noted. Owing to the change in the form of the meniscus when water is in contact with the toluene-xylene mixture, a correction of 0·125 c.c. is added to the volume of water found; a further correction of 0·03 c.c. for each c.c. of water in the distillate is added to allow for loss due to water retained in the condenser, etc. These corrections should, however, be verified for each separate apparatus. The method yields trustworthy results.—W. P. S.

Formic acid: Determination of —— in foods. H. Fincke. Z. Untersuch. Nahr. Genussm., 1913, **25**, 386—391.

The mercuric chloride method of determining formic acid (this J., 1911, 82, 235) presents difficulties in the case of certain products such as honey (this J., 1912, 402), rum, and wine vinegar, owing to the fact that the filtrate from the liquid after treatment with calcium carbonate when heated with mercuric chloride and sodium acetate may give a precipitate resembling mercurous chloride. This may be obviated by the addition of 1·5 to 2 grms. of sodium chloride per 100 c.c. of liquid containing about 2 grms. of mercuric chloride. Under these conditions two hours heating are sufficient, and the accuracy of the results is not affected. The following modification of Fenton and Sisson's method of detecting formic acid in vinegar, etc., is recommended:—Ten c.c. of the neutral or slightly acid liquid are treated with about 0·5 grm. of magnesium, the test tube cooled in water, and an addition of 6 c.c. of hydrochloric acid (sp. gr. 1·124) made drop by drop in about 15 minutes. After standing for an additional 5 minutes the liquid is filtered, and 5 c.c. of the filtrate tested for formaldehyde with milk and hydrochloric acid containing a trace of iron. When it is not required to detect traces of formic acid the liquid may be heated with sodium acetate and mercuric chloride in a boiling water bath (see this J., 1911, 916).—C. A. M.

Mixed glycerides of palmitic and stearic acids in lard. Bömer. *See* XII.

Synthetical preparation of α-distearin and β-palmitodistearin. Bömer and Limprich. *See* XII.

Theoretical basis of Polenske's difference values of fats. Bömer and Limprich. *See* XII.

Asbestos-porcelain: its employment in the filtration of alimentary liquids and of serums. Hinard. *See* XIXb.

Patents.

Milk: Sterilisation of ——. A. Shelmerdine, Liverpool. Eng. Pat. 17,554 of 1911, date of appl., Feb. 29, 1912.

The milk is caused to flow through a chamber containing electrodes, each 200 c.c. of the milk being subjected to a current of from 1·5 to 6·5 ampères at 200 volts, per 508 sq. in. of area of the electrodes.—W. P. S.

Pasteurising milk; Apparatus for heating, cooling, and mixing or stirring liquids, particularly applicable to ——. A. J. McDonald, Hendon. Eng. Pat. 4807, Feb. 26, 1912.

The apparatus consists of a "regenerator" and a heater arranged co-axially side by side. The "regenerator" is cylindrical in shape and has a removable inner casing, both cylinder and inner casing being closed at one end by a cap; a spiral partition is fitted between the cylinder and casing. Stirrers are provided in each vessel and are attached to a shaft which extends into both. A centrifugal governor fitted on the shaft controls the steam supply.—W. P. S.

Pasteurising apparatus [for milk, etc.]. A. J. McDonald, Hendon. Eng. Pat. 28,671, Feb. 26, 1912.

The supply of milk to the pasteurising apparatus is regulated by means of a valve and governor operated by the shaft which drives the rotating agitators in the apparatus. The same governor may control the steam supply to the engine.—W. P. S.

Milk; Desiccated —— and process of making the same. W. H. Swenarton, Montclair, N.J. U.S. Pat. 1,056,719, March 18, 1913.

Milk is concentrated under reduced pressure in a vessel where a relatively large surface is exposed, and the concentrated milk is then transferred in the form of a thin layer on to the surface of a drum heated to a temperature not exceeding 60° C., in a chamber from which the air is exhausted. The film of milk is removed from the drum when it contains from 1·5 to 5·5 per cent. of water.—W.P.S.

Milk and other liquids; Process for the condensation or concentration of ——. E. W. Kuhn. Fr. Pat. 448,160, Sept. 11, 1912.

The milk or other liquid is deprived of the greater proportion of its water by either of two methods, namely, freezing or filtration. In the freezing process, a series of tubes, through which a solution having a temperature below 0° C. is circulated, is rotated in the liquid until the surface of the tubes becomes coated with ice; another series is then substituted, and so on until the desired proportion of water in the form of ice has been separated from the liquid. In the second process, porous filter tubes are rotated in the liquid while a low pressure is maintained in the interior of the tubes by means of an exhaust pump. The water thus separated from the liquid may be concentrated separately in order to recover soluble salts, etc.; these are then added to the concentrated milk or other liquid. Soluble substances can also be recovered from the ice separated by the first process.—W. P. S.

Fat; Process for emulsifying —— [in the manufacture of margarine]. S. H. Blichfeldt, Southall, Middlesex. Eng. Pat. 4505, Feb. 22, 1912.

Emulsions of water and fat, containing up to 85 per cent. of fat, may be produced by violently agitating water in a suitable apparatus (one form of this apparatus is described) and slowly introducing the required liquid fatty matter until the desired quantity has been admitted.

Water and fat, in proportions corresponding with those of the desired emulsion, are then introduced continuously into the vessel through separate inlets.—W. P. S.

Margarine; Manufacture of ——. S. H. Blichfeldt, Southall, Middlesex. Eng. Pat. 4508, Feb. 22, 1912.

Separated milk is passed successively through a steriliser, a cooling device, and a fermenting chamber, and is then pumped into an emulsifier. Fatty material is also passed through a steriliser and cooler, and is pumped into the emulsifier, the two pumps being so regulated that the desired quantities of milk and fat are delivered to the emulsifier. The product is then delivered into a cooling chamber. The whole apparatus is arranged in such a manner that the materials (milk and fat) are not subjected to exposure to the atmosphere during any part of the process.—W. P. S.

Soya beans; Treatment of —— for their conversion into food products. N. Bergey, Paris. Eng. Pat. 5169, March 1, 1912.

Soya beans are immersed for from 1 to 7 days in water containing about 2·5 per cent. of an alkali such as calcium hydroxide, then washed, and placed while still moist in a suitable roasting apparatus. When the beans have been dried, they are roasted, decorticated, mixed with a quantity of fat such as vegetable butter, cacao butter, etc., and ground to a powder. The product may be used as an ingredient in the manufacture of a chocolate substitute. A coffee substitute is prepared by grinding the roasted beans, adding to the powder from 15 to 20 per cent. of its weight of glucose or molasses, and again roasting the mixture, the addition of the sugar being made, preferably, during the second roasting process. —W. P. S.

Phospho-protein compounds from fish; Process for manufacturing ——. Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappij, Amsterdam, Holland. Eng. Pat. 8524, April 10, 1912. Under Int. Conv., Dec. 20, 1911.

One hundred kilos. of haddock, freed from intestines, are heated to 50° C. for 10 hours with 500 litres of water, 125 grms. of chloroform and 125 grms. of toluene. The liquid portion is then separated, mixed with 5 kilos. of washed animal charcoal and 5 kilos. of kieselguhr, and filtered. Sulphur dioxide is passed into the filtrate until the precipitate which at first forms is re-dissolved, a further quantity of 5 kilos. of kieselguhr is added, and the mixture is filtered. The filtrate is treated with a quantity of sodium carbonate exactly equivalent to the amount of sulphur dioxide present in solution (as determined iodometrically), and the precipitate produced is collected, washed, dried at 50° C. under reduced pressure, and ground to a powder.—W. P. S.

Desiccation in vacuum of meat and other humid substances, without the use of antiseptics; Apparatus for the ——. C. Tellier, Paris. Eng. Pat. 16,249, July 11, 1912. Under Int. Conv., July 11, 1911. Addition to Eng. Pat. 12,206 of 1911 (this J., 1914, 791).

The meat, or other substance, is placed in a closed chamber surrounded by a cooling jacket, and carbon dioxide is then admitted, the air at the same time being exhausted from the chamber. Means are provided for recovering the carbon dioxide passing through the chamber. The latter is then placed in communication with a reservoir containing potassium hydroxide solution which absorbs the carbon dioxide, and a very low pressure is produced in the chamber. The connection with this reservoir is now cut off and the moisture evaporating from the meat is withdrawn from the chamber and condensed in a vessel containing a supply of saline solution at a temperature of − 25° C. The meat is sufficiently desiccated within a few hours, and, when removed from the chamber, may be kept exposed to the air almost indefinitely without undergoing decomposition.—W. P. S.

Vegetable and animal substances, Process of preserving —— by desiccation. Poulenc Frères and F. Billon. Fr. Pat. 448,534, Nov. 28, 1911.

The substance is frozen, for example, by treatment with liquid air, then ground to a powder, and the latter is dried under reduced pressure (below 4·6 mm.) while the temperature is maintained below 0° C. During the grinding and drying processes, the temperature must be sufficiently low to prevent any liquid drops forming on the surface of the substance.—W. P. S.

Food for animals; Manufacture of ——. A. Smythe, Craven Arms, Shropshire, and A. Dickson, Dublin. Eng. Pat. 24,231, Oct. 23, 1912.

Maize is partially roasted and, while still hot, is blown into a receiver or hopper by means of a fan which also draws in a quantity of cold air; the maize is thus broken up in such a manner that it is ready for packing in bags. If desired, the roasted maize may be mixed with molasses which has been heated by means of a current of hot air. —W. P. S.

Proteid [casein] preparations; Manufacture of ——. A. J. Boult, London. From Nyegaard & Co., Christiania. Eng. Pat. 16,336, July 12, 1912.

See U.S. Pat. 1,048,949 of 1912; this J., 1913, 157.—T.F.B.

Construction of drying plant for macaroni, vermicelli, and the like, as well as for pulpy and liquid substances. Eng. Pat. 14,430. *See* I.

Process of desiccating [distillery] slop. U.S. Pat. 1,057,142. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Asbestos-porcelain: its employment in the filtration of alimentary liquids and of serums. G. Hinard. Bull. Soc. d' Encourag., 1913, **119**, 253—265.

Pasteur's bacteriological experiments were conducted with plaster filters, which suffered from lack of permanence. A. Gautier introduced the porcelain filter thirty years ago, but, though germ-proof, it filtered too slowly, and the body now used is in reality a slack-burnt faience. The liquid when it enters the tube is subject to the laws of capillarity and of gravity, it exerts pressure on the porous surrounding walls, and proceeds through channels or ducts or by forming little reservoirs which ultimately find an overflow into a duct. Duclaux has found that in homogeneous filters the velocity of the liquid through a duct is proportional to the fourth power of the diameter of the duct. As a solid corpuscle in the liquid is attracted to the walls by a force proportional to the square of the distance, it follows that retention can be achieved only by making the pores fine almost to impermeability. To keep up the speed of delivery it is therefore necessary to have a great number of pores very close together, which is effected by increasing the fineness of grain. Pure asbestos is found in variable lengths, but always extremely fine, the diameter being 0·16—2 μ. This is the base of the Mallié filter (introduced in 1891), the binding material being originally clay, and now steatite. The efficacy of a filter suffers from the propagation of germs through the wall of the tube, owing to the mechanically retained organic matter acting as their food. Sinuosity of the ducts is said to be an obstacle to this penetration, and the asbestos filter is claimed to be specially suitable for this purpose. Tiraboschi, of Genoa, in 1905 obtained complete sterility after one month's filtration of a water artificially contaminated with coli, typhus, cholera and dysentery germs. From a recently improved form of filter, the author finds a sterile filtrate after 2¼ months, the town-water having been contaminated with 345,000 *B. coli* per c.c. after the filter had been already working three weeks. Candle filtration is also applicable to the sterilisation of fermented liquors, particularly wine, in which pasteurisation by heat would leave a taste. With the exception of *la casse*, all wine diseases are due to ferments which are insoluble and can therefore be removed by filtration. Success, with regard to bouquet, is dependent on absence of chemical action between the wine and the filter-candle, and for this purpose asbestos candles are preferable to those made from clay and whiting. When candles require sterilisation, it is recommended that they be dipped in a strong solution of permanganate and subsequently in a bath of sodium bisulphite. Serums and liquids for injection can only be sterilised by filtration. It is essential for intravenous injection that no solid particles should be present in the filtrate, and that the candle be chemically inert.—H. H. S.

Soap solutions, and the determination of hardness of water; Behaviour of calcium and magnesium salts with ——. H. Masters and H. L. Smith. Chem. Soc. Proc., 1913, **29**, 76.

In the titration of hard waters with soap solution, equivalent amounts of calcium and magnesium salts use up different quantities of soap, magnesium salts using up more than calcium salts. It is the unsaturated acids that cause this difference, saturated fatty acids giving soap solutions, which give accurate results with calcium salts and magnesium salts or with mixtures of the two. Potassium myristate makes a convenient stable solution for this purpose. The solubility of calcium oleate decreases, whilst the solubility of magnesium oleate increases with rise of temperature. With magnesium salts and sodium oleate a precipitate soon forms after titration at 15° C., and this carries down or adsorbs some sodium oleate, and so more soap is required. With calcium salts and sodium oleate at 15° C. no precipitate forms under the usual conditions, the liquid remaining translucent. With soaps made from the saturated fatty acids precipitates form with both calcium and magnesium salts.

Nitrites in potable waters; Method of determining ——. M. Lombard. Bull. Soc. Chim., 1913, **13**, 304—309.

The depth of tint of the azo-dye produced by the action of *p*-sulphanilic acid and phenol, under given conditions, is compared with those of a series of previously standardised solutions of potassium bichromate. The reagent is prepared by dissolving 1 grm. of sulphanilic acid in 100 c.c. of a saturated solution of pure ammonium chloride, and adding 1·5 grms. of phenol and 100 c.c. of (approximately $2N$) hydrochloric acid. 1 c.c. of this reagent is added to 50 c.c. of the water to be examined, the reaction is allowed to proceed for at least 15 minutes, and then an excess (1 c.c.) of ammonia is introduced. The standards are prepared by applying the reagent, in the manner indicated, to solutions containing 0·1—5 mgrms. of sodium nitrite per litre, and then matching the tints produced by suitably diluting a slightly acidulated solution of potassium bichromate. If the reagent is to be kept for a long period, it should be made up with water instead of acid, and, in such a case, 1 c.c. of the reagent and 1 c.c. of approximately $N/1$ hydrochloric acid are added to the water in testing. The method is accurate to 0·1 mgrm. with water containing 0·1—1 mgrm. of sodium nitrite per litre, and to 0·5 mgrm. with 1—5 mgrms. of nitrite per litre.—F. Sodn.

Manganese: Colourimetric determination of small quantities of —— *in water.* F. Haas. Z. Untersuch. Nahr. Genussm., 1913. **25**, 392—395.

One hundred c.c. of the water are acidified with 5 c.c. of 20 per cent. sulphuric acid, and, after the addition of 0·5 to 1 grm. of solid potassium persulphate, slowly heated until no further reddish-violet or brown colouration (from separating peroxides) appears. The liquid is now cooled, treated with a trace of sodium bisulphite, and the heating cautiously repeated until the colour has attained its maximum intensity. It is then cooled, and the colour compared with that of a $N/100$ potassium permanganate solution (1 c.c. = 0·11 mgrm. of manganese). If no reaction is obtained, the test should be repeated and the colourimetric comparison made with larger volumes of liquid. The method gives good results with waters containing from 0·05 to 0·1 mgrm. per litre. For amounts outside those limits the sample must be concentrated or diluted. Care must be taken that no trace of oxidisable substances is present in the colourimeter vessels.—C. A. M.

Carbonaceous dusts liable to be generated in premises under the Factory and Workshop Acts; Inflammability and capacity for transmitting explosions of ——. R. V. Wheeler. Report to Home Office, March, 1913. [Cd. 6662.]

In consequence of two serious dust explosions which occurred in November, 1911, at a provender mill in Glasgow, and an oil-cake factory in Liverpool (this J., 1912, 599), a series of experiments has been carried out at the Home Office experimental station at Eskmeals with samples of all kinds of carbonaceous dust, so far as known to the inspectors, which are liable to be generated on premises under the Factory and Workshop Acts, with a view to determining their degree of inflammability and capacity to transmit explosions. The samples (66) were taken by the factory inspectors from beams, ledges, or other projections in the course of their inspections. Two methods of testing were employed. In the first, *the relative ignition temperatures* were ascertained. A glass cylinder 8 cm. in diameter and 140 cm. long, open at both ends, was supported in a horizontal position. A platinum coil of 32-gauge wire, closely wound on a thin-walled tube of quartz of capillary bore, passed horizontally across the cylinder at a point 40 cm. from one end. Through the bore of the quartz tube a platinum and platinum-rhodium thermo-couple passed and was connected with a mille-voltmeter for temperature readings. An electric current could be passed through the platinum coil so that it could be heated to any temperature up to about 1400° C., and maintained at a constant temperature by the adjustment of an external resistance. The length of the heated coil was 17 mm., and its diameter 1·5 mm. The dust to be tested was placed in an even layer along a glass tube 2·5 cm. internal diameter and 45 cm. long. This tube was closed at one end by a rubber stopper carrying a glass tap of 1 cm. bore. The open end of the tube was at a distance of 30 cm. from the heated platinum coil. The tap was connected with an arrangement for giving a constant puff of air, consisting of a brass cylinder 65 cm. long and 11 cm. internal diameter fitted with a piston weighted so as to give a pressure of 2 lb. per square inch. The dust cloud was produced by suddenly opening the tap. The air blast, passing over the surface of the dust in the tube, raised the top layer and carried it into the larger tube and over the heated coil in a cloud that remained uniform during the stroke of the piston. If ignition occurred the temperature of the platinum coil was lowered 10° to 20° C., and a fresh trial made, and so on until two temperatures were obtained, differing by 10° C., at one of which inflammation took place, whilst at the other the dust cloud passed over uninflamed. The mean temperature was then taken to be the ignition temperature of the dust under the conditions of the test. The second test determined *the lowest temperature at which ignition* could be effected. The igniting surface in this test was a loosely rolled spiral of copper gauze contained in a porcelain tube of 25 mm. internal diameter and 10 cm. long. This tube was placed in a vertical position in a small electric furnace. A glass tube of the same diameter as the porcelain tube was placed on top of it and this glass tube was drawn out at its upper end and bent at right angles. In the horizontal part of this tube 0·2 grm. of the dried dust was introduced, and, on connecting this tube with the apparatus which gave a constant puff of air, the dust was blown in a cloud, downwards, through the furnace. If the temperature was high enough it ignited there and a flame appeared underneath. The results obtained for the relative ignition temperatures varied from 805° C., in the case of sugar, to 1140° C., in the case of extracted soya bean, but, in a great number of instances the material, under the conditions of the experiment, could not be ignited at all. The state of division of the samples varied very much and results are given for the percentage of the material which passed through a 200-mesh sieve. In the case of the tests for the lowest temperature at which ignition could be effected, the results varied from

540° C. for dextrin and sugar, to 830° C. for coal (foundry blacking), and again, no ignitions could be obtained with a very considerable number of samples. Results are given in each case for the percentage of non-combustible matter in the samples. The samples have been divided into three classes. (1) Dusts which ignite and propagate flame readily, the source of heat required for ignition being comparatively small, such, for example, as a lighted match. Included in this class are sugar, dextrin (calcined farina), starch, cocoa, rice, meal and sugar refuse, unextracted soya bean, cork, woodflour, malt, oat husk, grain (flour mill), maize, tea, compound cake, grain (grain storage), rape seed, cornflour, flour (flour mill), chicory, briquette, gramophone record, extracted soya bean. In this class sugar, dextrin, starch, and cocoa are the most dangerous; sugar exceptionally so. It ignites when projected, as a cloud, against a surface heated to below red heat, and, when ignition has taken place, the flame travels throughout the dust cloud with great rapidity. (2) Dusts which are readily ignited, but which for the propagation of flame require a source of heat of large size and high temperature, such as an electric arc, or of long duration, such as the flame of a bunsen burner. Included in this class are copal gum, leather, "dead" cork, cocoanut oil milling, rice milling, sawdust, castor oil meal, oil cake, offal grinding (bran), grist milling, horn meal, mustard, shoddy, shellac composition. (3) Dusts which do not appear to be capable of propagating flame under any conditions likely to obtain in a factory; either (*a*) because they do not readily form a cloud in air or (*b*) because they are contaminated with a large quantity of incombustible matter, or (*c*) because the material of which they are composed does not burn rapidly enough. Included in this class are "organic ammonia," tobacco, spice milling, drug grinding, cotton seed, cotton seed and soya bean, bone meal, coal (foundry blacking), lampblack, sack cleaning, retort carbon, rape seed (Russian), blacking, grain cleaning, charcoal, foundry blacking, brush carbon, stale coke, plumbago, bone charcoal, and mineral and ivory black.
—G. W. McD.

Gasworks pitch industries and cancer. Ross and others. *See* III.

Patents.

Bacteria; Means for exterminating ——. E. Langheld, London. Eng. Pat. 5869, March 8, 1912.

A preparation for destroying bacteria mechanically consists of a medium such as soap, paste, oil, glycerin, or ointment, to which is added from 20 to 90 per cent. of its weight of kaolin, bolus, or the like; the kaolin or bolus is the active ingredient of the preparation and must be in such a fine state of division and of sufficient hardness to cause the particles to be capable of "penetrating the smallest bacteria." The kaolin also absorbs the toxins of the bacteria. The preparation may be applied to the human body either externally or internally.—W. P. S.

Sewage, trade effluents, and the like; Filtration of ——. A. Burkill and R. Parkinson, Dewsbury, Yorks. Eng. Pat. 6003, March 11, 1912.

Channels or conduits having solid tops and perforated sides are fitted in a series of concrete tanks; the channels in each tank connect with vertical discharge chambers at the end of the tanks, and are also in connection with the channels in the adjoining tanks, pipes with valves being provided for this purpose. The tanks are partially filled with filtering material and the perforated channels afford a means of drawing off the water from the sediment collecting on the filtering material and allow the tanks to be primed with water before use.—W. P. S.

Sewage and refuse; Apparatus for the destruction of town ——. C. Birault, Paris. Eng. Pat. 13,009, June 3, 1912. Under Int. Conv., Sept. 30, 1911.

The furnace in which the refuse is burned is provided with rocking grates to which are imparted combined vertical and horizontal movements with an intermittent jolting action. The bars of the grates are spaced widely and a wide space is provided between one end of the grate and the wall of the furnace, in order that incombustible matters which are too large to fall between the bars may pass into the ash-box.—W. P. S.

Sewage treatment; Bacteria beds for ——. F. Robinson and R. Barrowclough, Mirfield, Yorks. Eng. Pat. 14,198, June 18, 1912.

In bacteria beds of the type where the liquid is distributed over a layer of clinker or the like by means of a rotary sprinkler, the exposed portions of the bed are subjected to the action of heat at suitable intervals of time in order to destroy insects' eggs, maggots, etc. The heat may be obtained from a series of gas burners attached to the rotary sprinkler, the latter also carrying the necessary pipes for the gas supply, or a portable apparatus may be employed. If convenient, radiant heat obtained by electrical means may be used.—W. P. S.

Sludge; Process of drying ——. K. Imhoff, Bredeney, Germany. U.S. Pat. 1,056,548, March 18, 1913.

The sludge is mixed with a substance which renders it capable of retaining bubbles of gas, and a gas is forced into the mass under pressure, or a substance which liberates a gas is added. When the pressure is relieved, the solid portions of the sludge are separated as a spongy mass which floats on the surface of the liquid present; the liquid portion is then drained off so as to leave the sludge in a dry condition.—W. P. S.

Filtering apparatus for water and other liquids. A. J. and P. A. G. Bell, Ravensthorpe, Yorks. Eng. Pat. 18,320, Aug. 9, 1912. Addition to Eng. Pat. 23,906 of 1911 (this J., 1912, 1144).

Scrapers or rakes are fitted by means of hinges to the horizontal arms attached to the central pipe in the apparatus described in the previous specification (*loc. cit.*). The scrapers may be fitted with rollers and may be either solid or hollow; if hollow, they are provided with valves to supply jets of water which aid in cleaning the inner sides of the chamber.—W. P. S.

Water; Apparatus for purifying —— *by heating.* L. Savery-Carlier, Bapaume, France. Eng. Pat. 23,522, Oct. 15, 1912. Under Int. Conv., Oct. 18, 1911. Addition to Eng. Pat. 30,378 of 1910 (this J., 1911, 645).

The vertical pipe, in which the water is treated with steam as described in the previous specification (*loc. cit.*), is closed at its lower end, whilst the upper end carries a closed tank. The latter comprises a separating compartment into which the water falls on issuing from the pipe, and a pure-water compartment, the two compartments being separated by a partition.—W. P. S.

Water; Apparatus for the sterilisation of —— *by means of quartz mercury-vapour lamps immersed in the water.* P. G. Triquet. Third Addition, dated Nov. 18, 1911, to Fr. Pat. 434,069, Nov. 14, 1910 (see this J., 1912, 253, 948, 1198).

Oxidation may be combined with sterilisation in the process and its modifications described previously (*loc. cit.*) by admitting air to the sterilising chamber. The air may be mixed with the water before the latter enters the chamber, or injected into the chamber, preferably at a point near the lamp.—W. P. S.

Water; Process for removing calcium salts from ——. C. A. Meygret. Fr. Pat. 448,386, Sept. 17, 1912.

The water is subjected to the action of a current of electricity whilst passing through a tank or series of tanks containing zinc anodes and carbon cathodes. The water is subsequently filtered.—W. P. S.

Oxychloride of copper in the form of paste specially serviceable in combating vine mildew and other cryptogamic and parasitic diseases of plants ; Process for the preparation of ——. Soc. Elettrica ed Elettrochimica del Caffaro. Fr. Pat. 448,283, Sept. 13, 1912. Under Int. Conv., Sept. 22, 1911.

Very finely powdered slaked lime is added, in small quantities and with continuous stirring, to a solution of copper chloride (47° B., sp. gr. 1·483), until a very thick, almost solid paste is obtained and all the copper is precipitated. The product contains 37·05 per cent. of copper. Other substances, such as arsenates, glucose, etc., may be added, if desired, to increase the activity of the preparation or to facilitate its application.—F. Sodn.

Human or animal bodies or parts of such bodies ; Process for indurating or mummifying ——. P. and G. Fratarcangeli, Frosinome, Italy. Eng. Pat. 6095, March 11, 1912.

The body, after suitable preparation, is washed with water, immersed in oil of turpentine for from 10 to 15 days ; then for 14 days in 96 per cent. alcohol containing 65 grms. of Norwegian tar per litre, next washed with oil of turpentine, dried for 3 days in the shade, and afterwards in the sun. Blood coagulum may be preserved by placing it for 3 days in water, the latter being changed every day, and then immersing it in the alcoholic Norwegian tar solution.—W. P. S.

Effluents ; Apparatus for separating floating matter from ——. R. Schilling, Schöneberg, Germany. U.S. Pat. 1,057,174, March 25, 1913.

See Eng. Pat. 20,179 of 1909 ; this J., 1910, 448.—T. F. B.

Method and apparatus for automatically effecting the separation of the constituents of mixtures [and for purifying water]. Fr. Pat. 448,019. *See* I.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Berberine ; Investigations on ——. M. Freund and others. Annalen, 1913, **397**, 1—117.

A series of papers on berberine and its derivatives. In the first Freund discusses the general results of the investigations on the decomposition of benzyltetrahydroberberine and of R-tetrahydro- and R-dihydro-berberine bases ($R=CH_3$, C_2H_5, $CH(CH_3)_2$, $CH_2{\cdot}CH(CH_3)_2$, $(CH_2)_2{\cdot}CH(CH_3)_2$, C_6H_5, $CH_2{\cdot}C_6H_5$). The other papers contain descriptions of the experimental work, viz. (with K. Fleischer) on derivatives of benzyldihydroberberine, (with H. Commessmann) on methyl- and ethyl-dihydroberberine and their derivatives, (with R. Lachmann) on isopropyldihydroberberine and its derivatives, (with H. Hammel) on isobutyldihydroberberine and its derivatives, (with D. Steinberger) on n-octyl- and isoamyl-dihydroberberine and their derivatives, and (with E. Zorn) on phenyldihydroberberine and its derivatives.—A. S.

Oil of Crithmum maritimum, L. (samphire oil) from Sardinia. A new natural terpene : critmene. L. Francesconi and E. Sernagiotto. Atti R. Accad. dei Lincei Roma, 1913, **22**, I., 231—237, 312—317, 382—386.

The oil was obtained by distillation with steam under a pressure of 2½ atmospheres. The yield from the entire plant was 0·16 per cent. and the oil had the sp. gr. 0·9816 at 29° C., $n_D=1{\cdot}4978$, $[\alpha]_D=+3{\cdot}18°$, saponif. value, 6·50, after acetylation, 11·24, esters, 2·27 per cent. ; combined alcohols, 1·80 per cent. ; free alcohols, 1·30 per cent. On distillation in a slow current of steam at atmospheric pressure the oil was separated into a volatile (51·6 per cent.) and a non-volatile portion (48·4 per cent.). The former consisted chiefly of terpenes : it had the sp. gr. 0·8612, $n_D=1{\cdot}4761$, $[\alpha]_D=5{\cdot}83°$. The oil differs in character from that previously described by Borde and by Délépine (this J., 1909, 623, 906, 1165 ; 1910, 715). Its chief constituents are α-phellandrene, dill-apiols, *p*-cymene, paraffin, and a new terpene, *critmene*, which has been identified as $\Delta^{1{\cdot}7-4{\cdot}8}$-*p*-menthadiene (β-terpinolene). Critmene is optically inactive ; it boils at 178°—180° C. at 759 mm., has the sp. gr. 0·8679 at 12° C., and $n_D=1{\cdot}4806$. It yields two isomeric nitrosochlorides (α, m. pt. 101°—102° C. ; β, m. pt. 104° C.), and nitrolpiperides (both melting at 138° C.), a nitrolbenzylamine derivative (m. pt. 104° C.), a nitrosate (m. pt. 104° C.) and a nitrosite (m. pt. 89° C.).—A. S.

Lower alcohols and their azeotropic mixtures with water ; The vapour pressures of the ——. *Part I. Ethyl alcohol.* R. W. Merriman. Chem. Soc. Proc., 1913, **29**, 68.

Quicklime made from marble was found to be the most efficient drying agent for ethyl alcohol. The density of dry alcohol, determined by the method recently described was found to be 0·80628 at 0°/4° C. The alcohol, at 100° C., has the power of partly dehydrating calcium hydroxide, so that the last fraction in the preparation of dry alcohol should be rejected. The vapour pressures above 14° C. were determined by distilling the dry alcohol through an eight-section Young evaporator column, keeping the pressure constant by means of a manostat (this J., 1911, 769). Below 14° C. another method was used, but the distillation method is the best method for determining vapour pressures if a cold room is available for the lower temperatures. The view was expressed that experimental results should be smoothed by the method of differences, and not by the use of an empirical formula. The boiling point is 78·30° C./760 mm., agreeing with Young's value. Ramsay and Young's values (Phil. Trans., 1886, **177**, i, 155) for the vapour pressures below 30° C. were shown to be somewhat inaccurate, but on being smoothed became almost identical with the results obtained by the author. The vapour-pressure curves of ethyl acetate (Wade and Merriman, this J., 1913, 108) and ethyl alcohol cut each other at a point corresponding with a pressure of 948·1 mm. and a temperature of 84·01° C. The boiling points of the azeotropic mixtures with water were determined, and compared with the boiling points of the pure alcohol. The differences between the two series of boiling points increases with the pressure, as also does the percentage of water.

Reaction of sodium nitroprusside with acetone. Cambi. *See* XXIII.

Patents.

Butadiene and its homologues ; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss, London. Eng. Pat. 3873, Feb. 15, 1912.

A primary or secondary glycol, or a mixture of the two, or a primary-secondary glycol, such as 1.4-, 2.3-, or 1.3-butylene-glycol or 3.4-hexylene-glycol, is treated in such a manner as to remove two molecules of water, the product being butadiene or a homologue. *Example.* 1.3-Butylene-glycol (obtained, for instance, by reduction of aldol) is run into a tube containing fragments of pumice stone saturated with syrupy phosphoric acid ; the tube is situated in a steel jacket heated by gas. The vapours evolved are cooled to remove water, unaltered glycol, unsaturated alcohols, etc., and the uncondensed portion is condensed by pressure or by refrigeration. The process may also be carried out by acting on the glycol or mixture of glycols with two mols. of hydrogen chloride, and subsequently treating the dichloride with alcoholic potash, diethylaniline, soda lime, or similar agent to remove two mols. of hydrogen chloride and form the butadiene.
—T. F. B.

Hypophysis glands; Manufacture of the therapeutically active substance contained in the ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 23,655, Oct. 16, 1912.

An extract of the active (infundibular) portion of the hypophysis is freed from albumin and mixed with one of the usual precipitants for alkaloids, such as phosphotungstic or phosphomolybdic acid, tannin, picric acid, potassium periodide, a mercury, gold, or platinum salt, etc.; the precipitate is washed and separated from its precipitant, and the solution thus obtained is evaporated to the point of crystallisation. For example, the sulphate of the active substance is obtained by washing the precipitate of the phosphotungstate with water containing sulphuric acid, adding barium hydroxide, filtering, neutralising with sulphuric acid, again filtering, and evaporating. The free base is readily soluble in water to an alkaline solution, and soluble with difficulty in alcohol, ether, acetone, ethyl acetate, etc.—T. F. B.

Lecithin; Process of obtaining tasteless and inodorous ——. H. Buer, Cologne, Germany. U.S. Pat. 1,055,514, March 11, 1913.

Finely-powdered and dried raw materials containing lecithin are extracted for a long time with 96 per cent. alcohol, preferably with constant agitation; the alcoholic extract is mixed with 33—35 per cent. by volume of cold aqueous 1—2 per cent. solution of common salt, and the lecithin, which separates after long standing, is freed from the fats, colouring matters, and bitter substances (which remain in solution) by filtration, and dried in a vacuum or other suitable drying apparatus at temperatures below 30° C.—T. F. B.

Phenylallylbarbituric acid. H. Hoerlein, Vohwinkel, and W. Kropp, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,056,793, March 25, 1913.

Phenylallylbarbituric acid, prepared as described in Ger. Pat. 247,952 (this J., 1912, 795), crystallises from water in white leaflets, of m. pt. 154°—155° C. It is a valuable hypnotic.—T. F. B.

Apocynaceae; Preparation of the active principle of the ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 255,537, Oct. 25, 1911.

The plant, if necessary after neutralisation of any free acid contained therein, is extracted with organic solvents, any after-treatment with boiling water or steam being as far as possible excluded. The active principle isolated in this way, crystallises with solvent of crystallisation in colourless, glistening prisms of extremely bitter taste. It begins to sinter at 130° C. and melts to a clear liquid at 135°—140° C. It dissolves with difficulty in cold water, more readily in hot water and in organic solvents. It contains: C 63·5, and H 8·4 per cent.—A. S.

Urea from cyanamide; Process for preparing —— by means of a catalyst. H. Immendorff and H. Kappen. Ger. Pat. 256,524, Dec. 25, 1910. Addition to Ger. Pat. 254,474.

Stannic oxide or chromium hydroxide is used as catalyst in the process described in the principal patent (see Fr. Pat. 433,457; this J., 1912, 257). Ferrous hydroxide, nickel hydroxide, and cobalt hydroxide are not applicable; they only convert the cyanamide into dicyanodiamide. —T. F. B.

Cyclic ketones; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 256,622, Dec. 22, 1911.

When adipic acid or one of its homologues or substitution products is heated, either alone under normal conditions, or under reduced pressure, or in presence of an inert gas; it is converted into the corresponding cyclic ketone. A quantity of lime or other agent facilitating the reaction, less than that corresponding to the amount of acid used, may also be present. The yields are stated to be higher and the products purer than when the calcium salt of adipic acid is submitted to dry distillation.—T. F. B.

Citronellol from geraniol; Process for preparing ——. A. Hesse. Ger. Pat. 256,716, Sept. 27, 1911.

Geraniol, or an essential oil or fraction of an oil containing geraniol, is heated with metallic sodium, either alone or in presence of an indifferent solvent such as a hydrocarbon, and the citronellol is isolated from the product by the usual method. The reaction may be carried out in presence of a current of hydrogen, this being especially desirable during the cooling of the mixture. The yield is stated to be about 70 per cent. The reduction of geraniol by means of hydrogen in presence of nickel or palladium only results in the formation of a saturated alcohol, $C_{10}H_{22}O$.—T. F. B.

Arylalkoxyacetic acids; Process for preparing derivatives of ——. Ges. f. Chem. Industrie in Basel. Ger. Pat. 256,756, July 18, 1911.

Arylalkoxyacetic acids of the formula, R.CH(OX)COOH, where R represents aryl or substituted aryl and X an alkyl, allyl, or aryl radical, are converted by known methods into their amides or ureides. The products are stated to possess valuable hypnotic and sedative properties and low toxicity. The esters of arylalkoxyacetic acids for use in the process may be obtained either by treating arylchloroacetic esters with sodium alcoholate, or by the action of alkyl halides on mandelic acid derivatives in presence of silver oxide.—T. F. B.

Glycollic acid compounds; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 256,858, Jan. 25, 1911.

Compounds of glycollic acid or its derivatives with titanic acid are obtained by the interaction of the two components. To obtain neutral products, the solutions are neutralised with alkalis or alkaline earths or their carbonates. For example, a solution of an acid glycollate readily dissolves freshly precipitated titanic acid. The products are practically colourless and soluble in water; they may be used in dyeing.—T. F. B.

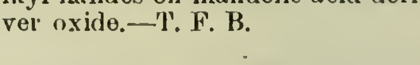
Camphor from borneol and isoborneol; Process for the manufacture of ——. Dr. C. Ruder und Co., Hamburg-Wandsbek, Germany. Eng. Pat. 24,779, Oct. 29, 1912. Under Int. Conv., Dec. 6, 1911.

See Ger. Pat. 250,743 of 1911; this J., 1912, 1054.—T. F. B.

Keto-bases and ketodiamines of the formulæ,

$$CH_3.CO.CH(R).CH_2.N(CH_3)_2$$

and



$$CH_3.CO.C(R){<}\begin{matrix}CH_2.N(CH_3)_2\\CH_2.N(CH_3)_2\end{matrix};$$

Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,963, Nov. 12, 1912. Under Int. Conv., Nov. 16, 1911.

See Ger. Pat. 254,714 of 1911; this J., 1913, 380.—T. F. B.

Tobacco; Method of freeing —— from nicotine. J. Sartig, Nikolasee, Germany, Assignor to Kentucky Tobacco Products Co. U.S. Pat. 1,055,360, March 11, 1913.

See Ger. Pat. 197,159 of 1906; this J., 1908, 592.—T. F. B.

Formaldehyde with sugars; Method of producing compounds of ——. R. Lauch and F. Quade, Assignors to J. A. von Wülfing, Berlin. U.S. Pat. 1,055,405, March 11, 1913.

See Eng. Pat. 15,671 of 1911; this J.; 1912, 843.—T. F. B.

Opium alkaloids ; Preparation of ——. K. F. M. Schaerges (M. Schaerges, trustee), Basle, Switzerland, Assignor to Hoffmann-La Roche Chemical Works, New York. U.S. Pat. 1,056,219, March 18, 1913.

See Eng. Pat. 24,379 of 1909 ; this J., 1910, 1177.—T. F. B.

Pharmaceutical compounds [*amides of iodocinnamic acids*]. W. Hiemenz and W. Kropp, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,056,542, March 18, 1913.

See Ger. Pat. 246,165 of 1910 ; this J., 1912, 605.—T.F.B.

Therapeutical compound [*esters of iodocinnamic acids*]. W. Hiemenz and W. Kropp, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,056,674, March 18, 1913.

See Ger. Pat. 246,165 of 1910 ; this J., 1912, 605.—T.F.B.

Erythrene and isoprene ; Processes of producing ——. G. Merling and H. Köhler, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,056,814, 1,056,815, 1,056,816, and 1,056,817, March 25, 1913.

See Eng. Pat. 19,919 of 1911 ; this J., 1912, 701.—T. F. B.

Isoprene ; Production of ——. K. Stephan, Charlottenburg, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,057,680, April 1, 1913.

See Fr. Pat. 438,789 of 1912 ; this J., 1912, 604.—T. F. B.

Alkylsulphites of amino-substituted pyrazolones and process of making same. M. Bockmühl and G. Ebert, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,056,881, March 25, 1913.

See Eng. Pat. 15,658 of 1912 ; this J., 1912, 1147.—T.F.B.

Glycoheptonic acid ; Manufacture of ——. A. Liebrecht, Frankfort, Assignor to G. Rosenfeld, Breslau, Germany. U.S. Pat. 1,057,437, April 1, 1913.

See Ger. Pat. 245,267 of 1911 ; this J., 1912, 557.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Quinol and sulphite ; Simultaneous oxidation of —— *by atmospheric oxygen.* J. Pinnow. Z. Elektrochem., 1913, 19, 262—268. (See also this J., 1913, 214.)

Even very small quantities of sodium quinoldisulphonate have a pronounced protective influence upon sodium sulphite solutions against atmospheric oxidation. This effect is also produced by glycerin, and the two substances can assist each other in this respect. In the presence of copper ions, the rate of oxidation of sulphite and of sulphite-quinol solutions is considerably increased, and in the mixed solution the presence of the copper ion produces a change in the ratio of sulphite oxidised to quinol oxidised. This change is in the direction of greater oxidation of quinol. The effect of the copper salt on the rate of oxidation may be counteracted to some extent by the use of sodium quinoldisulphonate, but the ratio of sulphite to quinol oxidised is not restored to its original value. This ratio, in fact, as well as the velocity of oxidation is largely dependent on the hydroxyl-ion concentration of the solution, which is in turn affected to some extent during oxidation by the diminution in quinol and the formation of quinolmonosulphonate. The improvement in developing qualities which is undergone by a sulphite-quinol solution on keeping is not due to the accumulation of sulphite by complex formation, but to the presence of quinolmonosulphonate.—W. H. P.

Quinonesulphonic acid ; Action of hydrochloric acid on ——. A. Seyewetz. Comptes rend., 1913, **156**, 901—903.

When quinonesulphonic acid (in the form of its sodium salt) is treated with concentrated hydrochloric acid at temperatures below 20° C., a chloroquinolsulphonic acid is formed. The sodium salt is readily soluble in cold water ; it reduces silver nitrate solution instantaneously, and in presence of alkali constitutes a powerful photographic developer ; its alkaline solutions are much more stable towards air than alkaline solutions of quinol. On the other hand, if quinonesulphonic acid is treated with hydrochloric acid at temperatures above 20° C., the sulphonic group is replaced by chlorine, and a mixture of monochloroquinol (m. pt. 104° C.) and dichloroquinol (OH : OH : Cl : Cl = 1 : 4 : 2 : 6 ; m. pt. 165° C.) is produced.—T. F. B.

Patents.

Colour photography. G. S. Whitfield, Watford. Eng. Pat. 5144, Feb. 29, 1912.

A weakly-coloured screen which registers with the original colour record negative or positive, is applied to a temporary support, coated with emulsion, and the coated side is placed in contact and in register with the original colour negative or positive ; exposure is made by passing light through the negative or positive, the film and screen are separated from the original, developed, fixed, and transferred to paper or other opaque support, with the screen uppermost ; the picture is then seen by reflected light.—T. F. B.

Film-screens with adjacent polychrome elements for colour photography, and their manufacture. L. Dufay. First Addition, dated Dec. 2, 1911, to Fr. Pat. 442,881, June 30, 1911 (this J., 1912, 1008).

The following modifications are made in the process described in the principal patent :—The celluloid film may be provided with an undulated surface on one or both sides, and by any process of pressure, rolling, or stamping, at any temperature. The screen can be formed of transparent coloured elements of suitable size, commingled in the fatty substance used for coating the celluloid. The celluloid may be coated on one side with the three primary colours and on the other with the complementary colours, forming a six-colour screen.—T. F. B.

Photographic paper ; Preparation of ——. Union Photographique Industrielle (Etabl. Lumière et Jougla Réunis). Fr. Pat. 448,624, Dec. 1, 1911.

Paper is immersed in a solution of a soluble chloride, bromide, or iodide, dried, and treated with a solution of silver nitrate. Then, in place of the usual finishing with gelatin or starch, the paper is treated with a reagent which will close the pores, such as a solution of sulphuric acid or caustic soda, or an ammoniacal cupric oxide solution : the paper is finally neutralised and washed. The tones of the resulting prints are said to be brighter and more vigorous than those obtained on the ordinary " printing out " papers.—T. F. B.

Protective covering for [*photographic*] *films and the like ; Process for preparing a* ——. C. Düren. Fr. Pat. 448,869, Sept. 30, 1912.

Celluloid solution (six parts) is mixed with shellac (three parts) and camphor (one part) and dissolved in a suitable solvent, *e.g.*, amyl alcohol (ten parts) ; this solution is applied to photographic films, etc., to form a protective covering.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Cellulose nitrates; Unstable products in ——. E. Berl and M. Delpy. Z. ges. Schiess- und Sprengstoffw., 1913, **8**, 129—130.

It is a common practice in continental factories to use alcohol for displacing water from wet nitrocotton. The authors have examined the residue remaining after the recovery of the alcohol by distillation. It is a brown powder containing traces of iron oxide, and calcium and sodium salts from the water used during the process of stabilisation. The original material exploded, when heated to 173° C., and contained 5·68 per cent. of nitrogen. When purified, by dissolving in alcohol and precipitating in water containing either ammonium chloride or dilute hydrochloric acid, a brown product was obtained which exploded at 162° C. Two-thirds of this latter body was soluble in ether, and this portion had a molecular weight of 1188, a nitrogen content of 10 per cent., and it exploded at 174° C. The alkaline saponification ratio of "nitrate nitrogen" to "nitrite nitrogen" was 4 to 1, whilst nitrocotton and nitroglycerin have a corresponding ratio of 1 to 2. The portion insoluble in ether was of a violet colour. It had a nitrogen content of 9·45 per cent., and exploded at 157° C. When from 10 to 20 parts of either product were added to 100 parts of stable nitrocellulose (which exploded at 181·5° C.) the point of explosion of the mixture lay between 180° C. and 182° C. Consequently, the authors point out that the temperature of explosion of nitrocellulose is no indication of its freedom from unstable bodies, in view of the fact, stated above, that such large proportions of unstable bodies, exploding at so low a temperature as 157° C., can be mixed with stable nitrocellulose without affecting the temperature of explosion.—G. W. McD.

Nitroglycerin; Denitration of the residual acids in the manufacture of ——. H. Lemaitre. Monit. Scient., 1913, **3**, 217—231.

The acids are allowed to pass down a denitrating tower, along with weak nitric acid (sp. gr. 1·11—1·16); at the base of the tower is admitted steam, superheated to as high a temperature as possible (with a leaden injector 250°—300° C. will be the maximum practicable temperature; a cast-iron injector might be used up to say 400° C.), or, in place of that, the vapours from the latter part of the apparatus for concentrating the denitrated acid, at 200° C., together with hot air. The weak nitric acid serves to supply some of the water needed for denitration, whilst the heat absorbed by the distillation of its nitric acid serves to keep the temperature of the upper part of the tower low, and thus enables the sulphuric acid to retain the water, which does not come over and dilute the distilled nitric acid. The recovered nitric acid distilled from the tower should be of sp. gr. 1·36—1·38. The sulphuric acid flowing from the base of the tower still contains 2·5 to 3·0 per cent. of nitrosulphonic acid, and enough water to allow of this being removed by heat alone. It is introduced into a concentrating apparatus of porcelain or quartz basins, divided into two parts. In the first part the nitrous gases are expelled, and collected in two condensing towers; the second is heated by a furnace, but also has a current of air at 300° C. blown into it, which carries the vapours of water and sulphuric acid, evolved during the concentration, into the denitrating tower. Not only is this arrangement very economical in fuel and labour, but the recovery of nitric acid (the final sulphuric acid contains less than 0·5 per cent. of nitrosulphonic acid) is much more nearly complete than in the ordinary process.—J. T. D.

Safety explosives; The testing of ——. V. B. Lewes. J. Roy. Soc. Arts, 1913, **61**, 521—532.

In 1896 the requirements of the Coal Mines Regulation Act led to the erection of a testing station at Woolwich, where all shots were fired with stemming. The gallery was 2 ft. 6 ins. in diameter and an explosive mixture of coal gas and air was used. A Home Office memorandum was issued in May 1912, revising the tests for explosives for inclusion in the Permitted List after March 31, 1913. A new testing station has been erected at Rotherham. The comparative dimensions of the Belgium gallery at Frameries, and the Rotherham gallery are as follows:—

	Frameries.	Rotherham.
Sectional area of gallery	2 sq. m. (5·25 ft. diam.)	1·8 sq. m. (5 ft. diam.)
Length of gallery	30 metres (98·7 ft.)	15·2 metres (50 ft.)
Material	wood	iron
Length of cannon bore	46 cm. (1·5 ft.)	120 cm. (4 ft.)
Diameter of cannon bore	5·5 cm. (2 ins.)	5·5 cm. (2 ins.)

At the Rotherham gallery the capacity of the chamber containing the explosive mixture of coal gas and air is 354 cb. ft., and the proportion of coal gas in the mixture is 13·5 per cent. At both Rotherham and Frameries the proportionate weight of dust and air in the gallery is approximately 10 per cent.; but, as the dust is raised by the explosive wave, the percentage present in the path of the outrush of heated products is probably far higher. In the coal dust test 120 oz. of dust are used. 40 oz. are spread on a board in the first 10 ft. in front of the cannon, whilst the remaining 80 oz. are placed in heaps in the remaining 40 ft. of the gallery, so that when the shot is fired, the rush of the products of combustion stirs up the dust cloud. The coal dust used at Rotherham is ground so as to pass through a 150-mesh sieve. An analysis gave the following results: Moisture, 2·4; volatile matter, 29·6; fixed carbon, 65·41, and ash, 3·94 per cent. The ignition point was 400° C. The cartridges used have to be 1⅜ ins. diameter with an allowance of 1/16 in. so that the cartridge only occupies half the sectional area of the bore. In the Rotherham test no tamping is used, but the charges are fired direct into the explosive mixture of coal gas and air, and also into finely divided coal dust suspended in air. The largest charge which fails to detonate either mixture, over a series of five shots is known as the "maximum charge," and this must not be less than 8 oz. (226·8 grms.). The German law requires that only "safety explosives" shall be used in mines liable to gas or dust, and leaves to the mine owners the onus of finding out what a "safety explosive" is, and this was the origin of the unstemmed shot. At the International Congress of Applied Chemistry at Berlin in 1903, Watteyne of the Frameries Station in Belgium, suggested that, as every explosive when fired unstemmed into a mixture of gas and air would cause ignition if the charges were only large enough, the largest charge which, in a given number of shots, fails to ignite the mixture, should be called the *charge limite*. This afforded a method for arranging explosives in the order of danger, and it seemed certain that an explosive which passed the test with a high *charge limite* would not only be safer, but that, if the *charge limite* was not exceeded, even a blown-out shot in a gassy mine would not be liable to cause disaster. It has been found that a mixture of coal dust and air alone is often more sensitive than when gas is present. Although the results of tests at each individual gallery are fairly concordant, no two galleries agree in the weight of the maximum charge assigned to various explosives, and, although the order of safety is much the same in various galleries, yet the determined maximum charge for any given explosive may vary by 50 per cent. at two different testing stations. These variations are due to a large number of factors. The shape and section of the gallery, the dimensions and bore of the gun, the percentage and character of the gas used in making the mixture, the warming of the gallery by sun, the composition, size, and freshness of the coal dust used, and even the atmospheric conditions, are all factors influencing the test, apart from the explosive itself. The check on the free expansion of the products of combustion by diminution of the area in the gallery does not affect all classes of explosives alike. As at Rotherham, the cartridges only occupy half the sectional area of the bore, an unstemmed shot, under these conditions, in no way represents a blown-out shot in practice. Using a cannon with a bore of 2¼ ins., Boyling has pointed out that an explosive which gave off carbon monoxide on explosion, when fired in cartridges of 1$\frac{3}{8}$ ins. diameter, passed the test with a maximum charge of 1000 grms., because the products, expanded in the bore, are cooled to such an extent that, when discharged into the mixtures, neither gas nor dust is ignited. When the cartridges were fired in a narrow bore of 1·57 ins., which they nearly fitted, 735 grms. ignited gas and 130 grms. ignited dust, because the carbon monoxide was blown out at a temperature high enough to ignite on coming in contact with air, and thus ignited the dust. The bore of the Rotherham cannon is much longer than that of the Frameries cannon, and it is considered that this must give rise to differences, as the increase in the length of the bore increases the length of the flash from the cannon. The great mass of metal conducts the heat away rapidly from the products of combustion. Using an explosive which will pass only with a maximum charge of 8 oz., the cartridge occupies only the bottom 7 or 8 ins. of the bore and has over 3 ft. of cold metal surface to cool the products before they reach the dust mixtures. On the other hand, an explosive which has a big maximum charge nearly fills the cannon, and the top of the charge and detonator fire direct into the mixture without the cooling help of the metallic contact, so that, to a certain extent, a dangerous explosive is favoured, and a safe one penalised. Reference is made to experiments at Rotherham, which seemed to show that the barometric pressure had considerable influence upon the test, as two explosives which, on one occasion, proved safe with 32 oz. and 30 oz. charges, with a barometric pressure of 29·3 ins., failed to pass the test on the subsequent day when the barometric pressure was 30·2 ins. The author points out that the liberation of considerable quantities of oxygen by an explosive must make the test more sensitive, and that this is probably the chief reason why the maximum charge in such explosives is reduced when fired in the dust test, as compared with the gas test. It is considered, however, that it is only when the explosive liberates more than 15 grms. of uncombined oxygen per 100 grms. fired that the maximum charge is affected. Other types of explosives liberate large quantities of carbon monoxide. The products of explosion, as well as the dust mixture itself, thus contain combustible gas, and, as it is already heated up far above its ignition point, it needs only instantaneous contact with air to produce flame. There is no period of delayed combustion to allow cooling to give safety, and for this reason, as well as on account of its poisonous nature, explosives yielding large percentages of carbon monoxide should, in the author's opinion, be looked upon with suspicion.—G. W. McD.

Flameless powder; Experiments with —— in Holland. S. Schilderman. Z. ges. Schiess- und Sprengstoffw., 1913, **8**, 126—128.

Using nitroglycerin-nitrocellulose flake powder manufactured for field guns and howitzers, experiments were carried out to observe the effect on smoke and muzzle flame of the addition of various ingredients. The original powder showed marked muzzle flame, but practically no smoke. The addition of 2 parts of potassium carbonate and 5 parts of vaseline diminished the muzzle flame very markedly, but produced heavy smoke. By the addition of 5 per cent. of sodium resinate only weak muzzle flame was observed, but there was again considerable smoke. With 5 parts of calcium resinate there was a fair amount of muzzle flame and considerable smoke. The use of 5 parts of potassium bicarbonate, or 6 parts of sodium resinate and 2 parts of lead chromate had the effect of practically eliminating muzzle flame, but there was a very marked quantity of smoke.
—G. W. McD.

Accident which occurred in I_3, a large dynamite cartridging hut in factory 2, British South African Explosives Company's Works, Modderfontein, on the 24th Sept., 1912. Major A. B. Denne, Chief Inspector of Explosives, Union of South Africa.

Six native workers were killed as the result of this explosion. The explosive in the building was dynamite 2D. A sample taken from a similar batch of explosive had the following composition:—Nitroglycerin (44·17 parts), nitrocotton (0·30), sodium nitrate (37·86), sodium carbonate (0·20), woodmeal (15·71), and moisture (1·27 parts), and the heat test was over 45 minutes. There were 154 lb. of explosive in the building. There were two tables in the building, on each of which was bolted down with brass nuts and bolts a diamond-shaped trough, at the extremities of whose longer axis the two cartridge fillers worked. The trough, which was made of hard wood, was 4$\frac{3}{4}$ in. deep along its major axis, whilst at the extremity of its minor axis the depth was 3$\frac{5}{8}$ in. only, thus assisting the flow of the dynamite in the direction required by the two "pick boys," as they are locally termed. The trough had two holes at the ends of its major axis and, screwed on from below, were two brass nozzles of the size required to take the "paper shell" rolled by the "wrapping" boys. The working portion of the brass nozzle was prolonged through the trough bottom up to the edge of the top, to ensure that the stick, with which the "pick boys" fill these cartridges, could not possibly strike on anything but a smooth surface. With the stick the worker pushes the dynamite into the paper wrapper. Whilst there was nothing to regulate the amount of force used by the worker beyond what may be called the stickiness or resistance of flow of the particular grade of dynamite, and the worker's own experience in cartridging, there was no possibility of dynamite being severely pushed or forced, except between the wood and brass. The dynamite, 2D, is fairly sensitive. Experiments with a falling weight of 1 kilo. in the Lentz machine resulted in detonation occurring, on an average, at the following distances. Guhr dynamite (10—15 cm.), dynamite 2D, 45 per cent. (20 cm.), dynamite 2B, 35 per cent. (25—30 cm.), and coal dynamite (100—200 cm.). It is considered that the accident originated in the trough of the machine and that probably undue force, or some impurity in the shape of grit, may have caused the ignition of a small particle of dynamite between the striking surfaces. The greatest care was taken in the factory to eliminate foreign matter from the ingredients which were to be mixed with the gelatin.—G. W. McD.

PATENTS.

Explosives. W. Fairweather, London. From Dynamit A.-G., vorm. A. Nobel und Co., Hamburg, Germany. Eng. Pat. 2407, Jan. 30, 1912.

In charging shells, etc., with trinitrotoluene or picric acid, it is usual to have the priming charge of lesser density than the main bursting charge, in order to facilitate transmission of detonation, as it has been found that trinitrotoluene or picric acid, when compressed to their highest practicable density, will not develop their maximum power unless such a charge of lesser density be interposed between the main charge and the means of initial impulse. A column of explosive of less than highest density, when subjected to great firing strain, is liable to be compressed until its maximum density is reached. Such compression, however, involves movement of the explosive in the casing, accompanied by considerable friction, which may cause ignition of the explosive. It has been found that such sensitive, highly shattering explosives, as tetranitromethylaniline, tetranitroaniline, and lead azide, even when they are compressed to their highest density, retain their property of detonating by means of the initial impulse.—G. W. McD.

Explosives. S. Adde, Grängesberg, Sweden. Eng. Pat. 13,373, June 6, 1912. Under Int. Conv., June 8, 1911.

The liquid constituent in the mother-lye remaining from the crystallisation of nitro-derivatives of xylol, cumol, and benzol, is gelatinised with nitrocellulose. When this body is added to explosives containing nitroglycerin it very considerably reduces their liability to freezing. It is stated that the liquid nitro-compounds mentioned above freeze at lower temperatures than the liquid nitrotoluenes which are commonly used in the manufacture of nitroglycerin plastic explosives to prevent freezing. The following example of a suitable composition is given:—Nitroxylol (20 parts), nitroglycerin (5), nitrocellulose (1), ammonium nitrate (32), ammonium perchlorate (40), and ferrosilicon (2 parts).—G. W. McD.

Explosive [from waste lyes from cellulose manufacture] and method of manufacturing same. F Raschig, Ludwigshafen-am-Rhine, Germany. Eng. Pat. 29,696, Dec. 24, 1912. Addition to Eng. Pat. 11,568, May 15, 1912 (see Fr. Pat. 441,419 ; this J., 1912, 845).

Potassium or sodium nitrate is mixed with the waste lyes coming from the manufacture of cellulose by the sulphite, or soda process. The liquid then flows on to highly heated revolving rollers whereby almost immediate evaporation to dryness is obtained without any separation of the ingredients of the mixture. The dry material when scraped from the rollers is immediately ready for use and can be pressed in the dry state. The following are given as examples of this explosive. (1) Sodium nitrate (68 per cent.), dry matter from either sulphite or soda cellulose waste lyes (32 per cent.). (2) Potassium nitrate (70 per cent.), dry matter from sulphite cellulose waste lyes (30 per cent.).—G. W. McD.

Explosive. R. Imperiali, Brescia, Italy. U.S. Pat. 1,054,777, March 4, 1913.

A mixture of an oxidising agent and an alloy of tungsten, aluminium, and silicon.—G. W. McD.

Explosive. L. G. M. Adinau, San Francisco, Cal., Assignor to L. Adinau Co. U.S. Pat. 1,056,389, March 18, 1913.

The explosive consists of : barium nitrate 69·30, trinitrotoluene 28·70, and lead chromate, 2·00 parts.—W. H. C.

Explosives. A. Nodon. Fr. Pat. 448,732, Dec. 4, 1911.

Liquid carbon compounds, such as alcohol, glycerin, benzene, and petrol, are mixed with kieselguhr or powdered pumice, and a hard grain is formed by incorporating with either pitch or paraffin. Liquid oxygen, contained in a brass cylinder, is placed in another double-walled brass cylinder, the space between the double walls of the outer cylinder being packed with felt or glass wool. The grains of kieselguhr, saturated with alcohol and pitch, are packed into the case round the cylinder containing the liquid oxygen. Immediately before use the cylinder is punctured, and after the liquid oxygen has distributed itself through the carbonaceous material, the charge is exploded by a detonator. A strong explosive is composed of : alcohol (31 parts), kieselguhr (25), and liquid oxygen (44 parts). A weaker explosive is prepared by adding 15 parts of water to the alcohol.—G. W. McD.

Detonating fuse. E. Burkard, Potsdam, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 1,049,665 and 1,049,666, Jan. 7, 1913.

Detonating fuse containing either trinitromethylaniline or trinitrochlorbenzol.—G. W. McD.

Detonating compositions for rim and central fire cartridges. W. Meyer. Second Addition, dated Sept. 7, 1912, to Fr. Pat. 435,049, Sept. 23, 1911 (this J., 1912, 303, 410).

The compositions consist of (*a*) mercury fulminate (25 parts), barium nitrate (35), antimony sulphide (15), barium chromate (4), barnim silicide (15), and powdered glass (6 parts) ; (*b*) mercury fulminate (20 parts), barium nitrate (40), antimony sulphide (20), calcium silicide (10), and lead peroxide (10 parts). It is stated that the addition of the silicides of the alkaline earths renders the action of the detonating fuse much more certain.—G. W. McD.

Explosive and process of producing same. F. Raschig, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,056,365, March 18, 1913.

See Fr. Pat. 440,625 of 1912 ; this J., 1912, 845.—T. F. B.

Explosive ; Sulphite-waste —. Continuous process for producing explosives. F. Raschig, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,056,366 and 1,056,367, March 18, 1913.

See Fr. Pat. 441,419 of 1912 ; this J., 1912, 845.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Ferrous sulphate monohydrate and its use in volumetric analysis. D. Florentin. Bull. Soc. Chim., 1913, **13**, 362—366.

The author recommends ferrous sulphate monohydrate as a substance for the standardisation of permanganate solution. It is easily obtained by adding 200 c.c. of 50 per cent. sulphuric acid to 400 grms. of re-crystallised ferrous sulphate, heating on the water-bath, and filtering off the white crystalline powder which separates. This is washed successively with 96 per cent. alcohol and anhydrous acetone and ether, and dried *in vacuo*. The monohydrate thus obtained is non-hygroscopic and does not undergo oxidation under ordinary conditions of storage. It dissolves readily in warm acidulated water.—A. S.

Calcium ; Determination of —— as tungstate. A. Saint-Sernin. Comptes rend., 1913, **156**, 1019—1020.

When a boiling ammoniacal solution of calcium chloride is treated with excess of a 20 per cent. solution of normal sodium tungstate, a heavy crystalline precipitate of calcium tungstate, $CaWO_4$, is formed. This is washed several times by decantation and then on a tared filter with hot water and dried at 100° C. The weight multiplied by 0·1944 or 0·1393 gives the quantity of lime or calcium respectively. Magnesium tungstate is soluble in water, and the method is thus suitable for the separation of calcium and magnesium and for the determination of calcium in hydraulic lime and cements.—A. S.

Fehling's solution ; The photosensitiveness of ——. A. Leighton. J. Phys. Chem., 1913, **17**, 205—210.

It has long been known that Fehling's solution is reduced spontaneously by the action of light. The most sensitive mixture is composed of 15 c.c. of Rochelle salt solution (200 grms. in 400 c.c.), 2·5 c.c. of copper sulphate solution (40 grms. in 200 c.c.) and 10 c.c. of sodium hydroxide solution (20 grms. in 200 c.c.). This solution was exposed to daylight, and showed perceptible reduction in 2 days. Experiments were then made with various ray-filters, with the result that it was established that the active rays are situated only in the ultra-violet portion of the spectrum. A 1 per cent. solution of quinine sulphate acidified with sulphuric acid or a 0·12 per cent. solution of tartrazine completely protects the Fehling's solution from the reducing action of sunlight. From these data it is calculated that there is a maximum sensitiveness of Fehling's solution to rays of wave-length between 400 and 350 $\mu\mu$; there is also a strong optical absorption of rays over this range when light is filtered through a layer of Fehling's solution. The failure of the red and yellow rays to cause a reduction of Fehling's solution seemed at first to be in disagreement with the generalisation that all radiations which are absorbed by a substance tend to eliminate that substance. But although the influence of the red rays is not sufficiently powerful to reduce Fehling's solution under normal circumstances, it was found that with the addition of a suitable quantity of reducing substance, incapable of itself reducing Fehling's solution in the dark, the red rays readily produced the effect necessary to determine reduction. Such a reducing agent was obtained by the addition of 0·0045 grm. of quinol to the above quantity of Fehling's solution, reduction being observed after 15 hours' exposure to red light filtered through potassium bichromate solution, but no reduction taking place in the dark. The latent influence of the red rays, according to the above generalisation, is thus demonstrated.—J. F. B.

Sodium nitroprusside ; Reaction of —— with acetone. L. Cambi. Atti. R. Accad. dei Lincei, Roma, 1913, **22**, I., 376—381.

According to Hofmann (Annalen, 1900, **312**, 1), sodium nitroprusside by the action of alkali is converted into sodium nitritoferropentacyanide, but as this does not give a colour reaction with acetone, the coloured substance produced in Legal's reaction for acetone by means of sodium nitroprusside and alkali (see this J., 1892, 846)

must be formed before the nitroprusside is converted into nitritoferropentacyanide. The final reaction product in Legal's reaction is hydrated sodium ferropentacyanide, $Na_3Fe(CN)_5,H_2O$, and it is probable that, in the first place, complex ions are formed containing, in addition to the $Fe(CN)_5$ group, a product formed by the condensation of the NO-group of the nitroprusside with the ketone. In agreement with this view it is pointed out that all ketones which give Legal's reaction contain the CH_2CO group, which is known to give isonitroso-derivatives with nitrous acid and alkyl nitrites. The complex ions mentioned above would yield, by fission, nitrogenous derivatives, chiefly isonitroso-derivatives, of the ketones, and the author was able to detect the isonitroso-derivatives of acetone and acetophenone in the reaction products from these ketones and in the products of decomposition of the coloured substances produced from the ketones in the first place by the action of sodium nitroprusside and alkali.
—A. S.

Examination of sulphuric acid for petroleum refining. Schulz. *See* IIa.

Studies on cellulose. Parker. *See* V.

Analysis of bauxite. Martin. *See* VII.

Radiations from uranium solutions and determination of radium by a radioactive method. Michiels. *See* VII.

Sources of error in the platinum assay. St. Rainer. *See* X.

Determination of mercury as metal by the dry method. Cumming and MacLeod. *See* X.

Theoretical basis of Polenske's "difference values" of fats. Bömer and Limprich. *See* XII.

Detection of pine oil in oil of turpentine. Utz. *See* XIII.

Determination of the viscosity of rubber solutions. Fol. *See* XIV.

Invert sugar and methods of determining sugar in the beetroot. Saillard. *See* XVII.

Determination of water in cane molasses. Pellet. *See* XVII.

Choice of solvent and method of cold extraction for the determination of hop bitter substances. Seibriger. *See* XVIII.

Direct determination of water in foods, etc., by distillation. Michel. *See* XIXa.

Determination of formic acid in foods. Fincke. *See* XIXa.

Behaviour of calcium and magnesium salts with soap solutions, and the determination of hardness of water. Masters and Smith. *See* XIXb.

Determining nitrites in potable waters. Lombard. *See* XIXb.

Colourimetric determination of small quantities of manganese in water. Haas. *See* XIXb.

PATENTS.

Combustible gases; Detectors of——. A. Philip and L. J. Steele, Portsmouth. Eng. Pats. 27,281, Dec. 5, 1911; 1469, Jan. 18, and 15,677, July 4, 1912.

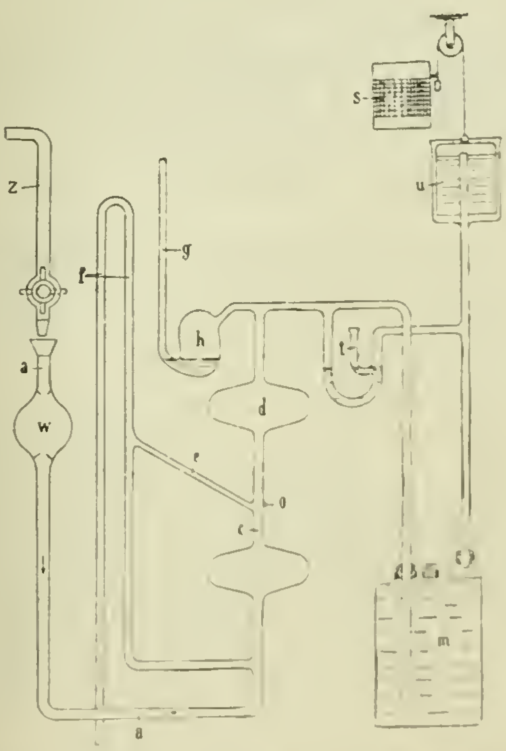
The patents relate to apparatus in which a wire is adapted to be heated by the catalytic combustion of the combustible gases in the atmosphere tested, and to give an indication by electrical means, such apparatus being described in Eng. Pats. 22,129 of 1906 and 5142 of 1910 (see this J., 1907, 1212). The apparatus is in a portable form, and the wire is arranged in a relatively large chamber which can be filled with the atmosphere to be tested so that the wire takes its supply by natural draught from this sample atmosphere and is unaffected by draughts in the mine, or by fluctuations in the supply. In a modification, the casing containing the wire has lateral openings at top and bottom at the same side, leading to a similar chamber through which the mine air passes. The wire constitutes a Wheatstone bridge, two of the arms being catalytically active. The indicator consists of a portable galvanometer, and the apparatus may be connected up with the battery of a miner's lamp.—A. T. L.

Combustible gases; Detectors of——. A. Philip and L. J. Steele, Portsmouth. Eng. Pats. 3002, 4003 and 4004 of 1913, dates of appl., Dec. 5, 1911, Jan. 18, and July 4, 1912.

In portable apparatus using the current from a miner's lamp, as described in the preceding abstract, the E.M.F. of the current varies and the strength of the current is so limited that special arrangements must be made in order to obtain the necessary sensitiveness. A variable resistance is provided in series with the battery, and is adjusted before making a test, so that a standard current is obtained through the bridge; for this purpose the connections are arranged so that this current is indicated by a deflection of the galvanometer, the catalytic wires being in a shunt circuit through which only a small current passes which does not heat the wires to the temperature at which they are active. The resistance having been adjusted, the current from the battery is caused to flow through the bridge in order to test the gas. The active and inactive wires of the bridge are so chosen as regards their length, section, specific resistance, temperature coefficient and emissivity, that over a small range, a given change of voltage will cause the same percentage change of resistance in each. For this purpose a catalytic wire of platinum or palladium may be coated electrolytically, for example with gold, to vary its emissivity or to render it inactive, or it may be kept at a temperature at which it is inactive. Catalytic wires of a porous nature may be used, made by squirting an alloy or a mixture of the powdered metal and a binder, as in the manufacture of lamp filaments.—A. T. L.

Gases; Apparatus for analysing——. O. Hüfner, Friedenau, Germany. Eng. Pat. 11,679, May 16, 1912.

In an automatic recording apparatus for analysing flue gases, etc., by means of absorption, in which the gas to be tested is alternately sucked into a holder, *d*, by means of a hydraulic pumping device and discharged into an absorption vessel, *m*, and automatic recorder, *u*, the volume of the gas sample is maintained constant and the pressure is maintained at atmospheric by means of an equalisation tube, *e*, connected at the zero point, *o*, of the



holder, *d*, and leading into the siphon, *f*. When the siphon discharges, an excess of flue gas is drawn through the holder, *d*, and passes through the tube, *c*, into the siphon which becomes filled with flue gas at atmospheric pressure, after which water from the supply pipe, *a*, rises in the tube, *c*, and cuts off the required volume of gas on reaching the point, *o*. An enlargement, *w*, is provided in the pipe, *a*, to render the apparatus independent of fluctuations of pressure in the water-supply pipe, *z*. The unabsorbed gas from the recording vessel, *u*, is discharged through the U-tube, *t*.—H. H.

Gas or gaseous mixture; Apparatus for automatically analysing a —— volumetrically and recording the same. F. K. Woodroffe, Liverpool, and H. W. Boultbee, Whitby, Cheshire. Eng. Pat. 5039, Feb. 29, 1912.

The apparatus comprises a multiple mechanically driven cam wheel, a pump, a multiple stop-cock or valve, a carbon dioxide absorption apparatus, and a valve recording apparatus with rotating drum. The cam wheel drives the pump and rotates the stop-cock by means of ratchet gear. By a suitable arrangement of the projections on the cam wheel the gas is sucked into the pump, brought to atmospheric pressure, driven to the absorber, and then measured. —G. W. McD.

Calorimeter. J. R. Bibbins, Assignor to The Colonial Trust Co., Pittsburgh, Pa. U.S. Pat. 1,055,699, March 11, 1913.

The thermal units developed in the calorimeter are indicated by an electrical device, which consists of a variable resistance in combination with a source of constant potential. The variation in the resistance, which consists of a tube containing at one end a liquid of high resistance and at the other a liquid of lower resistance, is obtained by altering the relative proportions of the two resisting liquids and this is effected by means of sensitive liquid thermometers.—W. H. C.

Gas-analysing apparatus. L. Sanders, Assignor to Sarco Fuel Saving and Engineering Co., New York. U.S. Pat. 1,055,420, March 11, 1913.

See Eng. Pat. 1683 of 1911; this J., 1912, 560.—T. F. B.

Albuminimeter. A. Kwilecki, Breslau, Germany. U.S. Pat. 1,056,913, March 25, 1913.

See Eng. Pat. 14,720 of 1911; this J., 1911, 1093.—T. F. B.

Testing hardness; Apparatus for ——. J. Kirner, Stuttgart, Assignor to Norma Compagnie G. m. b. H., Cannstatt-Stuttgart, Germany. U.S. Pat. 1,057,850, April 1, 1913.

See Eng. Pat. 28,283 of 1910; this J., 1911, 714.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Enzyme action; Reversibility of ——. Emulsin and β-methylglucoside. E. Bourquelot and E. Verdon. Comptes rend., 1913, **156**, 957—959.

If equimolecular solutions of (1) dextrose, and (2) β-methylglucoside, in aqueous methyl alcohol, are treated with emulsin, a condition of equilibrium is finally attained, the same in both cases. Hence the reversible action of emulsin, which has already been demonstrated as regards β-ethylglucoside (see this J., 1912, 739 and 800), is now proven for β-methylglucoside. The stronger the aqueous methyl alcohol employed, the higher is the proportion of glucoside to dextrose in the equilibrium mixture. Variation of the quantity of emulsin used, has no influence on the final state of equilibrium, but affects the rate at which it is attained.—J. H. L.

Iron bacterium; A new ——. E. M. Mumford. Chem. Soc. Proc., 1913, **29**, 79.

A new bacillus has been isolated from the Bridgewater Canal tunnels at Worsley, Lancashire. The bacillus designated by the laboratory number, M7, exerts a specific action on solutions containing iron. The organism is a facultative ærobe, and the action on iron solutions varies as the conditions are ærobic or anærobic. Under ærobic conditions the iron in solution, whether ferrous or ferric, is precipitated as ferric hydroxide. Under anærobic conditions neither ferrous nor ferric solutions are precipitated, but ferric hydroxide already precipitated biologically or chemically is dehydrated and reduced to bog-ore. In Nature these two actions are symbiotic, and are probably the cause of the deposits of bog-ore hitherto attributed to higher bacteria alone. An enzyme has been separated from the organism by the usual methods, and all the chemical reactions of the living organism have been reproduced by the enzyme. The optimum of the enzyme is 70° C. Neither the specific action of the organism on iron solutions nor the enzyme are produced in the absence of nitrogen in the medium. The enzyme is a complex substance containing amino-groups, but the basicity of the enzyme to acids bears no relation to the precipitating power. The organism is a short, round-ended bacillus, 2 microns by 0·4 micron in size. It exhibits a varying motility and forms endospores and involution forms. It grows well on ordinary media, the growth of greenish-brown nodules on potato being characteristic.

Books Received.

Proceedings of the Twenty-eighth Annual Convention of the Association of Official Agricultural Chemists, held at Washington, D.C., Nov. 20—22, 1911. Edited by H. W. Wiley, with the collaboration of A. L. Pierce. U.S. Dept. Agric., Bureau of Chemistry, Bull. 152, Oct. 9, 1912. Government Printing Office, Washington. 1912.

This volume, 9¼ by 5$\frac{13}{16}$ ins., contains the reports of the referees, etc., the recommendations and resolutions of the Association, the President's address, a list of the officers and referees of the Association for 1911—1912, and an alphabetical index. It contains 254 pages of subject matter and 4 illustrations.

Tests of Structural Timbers. By McGarvey Cline and A. L. Heim. U.S. Dept. Agric., Forest Service, Bull. 108, Sept. 23, 1912. Government Printing Office, Washington. 1912.

A volume, 9¼ by 5$\frac{13}{16}$ ins., containing 123 pages of subject matter, 29 illustrations in the text, and 7 plates. It deals with tests of the longleaf pine (*Pinus palustris*), the shortleaf pine (*P. echinata*), the loblolly pine (*P. taeda*), the Douglas fir (*Pseudotsuga taxifolia*), the western hemlock (*Tsuga heterophylla*), the western larch (*Larix occidentalis*), the redwood (*Sequoia sempervirens*), the Norway pine (*P. resinosa*), the tamarack (*Larix laricina*), and the red and white spruce (*Picea rubens and canadensis*).

Traité de Chimie Minérale. Par H. Erdmann. Directeur de l'Institut de Chimie Minérale de la Technische Hochschule de Berlin. Ouvrage traduit sur la 5 édition allemande, par A. Corvisy, Tome Premier. Introduction à la Chimie et Métalloïdes. Librairie Scientifique A. Hermann et Fils. 6, rue de la Sorbonne, 6. Paris, (Ve), 1913. Price 12 fr.

Volume (9⅝ by 6⅛ ins.), containing 551 pages of subject matter with 243 illustrations and 2 coloured plates, also a table of contents. The classification of the text is as follows: Part I. Introduction. I. Preliminary notions as to number, measure, and weight. II. The three states of aggregation. III. Calorific energy, molecular movement, and gaseous pressure. Measurement of temperatures. IV. Conductivity and ionisation. V. Nature of chemical change, and the fundamental laws involved. VI. Atomic and molecular theory. VII. Methods of determining atomic and molecular weights. VIII. Volumetric relations in the combination of gaseous elements. IX. Valency and affinity. X. Regular forms of solids. Part II. Metalloids. I. General properties and classification. II. Principal gases (O, H, N,). III. Rare gases (He, Ne, Ar, Kr, Xe). IV. Sulphur group. V. Halogens. VI. Phosphorus group. VII. Carbon group, including germanium.

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Canadian Section.

Meeting held at Kingston on Friday, February 28th, 1913.

PROF. W. L. GOODWIN IN THE CHAIR.

THE MANUFACTURE OF SULPHITE PULP.

BY F. M. WILLIAMS.

The writer has investigated the availability of woods, other than spruce and hemlock, for sulphite pulp making, and it is to be noted that several of these offer considerable promise. Hardly an issue of the technical trade papers passes without mentioning some new raw material for paper making, such as bagasse or sugar cane refuse, waste flax, cactus fibre, bamboo, cotton seeds hulls, corn stalks, etc., but in my opinion none of these materials, which must necessarily be gathered in loose form, will ever be available commercially, at the present prices of paper, so long as it is possible to obtain cellulose in the compact form in which it is found in a spruce log, which may be felled and floated hundreds of miles, if necessary, to the mill.

The next raw material essential to the manufacture of sulphite pulp is "lime." Only in certain localities is "lime" found of proper type, which contains a sufficiently high percentage, say 38—40 per cent. of magnesium oxide. Ordinary building lime or high calcium lime will not answer, for the reason that in the cooking process the sulphite bases are largely converted into sulphates. Calcium sulphate, being an insoluble compound, is not easily washed out of the pulp and also clogs up the acid system, while magnesium sulphate being soluble does not give this trouble. Soda and other bases have been used, but the cost is prohibitive compared with that of lime and magnesia. Canadian magnesite deposits will undoubtedly become available for this purpose. It will be necessary, however, to develop this industry under favourable conditions of mining and transportation in order to reduce the cost of the calcined magnesia to somewhere near $6.00 per ton at the mill, to compete with the present magnesian lime.

Sulphur, the next item in the list of raw materials, was for years almost exclusively imported from Sicily, but now a large proportion is obtained from Louisiana. Beyond a comparatively high water content at times, which must be watched by the sulphite pulp manufacturer, this sulphur is of remarkable purity, averaging about 99·5 per cent. pure.

Briefly the manufacture of sulphite pulp consists in cooking the chipped wood in a suitable container, called a digester, in a sulphurous acid solution of lime and magnesia. This operation dissolves the resinous and ligneous constituents of the wood which hold the fibre or cellulose together, the fibre remaining as soft pulp after removal of the soluble material by washing.

The successive steps in the manufacture of sulphite pulp may be enumerated as follows: Preparation of the wood, acid making, cooking, washing, screening and lapping.

Preparation of the wood.—The stick or log is first cut upon gang saws or slashers into 2-ft. lengths. In the case of peeled wood the bark is removed by hand while green. In the case of "rossed" wood the bark is removed by holding the 2-ft. stick against the face of a revolving disk barker. During this operation the stick itself is revolved either by hand or by an automatic attachment. Portions of the bark, deeply ingrowing, should be cut out by hand, otherwise there is a large waste of wood in going to the necessary depths upon the barker, for at best, the waste in rossing or barking is enormous, averaging as high as from 20—35 per cent. of the total wood. Several types of barkers have been designed with a view to reducing this enormous rossing loss, among which might be mentioned the Green Bay barker, in which the knives instead of being placed upon the flat side of the revolving disk are placed upon the edge and as the wood is moved forward and at the same time rotated in contact with these edge-knives, the irregularities of surface are followed. Peeled wood, however, while not showing so large a waste, brings from $1.50 to $2.00 a cord less than the "rossed" wood for the reason that the sap underneath the bark quickly discolours and stains upon exposure to the atmosphere.

Too much cannot be said of the importance of cleanliness in the preparation of the wood, if it is desired to make a high-grade pulp. The dirt from the black butt end of a stick or rotten heart will never be removed from the pulp by any process of cooking or screening, and will spoil more good paper than that stick was worth. It is a popular idea among some manufacturers that dirty methods may prevail in the wood-room and by relying upon the screens afterwards to remove the dirt, clean pulp may be made: this is not true.

The next step in the preparation of the wood is reducing it to chips. In this operation the stick is held endwise and diagonally against the face of a revolving disk with knives so placed as to reduce to chips of from $\frac{1}{2}$ to $\frac{3}{4}$ in. in length. From the chipper the chips are conveyed usually by means of a belt conveyor to the chip-bin located at the top of the sulphite mill and over the digesters.

Acid making.—This, as noted above, is a solution of the bisulphites of calcium and magnesium containing free sulphurous acid. The sulphur dioxide is obtained by burning either sulphur or iron pyrites. Sulphur, although more expensive, is more generally used in Canada that pyrites.

However, in foreign countries, for example, Germany and Sweden, pyrites has for some time been successfully used. The advantages in favour of sulphur are that it is much easier to obtain a stronger and more uniform acid. However, several companies in the United States are now burning pyrites successfully and, I believe, with marked economy over sulphur. Probably the last and most practical form of burner is that designed and installed by the Pyrites Engineering Co., of Carthage, N.Y., which consists of a rotary cylindrical tube burner with an auxiliary sulphur burner, the latter to be used only with lean pyrites ore which is not self-burning. This type of burner used in connection with a special form of tower absorption system shows excellent promise, and where installed is giving satisfaction and showing marked economy.

The original form of sulphur burner was of the low flat type receiving its oxygen for combustion upon the surface. With the entrance of Louisiana sulphur into the field it was found that the flat burner did not give the best results owing to the tendency of an oily film to form upon the surface, thereby retarding combustion. To overcome this objection several rotary burners have come into general use, the best known of these being the Stebbins and the Trombley-Paul burners.

Careful chemical supervision and control of the burner gases is essential, as the highest efficiency of any type of burner can only be obtained by careful regulation of the air supply, based upon regular analyses of the gas delivered. I have often found the burner gases to contain only 7 per cent. of sulphur dioxide, which, by proper regulation of the dampers and firing conditions, was easily brought up to 15 per cent.

An excessive amount of air used in burning the sulphur produces sulphuric anhydride, which causes much trouble in liming or clogging the acid system and digesters with insoluble sulphates. Too little air, on the other hand, will result in volatilisation of the sulphur.

The gas after leaving the burner is first air-cooled by passing through a stack or line of cast-iron pipe, after which it is further cooled by passing through lead pipes surrounded by water from which the gas passes to the absorption system.

There are three general types of absorption systems, the continuous, the intermittent or dumping system, and the tower system. In the continuous system the gas is admitted at the bottom of a series of tanks, or, in the case of the Barker system, compartments in a single tank, into which a solution of slaked magnesium lime or milk is introduced. The rate of flow of incoming lime-water and outgoing finished acid are under such relative control as to produce continuously a cooking acid of desired strength.

Of the intermittent or dumping systems, one type comprised three tanks on successive levels so that the lime water contained in the top tank will flow by gravity into the lower tanks in the descending series. The make-up or bottom tank is filled with lime water to the proper level, this tank being provided with an agitator; the gas is admitted at the bottom and caused to pass into the solution by means of a vacuum pump connected with the outlet of the second tank. The gas is in this way admitted until the solution clears and shows the proper strength by test, after which it is pumped over to the storage tank. The lower tank is again filled to proper level from the upper tank with the solution which has become partially saturated with gas which has escaped absorption in the previous make, and the operation is now repeated. One of the latest developments in the construction of acid systems is that recently brought out by the Stebbins Engineering Co., built of reinforced concrete, thereby overcoming the trouble due to leakage and decay of wooden tanks. It has a high absorption efficiency due to the fact that a series of baffle-plates, placed in a horizontal plane and extending the full width of the tank, cause the gas to pass in a thin sheet up through the lime water.

The third and last type of acid system, known as the tower system, consists of one or more towers from 60 to 100 ft. or more in height filled with limestone. The cooled gas from the burner is admitted to the bottom, while a shower of water enters at the top, and the sulphurous acid formed reacts with the stone giving the desired bisulphite solution. In the tower system recently designed by the Pyrites Engineering Co., and installed at the Hinckley Fibre Company's plant, the tower constructed of reinforced concrete is made in nine compartments arranged in series. By pumping the weaker acid from the first absorption to the top of the second compartment and so on, it is possible to obtain an acid of any desired strength.

The advantages of the tower acid system compared with the lime water systems lie in the fact that unburned stone may be used instead of calcined lime, also much less power is used by the centrifugal pressure pump to force the gas up through the towers than is used by the high pressure vacuum pumps necessary to draw the gas through the lime water absorption tanks.

After making the acid by any of the systems above described it is pumped over into a storage tank where it is further enriched by the addition of gas given off from the digester during the process of cooking.

The composition of the acid used in cooking by the quick cook process varies somewhat in different mills, but the following may be taken as a typical analysis:—Lime, 0·98 per cent.; sulphur dioxide, free, 2·65 per cent., combined 1·15 per cent.

Cooking.—There are two general processes of cooking, one known as the quick cook process of making sulphite and the other the slow cook or Mitscherlich process. Modern practice usually combines elements of both.

The digesters in which the pulp is cooked are upright steel shells of varying diameters up to 16 or 18 ft. and from 40 to 50 ft. high with conical ends and flanged openings at the top upon which the cover is securely bolted.

The proper lining of the digester, while apparently a simple detail in itself, has given more trouble and caused more serious thought than any other point in the manufacture of sulphite pulp. Formerly the common practice was to line the entire interior of the digester with lead, inside which an acid resisting brick and cement course was laid. In addition to the lead lining being an expensive and a laborious operation, it was found not entirely satisfactory, as the lead would creep and buckle from the effect of the changes in temperature to which it was exposed. It has been found thoroughly practical to do away with the lead lining by first laying up a course of acid proof brick with cement composed of litharge and glycerin. This method of lining a digester has been the subject of much litigation and forms the basis of the well known Russell digester-lining cases.

In the first or quick cook process the digester is filled with chips, the acid or bisulphite solution run in until the digester is filled, after which direct steam is admitted gradually, with the relief valve at the top of the digester, partially opened until a pressure of 75 to 80 lb. is obtained. The operation is continued from 7—9 hours or until the wood is throughly disintegrated, after which a valve is opened at the bottom of the digester and the pulp is blown into large tanks with perforated false bottoms, known as blow-pits, and washed with a hose from the top.

The resinous or ligneous matter of the wood which has been rendered soluble by the cooking operation is drained and washed in the blow-pits and is known as waste liquor. There is an enormous quantity of this material, as the cellulose portions of the wood form only about 50 per cent. of its total composition and the writer's own experience has shown this waste liquor to contain about ¾ of a lb. of soluble resinous ligneous material and mineral matter per gallon of liquor.

After draining and washing in the blow-pits, sufficient water is added to reduce the pulp to such a consistency that it will pass through a pipe either to a storage tank or directly upon the screens, which are made up of horizontal brass or bronze plates perforated with narrow slits 0·009 inch to 0·014 inch wide. Formerly these screen boxes were placed horizontally, but the more modern screens are slightly inclined doing away with the necessity of hand or mechanical scraping to remove the coarse material which will not pass the screens.

After screening, the pulp is run to a storage or stock chest and is then pumped to the wet machine, where by passing between press rolls upon a felt, sufficient water is removed to form a sheet containing from 60 to 65 per cent. of moisture. The sheet of pulp is now folded into bundles or laps and is ready for use in the manufacture of paper. For economy in freight and transport, especially upon long hauls, or for export, the moist pulp is run over a series of dryers which reduces the moisture content to practically the air-dry basis. Dry pulp for shipment to other countries is usually perforated or mutilated in order to avoid the customs classification of manufactured paper or pulp board.

The proper and accurate determination of the moisture in wet pulp is an important matter, as millions of dollars' worth of this commodity are usually bought and sold with settlements based upon the air-dry content. The slipshod methods of testing prevailing in some mills are criminal and it is not surprising to find constant friction between buyer and seller over moisture tests.

The proper selection of an average sample from the lap is important. A strip should be cut the entire width of the press roll, as this eliminates error due to unequal pressure at the ends as well as those due to crowns and grooves in the rolls. The number of samples taken from a car should be large enough to give a fair average and should be at least at the rate of one sample per ton of pulp. The samples should be weighed immediately after taking or placed in air tight containers. The scales for weighing the samples should be accurate to within 0·1 per cent. of the weight taken. Scales are often used in pulp testing upon which it was impossible to weigh closer than within 2 per cent. of the truth.

Drying the samples should be a very simple operation in a properly constructed oven, regulated to maintain a temperature of from 212° to 220° F. The author has seen pulp in process of drying on the dirty floor under the sulphur burners, over the steam boilers, on top of the office radiator, and samples burnt on one side and wet on the other leaning against the old box stove. On the other hand, in many mills accurate scales and modern ovens have been installed and proper attention is given to this important matter of testing.

In the Mitscherlich or slow process the digester, which may be either horizontal or vertical, is heated by indirect steam passing through coils of lead or copper pipe suitably arranged inside. This process has the advantage of better control of the strength of the acid during cooking since it is not diluted by the condensation from the steam. A weaker acid is used and longer chips; in some cases in good German practice, these are 2 in. in length. The time required by the Mitscherlich process was usually 48 hrs., but it has been quite materially shortened, especially in American mills. The operating conditions of one of the largest Mitscherlich mills in Germany are as follows;

Cooking Acid.

	per cent.
Total sulphur dioxide	4·4
Free ,, ,,	2·66
Combined ,, ,,	1·74
Lime	1·52

Length of chips crushed, 2 in.
Preliminary steaming of chips, 1 hour.
Time required to bring steam in coils to desired pressure, 8 hours.
Total cooking time, 24 hours.
Cooking temperature, 266° to 270° F.
Pressure 50 lb.

The digesters are not blown out but are allowed to cool sufficiently so that they may be openend at the bottom and the pulp forked out by hand. This operation of cooling and removal of the pulp requires about 8 hrs. making a total time consumed of from 32–36 hours per cook. The pulp after cooking is drained, washed, screened and lapped in a manner similar to that described above under the quick cook process.

In comparing the quick cook with the Mitscherlich process it is found that Mitscherlich pulp possesses a degree of strength of fibre which it is impossible to obtain by the quick cook process.

The manufacture of sulphite pulp has grown to an enormous industry. It still has its problems, many of which we trust will be solved in the near future. Some of these already mentioned may be summaried as follows:—Permanence of supply of suitable wood, minimising rossing losses, more perfect control of cooking conditions, and lastly and most important of all, the profitable utilization of the waste liquor.

Meeting held at Montreal, on Friday, March 28th, 1913.

PROF. R. F. RUTTAN IN THE CHAIR.

MODERN SHOE POLISHES AND DRESSINGS.

BY DR. J. T. DONALD.

Dressings.—This term includes all preparations used in cleaning or renovating boots and shoes where friction is not employed, whether the result be a gloss or not.

By far the most important and widely used dressing is "Ladies' dressing," so called because of its very general use on women's and children's foot wear of kid and goat leathers. This is essentially a coloured solution of shellac, borax or an alkali being the solvent and Nigrosin the colouring agent; a little glycerin is usually added to prevent cracking of the lac and to preserve the softness of the leather. When applied with a sponge, there is left on drying a thin coating of coloured shellac having a soft and pleasing gloss.

When a solution of soap is added to "Ladies' dressing," the soap overcomes the gloss of the shellac and the preparation is now "Gun metal dressing." This in the language of the trade "does not dry bright but gives to the article a dull gun-metal finish."

Patent leather dressing.—This is usually simply an oil such as olive or cotton-seed under some high sounding name, or vaseline, or a white wax reduced to a soft paste by means of turpentine. The application of any of these with a soft cloth brightens the gloss of the leather but has no effect upon cracks in the enamel, which are so troublesome in this style of leather.

For these there is a special preparation of guncotton in solution in amyl acetate coloured with a spirit-soluble black dye. On the evaporation of the solvent there is left an elastic pad of cotton filling the crack and adhering to the edges.

Nappy dressing for use on ooze, suede, nappy and castor leathers.—This is wood alcohol having in solution a colour insoluble in water. The alcohol cleans the nap of the leather and on evaporation leaves a deposit of colouring matter which, being insoluble in water, does not markedly soil damp garments.

White leather, as in military belts, claims a dressing for itself. The pipe clay of our forefathers is still in use, sometimes alone and sometimes in admixture with light magnesium carbonate. The mixture gives a lighter and more pleasing white than does the clay alone.

Another article is zinc oxide suspended in water containing a small percentage of an adhesive. This is applied by a sponge and in drying leaves a layer of the white pigment. By mixing with the white solids a small percentage of such substances as lampblack, umber, red and yellow ochre, we have preparations for canvas shoes of various colours.

Polishes.—These constitute by far the most important part of the output of a factory both in volume and money value.

The shoe polish almost universally used a generation ago, was made by mixing together some form of bone charcoal, sulphuric acid, neatsfoot or other oil, and molasses or other form of sugar syrup. The carbon imbedded in a paste of sulphate of lime was the chief factor in the polish developed by friction. Modern shoe polishes are prepared along entirely different lines, waxes being the bodies responsible for the polish or gloss.

For ordinary leathers, the requirements of a good shoe polish are, that it shall give a high gloss with a moderate friction, shall not be sticky or hold dust, shall be waterproof, and shall not soil clothing that may come in contact with the shoes.

Carnauba wax with its hardness and high melting point is the basis of modern friction polishes. The cheaper candelilla wax may to a certain extent replace the carnauba with but little difference in the quality of the polish.

There are two chief methods for working these waxes into polish:—The wax is emulsified by boiling in a solution of borax. The product is known as white stock. If polish is to be in the form of paste, the white stock while hot is mixed with a hot solution of ordinary laundry soap and sufficient Nigrosin to give the desired depth of colour. The mixture cools as a soft paste that may readily be applied by means of a brush or sponge. If the polish is desired in the liquid form, the best grade of Castille soap is used; a solution of this variety of soap does not gelatinise. Numerous trials have shown that no matter how dilute the soap solution—a satisfactory liquid cannot be obtained unless Castille soap is used. Both the paste and liquid forms are widely used. With a moderate friction, the hard waxes held upon the leather by the soap, give a beautiful and very desirable polish.

The second method of dealing with the hard waxes is as follows:—Carnauba or candelilla or a mixture of the two with beeswax and ceresin or paraffin is dissolved in hot turpentine and mixed with very finely pulverised bone charcoal. When properly cooled there results a firm paste that spreads rapidly under a brush or sponge. When this mixture is poured into boxes it must be promptly cooled, otherwise there is a separation of the harder waxes from the solvent, the result being a granular sloppy mass instead of the firm paste desired. If the harder waxes alone were used it would be difficult to prevent separation from the turpentine on cooling, hence the admixture of softer waxes. Beeswax gives also a toughness or lack of shortness to the paste and a smooth finish that cannot be obtained without it. These softer waxes reduce the gloss available from the carnauba or candelilla. The use of bone black as a colouring agent is an attempt to overcome the weakness inherent in the use of the softer waxes and to add to the gloss obtainable from the waxes that obtained by friction of the bone carbon.

For tan leathers the same goods are used except that a brown or yellow dye and pigment replace the Nigrosin and bone char. The application of the tan polish is frequently preceded by the use of a cleaning solution to remove stains and discolouration.

A popular cleaner is a mucilage of gum tragacanth containing a small percentage of oxalic acid. So remarkable is the power of tragacanth to hold water that this article, in appearance a thick cream, is 97 per cent. water, gum and acid constituting the remainder.

Liverpool Section.

Meeting held at the University, on Wednesday, February 12th, 1913.

PROF. F. G. DONNAN IN THE CHAIR.

CHEMISTRY APPLIED TO COAL MINING.

BY DR. JOHN HARGER.

Coals are conglomerates of four classes of substances, humus bodies, resin bodies, carbon residuum, and hydrocarbons.

	Approximate composition. C	H	O	Calorific power in Calories	Calorific intensity in air.
Humus bodies .	63	5·0	32	6470—6490	2670° C.
Resin bodies ..	79	10·0	11	9120—9140	2250° C.
Carbon residuum	95·7	2·5	1·5	8670—8680	
Hydrocarbons .	n	2n + 2	—	12,000	

The properties of a coal, and, to a certain extent, the danger or safety of a coal mine, depend upon the relative proportion of these four constituents. At present it is only possible to estimate each of these constituents approximately. An approximation to the humus bodies can be obtained by an estimation of the hygroscopic moisture in the air-dried coal, taken together with the amount of oxygen and other constituents. The true resin bodies can be estimated by extraction with pyridine.

The composition of firedamps and more especially of the inflammable part of them is of great importance, the present method prescribed by the Home Office being only correct when the inflammable gas is pure methane. The method is briefly as follows: The carbon dioxide is first estimated by absorption; the inflammable gas is then burnt by passage over a hot platinum spiral, the contraction is measured and the carbon dioxide formed is absorbed. The volume of inflammable gas is taken to be half the contraction and equal to the volume of the carbon dioxide formed.

The assumption that the inflammable gas is always pure methane is quite incorrect. It is true that most of it is methane and in some firedamps there appears to be no other inflammable gas. But gas is given off from coal for months after it is mined, and in mines where a large quantity of coal is left in the goafs a considerable quantity of firedamp comes off therefrom. In many cases the author has found large quantities of heavy hydrocarbons in this firedamp.

In a sample of air containing 2½ per cent. of inflammable gas, 5 per cent. of ethane in the latter might pass undetected by the present method of analysis. A mixture of equal volumes of hydrogen and ethane behaves on combustion with air in exactly the same way as pure methane, *i.e.*, the contraction is twice the volume of the carbon dioxide formed. Also a mixture of two volumes of ethylene and 1·33 volumes of hydrogen gives exactly the same volume changes.

All these gases, methane, ethane, ethylene, and hydrogen, have been found in firedamps by Playfair, Bischoff, Wheeler, and others, whilst from some coal dusts Bedson has sucked off inflammable gas in which the value for n in the formula C_nH_{2n+2} was as high as 4·4.

A mine atmosphere containing 2½ per cent. of pure methane, in the author's opinion, may be regarded as quite safe if coal dust is absent, but one with 2½ per cent. of firedamp containing hydrogen, ethylene, or heavy hydrocarbons may be explosive, even without dust.

A few examples of analyses of firedamp from the same mine on different days and from several different places are shown in the table. It will be seen that generally there is an indication of the presence of higher hydrocarbons, and in No. 12 of hydrogen. Recently results quite similar to those given in the table were found in another mine, while in a third (a new mine with practically no goaf) the figures agree for pure methane or for a mixture in which the higher hydrocarbons, if present, are balanced by some hydrogen.

No. of analysis.	Contraction on combustion.	CO_2 formed.	Ratio, contraction : CO_2.
1	0·515	0·262	1·97
2	0·394	0·199	1·98
3	0·407	0·203	2·00
4	0·476	0·238	2·00
5	0·420	0·216	1·94
6	0·143	0·073	1·96
7	0·553	0·282	1·96
8	0·484	0·241	2·00
9	0·424	0·224	1·90
10	0·151	0·076	1·99
11	0·631	0·336	1·88
12	0·520	0·220	2·36
13	0·776	0·402	1·93
14	0·240	0·122	1·97
15	0·142	0·080	1·77
16	0·130	0·077	1·69
17	0·153	0·081	1·89
18	0·464	0·253	1·83
19	0·410	0·212	1·93
20	0·372	0·197	1·89

Numerous experiments have been made on gases sucked from coals from various seams. The coal in each case was put, at the fresh coal face, into a small bottle which was then closed by a rubber bung having a hole filled with a glass rod. At the laboratory the glass rod was pushed in by a tube having a mercury luted stop-cock; the tube was sealed on to a Töpler pump and after the rubber stopper, etc., had been luted with mercury the bottle was exhausted. The gas was pumped off from time to time until practically no more came.

In one experiment the first sample of gas obtained, after absorption of carbon dioxide, showed on combustion 28·3 per cent. contraction and 18·0 per cent. carbon dioxide formed. The gas was diluted with fresh air for analysis.

If it is assumed that the inflammable gas was methane the contraction would indicate 14·15 per cent., and the carbon dioxide formed 18.00 per cent.—a difference of 3·85. A later sample from the same experiment similarly indicated from the contraction 12·35 per cent. methane, and from the carbon dioxide formed 13·80 per cent.—a difference of 1·45.

By the following method it is possible with the Haldane apparatus to estimate the actual volume of inflammable gas without making any assumption as to its composition. First, in one portion of the sample estimate the carbon dioxide and oxygen, and note the volume of residual inflammable gas + nitrogen. Next, in a fresh portion of the sample, estimate the carbon dioxide; burn the inflammable gas, absorb first the carbon dioxide formed, and then the residual oxygen, and note the volume of the residual nitrogen. From (1) the inflammable gas + nitrogen and from (2) the nitrogen, the volume of inflammable gas is ascertained. By this method one also finds the amount of oxygen used, which is very important as a check on the other figures. The actual volume of the inflammable gas and the carbon dioxide formed having been ascertained, the average value of it in the formula C_nH_{2n+2}, or other formula, can be calculated, since two volumes of hydrocarbon give two volumes of carbon dioxide on combustion, when it contains one atom of carbon in the molecule, four volumes when it contains two atoms in the molecule, etc.

An improved new method of estimating the inflammable gas which has been worked out is as follows :—The carbon dioxide and oxygen are first estimated and the residual mixture of nitrogen and inflammable gas is driven into the combustion pipette. The latter contains, instead of the simple platinum spiral, one covered with copper oxide. The spiral is heated by an electric current in the usual way, and the inflammable gas is thus converted into carbon dioxide and water. The volume is measured, the carbon dioxide is absorbed and the volume again noted. The reduced copper is re-oxidised by introducing some air and heating the wire. The air is then removed from the pipette which is washed out with nitrogen ready for the next test.

In gas analysis apparatus which is in regular use, all rubber connections between the cocks and pipettes should be done away with and the tubes sealed together. Such apparatus will be less troublesome in the end and more reliable, as numerous possible sources of leakage are removed.

A large number of experiments were made with various catalytic substances for the preparation of inert gas free from carbon monoxide. It was found that bog iron ore is a very strong catalyst, and in presence of a small quantity of oxygen effects the combustion of the last traces of carbon monoxide to carbon dioxide at a temperature of 200° C. or over. Below 200° there is some action but too slow to be of practical use. Incidentally it was found that a mixture of hydrogen and air, when passed over bog iron ore, burnt at a temperature of 100° C. and slowly at even lower temperatures. It is possible to use bog iron ore instead of palladium preparations in gas analysis.

With copper oxide, in the absence of air, carbon monoxide is burnt at temperatures below 100° ; hydrogen at one or two degrees above 100° C. and rapidly at 150° C., while methane is apparently untouched at these temperatures. The use of copper oxide at 150° C. is suggested for removing hydrogen from methane when the latter is required pure and also for estimating hydrogen in presence of methane. The use of bog iron ore and copper oxide for removing traces of carbon monoxide on the large scale is described by the author in T.I.M.E., Vol. XLIV., Pt. 2 " Gob-fires and the Prevention of Gob-fires in Mines."

The temperature of ignition of methane and air mixtures is about 650°—700° C. (Dixon and Coward). If a calculation of the calorific intensity of 2½ per cent. methane in air is made the result is about this figure (650°—700° C.). But one cannot light such a mixture with a flame or make it burn with an electric spark ; it is only when the percentage of methane reaches 5½ that the mixture becomes inflammable, when the percentage of methane reaches 13 the mixture again becomes non-inflammable *per se.* Although there is still over 18 per cent. of oxygen in the mixture, the excess of methane inhibits the reaction.

The presence of carbon dioxide in moderate amount does not appear to influence the combustion of liquid, gaseous, or solid combustibles, but in certain cases it does seem to exercise a profound influence on the *starting* of such combustions. The effect is far out of proportion to the dilution, and is not explicable by reference to specific heats or other similar data. It may be due, at least partially, to the property of absorption of radiant heat possessed by carbon dioxide and methane. Tyndall gives the relative absorptive powers for radiant heat of various gases as follows, viz. :—Oxygen 1, nitrogen 1, hydrogen 1, chlorine 39, carbon dioxide 90, methane 403, ethylene 970, ammonia 1195, water about 5000.

In some experiments with coal dust it was observed that 1 volume of carbon dioxide had as great a retarding effect on the starting of ignition as 12 volumes of nitrogen, but once combustion had started the carbon dioxide appeared to have very little, if any, more effect than an equal volume of nitrogen.

DISCUSSION.

Professor E. C. C. BALY said that the author had stated that the presence of hydrogen and higher hydrocarbons in mine air would not be accurately estimated by the Haldane apparatus. If, however, one studied Dr. Harger's own figures, and worked out the difference which would result if the gas were pure methane or the mixture which gave the most divergent results, the percentage difference would only change from 3·1 per cent. to 2·89 per cent., a variation which did not seem to be very serious from the point of view of mine ventilation. A second point was that considerable discrepancies arose from the dirty state of the apparatus. In fact the dirtier the apparatus the greater the variation. From his experience of analysis of 300 to 400 samples of mine air, he found that the higher the methane content, the more nearly was the carbon dioxide absorption equal to half the contraction. With a perfectly clean apparatus and a high methane content one figure was almost exactly double the other. It did not seem to matter very much, so long as the gas was an explosive one, whether it was pure methane or methane mixed with some hydrogen or higher hydrocarbon. The only difference it might make in the working of the Act was that the limits of gas allowed might have to be modified. Finally, with regard to Dr. Harger's figures connecting absorptive power and radiant heat surely there must be more modern results than those given by Tyndall. Angström, Coblentz, and others must have used considerably more accurate apparatus and their results must be correspondingly more valuable. The figures, especially those for carbon dioxide and water, certainly seemed to require modification.

Mr. W. H. PATTERSON asked whether the pyridine used in the separation was the means of separating the two resinous products mentioned in the tables of coal analysis. What evidence was there for this separation taking place ? Figures obtained by himself for extractions were inconsistent with a simple separation by the solvent action of pyridine, and a separation of two resinous products of which one combined with, and the other was dissolved by pyridine, would account for this.

Mr. A. CAREY asked whether Dr. Harger had done any work on the action of bog iron ore on flue gases in an actual boiler ? Also if the respective catalytic actions of bog iron ore and bauxite had been compared ?

Mr. H. B. STOCKS asked whether the action of phenol and terpineol as well as pyridine for dissolving out the resinous products of coal had been tried. Acetone might also be worth trying.

Dr. A. HOLT asked, with regard to the gas which came off from coal, if the coal completely lost that gas or was there some left which could be pumped off afterwards ? Did the coal dust re-absorb the gas to any extent, or in other words, could this be called a reversible process ? Secondly, with regard to the dust itself, did the hydrocarbons condense on its surface ? If so, was it this condensed hydrocarbon which started the explosion ? Had any experiments been made on this subject ?

Mr. R. E. SLADE said that he believed that if there were some gases which did not come off at 100°, probably these gases were adsorbed. Carbon would adsorb carbon dioxide at 500° and 600° C.

Dr. HARGER, in reply, thought Professor Baly had missed the point, because the behaviour of pure methane was so different to that of hydrogen and the higher hydrocarbons. Hydrogen, when present in comparatively small quantities, acted as a trigger and caused the mixture to ignite instantly. Methane was the most stable of all the paraffin hydrocarbons. Supposing that the limit allowed were 5½ per cent. of methane ; this would be non-explosive, but a corresponding amount of ethane (2½ per cent.) was very dangerous. As to the extraction by pyridine, his figures were not from his own experiments, but other people's work, but he had no doubt that it was the resinous portion that the pyridine extracted. The difficulty was that the analyses were not to be relied upon, as the pyridine, besides extracting certain resinous matters, united with the residue, and until this product had been split up no very definite conclusions could be drawn. He believed that every other solvent had been tried, and apparently none were of any use. If, however, the action of terpineol had not been studied thoroughly Mr. Patterson might try this. The evolution of gas seemed to stop after a week, and then, if the coal were raised to 100° C., the gas came off in volumes. The gases occluded by coal dust were of the greatest importance because it was the oxygen and the hydrocarbons which were the most readily occluded and which were the most dangerous. It did not really matter whether the absorption of the gases in coal were called adsorption or occlusion.

London Section.

Meeting held at Burlington House, on Monday, April 7th, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

PRODUCTION OF HYDROGEN FROM WATER AND COAL FROM CELLULOSE AT HIGH TEMPERATURES AND PRESSURES.

BY DR. F. BERGIUS.

The progress of chemical knowledge has very often been caused by the progress of experimental possibilities and the improvement of experimental methods. Thus the chemistry of high temperature grew up after the introduction of electrical methods into the chemical laboratory. By electrical methods chemists were enabled easily to produce high temperatures. At the same time the electrical and optical methods of measuring these temperatures were so much refined that the handling of high temperature experiments ceased to be a difficult task.

The laboratory results were soon made use of in technical work and now we have a large industry, based upon the methods of electrical heating.

If we adopt this methodical point of view it will be observed that there is noticeable progress in every science, whenever new methods and a new instrument is introduced. I may refer to the combustion furnace in organic chemistry, to the optical methods, refractometry, and spectroscopy, to the measurement of electrolytic conductivity, to the method of producing high temperatures, to the liquefaction of gases and the production of low temperatures. One of the most recent methods introduced into the laboratory is that of handling very high pressures conveniently and without danger.

It is this subject to which I wish to call attention here, not merely because some very promising results have been obtained already during the last few years, but also because I am convinced that many important results will be obtained through this experimental method.

Chemical reactions under pressures higher than that of the atmosphere are not unknown in the laboratory and in chemical industry, but these efforts are characterised by their purely qualitative nature and the limited extent to which the pressure could be raised. The former was due to the lack of appreciation of the extent to which chemical reactions may be influenced by pressure, and this in general led to a mere attempt at raising the temperature of a liquid component of a chemical reaction above its boiling point. The second restriction lay in the inadequacy of technique and in the construction of the retaining vessels.

Now the principles of modern physical chemistry teach us that besides this application of pressure so often employed there are other ways of influencing chemical reactions by means of pressure. For instance, the law of mass action tells us when and in what direction an equilibrium will be changed by an increase of concentration, that is of pressure of any one component of a chemical reaction. Leaving aside reactions in condensed systems, that is in the liquid and the solid state, there remain those reactions with *gaseous* components which are most easily affected by pressure.

Homogeneous gaseous reactions under the influence of pressure are forced in the direction in which a reduction of the number of molecules takes place. A chemical reaction can therefore be carried further by an increase of pressure whenever the reaction is accompanied by a diminution of volume.

An excellent example of this sort is the synthesis of ammonia from its elements. A glance at the equation, $N_2+3H_2=2NH_3$, shows that four molecules of the mixture of nitrogen and hydrogen give two molecules of ammonia. The reaction thus leads to a diminution of molecules or a decrease of volume. The formation of ammonia must therefore be carried further by increased pressure. The utilisation of this fact made possible the technical method of synthesising ammonia from its elements. This achievement of highest economic value was obtained by the extraordinary and systematic researches in high pressure work carried out by Haber and Le Rossignol.

It may suffice to mention that this reaction is carried on at about 200 atmos. and at temperatures between 500°—600° C. in order to show that an entirely new experimental method had to be worked out. The many difficulties were overcome mainly through the extraordinary skill of Le Rossignol. To-day this process has left the experimental stage and is in the hands of the Badische Anilin und Soda Fabrik, by which it has been developed into a very large industry.

When a gas enters into reaction with a liquid or a solid with the formation of a new liquid or solid substance, it is evident that pressure must again further chemical combination as predicted by the law of Le Chatelier. Heterogeneous reactions under very high pressure have not yet been used on the large scale, but according to my own results it is possible to effect, for instance, the oxidation of calcium oxide to peroxide by means of gaseous oxygen. At atmospheric pressure no appreciable reaction takes place, not because reaction cannot take place, but simply because the speed of reaction is far too slow. Reaction velocities increase with higher temperatures, but at the same time the dissociation increases also. Now by subjecting lime in fused sodium hydroxide to the action of oxygen under pressures above one hundred atmospheres, it was possible to cause formation of the peroxide from ordinary limestone.

The dissociation pressure, that is the pressure of oxygen given off by the peroxide or pressure of oxygen remaining during the action of this gas on the oxide, was measured at various temperatures. The equilibria could thus be determined and were found to coincide by both methods. At temperatures at which the reaction velocity had sufficiently increased as to become measurable, for instance at 300° C., the pressure of oxygen was found to be 120 atmospheres. This is the pressure of oxygen necessary to cause the gas to combine with solid calcium oxide and to convert the latter completely into peroxide. Other examples of similar reactions are found in the extensive researches of Ipatiew on the hydrogenation of various organic compounds in the presence of catalysts at high pressures. He was able, for example, to obtain alcohols from ketones and hexahydroaniline from aniline. He also succeeded in displacing some metals from aqueous solutions of their salts by hydrogen under pressure. Thus copper, silver, and mercury were precipitated from solutions of their sulphates under 100 atm. with formation of sulphuric acid, and so forth.

A third possibility of the application of high pressure for promotion of chemical reactions lies in the ability to retain the liquid state from the boiling point up to the critical point. The physical properties of a liquid may therefore be utilised at high temperatures, and thus reactions be caused to take place which at low temperatures cannot be carried out. Furthermore, the physical properties of a liquid may undergo remarkable changes between the boiling point and the critical point, as for instance the electrolytic dissociation of water. According to A. A. Noyes the dissociation of water increases between these temperatures nearly 2000-fold.

This suggests that water must act as a fairly strong acid or base at high temperatures provided it is kept in the liquid state. In the presence of a metal we may expect therefore a reaction with evolution of gaseous hydrogen. Led by this assumption, I have undertaken in collaboration with my assistant, Herr Specht, a series of experiments on the action of liquid water on metals, particularly on iron. The results have been very gratifying, for we believe to have found in this reaction a basis for a new technical process of generating hydrogen.

Since iron and water are the sole reacting substances, it is evident that it is possible to obtain an extremely pure quality of gas, mainly because the dangerous impurities, carbon and sulphur compounds of iron, are practically not attacked by the acid water. The gas has been analysed and has proved to contain more than 99·95 per cent. of hydrogen. Thirty litres of gas were passed over heated copper oxide in a combustion tube; the water was condensed, absorbed in drying tubes and the carbon dioxide formed absorbed in the usual way, care being taken to move all possible carbon dioxide from the condensed water.

In a second experiment, 200 litres of hydrogen were passed, under pressure, through a copper coil cooled with liquid air. The condensed fraction was driven by vaporisation into a gas burette, measured and analysed for CO_2,CO, saturated and unsaturated hydrocarbons. The analysis was as follows:—

	per cent.
Hydrogen	99·9495
Carbon monoxide	0·0011
Saturated hydrocarbons	0·0416
Unsaturated ,,	0·0078

The speed of reaction naturally depends on the temperature, but it is also affected by the presence of electrolytes such as sodium chloride, ferrous chloride, and so forth. The presence of a noble metal also accelerates the attack of the iron.

This is shown by the following table:—

	Temp.	Quantity of hydrogen per hour.
		c.c.
Iron and pure water	300°	230
,, ,, ,, $+FeCl_2$	300°	1390
,, ,, ,, $+FeCl_2+Cu$..	300°	1930
,, ,, ,, $+FeCl_2+Cu$..	340°	3450

This table shows that the reaction increases with the increase of temperature. Within the limits practically obtainable, the speed of reaction is so great, that in a retaining vessel of ten gallons capacity about 3000 cubic feet a day may be generated. A great advantage of this method lies in the fact that the hydrogen is at once under high pressure and may be filled into cylinders without previous compression. It is evident that between the generator and the steel bottle in which the hydrogen is collected a reflux condenser must be used in order to condense the water.

It is, furthermore, of the highest importance that the oxidation of the iron does not take place merely on the surface but penetrates the iron and oxidises it quantitatively to Fe_3O_4 according to the equation,

$$3Fe+4H_2O=4H_2+Fe_3O_4.$$

The latter is precipitated as a finely divided powder readily reducible by carbon or carbon monoxide.

The oxidation product can therefore be regenerated and re-enter the cycle-process. This reduces the total expense of the process to that of the reduction of Fe_3O_4 and the energy required for heating the reacting mass with mainly liquid water to about 300°.

Compared with the latest and cheapest technical process, that of Linde-Frank-Caro, which separates hydrogen from carbon monoxide by liquefaction of carbon monoxide and other impurities of water gas, this new method offers the advantage of producing a very much purer gas without cost of purification, without cost of compression, and without any movable parts in the apparatus. The total energy expended is derived from coal, of which only about 60 per cent. is needed in comparison to the Linde process. Finally, the apparatus is not only much cheaper but requires less space for the same output. Our first experimental plant in Hanover has a capacity of about 1000 cubic feet an hour generated in six high pressure vessels of about ten gallons each.

As I have mentioned before, it is possible to retain under pressure a substance in the liquid state far above the boiling point. The physical properties of the liquid state can thus be made use of at high temperatures. Now one of the most prominent physical properties of water in the liquid state is its very large heat capacity and heat conductivity. If, therefore, we surround with water a chemical substance undergoing chemical reaction under evolution of heat, we are able to prevent superheating of the substance. This affords a means of conducting an exothermic chemical reaction at a definite temperature without local superheating and uncontrolled decomposition at undefined temperatures.

A process of decomposition occurring every day in nature on the largest possible scale is the decomposition of cellulose. This reaction is exothermic, giving off a large amount of heat. According to our own experiments the reaction evolves 70,000 grm. calories for each grm.-mol. of $C_6H_{10}O_5$. This heat would suffice to raise the temperature of the reacting mass to about 1200° C. provided none of the heat could escape. In nature the velocity of this reaction is so slow, that complete decomposition of cellulose in the form of wood or peat or similar products requires geological epochs till the end product of this process, our natural coal, is formed. Consequently the heat evolved during the reaction is conducted off quickly enough not to permit a noticeable rise of temperature. Every attempt to transfer this process of nature to the laboratory for thorough study means that this reaction is made to take place in hours or days, for which nature can afford to take milllions of years. The speed of reaction is easily increased by allowing the reaction to run at higher temperatures, but the large amount of heat generated in so short a time has always caused superheating, which in turn leads to a more or less complete change of coal into coke. This has been the stumbling block of all previous laboratory attempts to obtain from natural products containing cellulose a substance whose chemical and physical properties are identical with those of natural coal.

If we leave out of consideration those grades of anthracite which have an extraordinarily high carbon content, we may say that coal calculated free of ash has a hydrogen value of not less than 4½ per cent. All artificial products of which analyses are at hand show a much smaller hydrogen percentage. This means that a secondary reaction has set in through which the coal has been partly changed into coke.

	Carbon.	Hydrogen.
	per cent.	per cent.
Natural bituminous coal	75 to 90	4·5 to 5
Bergius and Specht	74·3 to 85·2	4·5 to 5·2
Stein	81·3	3·8
Klason	82·5	4·1

This table gives a summary of recent experiments in this line. In spite of various precautions for prevention of superheating, no one has succeeded so far in obtaining a product with sufficiently high hydrogen percentage.

The equipment of our high pressure laboratory suggested to us the possibility of eliminating this source of error by allowing the reaction to take place in water kept in the liquid state by means of high pressure. Water penetrating the reacting mass must, on account of its high specific heat, serve as an excellent thermostat and prevent completely the dangerous local superheating in consequence of its good conductivity. A further great advantage for the study of the reaction itself lies in the absolute constancy and definiteness of the temperature in question throughout the whole mass. We are thus able to study the reaction at any desired temperature.

When subjected to this reaction at 340° for about twelve hours, pure cellulose yields a black powder which proves to be soft coal of about 84 per cent. carbon, 5 per cent. hydrogen, and 11 per cent. oxygen. At the same time carbon dioxide is evolved and is found under compression in the reaction vessel.

The proportion of substances found allows us to formulate the reaction about as follows :—

$$4C_6H_{10}O_5 = C_{21}H_{16}O_2 + 3CO_2 + 12H_2O.$$

The heat of reaction can be calculated in the ordinary way and proves to be about 70,000 cal.

Experiments on formation of coal.

Material.	Temp. °C.	Duration, hours.	Analysis of coal.			
			C per cent.	O per cent.	H per cent.	N per cent.
Peat, original dry subst.	—	—	52·4	41·4	5·50	0·70
,, ...	250	8	74·3	19·4	5·20	1·07
,, ...	300	8	77·0	16·9	5·00	1·07
,, ...	340	8	81·2	13·3	4·65	0·89
,, ...	340	24	84·0	10·4	4·62	0·95
,, ...	340	61	83·5	11·0	4·60	0·97
Cellulose	310	64	83·7	10·9	5·40	—
,, ...	340	8	83·1	11·7	5·20	—

The table shows that the carbon percentage rises with the length of heating and the temperature at which the reaction takes place. It reaches, however, a final value at about 84 per cent. carbon, beyond which it does not go, even after very prolonged heating. This substance therefore represents the stable end product of the voluntary reaction of decomposition mentioned above. Every further increase in the carbon value of natural coal cannot represent a further decomposition caused by the same reaction in still greater periods of time. This reaction evidently stops at this point, and only through reactions caused by new external conditions can the carbon percentage still further be raised.

What has been said of cellulose is equally true of natural products containing cellulose, such as peat or wood and so forth. The chemical structure of the carbonaceous product is hardly affected. With an increase of bituminous matter the gas shows increasing amounts of methane, and the coal some additional hydrogen.

As mentioned above, the experimental methods employed allow not only an excellent regulation but also a variation of temperature. It was therefore of interest to study the speed of the reaction at various temperatures in order to calculate from them the rate at which the reaction takes place in nature. Of course the range of temperature in which such parallel determination is possible is naturally restricted. We have carried them through at 310° and 340° C.

The end product in both cases, whether heated for 64 hours at 310° or for 8 hours at 340°, is nearly identical according to the analysis.

A rise of temperature of 30° has accelerated the reaction eight times. Eight is two to the third power, an increase obtained in three times ten degrees rise of temperature. Consequently an elevation of ten degrees approximately doubles the speed of the reaction. This is the normal temperature coefficient of a purely chemical reaction. Accepting this coefficient for our reaction, we are able to calculate approximately how many years were required for the conversion of peat into natural coal.

On the assumption that the reaction took place at a normal average temperature of 10 degrees centigrade in accordance with the generally accepted theory of Potonié, we may say that for the formation of coal 87 per cent. carbon $2^{33} \times 8$ hours is the time required in nature. This is easily calculated to be about 8 millions of years. I give this figure with all due reserve, but it is probably correct as far as the order of magnitude is concerned.

Our geologists calculate this period to be several millions years, which is a good agreement with the results of our chemical method.

Now the product obtained by this method has all the chemical properties of natural coal. The analysis shows that it has the required composition, and furthermore all the qualitative reactions demanded by Donath for fossil coal (Steinkohle) are found to be fulfilled. The physical properties, however, differ widely from what we expect from natural coal. The new product is a very finely divided blackish powder easily suspended in water. When heated to higher temperatures it resembles a high grade of soot and might be used as a pigment.

It is, however, not impossible to convert this finely divided powder into a substance with all the physical properties of natural coal. This may be accomplished by a process most likely analogous to that used by nature. It consists not only of heating the coal powder to temperatures above 300°, but subjecting it at the same time to extremely high pressure, far beyond the few hundred atmospheres required during the reaction of carbonisation. Both factors seem to be of equal importance, since at ordinary temperatures even the highest pressure at our disposal, about 5000 atmospheres, have not been able to modify the chemical composition of the powder. To be sure, there results a coherent mass with the outer appearance of coal possessing the proper specific gravity, but the chemical analysis shows that the carbon content has not changed. If, however, the temperature during compression is again raised sufficiently high to allow chemical processes to take place within a few hours, which in nature at low temperatures can go on for millions of years, that is, if we raise the temperature during compression to about 340°, an entirely different product results. We assume in this case that the extremely high pressure forces the substance to undergo a new reaction, which has nothing to do with the reaction of carbonisation found before to run on its own accord in the laboratory as well as in nature. The new reaction raises the carbon value of the coal, causing it to resemble more and more the natural anthracite, with strata at right angles to the direction of compression and with specific gravities increasing according to the temperature employed and the duration of compression.

Leaving out the effect produced by temperature, which was merely a means of accelerating in the laboratory the slow process of nature, we find for the effect of pressure perfect analogy in our natural coal fields. Whenever we find that a coal field has been subjected to a compression as a result of an upheaval of the surface layers, we may safely count on an increased carbon content of the coal and a conversion of coal to a greater or smaller degree into anthracite.

Our experiments therefore justify us in saying that the formation of coal in nature takes place in two distinct reactions, namely, first the reaction of carbonisation, and secondly the formation of anthracite. The former represents from the point of view of the physical chemist a reaction progressing on its own accord under ordinary pressure. The latter on other hand will not take place under ordinary pressure no matter how long we wait. Increased pressure alone is capable of forcing the chemical system to undergo a change in the direction of increasing the percentage of carbon. In both cases elevation of temperature does not determine whether the reaction will take place or not. Rise of temperature merely hastens the reaction which goes on just as well at lower temperatures. Here there is a difference of highest significance between the effect of temperature and that of pressure. Without the latter no formation of anthracite can occur. Thus we see that it is not by no means justified to attribute to anthracite in each and every case a greater age than to ordinary coal. It is true that in many cases anthracite dates from a very early period, but ordinary coal may be just as old if not older. It remained coal because sufficient pressure was not at hand to cause the transformation.

This explains why anthracite is often found in strata which are geologically of recent date, while in paleozoic strata often coal has been found with a carbon content lower than that of coal found in mesozoic strata.

I hope to have given a short survey of the lines followed in the high pressure experiments in my laboratory. Such experiments have not merely as their aim the solution of technical problems, but lend themselves to the solution of purely scientific problems as well, for the product obtained by the artificial carbonisation of cellulose lays no claim to become a substitute for natural coal and there seems little hope to rival nature in this process with equal efficiency. At any rate to-day when our mines are still productive it is more profitable to rely on nature's storehouse. Perhaps in years to come, when this happy condition has ceased, the study of the process of carbonisation may have more than scientific interest for the explanation of the natural process, and may serve as a basis for methods of supplying the indispensable coal. We may not be far from this point since various endeavours seem to be very promising, especially those of obtaining coal from peat by wet carbonisation according to the process of Ekenberg and Testrup as worked out in this country.

Now if we ask what has enabled us to work with high pressure experiments almost as conveniently as in ordinary test tubes and flasks, the answer will lie in our ability to join tubes and bombs with each other and with measuring apparatus without danger of leakage even at pressures as high as 400 atm. and at temperatures up to 500°. The principle of such air-tight joins first employed by Haber and Le Rossignol rests on a union of two parts closing upon each other not with an extended surface but merely in a circular line of contact between two cone-shaped ends of the parts to be joined.

The two cones are clamped and forced together by a screw. Expansion on heating does not cause leakage because both parts expand equally especially if made of the same metal. The same method is employed for closing up the reaction vessels. We have used such cones as large as 20 centimetres in external diameter with excellent results at pressures up to 400 atm. They offer not only a very convenient means for joining and closing up tubes and bombs but they show little deterioration in use. Moreover they may be used in large number in the same apparatus without difficulty. In our own experiments we have used as many as 20 joins in one apparatus heated to 400° at 150 atm. For three weeks no decrease of pressure could be detected.

For small laboratory experiments we employ for reaction vessels hollow steel blocks. A small hole on the side gives room for a thermo-element for controlling the temperature. This is the cone which is tightened by means of a screw. The cone has a tube with which valves or gas bottles may be attached to the vessel. For regulating and reducing the pressure and for closing off tubes we use the Le Rossignol valve which has given complete satisfaction. With an increase in the size of the apparatus it is advisable to use large flasks of pressed steel made according to the Ehrhardt method. I have used those flasks with a capacity of twelve gallons, but they can easily be made to hold up to 200 gallons. For the general introduction of high pressure methods into chemical industry we may feel assured that no insurmountable obstacles will present themselves as far as the construction of the necessary apparatus is concerned.

DISCUSSION.

Professor H. E. **ARMSTRONG** said that it had always been supposed that coal was formed naturally by a process such as that described. The question he was inclined to raise was—to what extent the material produced was "coal" in the English sense of the word; whether it was not more akin to German "Kohle" or carbon? Anthracite coal corresponded more nearly to the latter and was absolutely different from the bituminous coal they were accustomed to deal with. The author had told them that his product had the properties of coal—but coal had so many properties that it was difficult to define them. Few probably had any conception of the extraordinary extent to which coal varied in its nature and composition. What was meant in saying that the product had the properties of coal? Supposing it were submitted to distillation, what would be got from it? Obviously a very large number of different materials had been converted into coal at different periods and in different localities; coal was never made from cellulose alone. As only one of the natural materials which go to form coal had been made use of, the problem had been only partially solved, though no doubt other materials would be similarly affected and some of them would give rise to a product more closely akin to the bituminous varieties of coal. From the geological point of view, the problem of chief importance was not so much how coal was formed but what were the materials—what the character of the vegetation—which gave rise to it. So far as the chemist could throw light on the nature of the process by which coal was formed, they had before them that evening a complete solution of the problem.

Dr. C. C. **CARPENTER** was particularly struck with the method on which the author's investigations were based, that was the use of a water bath in which any required temperature could be attained. That was a delightful piece of apparatus, without which the investigations could not have been carried through. He also admired, from an engineering point of view, the methods by which the author carried out his investigations over long periods without any leakage. That was one of the well-known difficulties attached to experiments of that character, and it was only with special methods of jointing up the many parts that were required throughout that it was possible to carry out an experiment without leakages which would interfere with accuracy.

Dr. H. G. **COLMAN** said that Dr. Bergius had started with either cellulose or material consisting mainly of cellulose, namely peat, and from the appearance of the coal-like product and from the description given, it appeared that the product must be a non-caking coal which showed no tendency to melt on heating. This substance really represented that portion of the coal which was formed by the slow degradation of the cellulose material in nature, but many other substances than cellulose were present during the coal formation, and it was the degradation of those substances which gave to bituminous coal its special character. Had Dr. Bergius yet made experiments with other substances than cellulose and peat, for example with the flora most nearly allied to those flourishing in the carboniferous period, and in the latter case had the method yielded a substance of the character of bituminous coal? The author's process for the production of hydrogen was also a matter of great interest at the present time. Was Dr. Bergius in a position to give an approximate estimate of the cost of production?

Mr. W. J. A. **BUTTERFIELD** asked whether Dr. Bergius had any suggestion to offer as to the origin of the enormous quantities of methane which were evolved from coal seams when they were opened up (in many cases forming a very appreciable percentage of the total weight of coal won). From what had been said it was unlikely that this methane came from the cellulose itself. Presumably it came from some of the resinous bodies which went to form bituminous coal.

Dr. H. P. **STEVENS** asked what was the material referred to as "pure cellulose"? "Cellulose" was a word that connoted a whole group of compounds, and it would be extremely interesting to try the various types of celluloses which could now be prepared in an approximate state of purity. If the various celluloses were treated by the author's process and the products examined, the data would be of great value in solving the problem of the origin of coal.

Mr. D. A. **LOUIS** said that he did not approve of the absence of methane in the equation explaining the author's view in the formation of coal. This gas was a constant and characteristic associate of coal in nature, and it was the pronounced predominance of this gas at St. Etienne, a coal-field he had visited some years ago, which led to those brilliant series of investigations by which it was demonstrated that coal could be produced from cellulose by successive elimination of hydrogen, carbon, and oxygen, partly as oxides, partly in the form of methane and even with the liberation of free hydrogen. Moreover, internal evidence was furnished by coal itself in support of this view.

The following two equations would serve as examples illustrating the statement :—

$$C_{12}H_{20}O_{10} = \underset{\text{Boghead}}{2(C_2H_3)} + 5CO_2 + 3CH_4 + H_2$$

$$4C_{12}H_{20}O_{10} = \underset{\text{Coal}}{2(C_9H_6O)} + 16CO_2 + 14CH_4 + 6H_2O$$

The production of different kinds of coal was accounted for by differences in the materials from which coal had originated. The work referred to was mainly done by M. B. Renault and published in the Bul. Soc. Ind. Min., Vols. XIII and XIV, 1899, 1900. Dr. Bergius, in his experiments, certainly had obtained from cellulose, and in a most interesting manner, a black substance which might or might not be coal. The specimen passed round looked more like jet or cannel.

Mr. A. Chaston Chapman asked whether the calorific power of this artificial coal had been determined. It would be interesting to know how the calorific power as determined in the bomb calorimeter compared with the calculated number, or in other words, whether the relationship was of the same order as in the case of natural coal. Possibly such a comparison might throw some light upon the nature of the chemical combinations existing in the artificial product.

Mr. J. S. S. Brame said that Dr. Bergius not only had made a great advance on the previous work of Stein and Klason, who had heated cellulose materials at much lower pressures, but had certainly shown them the probable course of the changes in nature. But they would like to have further details as to the coal-like properties of the coal which had been obtained. Coals of the same percentage composition and ultimate analysis exhibited very different qualities in practice. One which yielded practically nothing to pyridine might analyse the same as another which gave as much as 35 per cent. of extract with pyridine. There was obviously a very great difference between these two, and when coal was produced by these processes it would be very interesting to know which particular variety of coal it most nearly resembled.

Another point of interest, and one which had not received perhaps the attention it should, was that some of the most important changes which had taken place in the formation of the coal substance from the original cellulose material were believed to have taken place before any due to subsequent geological actions had occurred. Very big changes in cellulose had been shown to be due to bacteriological and general fermentation processes at very shallow depths, no greater than the present peat bogs, and the material which had been produced by these processes—a material which was generally known as a humic substance—contained about 62 per cent. of carbon, 5 per cent. hydrogen and 33 per cent. oxygen. Therefore it would be interesting to know whether the peat with which Dr. Bergius had experimented had undergone any bacteriological change; that was, whether he was dealing with a mud peat, a substance which had produced "sapropil," or whether he was dealing with a mossy peat, a substance in which the cellulose itself had undergone very little change.

Little reference had been made in the paper to the percentage of methane in the gases. Had Dr. Bergius any arrangement by which he could draw off the gases in the case of peat substances. It would be very interesting to know whether he had examined those gases, and whether they contained carbon dioxide only, as shown by the equation, or whether methane accompanied them, and whether carbon monoxide was also present?

Dr. J. Lewkowitsch said the question of hydrogen led him to ask how far the diameter of these vessels could be increased. They had heard from Dr. Bergius that he could deal with vessels holding some 10 or 12 gallons. Considering the quantity of hydrogen that might be required, not exactly for chemical operations, but for other purposes, he wished to know how far it was safe to extend the diameter.

Dr. R. Seligman asked of what Dr. Bergius made his generating flask. From the description it was apparently made of steel, and it seemed to him that it must take part in the reaction which would then become rather an expensive way of making hydrogen. How long would the vessels last?

Dr. Bergius, in reply, said that he might be able to give an answer to all the questions which had been asked in about ten years. The differences in the coals found in nature were certainly due to a difference of the raw material of carbonisation. The study of all these materials and therefore the imitation of every sort of natural coal in the laboratory demanded thousands of experiments which could not be executed till now.

The first and principal task for the process in question was to find out the dominating reaction in the natural process. For that purpose they must use the principal material which in nature was responsible for the formation of coal. This material was cellulose and therefore they had studied the decomposition of that.

They used at first the purest natural material they had, and which was considered by geologists as one of the chief materials in the formation of coal, namely, the purest peat, called in Germany "Hochmoortorf." The same material was found in Scotland in large quantities. There was not very much other substance in it, because all that peat was nearly free from bacteriological life, and after a small decomposition had taken place it was entirely free from that life, since the materials of the first decomposition were antiseptic. Therefore in "Hochmoortorf" or peat there would not be much bacteriological life, but only "florestic" life. The "florestic" material in the peat was chiefly cellulose, but there certainly were in those pieces of peat living cells and those living cells contained other substances. There were products similar to fats and albuminoids; but all these materials were only a small percentage of the cellulose material in it. Putting the matter shortly, they had not found pure carbon dioxide if they employed peat. They only found it if they took pure cellulose. The quantity of methane found in the gas of decomposition of peat was about 10 per cent., and sometimes a little more. The source of that methane was the decomposition of the fatty substances in the material. With the help of the development of thermodynamics and of the law of Nernst, they were able to calculate now by approximation the stability of all materials like cellulose, fats, oils, acids, and such things. They knew that the fats at first were decomposed into acid and glycerin. That was a reaction which certainly existed as well in nature as in the different methods of industry. By the known theorem they knew what would be the decomposition products of those fats at ordinary temperatures. They found that the fatty acids must give off carbon dioxide and methane, and there must be formed hydrocarbons, similar to those found in petroleum. They could reckon that the experiments made by Engler on the formation of petroleum from fats agreed with the above-mentioned calculation. They found that if they took a material forming in nature bituminous coal, in the gas there was methane, and the more fats and similar products in the material the more methane in the gas. They found that in the water surrounding their coal there were quantities of colloidal solution of hydrocarbons. If they took this water containing dissolved material, and suddenly heated it or added some sodium chloride, they found that some material was precipitated but the clear salt solution remained. They had sometimes made products similar to petroleum on those lines. If in nature not "Hochmoortorf" but the peat which contains much animal substance, fat, waxes, and things of that kind, were subjected to the action of carbonisation, in geological epochs the cellulose must undergo decomposition as had been shown; whereas the fats would be decomposed into methane, carbon dioxide, and hydrocarbons, and those hydrocarbons were in colloidal solution. If those solutions came into contact with a salt deposit, hydrocarbons must be precipitated and deposited near the region where the salt was lying. Therein might be found an explanation of the connection between the deposits of salt and the deposits of petroleum which was very frequent. He was sure that the coals they made were not analogous to all the different kinds of natural coal, but they are identical with a natural coal free from impurities. If different materials were decomposed different materials would enter that stuff, but they would not be chemically combined with the chief substance. They would only represent the impurities of natural coal. Cannel coal especially was such a product. Cannel coal had much more hydrogen, and it contained a quantity of decomposed animal materials.

The diameter of the hydrogen vessels might be enlarged very much. They could obtain vessels to-day from Germany which would hold 200 gallons and the diameter of the vessels would be from 40 to 50 centimetres. One cubic metre of space in the vessel gave 3000 cubic metres of hydrogen, so that there was no difficulty in making vessels large enough for that process. With six small vessels of about 12 gallons each they could make about 1000 cubic metres of hydrogen a day and they could get vessels which were about 20 times that size.

The cost of the hydrogen differed according to the quantity produced; it would be about ½d. a cubic metre at atmospheric pressure, and in large plants cheaper. The analyses of coal which he had given were calculated free of ash. The quantities of ash were different.

Mr. E. Grant Hooper asked whether Dr. Bergius had distilled the coal made in his experiments and what were the distillation products of the coal he had produced?

Dr. Bergius said they had heated some and found aromatic compounds. They could not say exactly all the compounds that were in the tar. Carbon monoxide only existed in extremely small quantities in the peat and there was no carbon monoxide in the gas from the cellulose. The amount of inorganic matter in the peat varied from 1 per cent. to 40 per cent., therefore they must calculate free of ash, and the material in their experiments had 3 or 4 per cent.

For avoiding the attack of the vessels by the water, there were different ways. They chose special qualities of steel. But, apart from that, there were other means of getting round this difficulty.

Scottish Section.

Meeting held at Glasgow on Tuesday, 25th March, 1913.

DR. THOMAS EWAN IN THE CHAIR.

THE FIXATION OF NITROGEN BY MIXTURES OF BARIUM OXIDE AND CHARCOAL.

BY THOMAS EWAN, M.SC., PH.D., AND THOMAS NAPIER.

In 1860 Margueritte and de Sourdeval (Comptes rend., **50**, 1100, 1860) announced, without further detail, that a mixture of baryta and carbon, when calcined in presence of atmospheric air, combines very readily with nitrogen. The reaction was again studied by Mond in 1879 (this J., 1889, 505). He found that the formation of cyanide requires a temperature of at least 1200° C. and proceeds most readily at 1400° and that 40 per cent. of the barium may be cyanised without difficulty. Barium cyanide is not acted on by carbon monoxide but is destroyed by carbon dioxide at high temperatures. At the temperature of the reaction barium carbonate fuses and must be mixed with sufficient carbon to form an infusible mixture.

Hempel (Ber., 1890, **23**, 3388) made a few experiments on the effect of pressure on the reaction, by heating a mixture of barium oxide and charcoal electrically in nitrogen at pressures varying from 1 to 60 atmospheres. The percentage of the barium cyanised increased rapidly with the pressure.

A considerable improvement in the technology of the process was made by J. B. Readman (Eng. Pat. 6621, 1894) by the application of the electric furnace for the production of the high temperature required. The process in this form was worked by the Scottish Cyanide Co. for some years.

The discovery that a large part of the nitrogen fixed is in the form of barium cyanamide, $BaCN_2$, was first published by Frank and Caro (Eng. Pat. 25,475, 1898).

The recent experiments of Kühling (Ber., 1907, **40**, 310) and of Kühling and Berkhold (Ber., 1908, **41**, 28) have shown that the action of nitrogen on a mixture of barium carbonate and charcoal begins at about 950° C., the quantity of nitrogen fixed increasing rapidly with the temperature. The addition of small quantities of barium chloride to the mixture has little or no effect on the fixation of nitrogen whilst large quantities diminish it. According to N. Caro (Ger. Pat. 212,706, 1907) alkali or alkaline earth fluorides accelerate the reaction and make it possible to work at 900°—1100° C., and a similar claim is made for potassium carbonate by Snodgrass in a Transvaal patent of 1907.

Our experiments were begun early in 1909 in order to find out whether, with the help of a suitable catalyst, it is possible to fix nitrogen by the barium process without resorting to the very high temperatures hitherto employed. We began by studying the behaviour of pure barium carbonate, in very much the same way as Kühling and Berkhold, with whose work we were not, however, acquainted at the time.

A mixture of 2 parts of pure barium carbonate and 1 part of well burned wood charcoal, made by grinding the constituents together in a mortar, was placed in an iron boat which was heated in a porcelain tube in a current of dried nitrogen. The supply of nitrogen was regulated so that 2 litres of gas were collected at the exit end of the porcelain tube in 2 hours. The regulation and measurement of the temperature of the boat were very troublesome. In the early experiments the porcelain tube was heated in a gas-fired furnace in which different parts of the tube differed in temperature by 50° C. or more; by exploring the tube with a thermocouple before each experiment it was possible to find a region of fairly even temperature in which the boat and thermocouple were placed. The platinum-rhodium couple, enclosed in a quartz tube, was placed inside the porcelain tube and as near the boat as possible; the quartz, however, soon becomes porous under the combined action of the high temperature and of vapours containing barium compounds and the platinum wires are then acted on becoming very brittle. The E.M.F. of the couple changes rapidly and requires frequent calibration. These difficulties were overcome by using a Heraeus electric furnace in which the distribution of temperature along the tube does not change from day to day. The thermocouple was placed in the annular space between the porcelain tube and the tube on which the platinum foil resistance is wound. The boat occupied the central 2 inches of the heated tube, which was 12 ins. long; the greatest difference of temperature in the central 2 ins. was 9° and the couple outside the tube read 5° higher than inside. The melting points of antimony, 624°, sodium chloride, 798°, sodium carbonate, 852°, and potassium sulphate, 1066°, were used in standardising the pyrometer.

In the experiments, the results of which are given in Table I., the current of nitrogen was passed for 2 hours from the time at which the required temperature was reached, the boat was then allowed to cool off in an atmosphere of nitrogen. About 3 minutes were required to raise the temperature from 900°, at which the absorption of nitrogen just begins, to the experimental temperature. The whole of the gas collected, consisting essentially of carbon monoxide and nitrogen, was analysed, and also the contents of the boat. The analysis of the product was made by placing the boat in a corked flask full of water until everything was dissolved, after which the solution was filtered quickly and made up to a known volume. In suitable portions of the solution the total quantity of soluble barium compounds and the cyanide were estimated by titration with normal hydrochloric acid and silver nitrate respectively. Cyanamide was estimated in a third portion of the solution by neutralising it with nitric acid and boiling for about 20 minutes in order to expel the greater part of the hydrocyanic acid; after cooling and adding a few drops of ammonia, excess of silver nitrate is added and the precipitate of silver cyanamide filtered off and washed thoroughly. It is then dissolved in very dilute, cold nitric acid and the solution titrated with ammonium sulphocyanide and iron alum. The barium carbonate in the insoluble residue is dissolved in hydrochloric acid, preferably after burning off the charcoal, and then precipitated with ammonium carbonate, filtered off, washed and titrated with hydrochloric acid.

The results of a number of experiments made in this way are contained in the following table.

TABLE I.

No.	Average temp. of boat.	Time hrs.	Grams $BaCO_3$ used.	Gas collected.		Mols. N_2 used to 1 mol. $BaCO_3$	Percentage of the $BaCO_3$			Per cent. of N_2 fixed as cyanamide.	Per cent. of the N_2 absorbed
				% CO.	c.c. N_2		combined with N.	converted into BaO.	unchanged.		
3	860	2	2·784	14·5	1690	5·6	0	13·0	87·0	0	0
38	933	2	3·105	23·8	1445	3·8	1·03	34·5	64·5	6·0	0·25
35	960	2	0·565	6·9	1850	28·9	40·7	46·6	12·7	5·6	1·4
34	955	2	0·566	8·8	1812	26·6	37·3	50·7	12·0	10·4	1·4
28	960	2	1·110	19·7	1582	11·9	30·4	59·3	10·3	1·2	2·5
30	960	2	1·291	20·3	1566	10·1	27·6	59·0	13·4	4·0	2·6
29	963	2	1·340	20·2	1576	9·8	29·9	54·0	16·1	5·0	3·0
26	961	2	1·416	22·5	1512	8·9	21·9	63·0	15·1	2·1	2·4
27	960	2	1·577	23·2	1504	7·9	16·8	62·0	21·2	5·3	2·1
4	971	2	2·624	40·4	1148	3·6	14·0	68·8	17·2	8·0	3·9
8	969	2	2·787	38·4	1212	3·6	10·1	65·8	24·1	7·0	2·8
33	961	2	1·335	58·2	88	0·55	1·7	22·7	75·6	0·0	3·0
25	1000	2	2·786	39·8	1172	3·5	39·3	44·3	16·3	5·0	11·2
39	1000	1¾	2·308	36·7	1266	4·6	36·3	46·5	14·6	13·8	7·2
2	1070	2	2·720	39·4	1188	4·4	45·0	38·8	16·2	11·0	10·3

The most interesting result of these experiments is that the percentage of the barium cyanised in the same time and at the same temperature is a function of the quantity of nitrogen passed over it. Kühling and Berkhold used the same quantities of barium carbonate and of nitrogen in each of their experiments, and therefore failed to observe this connection. In our experiments at 960° the quantity of nitrogen passed over the mixture varied from 0·55 to 28·9 molecules per mol. of barium carbonate used, the corresponding increase in the percentage of the barium combined with nitrogen being from 1·7 to 40·7, the percentage of carbon monoxide in the gas collected after passing over the barium carbonate on the other hand decreased from 85·2 to 6·9. This led us to suspect that the reaction is reversible, the small amount of change when little nitrogen is used being simply due to the reaction being stopped by the accumulation of carbon monoxide.

In other respects our results agree closely with those of Kuhling and Berkhold. They may be summarised briefly as follows:—1. The absorption of nitrogen begins between 900° and 930°. 2. The amount absorbed under the same conditions increases very rapidly with the temperature, for example if 4 mols. of nitrogen are passed over 1 mol. of $BaCO_3$ in 2 hours about 1 per cent. of the barium will combine with it at 930, about 14 per cent. at 960 and about 40 per cent. at 1000°. 3. The greater part of the nitrogen fixed is in the form of cyanide. 4. At 960°, about 2½ per cent. of the nitrogen used is fixed, at 1000° about 10 per cent. (under the conditions of our experiments).

The results of a few experiments in which potassium carbonate was added to the mixture of barium carbonate and charcoal may be given here as they were made in exactly the same way as those included in Table I.

TABLE II.

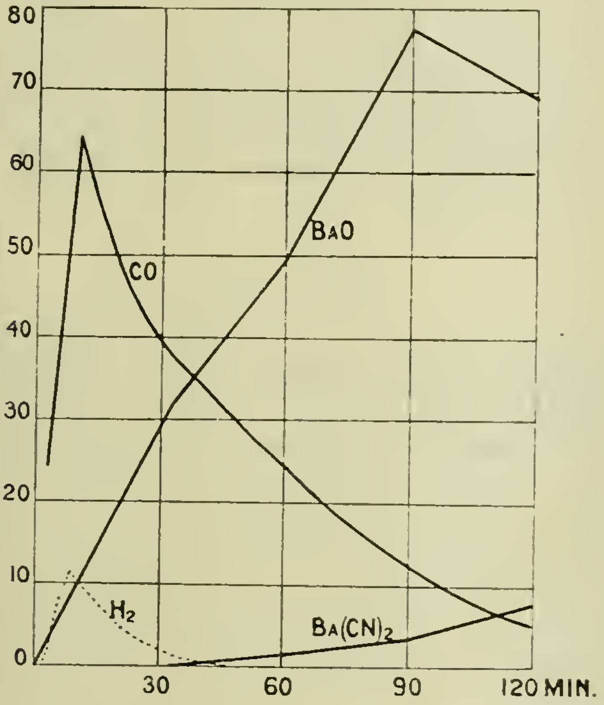
No.	Average temp. of boat.	Time hrs.	Mols. N_2 used to 1 mol. $BaCO_3$	% CO in gas collected.	% K_2CO_3 in the mixture of K_2CO_3 + $BaCO_3$	% of the Ba combined with N_2.		% of the N_2 absorbed.
						observed.	calculated.	
9	957	2	5·6	35·2	4·7	20·2	16·0	3·6
14	963	2	4·3	39·4	7·4	19·4	12·5	4·5
7	964	2	5·0	26·9	10·0	26·9	14·7	5·4
15	960	2	4·3	44·7	11·5	18·7	12·5	4·4
10	966	2	5·6	38·9	16·7	13·2	16·2	2·4
16	960	2	6·9	31·8	40·0	8·4	19·7	1·2

The figures in the column headed "per cent. of the Ba combined with N_2, calculated" are the results which would be obtained with pure barium carbonate using the same excess of nitrogen (interpolated from Table I.). The addition of quantities of potassium carbonate up to 11 per cent. seems to improve the results but the improvement is no more than would be produced by a difference of 10° or 20° in the temperature, a quantity which falls within the limits of accuracy of the measurements since these experiments were made with the gas-fired furnace.

The conditions under which the reaction occurs in the experiments just described are really rather complicated, the composition of the gas in contact with the mixture changing continuously during the run, so that it is impossible to draw any very certain conclusions about the nature and course of the reactions which take place. The state of affairs is brought out clearly by a set of four experiments in which equal quantities of the barium carbonate-charcoal mixture were heated for ½, 1, 1½ and 2 hours respectively in a current of nitrogen of constant speed. The gas escaping during each 10 to 15 minutes was collected and analysed, and the solid product was also analysed at the end of each run. The temperature was the same in all four experiments, about 950°. The results are given in diagram 1, in which the curves marked CO and H_2 represent the percentages of carbon monoxide and hydrogen in the gases collected at the exit end of the tube and those marked BaO and $Ba(CN)_2$ represent the percentages of the barium carbonate which are converted into barium oxide and into barium cyanide and cyanamide at any time during the progress of the experiment. It will be seen that carbon monoxide is evolved very rapidly at first. That the maximum quantity is not found at the beginning of the run is due to the arrangement of the apparatus. The boat containing the barium carbonate and charcoal was placed in the centre of a porcelain tube which was initially full of pure nitrogen, and about 10 minutes were required for the gases evolved from the boat to reach the exit end of the tube. The hydrogen found is derived partly from the charcoal, which usually contains about 1 per cent. of it, and partly from the barium carbonate which, as Finkelstein (Ber. 1906, **39**, 1585) has observed, retains small quantities of water very tenaciously.

No cyanide is produced until some 30 per cent. of the barium carbonate has been converted into oxide and the quantity of carbon monoxide in the gas has fallen to about 30 per cent. and the percentage of carbon monoxide falls steadily as the formation of cyanide progresses.

Diagram I.



The results above described indicate, as already mentioned, that the absorption of nitrogen by barium oxide and charcoal is reversible. Direct proof of this was obtained by trying the action of pure carbon monoxide on a mixture of barium cyanide and cyanamide which was made by heating dry barium ferrocyanide *in vacuo* at about 1000°. The mixture was placed in an iron boat in a porcelain tube which was evacuated and then filled with pure carbon monoxide and heated at 960° for 2 hours. After cooling, the gases were pumped out and analysed and found to contain 18·2 per cent. of CO and 81·8 per cent. of N_2. The compositions of the mixture used and of the product (calculated in grm.-molecules per 100 grms. of mixture) were :—

	Initial mixture.	Final mixture.	Increase.
$Ba(CN)_2$	0·158	0·164	+0·006
$BaCN_2$	0·182	0·032	—0·150
BaO	0·087	0·220	+0·133

The principal change which has occurred is obviously $BaCN_2+CO=BaO+2C+N_2$. A little cyanamide has also been converted into cyanide, $BaCN_2+C=Ba(CN)_2$. It does not necessarily follow, however, that carbon monoxide acts on the cyanamide only, because, as will be shown later, cyanide and cyanamide (in presence of carbon) tend towards an equilibrium the relative quantities depending on the quantity of barium oxide present.

We may assume, therefore, that the fixation of nitrogen is due to one, or both, of the reversible reactions

$$BaO+2C+N_2 \rightleftarrows BaCN_2+CO.$$

$$BaO+3C+N_2 \rightleftarrows Ba(CN)_2+CO.$$

If barium oxide, cyanide, cyanamide, and charcoal did not mix, but remained as separate phases, then when equilibrium was attained at any given temperature the ratio of the partial pressures of carbon monoxide and nitrogen in the gaseous phase would be independent of the relative quantities of the solid or liquid substances ; and if a mixture of barium oxide and charcoal were heated in an atmosphere of carbon monoxide and nitrogen containing less than the equilibrium quantity of carbon monoxide the reaction would go on until the whole of the barium oxide was converted into cyanide or cyanamide. If, on the other hand, the barium compounds do mix the ratio of the partial pressures of carbon monoxide and nitrogen in the gas when equilibrium is attained at any given temperature will depend on the relative quantities of cyanide, cyanamide and oxide in the mixture. The latter appears to be the actual state of affairs and we have attempted to determine the relation between the composition of the solid (or fused) mixture and that of the gaseous phase at three different temperatures (1000°, 1100° and 1150°).

The method finally adopted was to heat the barium mixture in a current of gas containing carbon monoxide and nitrogen until the gas escaping from the apparatus had the same composition as that entering it. To make sure that equilibrium was really attained two experiments were made with each mixture of carbon monoxide and nitrogen, one in which the initial material contained no combined nitrogen and a second in which it contained much more combined nitrogen than the final product.

For the experiments with nitrogen-free raw material a mixture of pure barium carbonate, charcoal and reduced iron was heated in a vacuum at the temperature of the subsequent experiment so long as gas was evolved ; the product always contained a little undecomposed carbonate. The nitrogenous raw material was made by heating a mixture of dry barium ferrocyanide and charcoal (sometimes with a little reduced iron) in a current of nitrogen at about 1000°. Analyses of the products so obtained are given in Tables III. and IV. The addition of iron to the mixtures was intended to accelerate the attainment of equilibrium between the cyanide and cyanamide as explained later.

The mixture was placed in a wrought-iron boat (lined with magnesia at the highest temperatures to prevent the fusion of the iron in contact with the charcoal) and heated in a porcelain tube in the electric furnace. The temperature was usually kept constant within 2°. A definite mixture of carbon monoxide and nitrogen (freed from oxygen, carbon dioxide and moisture by passing it first over red-hot copper and then through a concentrated solution of caustic potash and finally strong sulphuric acid) was passed over the boat until the composition of the gas was no longer affected. In several cases the product, after cooling, was reground and retreated in order to make sure that no unattacked substance had been enclosed in the fused or semi-fused mass.

In the first experiments the boat was left to cool off, after the experiment, in the stagnant mixture of carbon monoxide and nitrogen left in the tube. We overlooked the fact that the equilibrium changes as the temperature falls and that carbon-monoxide is absorbed on cooling. The results of the experiments made in this way are therefore affected by a small error, it is not very serious because the principal change during cooling is the conversion of barium oxide into carbonate. To avoid this error we first tried to obtain more rapid cooling by pushing the boat quickly into the cold end of the porcelain tube ; still more rapid cooling was attained by attaching a water-cooled, quartz tube to the end of the porcelain tube, by pushing the boat into this, at the end of the experiment, it could be cooled below the reaction temperature in a few seconds. Finally we arranged the porcelain tube vertically and placed the mixture in a small iron gauze basket which was enclosed in a perforated steel capsule supported by an iron rod which passed through a packed gland at the upper end of the tube. The lower end of the tube was fixed into a wide-necked flask containing mercury. At the end of the experiment the capsule and its contents were pushed down under the surface of the cold mercury ; in this way the material was cooled in one or two seconds and also removed from contact with the carbon monoxide.

In order to estimate the error produced by the absorption of carbon monoxide in cooling, analyses of the gas left in the tube were made in three experiments with the following results :—

No.	Boat cooled.	% CO in gas.		Temp.	c.c. CO absorbed.
		Before cooling.	After cooling.		
97	In cold end of porcelain tube	4·9	4·9	1100	0
100	"	46·2	32·5	1100	16·8
101	In quartz tube	44·1	37·4	1151	8

The quantity of carbon monoxide absorbed could convert 5 per cent. of the barium present into carbonate in No. 100 and about 2·4 per cent. in No. 101. When the quantity of carbon monoxide in the gas is small the error is negligible.

The total quantity of barium found by analysis in the product agreed very closely with that taken (from 1 to 1·5 gram $BaCO_3$) the deficit being usually less than 3 per cent.; up to 1150°, therefore, the mixtures of barium compounds are practically non-volatile. Carbon and iron were of course always present in the products in considerable quantities, but they were not estimated.

In Table III. the results of the experiments in which equilibrium was attained from opposite directions are collected together.

It is obvious from the figures in the last two columns of the table that a true equilibrium is established, the composition of the product obtained with any given percentage of carbon monoxide being practically the same whether the original mixture contains much combined nitrogen or none. In Nos. 87—94 the product was allowed to cool slowly and therefore contains rather less nitrogen than corresponds with true equilibrium; this does not affect the above conclusion because each pair of experiments is affected equally and in the same direction.

Table IV. contains the remainder of the determinations of the equilibrium; these were not made in duplicate the experiments included in Table III. having shown that the absorption of nitrogen is completed in a comparatively short time.

TABLE III.

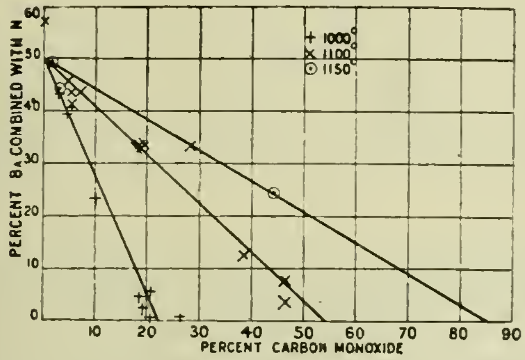
No.	Initial mixture, % composition.						% CO in gas.	Hours Heated.	Temp.	% of Barium in product in the form of				% of the Ba combined with N.	
	$Ba(CN)_2$	$BaCN_2$	BaO	$BaCO_3$	Char.	Fe.				$Ba(CN)_2$	$BaCN_2$	BaO	$BaCO_3$	charge.	product.
95	17·5	16·3	12·9	6·2	20·5	26·6	4·5	1·5 1·25 1·75	1001	37·8	1·8	53·7	6·7	61·4	39·6
96	—	—	—	58·4	20·8	20·8	5·5	1·0 5·0	1002	38·6	2·3	52·4	6·8	0	40·9
91	15·2	14·1	11·1	5·5	17·5	36·6	5·4	2·5 2·5	1101	32·5	8·8	45·8	12·9	61·4	41·3
92	—	—	—	60·0	20·0	20·0	5·25	2·0 2·0 2·5	1100	34·1	9·3	45·8	10·8	0	43·4
87	17·8	18·2	10·4	7·6	19·8	26·2	18·4	2·0	1102	31·3	2·5	50·8	15·5	65·3	33·8
88	16·1	16·3	9·2	6·8	17·7	33·9	18·3	4·0	1100	30·3	2·7	48·8	18·1	65·3	33·0
89	—	—	—	60·3	19·6	20·1	19·2	1·5 3·0	1100	28·5	5·4	48·3	17·8	0	33·9
93	17·3	16·1	12·7	6·2	20·0	27·7	46·4	2 2 2	1100	0·9	2·6	67·5	29·1	61·4	3·5
94	—	—	—	60·0	20·0	20·0	46·4	1 1·25 1	1100	1·3	1·9	65·0	31·9	0	3·2

TABLE IV.

No.	Initial mixture, % composition.						% CO in gas.	Hours heated.	Temp.	% of the barium in product in the form of				% of the Ba combined with N.		Cooling.
	$Ba(CN)_2$	$BaCN_2$	BaO	$BaCO_3$	Char.	Fe.				$Ba(CN)_2$	$BaCN_2$	BaO	$BaCO_3$	charge	product	
109	—	—	—	34·8	43·5	21·7	3·0	4·5	1000	37·5	5·6	42·2	14·7	0	43·1	Hg.
108	—	—	—	40·0	40·0	20·0	10·1	6·2	1000	20·6	2·5	62·1	14·8	0	23·1	Hg.
105	—	—	—	42·3	38·5	19·2	18·7	5·25	1000	4·6	0·3	80·2	14·8	0	4·9	quartz
104	—	—	—	40·0	40·0	20·0	19·4	1·75 2·25	1000	2·0	0·1	81·2	16·7	0	2·1	quartz
106	—	—	—	56·5	21·7	21·8	20·8	1 4·7	1000	0·3	0·1	92·2	7·4	0	0·4	quartz
107	—	—	—	40.0	40·0	20·0	20·9	4·1	1000	3·5	2·3	80·8	13·4	0	5·8	Hg
99	—	—	—	56·5	21·7	21·8	26·4	2 4	1000	0·7	0·1	90·6	8·6	0	0·8	porcn.
110	—	—	—	37·7	42·8	19·5	0·1	82·25	1100	21·2	35·9	20·7	22·2	0	57·1	slow
97	—	—	—	55·6	23·1	21·3	4·9	2 2	1100	41·4	4·3	46·9	7·4	0	45·7	porcn.
84	21·8	22·1	12·6	9·2	24·0	10·3	7·2	2	1101	39·7	4·1	49·0	7·2	65·3	43·8	slow
98	—	—	—	56·5	21·7	21·8	28·1	1·6 2·0	1100	32·2	1·1	57·9	8·9	0	33·3	porcn.
85	21·8	22·1	12·6	9·2	24·0	10·3	38·7	2	1102	6·7	6·1	59·0	28·2	65·3	12·8	slow
100	—	—	—	56·5	21·7	21·8	46·4	2 1·8	1100	6·6	1·1	78·5	13·8	0	7·7	porcn.
103	—	—	—	40·0	40·0	20·0	1·6	1·7 2·75	1150	39·7	9·7	34·5	16·2	0	49·4	quartz
102	—	—	—	56·5	21·7	21·8	3·1	1·5 1·0	1151	42·5	1·9	51·2	4·4	0	44·4	quartz
101	—	—	—	57·8	21·1	21·1	44·1	1·5 1·5	1151	22·5	1·8	61·5	14·2	0	24·3	quartz

In diagram 2 the percentages of the barium combined with nitrogen after equilibrium is reached are plotted against the corresponding percentages of carbon monoxide.

DIAGRAM II.



It will be seen that with one or two exceptions the experimental points lie very nearly on three straight lines which converge towards a point representing the conversion of one-half of the barium oxide into cyanide and cyanamide in contact with pure nitrogen. It is improbable that these straight lines represent the true form of the curves below one per cent. of carbon monoxide. Our experiments show that equilibria in which less than 50% of the barium is combined with nitrogen are attained rapidly and easily, but that, for some reason, the speed of fixation of further quantities of nitrogen is extremely small. When, for example, a mixture of barium carbonate and charcoal is heated in a current of nitrogen at 1100° over 45 per cent. of the barium combines with nitrogen in two hours, whilst a further 80 hours are required to carry the conversion to 57 per cent. (No. 110, Table IV.). It is therefore possible that true equilibrium in presence of pure nitrogen will only be attained when the whole of the barium is combined with nitrogen.

We have made many attempts to find a theoretical interpretation of these results but without success. An accurate knowledge of the mutual solubility of the compounds is necessary for a proper understanding of the equilibrium and we have not found time to investigate this. The arrest of the reaction at half conversion appears, however, to be most readily explained by the assumption that a compound, $BaO.Ba(CN)_2$, is formed in which the barium oxide is very much less active than the uncombined substance. This would also explain the fact that up to 1150° the mixtures lose nothing by volatilisation, whereas barium cyanide itself, as is mentioned later, is readily volatile at much lower temperatures.

Two experiments may be quoted here in order to give some indication of the rate of absorption of nitrogen by a mixture of barium oxide and charcoal. An intimate mixture of 2 grms. of barium carbonate and 1 grm. of charcoal was first heated at 1100° *in vacuo* until no further evolution of carbon monoxide occurred. It was then treated with a steady current of nitrogen at the same temperature and the carbon monoxide produced collected at short intervals and measured. The total quantity of nitrogen fixed was then estimated by analysis of the product. The quantity of carbon monoxide evolved agreed fairly well with the quantity of nitrogen fixed and its rate of evolution therefore afforded a fairly accurate indication of the progress of the reaction. The results were as follows:—

TABLE V.

	a.		*b.*	
Time of passage of nitrogen (minutes).	Per cent. of the barium combined with N.	Per cent. combined per minute.	Per cent. of the barium combined with N.	Per cent. combined per minute.
10	132·	1·32	21·7	2·17
20	21·7	0·85	32·0	1·03
30	27·0	0·53	37·5	0·55
40	30·4	0·34	41·5	0·40
60	34·5	0·20	46·0	0·22
80	36·9	0·12	48·2	0·11
100	38·8	0·09	49·5	0·06
120	40·0	0·06	50·2	0·03

In *a* the quantity of nitrogen supplied per minute was sufficient to combine with 7·5 per cent. of the barium, in *b* it was equivalent to 17·5 per cent. per minute. The great increase in velocity produced by an increase in the supply of nitrogen shows very clearly that the reaction itself is a fast one. The diminution of speed which accompanies the conversion of the barium oxide is due partly to the diminution of the available barium oxide and probably partly to the formation of a protective glaze of a readily fusible mixture of barium cyanide and oxide over the surface of the unattacked particles.

Side by side with the main reaction between barium oxide, nitrogen and carbon which has been discussed, two other reactions take place: $BaCO_3+2C\rightleftarrows BaO+3CO$ and $Ba(CN)_2\rightleftarrows BaCN_2+C$.

The presure of carbon monoxide in equilibrium with barium carbonate and carbon at any temperature may be calculated from a knowledge of the dissociation pressure of barium carbonate and of the equilibrium

$$CO_2\rightleftarrows 2CO+C.$$

The initial dissociation pressure of barium carbonate (when less than 10 per cent. of it is decomposed) as determined by Finkelstein (Ber. **39**, 1585, 1906) is given by the expression $\log_{10}p_{CO_2}=\frac{-13860}{T}+\log_{10}T+8{\cdot}197$, where T is the absolute temperature and p_{CO_2} the pressure of CO_2 in mm. Hg. The pressures of carbon monoxide and dioxide in equilibrium with carbon have been measured very accurately by Rhead and Wheeler (J. Chem. Soc., 1911, 1140). They have expressed their results by an equation* which, after some numerical transformation becomes

$$\log_{10}\frac{p_{CO_2}}{p_{CO_2}}=\frac{8263}{T}-0{\cdot}00067T—10581,$$

where p_{CO_2} and p_{CO} are the partial pressures of carbon dioxide and carbon monoxide respectively in mm. of mercury and T is the absolute temperature. Combining these two expressions we obtain the pressure of carbon monoxide (in mm. of mercury) which is in equilibrium with a mixture of barium carbonate (very little decomposed) and carbon at the absolute temperature T,

$$\log_{10}p_{CO}=-\frac{11062}{T}+0{\cdot}5\ \log_{10}T+0{\cdot}00033T+9{\cdot}389.$$

From this expression the following table is calculated:—

Temperature (C°)	p_{CO} in mm.
800	9·2
900	77·5
1000	479
1100	2312
1200	9078

From these figures it appears, in accordance with our experience, that the decomposition of barium carbonate must take place to a considerable extent before any barium cyanide can be formed. As Finkelstein has shown the dissociation pressure of barium carbonate falls rapidly as decomposition proceeds owing to dilution or combination with barium oxide and apparently barium cyanide has a similar effect since when mixed with oxide and cyanide some barium carbonate can remain undecomposed even at 1180° when the pressure of carbon monoxide in contact with it has fallen to a few millimetres.

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* This equation represents the experimental results very exactly; it does not, however, appear to us to have the theoretical significance which the authors ascribe to it. They write Le Chatelier's general equation in the form $\log_e\frac{c_1{}^2}{c_2}+\log_e P+\frac{1}{2}\int L\frac{dT}{T}=\text{const.}$ Reference to Le Chatelier's original memoir (Ann. des Mines, 1888 [8], 13, 157) shows that the quantity under the sign of integration should be $L\frac{dT}{T^2}$, L being the heat absorbed by the reaction $2CO=C+CO_2$ at constant pressure and not that evolved at constant volume as Rhead and Wheeler have taken it to be. By introducing the value $L=38055+2{\cdot}02T—0{\cdot}0031T^2$ into the erroneous formula and neglecting the integration entirely they obtain the formula $\frac{1}{2}\cdot\frac{38055+2{\cdot}02T-0{\cdot}0031T^2}{T}+\log_e P+\log_e\frac{C_1{}^2}{C_2}=K$ which represents their results very well, and has therefore been used in our calculations.

We are unable to give any explanation of the curious fact that the quantity of carbonate remaining undecomposed under otherwise similar circumstances increases with the excess of charcoal present in the mixture (compare Nos. 106 and 99 with 104 and 107, Table IV., also Nos. 102 and 103, Table IV.).

It has been assumed that the absorption of nitrogen is preceded by the formation of barium carbide thus:—

$$BaO + 3C = BaC_2 + CO$$
$$\text{and } BaC_2 + N_2 = Ba(CN)_2$$

As far as we know this hypothesis was first made in the analogous case of the formation of potassium cyanide from potassium carbonate, carbon and nitrogen by F. R. Hughes (Graham, Report of Juries, Exhibition of 1851, 1, 95) and again independently by Berthelot in 1868 (Comptes rend., 67, 1141). N. Caro (Chem. Ind., 1895, 14, 289) appears to have been the first to extend the hypothesis to the alkaline earths. We are not aware that any experimental evidence exists showing that barium carbide is really formed under the conditions in which nitrogen is fixed. We therefore heated an intimate mixture of 2 parts of barium carbonate and 1 part of charcoal in an iron boat in a porcelain tube, which was connected to a Töpler pump and to a pressure gauge. The temperature of the boat was gradually raised to 1100° the gases evolved being continuously pumped out; after about an hour the quantity of gas collected indicated almost complete decomposition of the carbonate, the pressure was about 3 mm. and it showed little tendency to increase when pumping was discontinued. The temperature was then raised to 1200° and the pumping continued at intervals for 9½ hours, the pressure fell gradually to about 1 mm. of mercury and on lowering the temperature to 1100° it was too small to be read on the gauge. The material left in the boat gave off acetylene when dissolved in water, a quantitative analysis showed that 15·9 per cent. of the barium carbonate used had been converted into carbide. 8·3 per cent. of it had remained unchanged and the remainder had been converted into oxide. It appears, therefore, that at 1200° the equilibrium pressure of the reaction $BaO + 3C \rightleftarrows BaC_2 + CO$ is about 1 mm. of mercury when only a small quantity of carbide is present, with more carbide it might be smaller but would not be greater.

The approximate equation which Nernst has deduced from his thermodynamic theorem may be used in order to show that this result is at least not improbable. For the case under consideration Nernst's equation becomes

$$\log_{10} p_{co} = -\frac{Q}{4{\cdot}571\ T} + 1{\cdot}75 \log_{10} T + 3{\cdot}6$$

where pco is the equilibrium pressure of carbon monoxide in atmospheres at the absolute temperature T and Q is the heat evolved by the reaction $BaC_2 + CO = BaO + 3C$. Introducing the values of pco and T above measured Q is found to be 74,000 cals., from which we obtain the heat of formation of barium carbide from its elements, Ba (metal) $+ C_2$ (amorph.) $= BaC_2 + 23{,}400$ cals. The heat of formation of barium carbide has not been measured, but that of calcium carbide is 19,700 cals. and the following comparison of the heats of formation of some calcium and barium compounds indicates that the difference between them has quite a possible value.

Heat of formation of Ba—Heat of formation of Ca-compound.

Hydride	..	— 8·7	Cal. per atom metal.
Carbide	..	+ 3·7	,, ,, ,,
Nitride	..	+12·4	
Oxide	..	—25·5	
Fluoride	..	—16	
Chloride	..	+ 6·1	
Bromide	..	+10	
Sulphide	..	—11	
Carbonate	..	— 6	

Using the above value of Q, and calculating pco in mm. of mercury instead of in atmospheres, Nernst's equation becomes:—

$$\log_{10} p_{co} = -\frac{16250}{T} + 1{\cdot}75 \log_{10} T + 5{\cdot}48$$

from which the following table is calculated:—

t	T	p_{co} (mm.)	p_{co} (atmos.) × 100
950	1223	0·004	0·00056
1000	1273	0·014	0·0018
1100	1373	0·138	0·018
1200	1473	1·0	0·129

The figures in the last column are the same as the maximum percentage of CO which if mixed with nitrogen at 1 atmosphere pressure could exist in presence of barium carbide at the temperatures given in the first column. It is clear, therefore, that barium carbide could not be formed at all in presence of the mixtures of carbon monoxide and nitrogen from which the latter is freely absorbed by barium oxide and carbon, and it cannot be regarded as an intermediate product in the reaction.

It is, however, quite probable that in the analogous reaction with calcium oxide the carbide is a necessary intermediary. For the reaction $CaC_2 + CO \rightleftarrows CaO + 3C + 103{,}200$ cals., Nernst's equation becomes:—

$$\log_{10} p_{co}\ (\text{atmos.}) = -\frac{103200}{4{\cdot}571\ T} + 1{\cdot}75 \log_{10} T + 3{\cdot}6$$

The substantial accuracy of this equation has been verified by Rothmund (this J., 1902, 761).
The equation gives:—

$$p_{co} = 1 \text{ atmosphere at } 2117°\ C$$
$$p_{co} = \tfrac{1}{2} \quad ,, \quad \text{at } 2037°\ C$$

The Cyanid Gesellschaft (Eng. Pat. 16,298, 1902) states that "nitrogen has no action on a mixture of lime and carbon at 1100° and the reaction $CaO + 2C + N_2 = CaCN_2 + CO$ takes place best at a temperature of 2000°, at this temperature only a little of the nitrogen is unabsorbed."

The last statement indicates that at 2000° the partial pressure of the carbon monoxide evolved is about 1 atmo., which agrees very well with the above calculation.

We have finally to consider the relation between barium cyanide and cyanamide and carbon. Our results may be arranged under the headings:—

(*a*) Behaviour of pure barium cyanide when heated.

(*b*) Behaviour of barium ferrocyanide when heated.

(*c*) Composition of products obtained by the action of nitrogen on mixtures of barium carbonate and charcoal.

a. Behaviour of pure barium cyanide when heated.

Barium cyanide was prepared by A. Joannis (Ann. Chim. phys., 1882 [5], 26, 484) by treating crystallised baryta, $Ba(OH)_2 8H_2O$, with dry hydrocyanic acid until the crystals nearly disappeared, a small excess of the acid was then added to the concentrated solution, which was evaporated *in vacuo* in the cold until the hydrate $Ba(CN)_2 2H_2O$ was left. This was then heated very gradually *in vacuo* to 100°. An analysis of the product gave 72·04 per cent. Ba and 27·21 per cent. CN, which corresponds with 99·29 per cent. $Ba(CN)_2$, 0·18 per cent. $Ba(OH)_2$ and 0·53 per cent. water. By following Joannis' directions exactly we always obtained a product containing about 92 per cent. of $Ba(CN)_2$ and 8 per cent. of $Ba(OH)_2$. Even when a cold solution, an analysis of which showed it to contain Ba and CN in the correct proportions, was evaporated *in vacuo* at a few degrees above zero, the salt deposited contained about this proportion of hydroxide. It is obvious that the saturated solution is hydrolysed to a considerable extent and the free hydrocyanic acid escapes in a vacuum. The impure crystals of the dihydrate can, however, be dried without much further change. This observation led us to a fairly easy method of preparation of the anhydrous salt. Pure, recrystallised barium hydroxide is dried *in vacuo*, yielding a very fine, dry powder of $Ba(OH)_2$. This is suspended in dry petroleum ether and an emulsion of anhydrous hydrocyanic acid and petroleum ether added to it in about theoretical quantity. In this way the solid hydrate is obtained without evaporation $Ba(OH)_2+2HCN=Ba(CN)_2{\cdot}2H_2O$. The crystals, when dried *in vacuo* at a gradually rising temperature, yield a product with only 5 per cent. of barium hydroxide and by shaking this with a small excess of dry hydrocyanic acid and petroleum ether and again drying *in vacuo* a product was obtained containing 97·33 per cent. $Ba(CN)_2$, 0·37 per cent. $Ba(OH)_2$, 1·42 per cent. $BaCO_3$.

The dry salt fuses at about 600°, it is distinctly volatile even at its melting point, for example a sample lost 42 per cent. of its weight when heated for 1 hour at 650° *in vacuo*, and 65 per cent. of its weight when heated for 1¼ hours a 800° in an atmosphere of nitrogen. From Joannis' determinations of the heat of solution of the anhydrous salt and of the heat of neutralisation of baryta by hydrocyanic acid the following heats of reaction may be calculated :—

$$Ba+2C\,(\text{amorph.})+N_2=Ba(CN)_2+54{\cdot}25\text{ cals.}$$
$$BaO+3C\,(\text{amorph.})+N_2=Ba(CN)_2+CO-43{\cdot}1\text{ cals.}$$

The following table contains the results of a number of experiments in which dry barium cyanide was heated.

TABLE VI.

Composition of product.

No.	Temp.	Time of heating.		Composition of product. Mols. per 100 mols. $Ba(CN)_2+BaCN_2$			Remarks.
		hrs.	min.	$BaCN_2$	$BaCO_3$	BaO.	
68	500	17	50	8·2	< 11	0	N_2 : nothing volatilised : fritted.
60	550	1		3·2	9·6	0	vacuum : nothing volatilised : caked but not fused:
62	600	1		11·6	?	?	N_2 : nothing volatilised : semi–fused.
63	620	2		25·4	14·0	7·5	N_2 : nothing volatilised : semi-fused.
64	620	4		29·0	15·4	4·5	N_2 : nothing volatilised : almost completely fused.
70	620	4		63·4	< 19·3	6·9	N_2 : spongy Fe added : fused.
61	650	1		46·2	1·4	about 8·5	vacuum : about ½ volatilised : completely fused.
66	700	1		30·7	8·8	10·2	N_2 : nothing volatilised : porous fused mass.
67	700	3	30	30·5	8·4	18·0	N_2 : nothing volatilised : porous fused mass.
59	800	1		41·4	5·2	?	vacuum : about ⅔ volatilised : completely fused.
65	800	1	15	29·5	12·5	18·4	N_2 : about ⅔ volatilised : completely fused.
58	1000	1		53·4	?	?	vacuum : about ¾ volatilised : fused.
69	620	4		13·6	?	4·8	N_2 : Iron boat lined MgO : fritted to hard mass.
71	620	4		12·9	?	2·5	N_2 : Carbon boat : charcoal added :
72	700	2		12·9	?	7·0	N_2 : MgO boat :
73	705	2		25·6	?	3·0	N_2 : carbon boat : charcoal added :

Of the above experiments the first 12 were made in iron boats ; in every case the product was dark coloured, owing to the separation of carbon, but it was noticed that the greater part of the carbon had separated in contact with the iron boat. This led us to try experiment 70 in which an excess of finely divided iron (made by reducing ferric oxide in coal gas) was added to the cyanide. The increased quantity of cyanamide formed is very striking ; the only other experiments in which anything approaching to this quantity of cyanamide is formed are those in which a considerable quantity of the material volatilised, if the volatile material is barium cyanide the relatively large quantity of cyanamide in the residue would be easily understood. In the last four experiments in Table VI., iron was excluded as far as possible. The effect of iron on the change is clearly seen by comparing the four experiments in each of which the barium cyanide was heated for 4 hours at 620°.

No.	Mols. $BaCN_2$ in 100 mols. of $(BaCN_2+Ba(CN)_2)$.	Conditions.
69	13·6	Iron boat lined with MgO.
71	12·9	Carbon boat.
64	29·0	Iron boat.
70	63·4	Iron boat ; excess spongy iron added.

It is evident that the greater the surface of iron in contact with the barium cyanide the greater is the quantity of it converted into cyanamide under otherwise similar circumstances. A comparison of Nos. 62, 63 and 64 or of Nos. 60 and 68 shows that the formation of barium cyanamide is very slow, especially at low temperatures ; it is therefore probable that the iron merely accelerates this change catalytically.

TABLE VII.

No.	Time of heating. (Hours.)	Temp.	Grams charcoal per gram Ba_2FeCy_6	Per cent. of the barium in the product in the form of					mols. $BaCN_2$	mols. BaO.
				Ba_2FeCy_6	$Ba(CN)_2$	$BaCN_2$	BaO	$BaCO_3$	per 100 mols. $Ba(CN)_2+BaCN_2$	
1	2½	580	0	33·7	21·9	43·4	0	1·0	66·5	0
2	½	850	0	0	36·4	43·7	19·9	0·0	54·7	24·8
3	1	1000	0	0	36·2	41·8	20·0	2·0	53·6	25·6
4	2	1000	0	0	37·4	7·3	50·2	5·0	16·3	112·3
5	1	bright red	0·17	0	31·2	33·9	22·1	12·7	52·1	33·9
6	1	,,	0·17	0	30·8	30·6	27·9	10·7	50·0	45·4
7	2	850	0·2	0	29·8	16·2	46·2	7·7	35·2	100·4
8	2	850	0·36	0	21·7	12·8	36·2	29·2	37·1	104·9
9	1 2	700 850	0·52	0	15·9	2·2	38·2	43·7	12·2	211

There is no evidence in these experiments that the reaction $Ba(CN)_2 = BaCN_2 + C$ is reversible. In Nos. 71 and 73 excess of charcoal was mixed with the barium cyanide, but the conversion into cyanamide went as far (or further) than in the parallel experiments 69 and 72 with no charcoal.

(*b.*) *Products obtained by heating barium ferrocyanide.* Barium ferrocyanide is most easily made by mixing hot, concentrated solutions of equivalent quantities of barium chloride and sodium ferrocyanide (if potassium ferrocyanide is used a double potassium barium ferrocyanide crystallises out). The salt loses the greater part of its water of crystallisation at 160°, but, as Drechsel (J. pr. Chem., 1880 (2) 21, 77) observed a little water is retained even at this temperature. By heating 3·328 grms. of the salt, previously dried at 160°, in vacuo at 1050° until decomposition was complete we obtained 26·5 c.c. of hydrogen (at 19° and 1 atmo.) which corresponds with 0·6 per cent. of water in the dried salt. When the dry salt is heated in a vacuum or in an atmosphere of nitrogen decomposition begins at about 500°, nitrogen is evolved and a mixture of carbon, iron and barium cyanide and cyanamide remains behind. Drechsel had already observed, qualitatively, the formation of barium cyanamide and attributed it to the action of water on barium cyanide, but the quantities produced are much too large to be explained in this way. The compositions of the products which we have obtained by heating barium ferrocyanide, either alone or mixed with charcoal, are given in Table VII.

TABLE VIII.

No.	Temp.	Time of Heating (Hours).	Mols. $BaCN_2$ per 100 mols. $BaCN_2 \times Ba(CN)_2$ in the product.	Mols. BaO per 100 mols. $BaCN_2 \times Ba(CN)_2$ in the product.
38	933	2	6·0	3350
35	960	2	5·6	114
34	955	2	10·4	136
28	960	2	1·2	195
30	960	2	4·0	214
29	963	2	5·0	180
26	961	2	2·1	287
27	960	2	5·3	370
4	971	2	8·0	493
8	969	2	7·0	650
33	961	2	0	1340
25	1000	2	5·0	112
39	1000	1¾	13·8	128
2	1070	2	11·0	87

TABLE IX.

No.	Time of Heating (Hours).	Temp.	Mols. $BaCN_2$ per 100 mols. $BaCN_2 \times Ba(CN)_2$ in product.	Mols. BaO per 100 mols. $BaCN_2 \times Ba(CN)_2$ in product.
109	4·5	1000	13·0	98
95	4·5	1001	4·5	136
96	6	1002	5·6	128
108	6·2	1000	10·8	269
105	5·2	1000	6·1	1640
107	4·1	1000	40·0	1390
110	82·2	1100	62·9	36
97	4·0	1100	9·4	103
91	5·2	1101	21·2	111
92	6·1	1100	21·4	106
84	2·0	1101	9·4	111
87	2·0	1102	7·4	150
88	4·0	1100	8·2	148
89	4·7	1100	16·0	160
98	3·6	1100	3·3	174
85	2·0	1101	47·6	461
93	6·0	1100	74·0	1930
94	3·3	1100	60·0	2030
100	3·8	1100	14·3	1020
103	4·4	1150	19·6	70
102	2·5	1151	4·3	115
101	3·0	1151	7·4	253

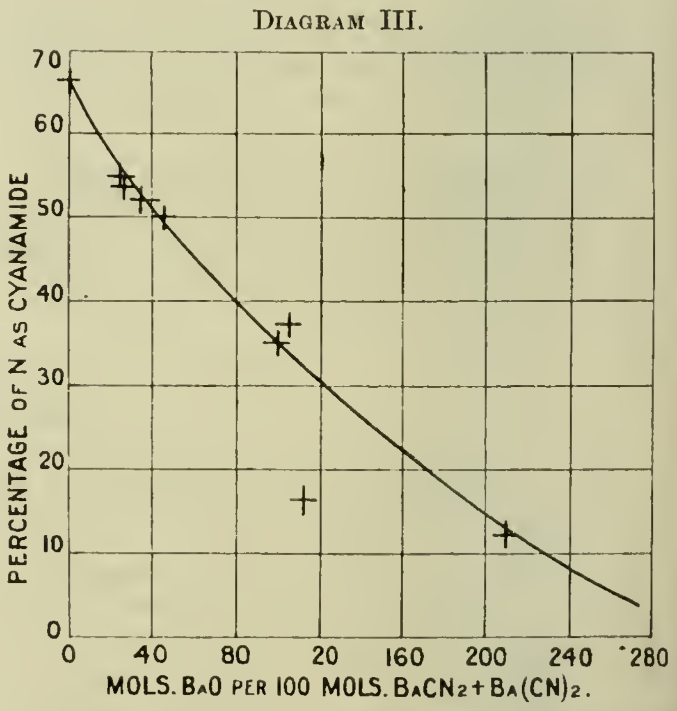
In experiments 1—3 of Table VII. the barium ferrocyanide was heated alone in a vacuum: in No. 4 the product of No. 3 was heated in pure carbon monoxide. In the remaining experiments (5—9) well-roasted charcoal was mixed with the ferrocyanide and the heating was done in an atmosphere of nitrogen.

(*c.*) *Composition of products obtained by the action of nitrogen on mixtures of barium carbonate and charcoal.*

Tables VIII. and IX. contain the relative quantities of barium cyanide, cyanamide and oxide contained in the products obtained in the various experiments tabulated in Tables I., III., and IV. A few results are omitted because the actual quantities of cyanamide were too small to be estimated accurately.

The results collected in Tables VI.—IX. are best considered together: at first sight they appear to be perfectly chaotic. There is, however, some relation between the percentage of the combined nitrogen which is in the cyanamide form and the quantity of barium oxide in the mixture. This comes out most clearly when the figures in Table VII. are plotted graphically. (Diagram III.) As the mixture is diluted more and more with barium oxide the combined nitrogen passes more and more into the form of cyanide. This seems to be quite independent of the temperature at which the barium ferrocyanide was heated. This regularity does not appear at all in the composition of the synthetic mixtures (Tables VIII. and IX.). The percentage of the nitrogen in the form of cyanamide in these mixtures appears to have no relation to the quantity of barium oxide present, it is also hardly affected by the temperature. Time may, however, be an important factor; the one experiment in which the mixture was heated for a very long time (82·2 hours in No. 110) gave a result which falls nearly on the curve in Diagram III., and the same remark applies to the experiment in which barium cyanide was heated with finely divided iron (No. 70, Table VI.). In the other experiments with barium cyanide the change was obviously incomplete and no regularity could, therefore, be expected.

DIAGRAM III.



It may be pointed out that a definite relationship between the quantities of barium cyanide, cyanamide and oxide present in a mixture could only be expected if the three substances were completely miscible and if the reaction $Ba(CN)_2 = BaCN_2 + C$ were reversible. If the reaction is reversible and either barium cyanide or barium cyanamide forms a solid phase, then there is no necessary connection between the quantities of them present in a mixture because the absolute quantity of a solid phase may vary to any extent without affecting the equilibrium. Our want of knowledge of the mutual solubilities of the nitrogen and oxygen compounds of barium again makes it impossible to give a satisfactory explanation of this reaction. We regret that lack of time makes it necessary for us to leave the question in this unsatisfactory position.

The experiments described were made in the laboratory of the Cassel Cyanide Co., Ltd., and our thanks are due to the directors of the company for permission to publish them.

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I.—GENERAL PLANT; MACHINERY.

Combining gases with liquid or with soft or granular masses; Apparatus for ——. A. de Kadt, Harburg a/d Elbe, Germany. Eng. Pat. 5773, Mar. 7, 1912.

The amount of gas absorbed by a liquid or other material in a closed vessel, for example, in the combination of hydrogen with fats or oils in the presence of a catalyst, is determined by means of a gas meter or other measuring instrument arranged on the pipe supplying the gas and adapted to cut off the supply when a certain amount of gas has been supplied or combined. In the case in which the gas is introduced through a fine spray nozzle at the bottom of the liquid, and unabsorbed gas from the top of the vessel is withdrawn and again introduced into the liquid, two meters are fitted upon the inlet and outlet pipes respectively so as to act differentially upon an indicator needle which thus records the difference between the volume of gas supplied and the volume unabsorbed. The needle may control an electric contact by which the gas supply is shut off and the circulating pump stopped as soon as the requisite amount of gas has been absorbed. —H. H.

Furnaces. O. H. Krueger, Los Angeles, Cal., U.S.A. Eng. Pat. 13,670, June 11, 1912.

The furnace is divided into two chambers by a transverse hollow partition, spaced apart from the roof and the grate. Fuel is charged into the first chamber, and fed forward by mechanical means into the second chamber, passing below the partition, through which air is supplied. The gases and vapours distilled from the coal in the first chamber are deflected on to the top of the burning fuel in the second chamber, by the sloping roof of the former.—W. H. C.

Apparatus [Furnace] for the treatment of materials. C. E. Mark, Chicago, Ill. U.S. Pat. 1,057,489, April 1, 1913.

The hearth of the furnace is formed of permeable material, and rests upon a bed of impermeable material. Air or any other suitable gas is forced through perforated pipes, arranged between the upper and lower beds, and passes through the upper permeable hearth to act on the substance undergoing treatment thereon.—W. H. C.

Char; Kiln for drying [revivifying] ——. R. S. Kent, Brooklyn, N.Y. U.S. Pat. 1,058,369, April 8, 1913.

The kiln comprises a series of vertical retorts arranged in a chamber having a fire-box at one side and closed at the opposite side. The combustion products from the fire-box pass through a long flue to the upper part of the retort-chamber and are directed by a horizontal baffle to the far side of the retort-chamber and back through the lower part of the chamber to an outlet beneath the fire-box. The retorts are of elliptical section and are arranged with their major axes across the path of the heating gases.—A. T. L.

Roasting furnace; Multiple-stage —— with stirrers and arched hearths. J. Lütjens and W. Ludewig. Fr. Pat. 449,144, Oct. 8, 1912.

The claim is for making the stirrers with the same curvature as the hearths.—W. H. C.

Separator. I. Blount, New York. U.S. Pat. 1,057,214, Mar. 25, 1913.

Comprises constructional improvements in separators of the type having an outer cylindrical casing with inner perforated walls parallel thereto forming an inner chamber into which the solid and liquid material to be separated is introduced and an outer chamber from which the separated liquid is drawn off.—H. H.

Separating solids from liquids; Centrifugal machine for ——. T. H. Miller, Poughkeepsie, N.Y., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 1,057,443, April 1, 1913.

The materials to be separated are fed into a rotary, horizontal, conical separator, through a hollow sleeve; the latter passes axially through the trunnion at the larger end of the conical separator, and is provided with an internal screw conveyor, rotated in the same direction as the sleeve, but in the opposite direction to the separator. The materials are delivered all round the internal periphery of the separator, through an aperture in the sleeve.—W. H. C.

Separating materials from gases. W. J. Baldwin, Brooklyn, N.Y. U.S. Pat. 1,057,613, April 1, 1913.

A gas containing specifically heavier materials is passed longitudinally through the spaces between a number of concentric, horizontal, cylindro-conical, perforated screens, which are rotated within a casing. The materials are agglomerated by the addition of a little water, and are thrown out radially through the perforations.—W. H. C.

Drying apparatus. W. Lierfeld, Dortmund, Germany. U.S. Pat. 1,057,247, Mar. 25, 1913.

A drying apparatus comprises a cylindrical casing revolving upon a horizontal axis and having a series of shelves projecting radially inwards. Supported concentrically within the casing is an open frame carrying a second series of shelves or abutments parallel to the first and adapted further to break up or distribute the falling material which has been carried up to the top of the casing by the outer shelves.—H. H.

Drying apparatus. J. B. Adt, Baltimore, Md., Assignor to the John B. Adt Co. U.S. Pat. 1,057,912, April 1, 1913.

The apparatus consists of a rotary cylinder provided inside with "gangs" of pipes, which are rotated with it. The delivery end of the cylinder is enclosed by an air expansion chamber, through which the moist air is discharged. The drying is effected by a current of air, which is heated in a chamber at the feed end of the cylinder heated by "gangs" of pipes, through which the steam from the "gangs" of pipes in the main cylinder is discharged.—W. H. C.

Dryers and heat producing apparatus. G. J. H. Petitpierre. Fr. Pat. 449,493, Oct. 17, 1912. Under Int. Conv., May 15, 1912.

The dryer consists of a chamber in which a series of jets of steam are allowed to expand, the steam serving both as a heating and drying agent. The heat producing apparatus consists of a chamber or series of chambers, in which the steam is expanded and which are heated by jets of steam, which impinge on the exterior.—W. H. C.

Drying of wood, cereals, fodder, legumes, fruits, cement, bricks, etc.; Application of absolutely dry superheated steam to the artificial ——. E. Wiart. Fr. Pat. 449,913, Oct. 28, 1912.

Processes of drying by hot air or radiation may require 60 to 100 days. An economy in time of 60—80 per cent. is said to be effected by introducing into a chamber from above superheated steam from two or more flues so that the top of the stack of material may attain a temperature of 80°, and the bottom, a temperature of 50°—55° C. —H. H. S.

Filter. G. J. Young. Reno, Nev. U.S. Pat. 1,057,475, April 1, 1913.

A number of chambered, disc-like frames covered with suitable filtering material are supported on and rotated by a central, horizontal, hollow shaft. A stationary, hollow, slotted shaft passes through the rotating shaft, and is connected with apparatus for producing vacuum or pressure. The discs are rotated in the liquid to be filtered and each chamber during its rotation is successively in communication with the vacuum and pressure channels. The clear liquid passes through the filtering medium into the interior of the discs, and is discharged through the vacuum pump. The solids left on the surface of the discs are discharged by the air pressure, assisted by scrapers.—W. H. C.

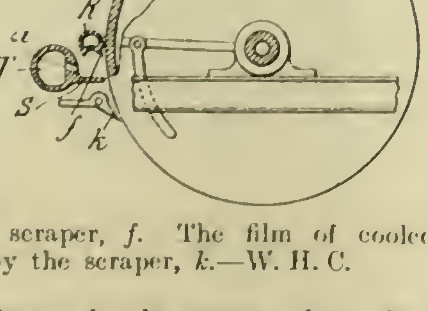
Vegetable products; Process of expelling volatile matter from ——. D. M. Balch, Coronado, Cal. U.S. Pat. 1,058,137, April 8, 1913.

The vegetable matter is dried and ground to powder, and then placed in trays in a suitable chamber which is heated to 450° C. until the larger part of the volatile matter is expelled without incinerating the material. The heating is afterwards continued in the presence of air until all the volatile matter is expelled.—A. T. L.

Gas poor in oxygen; Preparation of —— under pressure. H. von Eicken. First Addition, dated Oct. 14, 1912 (under Int. Conv., Dec. 13, 1911), to Fr. Pat. 432,912, June 28, 1911 (this J., 1912, 117).

In the machine described in the principal patent, in which the exhaust gases of an internal-combustion engine are compressed for use in raising or forcing inflammable liquids, a failure of the ignition in the engine would cause some unburnt gas and air to be mixed with the compressed gases. To avoid this, according to the present invention, the compressor delivers against a fixed pressure determined by a loaded balanced delivery valve, and the size of the fly-wheel is determined so that the engine will stop should two successive ignitions be missed.—A. T. L.

Spreading and levelling melted and emulsified materials on a cooling surface; Arrangement for ——. C. Christensen and O. Vang-Lauridsen. Fr. Pat. 449,269, Sept. 10, 1912.



The material is fed through the inclined apertures, *a*, from the transverse tube, *T*, on to the distributer proper, *S*, by which it is spread on the surface of the cooling drum, *K*. The layer is levelled by the heated spreader, *R*, and any excess stripped off by the scraper, *f*. The film of cooled material is removed by the scraper, *k*.—W. H. C.

Volatile substances; Process for the recovery of —— from materials impregnated with them. M. Hondard and J. Vasseur. Fr. Pat. 448,665, Dec. 2, 1911.

The vapours are withdrawn from the still or vessel containing the impregnated material by the action of an injector, which is operated by the vapour of some other substance capable of condensing with the vapour withdrawn. The pressure in the still is diminished whilst the pressure in the condenser through which the vapours are passed is increased.—W. H. C.

Drying; Process and apparatus for ——. W. H. Allen. Fr. Pat. 449,061, Oct, 5, 1912.

See U.S. Pat. 1,040,486 of 1912; this J., 1912, 1069.—T. F. B.

Furnaces; Regenerative reversible ——. A. Reynolds. Fr. Pat. 449,205, Oct. 10, 1912.

See Eng. Pats. 16,041 and 20,144 of 1911; this J., 1912, 1112.—T. F. B.

Filter; Rotary —— with compartments. O. Riemann. Fr. Pat. 449,351, Oct. 12, 1912. Under Int. Conv., Oct. 14, 1911.

See Ger. Pat. 251,932 of 1911; this J., 1913, 74.—T. F. B.

Evaporating, distilling, and similar apparatus. Techno-Chemical Laboratories, Ltd. Fr. Pat. 449,399, Oct. 14, 1912. Under Int. Conv., Oct. 14, 1911.

See Eng. Pat. 22,670 of 1911; this J., 1913, 183.—T. F. B.

Evaporating apparatus with superposed compartments. Soc. d'Exploit. de Proc. Evaporatoires (Système Prache et Bouillon). Fr. Pat. 450,135, Nov. 4, 1912. Under Int. Conv., Nov. 18, 1911.

See Eng. Pat. 25,458 of 1912; this J., 1913, 275.—T. F. B.

Separation by means of centrifugal force; Process and apparatus for ——. W. J. Gee, and The Hydraulic Separating and Grading Co., Ltd. Fr. Pat. 449,980, Oct. 29, 1912. Under Int. Conv., Nov. 7, 1911.

See Eng. Pat. 24,803 of 1911; this J., 1912, 1167.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Gaseous mixtures; Influence of incombustible dusts on the inflammation of ——. Third Report of the Explosions in Mines Committee, March 11, 1913. [Cd. 6704.]

A detailed account of an investigation conducted mainly with the object of testing the accuracy of Abel's conclusions (Report to Secretary of State for the Home Dept., Mar. 23, 1881) regarding the supposed action of incombustible dusts in promoting the inflammation of non-inflammable mixtures of firedamp and air. Exception is taken to Abel's statement that flame can be propagated in a current of air containing as little as 3·5 per cent. of firedamp and having a velocity of 200 ft. per min. or more, since the combustible portion of the firedamp used in Abel's experiments was practically all methane and the lower limit of inflammation of the latter gas in admixture with air is 5·6 per cent. according to Burgess and Wheeler (this J., 1911, 1302) and between 5·0 and 6·7 per cent. according to all other workers. Abel's results were probably due to incomplete mixing of the firedamp and air, for with an apparatus adapted to produce "streaky" gaseous mixtures, phenomena similar to those recorded by Abel—but, it is suggested, misinterpreted by him—were found to occur. By repeating Abel's experiments under conditions as similar as possible to those employed by him (but with well-mixed gases), and measuring the rapidity with which flame was spread through the mixtures in the absence and presence of various dusts in suspension, it was found that the inflammability of mixtures below the lower limit of inflammation, or of explosive mixtures, travelling at various rates, was decreased when an incombustible dust (stone or calcined magnesia) was present. This conclusion was confirmed by the results of further experiments made in a horizontal iron gallery, in a vertical glass tube, and in a spherical explosion vessel. It is considered therefore that the conclusions published by Abel are erroneous, and that, regarded merely as heat-absorbing material alone, incombustible dusts would tend to decrease, rather than increase, the inflammability of gaseous mixtures containing them.—W. E. F. P.

Lighting gas; Crude tar for cooling and washing ——. A. Beuthner. J. Gasbeleucht., 1913, **56**, 354.

By passing the hot gases from the retorts through a cooling tower supplied with tar instead of ammoniacal liquor, the whole of the naphthalene, the greater part of the tar and carbon bisulphide and a part of the hydrogen sulphide are removed. One of the annular atmospheric coolers was adapted for this purpose. The hot gas was passed upwards through the annular chamber, the cold tar being admitted at the top and divided into thin streams by a grating. When the tar-cooler was used, the amount of oil required in the naphthalene washers was 1 kilo. per 1000 cb. m. of gas, as compared with 6 to 8 kilos. without the tar-cooler. About 15 litres of tar per minute are pumped to the cooler in order to cool 100 cb. m. of gas from 50° to 30° C. The tar circulates repeatedly through the cooler from the main tar reservoir. The heating and lighting value of the gas is not reduced.—A. T. L.

Crude petroleum from Nova Scotia. Bull. Imp. Inst., 1913, **11**, 89.

The sample consisted of a heavy black oil floating on water, and gave the following results on distillation: below 110° C. (largely water), 4; 110°—300° C. (kerosene), 56; above 300° C. at 30 mm. pressure (lubricating oil), 12; residue (bituminous matter), 28 per cent. The bromine absorption value of the crude oil was 8·2 and that of the kerosene fraction, 11·7 per cent.—A. S.

Petrol from Tasmania. Bull. Imp. Inst., 1913, **11**, 87—89.

The sample of petrol examined was obtained by the distillation of shale, extensive deposits of which (7 ft. thick seam extending over 2000 acres) exist south of Latrobe, in the Mersey district of Tasmania. The petrol had the sp. gr. 0·760, flash-point below 15·5° C., bromine absorption 113 per cent. It would be quite suitable for use as a solvent, etc., but for employment as a motor spirit, it would be necessary to fractionate, and accept only that portion (68 per cent.) boiling below 120° C.—A.S.

Paraffin wax; Determination of —— in petroleum oils. A. Scheller. Petroleum, 1913, **8**, 905—906.

Experiments on a small scale have shown that considerable amounts of paraffin wax are lost during the "cracking" process in distillation, the loss varying with different kinds of oil. For example, when the residues of three oils (after distillation of the petroleum spirit) were distilled (a) alone and (b) in a current of steam, the amounts of paraffin wax in the distillates (determined by Holde's method; this J., 1897, 362, 471) were (a) 5·7, 13·1 and 12·3 per cent. and (b) 11·3, 16·7 and 17·9 per cent. respectively. These results indicated that the amounts of paraffin wax determined by Holde's method in the fraction of a petroleum oil distilling above 300° C. were probably too low. Parallel determinations were therefore made by Holde's method and by the following direct method: The crude oil was distilled up to 250° C., and the residue washed with light petroleum spirit into a separating funnel and shaken with half its volume of a mixture of equal parts of sulphuric acid (sp. gr. 1·84) and fuming nitric acid. After standing for 24 to 36 hours in a moderately warm place the acid was drawn off, and the oil transferred (with the aid of petroleum spirit) into another separating funnel, where it was washed with alkali solution and then with hot water. After distillation of the petroleum spirit the paraffin wax was determined by Holde's method. Usually it was of a brown colour, but the resin-like brown substances could be removed by treatment with hot alcohol. The amounts of paraffin wax thus determined in four different kinds of crude oil were from 0·2 to 2·1 per cent. higher than those obtained by Holde's method. The new process gives the real amount of paraffin wax, but the results given by the older process approximate more closely to those obtained in practice on a large scale.—C. A. M.

Fuel briquetting in the United States. E. W. Parker. U.S. Geol. Survey. [T.R.]

The quantity of briquetted fuel made in the United States in 1912 at 19 plants was 220,064 short tons, valued at $952,261, as compared with 218,443 tons, valued at $808,721, in 1911. Of these plants 7 used anthracite culm, 9 used bituminous or semi-bituminous slack, 1 used residue from gas manufactured from oil, 1 used mixed anthracite culm and bituminous slack, and 1 used peat. The most desirable material for producing a smokeless product is anthracite culm, a plentiful supply of which still remains in the anthracite region of Pennsylvania, and more is produced daily in the mining operations. It is hoped that in the near future the small sizes of anthracite that are now sold for raising steam, in competition with bituminous coal and at prices below the actual cost of production, will become more valuable as a raw material for the briquette manufacturer. The output of these small sizes, produced by breaking up large coal, exceeds 20,000,000 long tons annually, exclusive of 3,000,000 to 4,000,000 tons annually recovered from the culm banks by washeries. As briquetted fuel it should be worth $3 to $4 per ton. The cost of briquetting is $1 to $1.25 per ton.

Experience in European countries and investigations made at the fuel-testing plant of the United States Geological Survey at St. Louis, and later by the Bureau of Mines at Pittsburgh, have shown that lignites may be successfully briquetted without the use of any additional binding material, and that the most satisfactory binders for anthracite, semi-anthracite, bituminous and subbitumous coals are coal-tar pitch, gas-tar pitch and asphaltic pitch, or inexpensive cementing mixtures that are practically waterproof. Of the 19 briquetting plants in operation in the United States during 1912, 10 used as a binder coal-tar pitch, or mixtures in which it is the chief ingredient; 1 plant used asphaltic pitch, 2 used water-gas pitch, 4 used mixed binders whose composition is not made public, and 2 (1 operating on peat and the other on carbon residue) used no binder.

Application of the dimethyl sulphate test for determining [detecting] small amounts of petroleum or asphaltum products in tars. Reeve and Lewis. *See* III.

Patents.

Fuel; Manufactured ——. W. H. Aston, Worcester. Eng. Pat. 7829, April 1, 1912.

About 5 cwts. of white or blue clay, ¼ lb. common starch liquefied with two gallons of water, and 8 gallons of gas tar are thoroughly mixed together. Equal weights of the above mixture and of waste material such as wood shavings, sawdust or chippings, coal dust or the like are thoroughly mixed together and compressed into tubular or grid shapes.—W. H. C.

Lump coal from small coal; Process for the production of —— without agglomerates. H. J. Phillips, London, and A. Phillips, Tredegar. Eng. Pat. 14,406, June 20, 1912.

Non-porous briquettes are produced by first grinding the coal with water, and after draining off the excess of water compressing the pulp into briquettes. The latter are then passed on an endless belt or plate conveyor through a tunnel kiln. The temperature at the inlet end is kept at about 100° C. to dry the briquettes, but at the outlet end it is allowed to rise to from 105° C. to 400° C. as found suitable. The hot briquettes as they leave the kiln are re-compressed at a higher pressure than before. —W. H. C.

Suction gas-producer; Continuously working ——. Comp. de Fives-Lille. First Addition, dated Oct. 5, 1912, to Fr. Pat. 412,215, Feb. 1, 1910 (this J., 1910, 998).

The construction of the producer described in the principal patent is modified by forming an annular vaporising chamber in the cast-iron base, this chamber being separated from the conical steel ring which forms the lower part of the furnace wall by a narrow space. By this arrangement, the quantity of water evaporated is not in excess of that required, and no body of water need be kept in the vaporiser to prevent excessive heating. The steam-outlets are near the top of the vaporiser and the steam is superheated in passing through the space between the vaporiser and the furnace wall.—A. T. L.

Gas producers. Gasmotorenfabrik Aktienges. Cöln. Ehrenfeld. Fr. Pat. 449,172 Oct. 9, 1912.

In a suction gas-producer, the conical wall of the furnace chamber forms the vaporiser. This vaporiser is open at the top to the space within the producer casing and the mixture of steam and air within the casing has free access to the lower part of the fuel column at all points of the circumference.—A. T. L.

Petroleum; Apparatus for making combustible gas out of ——. J. T. Davis, Alameda, Cal., Assignor to Technical Development Co., San Francisco, Cal. U.S. Pat. 1,058,660, April 8, 1913.

The petroleum is caused to flow downwards through a series of superposed horizontal pipes in a heating chamber, these pipes being connected alternately at opposite ends so as to form a continuous conduit. Each pipe connection at one end of the chamber has a branch leading to a common vertical pipe, and the gases or vapours passing up this pipe are led through a long tortuous brickwork conduit arranged within a second heating chamber.—A. T. L.

Petrol, petroleum, benzene, etc.; Process and apparatus for the continuous and systematic purification of ——. E. A. Barbet. Fr. Pat. 449,960, Jan. 6, 1912.

The oil is caused to flow continuously through three vertical cylindrical vessels in succession in which it is treated with sulphuric acid, water, and caustic soda respectively. Each of these vessels is packed with glass balls, and is provided with an inlet for the oil near the bottom, an inlet for the acid, water or alkali somewhat below the top, an overflow pipe at the top by which the oil which has passed upwards through the heavier descending liquid is led away to the next succeeding vessel, and with an outlet pipe arranged at a lower point than the oil inlet by which the acid, water or alkali flows away. In order to keep the acid, etc., at a suitable level, this outlet pipe runs up outside the vessel to the necessary height. By this arrangement the purification takes place continuously and the oil is intimately mixed with the acid, etc., in ascending through the column of glass balls.—A. T. L.

Gas producers. A. F. Matlack, Philadelphia. Eng. Pat. 7712, March 29, 1912.

See U.S. Pat. 1,025,198 of 1912; this J., 1912, 526.—T.F.B.

Fuel calorimeters. Eng. Pat. 24,196. *See* XXIII.

Gas calorimeter. U.S. Pat. 1,058,483. *See* XXIII.

Gas-analysing apparatus and process. U.S. Pat. 1,057,767. *See* XXIII.

Test-burner. U.S. Pat. 1,058,702. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Turpentine oil obtained direct from wood by destructive distillation and in the manufacture of cellulose by the soda process. H. Bergström. Papierfabr., 1913, 11, 398—400.

There is an increasing production of turpentine oil directly from the wood, either by the distillation of wood waste or by recovery as a by-product in the manufacture of cellulose by the soda process. The oil obtained by distilling the wood with steam contains larger proportions of oxidation products and polyterpenes than the oil from the oleo-resin; also when both oils are similarly purified, the former generally contains less pinene than the latter. Nevertheless both oils are stated to be of equal value for painters' work. In the manufacture of cellulose, pure caustic soda is now rarely employed, the sulphate process being generally adopted. The sulphur compounds thereby produced impart to the crude recovered turpentine oil a very objectionable odour, but by suitable purification and re-distillation the malodorous products may be eliminated, and the purified oil is then equal in quality to the natural oil of the wood. The quality of the refined oil depends chiefly on the care devoted to the distillation; contrary to some opinions, the age of the crude oil before refining has no influence. Oils obtained from the ordinary American and French resin-yielding woods contain more pinene than those from the Scandinavian pine. The colour reactions, *e.g.*, those of Herzfeld (this J., 1905, 108) and Utz (this J., 1905, 562), for the detection of wood turpentine oil are not always reliable; they give a positive result with the lighter portions of the crude oil and with the fractions boiling up to 185° C. of pine wood oil after these have been kept for some time. By rectification of the crude oils, however, it is possible to obtain fractions which do not respond to these colour reactions. Neither are optical tests very reliable, because in the manufacture of cellulose a mixture of different varieties of wood is frequently employed in various proportions, and whereas the oil from pine wood is dextro-rotatory, that from spruce wood is lævo-rotatory.—J. F. B.

Increase in South Russian coke oven by-products. Chem. Trade J. April 19, 1913. [T.R.]

The returns show that the average number of coking ovens at work per month in the Donetz basin in 1912 was 436 with recuperative apparatus, out of a total of 720, counted at end of year. There was a rapid increase in the production of primary by-products in South Russia compared with 1911. The quantity of coal-tar obtained was 19,040 tons, 75·35 per cent. more than in 1911. The quantity of ammoniacal liquor obtained (25 per cent.) in 1912 was 10,000 tons, or about 2½ times the production of 1911. In secondary by-products there was a particularly large increase in the production of sulphate of ammonia, which last year amounted to 3945 tons, 7·7 times that of 1911. The quantity of heavy oil produced was 3763 tons, or 45·70 per cent. more than in 1911, the figures for pitch being 4694 tons, an increase of 43·40 per cent. The production of ammonia spirit last year amounted to 104 tons, over twice that of the preceding year.

Patents.

Wood waste; Utilisation of ——. J. Buisson. Fr. Pat. 449,350, Oct. 12, 1912.

The wood waste is ground up and mixed in a steam-jacketed vessel with a binder formed by evaporating to dryness the lyes obtained in making wood-pulp. The mixture is pressed into briquettes and these are carbonised in a closed chamber at a temperature of 350° C. and the residue allowed to cool before exposure to air.—A. T. L.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,375, June 6, 1912.

The electrodes are composed of Cu 92, and Al 8 parts.
—W. H. C.

Dry distillation of organic substances dissolved or suspended in a liquid; Process for the ——. E. S. Sandberg and G. K. Sundblad. Fr. Pat. 449,953, Oct. 29, 1912. Under Int. Conv., Oct. 30, 1911.

See Eng. Pat. 24,125 of 1912; this J., 1913, 279.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Petroleum or asphaltum products in tars; Application of the dimethyl sulphate test for determining [detecting] small amounts of——. C. S. Reeve and R. H. Lewis. J. Ind. Eng. Chem., 1913, **5**, 293—295.

The method of carrying out the dimethyl sulphate test (see this J., 1908, 114; 1912, 65) proposed by Sommer (this J., 1910, 682) is not sufficiently delicate to detect the presence of 10 per cent. of asphaltum in tar-asphaltum mixtures as used in road-making and paving. The authors describe experiments showing that the presence of even as little as 3 per cent. of asphaltum may be detected if the test be applied to separate high-boiling fractions obtained by distillation. For example with mixtures containing 10 per cent. of asphaltum, positive results were obtained with the 315°—350° C. and 350°—375° C. fractions, but not with the 270°—315° C. fraction or with the total distillate as in Sommer's method. With mixtures containing 3 per cent. of asphaltum, positive results were obtained with the 350°—375° C. fraction, but not with the 315°—350° C. fraction.—A. S.

Anthraquinone and anthracene; The preparation of chlorine derivatives of——. H. Schilling. Ber., 1913, **46**, 1066—1069.

The method used was to sulphonate the four known chloroanthraquinones (α-mono, β-mono, 1·5-di and 1·8-dichloroanthraquinones) and then substitute chlorine for the sulphonic groups by passing chlorine gas into the aqueous solution of the acid (Ger. Pat. 205,195). The sulphonation was carried out in each case with and without a mercury catalyst and in this way eight new polychloroanthraquinones were obtained. The corresponding chloroanthracenes were obtained by reduction with zinc dust and ammonia. The melting points are tabulated.—J. B.

Patents.

Nitro-aminoanthraquinones; Process for preparing——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 450,171, Nov. 5, 1912.

When the nitramines of anthraquinone are treated with mineral acids, other than concentrated nitric acid, they undergo intramolecular transformation, nitro-aminoanthraquinones being produced. Thus, α-nitraminoanthraquinone is converted into a mixture of 1-amino-2-nitro- and 1-amino-4-nitroanthraquinone, whilst β-nitramino-anthraquinone furnishes only 1-nitro-2-aminoanthraquinone. The β-nitramines may be conveniently prepared by heating the corresponding isodiazo compounds with oxidising agents such as sodium hypochlorite or potassium ferricyanide.—T. F. B.

Bases from tar or tar oils; Process for increasing the fungicidal and insecticidal properties of——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 257,848, Sept. 19, 1911.

The crude, insoluble tar bases are passed over highly heated contact substances, with or without a stream of hydrogen. The products are stated to possess fungicidal and insecticidal properties as powerful as those of nicotine.
—T. F. B.

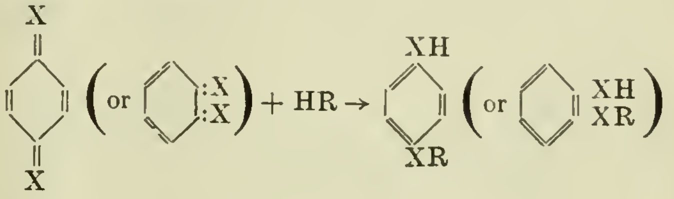
Systematic purification of petrol, petroleum, benzene, etc. Fr. Pat. 449,960. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

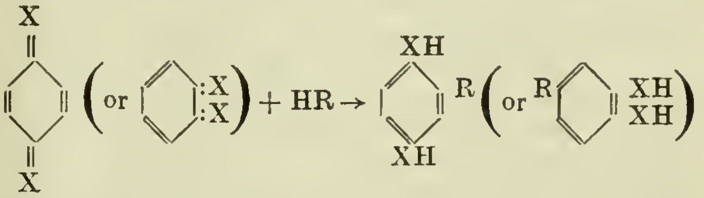
Dyestuff formation; Quinonoid addition as the mechanism of——. A. G. Green. Chem. Soc. Proc., 1913, **29**, 116.

The following generalisation correlates a large number of well-known facts, and affords a ready explanation of the ease with which many very complex dyestuffs are produced. 1. All quinones and quinone-like compounds, by reason of their high degree of "unsaturation," exhibit a great attraction for hydrogen or equivalent groups, by the assumption of which they can pass into more saturated compounds. 2. A very large proportion of dyestuff syntheses and the individual steps in such syntheses may be represented as consisting in the linking up of molecules brought about through the attractive forces of quinonoid groups. 3. Such reactions may occur in two ways, namely:

(*a*) *Direct addition:*



(*b*) *Indirect Addition:*



4. In the presence of an oxidising agent, such as chromic acid, atmospheric oxygen, nitrobenzene, or another quinonoid compound, the above additive products may be again converted into quinonoid derivatives, which under suitable conditions are ready to react again in the same way as before. Such alternate additions and re-oxidations may occur several times in succession, thus producing very complex molecular structures, such as those in the Induline and Aniline Black series.

Triphenylmethane colour-bases. E. Noelting and J. Saas. Ber., 1913, **46**, 952—967. (See also this J., 1913, 16).

Crystal Violet, as prepared from Michler's ketone and dimethylaniline, contains some pentamethyl compound in addition to the hexamethyl. This can be reduced to a minimum by using a large excess of dimethylaniline, and finally eliminated by re-crystallisation. The pure product gives two types of colourless base—with caustic potash it gives the carbinol, $HO.C[C_6H_4.N(CH_3)_2]_3$ and with ammonia it gives the carbinol-amine, $NH_2.C[C_6H_4N(CH_3)_2]_3$ (compare Ber. 1908, **41**, 3909). Diethylamine precipitates the carbinol and not the diethylcarbinol-amine as might be expected. Trimethylamine in excess does not give the carbinol but the coloured (violet) tertiary ammonium base, $HO(CH_3)_2N : C_6H_4 : C : [C_6H_4N(CH_3)_2]_2$, which slowly changes into the carbinol. Pure "hexamethyl" Crystal Violet as prepared by the authors does not give a coloured ether extract when its solution is treated with alkali if care is taken to keep the temperature low and no excess of alkali is used. The intensely brown coloured extract obtained with ordinary Crystal Violet is due to the presence of the pentamethyl product which gives a quinonoid imide base. All dyestuffs of this type which contain an incompletely substituted amino group give these characteristically coloured bases. The coloured extract obtained by Baeyer and Homolka (Annalen 1909, **372**, 115) appears to be due to decomposition by the excess of alkali:—

$$C{:}C_6H_4{:}N(CH_3)_2OH \rightarrow {:}C(OH).C_6H_4.NH.CH_3 + CH_2O + H_2$$

Hantzsch has demonstrated the existence of the coloured ammonium bases by conductivity experiments. Their existence is also demonstrated by the fact that when Crystal Violet is treated with alkali an appreciable time is required before the colourless carbinol is formed. These bases are insoluble in ether and have the same colour as the parent substance. In general the carbinol-amines are less soluble than the carbinols and more stable to acids. They give colourless solutions in acid in the cold. *Ethyl Violet* gives the carbinol-amine with some difficulty. Its carbinol is partially etherified by crystallisation from alcohol. *Victoria Blue B* obtained from phenyl-α-naphthylamine and Michler's ketone gave no carbinol or carbinol-amine, but the imide-base,

$$C_6H_5.N : C_{10}H_6 : C : [C_6H_4.N(CH_3)_2]_2$$

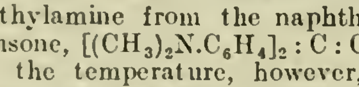
which crystallises from ligroin in dark violet crystals. *Night Blue*, the *p*-tolyl analogue, gave a similar product. In both cases a leuco base was obtained by reducing the imide. *α-Naphthol Blue* obtained by condensing Michler's ketone with α-naphthol gave a very stable quinonoid base, but no carbinol or carbinol-amine could be obtained. The leuco base is readily obtained by reduction. *Naphthol Blue*, obtained by condensing dimethyl-α-naphthylamine with Michler's ketone contains, like Crystal Violet, a penta-methyl as well as a hexamethyl derivative. Ammonia gives the carbinol-amine. Alkalis tend to split off dimethylamine from the naphthalene nucleus, giving the fuchsone, $[(CH_3)_2N.C_6H_4]_2 : C : C_{10}H_6 : O$. By keeping down the temperature, however, the carbinol can be obtained. It crystallises from ligroin, in which the fuchsone is insoluble.—J. B.

Rhodamines ; Tetrachlorinated ——. M. Bloch. Bull. Soc. Ind. Mulhouse, 1913, **83**, 81—84.

Tetramethyltetrachlororhodamine is obtained by heating 1 mol. of dimethyl-*m*-aminophenol with 1 mol. of tetrachlorophthalic anhydride. The phthalate of the rhodamine which is formed is decomposed with sodium carbonate and the base is converted into its hydrochloride, which forms fine green crystals. Cotton is dyed a red-violet shade, wool and silk a redder shade. The shade on silk is fluorescent. The dyeings are remarkably fast to light and alkali. The rhodamine could not be esterified, probably owing to steric hindrance. By heating equimolecular quantities of tetrachlorphthalic anhydride and dimethyl-*m*-aminophenol in xylol solution, tetrachlorodimethylamino *m*-hydroxybenzoylbenzoic acid,

$$C_6Cl_4(COOH).CO.C_6H_3(OH)N(CH_3)_2$$

is obtained, and a product insoluble in alkali, probably the di-dimethyl-*m*-aminophenol-ester of tetrachlorphthalic acid. *p*-Phenylenediamine and its derivatives give products of the type:



$$C_6Cl_4\left\langle\begin{array}{l}—C : N.C_6H_4.NR_2\\ \quad\cdot\\ CO.O\end{array}\right.$$

The tetrachlorodimethylamino-*m*-hydroxybenzoylbenzoic acid condenses with *p*-cresol to give an aporhodamine, also with resorcinol and pyrogallol to give the corresponding mixed rhodamines and fluoresceins.—J. B.

Food colours ; The quantitative separation and determination of subsidiary dyes in the permitted ——. W. E. Mathewson. U. S. Dept. Agric., Bureau of Chem., Circular No. 113, March 26, 1913.

Fast Red E in Amaranth. The solution of about 0·2 grm. of dyestuff is treated with 5 c.c. of 5 *N*-hydrochloric acid and diluted to 50 c.c. It is then extracted three times with 50 c.c. of amyl alcohol and the three extracts washed with three 50 c.c. lots of *N*/4 hydrochloric acid, which are added to the separators containing the amyl alcohol in the same order as with the original solution. The contents of the last two separators are given a fourth washing, the last one a fifth. The united extract is then diluted with gasoline and the Fast Red E removed with caustic soda and titrated with titanium trichloride. *New Coccin in Amaranth.* 50 c.c. of a 0·02 per cent. solution of the colour are treated with 10 c.c. of *N*/10 benzidine solution (9·2 grms. of benzidine dissolved in *N*/2 hydrochloric acid), and after standing for two minutes, the solution is filtered and titrated with titanium trichloride. The method is empirical and the result is obtained by parallel analyses of known mixtures. Amaranth can also be separated from New Coccin by converting its 6-sulphonic group into the cyanide group by the action of potassium cyanide (Lange, Ger. Pats. 189,935 and 191,838). The cyanide is a maroon dyestuff, easily separated by the amyl alcohol method. *Monosulphonated dyestuffs in Ponceau 3R* are determined by extracting the colour acids with amyl alcohol as in the case of Fast Red E. *Orange II in Orange I.* Use is made of the fact that Orange I is more soluble in dilute sodium carbonate solution than Orange II. About 50 c.c. of the dyestuff solution are mixed with 10 c.c. of concentrated hydrochloric acid and shaken with 50 c.c. of amyl alcohol. All the dyestuff passes into the amyl alcohol, which is then washed with six 50 c.c. lots of *N*/1 sodium carbonate solution, the alkaline extracts being washed twice with 50 c.c. of amyl alcohol each time. Gasoline is then added and the colour removed and titrated as before.—J. B.

Dyestuffs ; Identification of small amounts of —— *by oxidation with bromine.* W. E. Mathewson. U.S. Dept. Agric., Bureau of Chem., Circular No. 114, March 21, 1913.

To a few c.c. of the dye solution bromine is added drop by drop, using twice the number of drops required to destroy the colour. The excess of bromine is then taken up with hydrazine sulphate and an excess of sodium carbonate added. A second portion is treated in the same way, except that a few drops of α-naphthol solution (10 per cent. in 50 per cent. alcohol) are added before making alkaline. A table shows the behaviour of eighteen common dyestuffs. The reaction in the case of azo dyestuffs is the splitting of the azo group with the formation of a diazonium salt, which combines with the α-naphthol to give characteristic colours (see Schmidt, this J., 1912, p. 223). In the case of some azo dyestuffs the diazonium compound combines with certain oxidation products which are formed.—J. B.

Patents.

Azo colouring matters ; Production of —— *suitable for lakes.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,146, June 28, 1912.

Benzoyl-1-8-aminonaphthol-4-6-disulphonic acid is combined with the diazo compound obtained from any of the following bases: *m*-toluidine, 4-amino-1-3-dimethylbenzene, α-naphthylamine, *o*- or *p*-anisidine, *o*- or *p*-phenetidine. The blue-red dyestuffs produced are suitable for the production of lakes (see also Eng. Pat. 26,457 of 1904 ; this J., 1905, 1075).—J. B.

Diazotisable azo dyestuffs for cotton and process for making them. Act.-Ges. f. Anilinfabr. Fr. Pat. 449,012, Oct. 3, 1912. Under Int. Conv., Nov. 29, 1911.

Two mols. of a diazo compound of the benzene or naphthalene series are combined with symmetrical 3.3′-diaminodiphenylurea or its homologues or analogues, the products are acidylated by means of the halogenides of nitroarylcarboxylic acids, and the nitro group is reduced. The dyestuffs obtained in this manner dye cotton directly yellow to orange shades. They may be diazotised, either in substance or on the fibre, and combined with suitable components ; thus, when combined with β-naphthol, fast orange to red dyestuffs are usually produced.—T. F. B.

Azo dyestuffs and process for producing them. Act.-Ges. f. Anilinfabr. Fr. Pat. 449,653, Oct. 21, 1912. Under Int. Conv., Dec. 19, 1911.

A suitable diazo compound is combined with a 2-aminophenyl-oxyacetic acid in which the 4-position contains an alkyl or alkyloxy group, or with 1-amino-2-naphthyloxyacetic acid. For example, the dyestuff from benzidine and 2-amino-4-methylphenyloxyacetic acid dyes cotton reddish-brown shades. These dyestuffs can be converted into new dyestuffs by treatment with acids ; this results in the elimination of water between the carboxyl group and the amino group. In the example given above, the condensed dyestuff is yellow. This condensation may be effected on the fibre.—T. F. B.

Sulphide dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 449,983, Oct. 29, 1912. Under Int. Conv., Nov. 4, 1911, and Oct. 11, 1912.

See Ger. Pat. 253,934 of 1911 ; this J., 1913, 80. Perimidine itself, or homologues or other derivatives thereof may be used in place of nitro- or amino-perimidines.
—T. F. B.

Indigo in a form similar to natural indigo; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 450,145, Nov. 4, 1912. Under Int. Conv., Nov. 7 and 10, 1911.

Indigo is isolated from the products obtained by fusing indoxyl or indoxylcarboxylic acid with alkali, or from alkaline solutions of Indigo White, by oxidation in presence of a colloidal substance or a carbohydrate. If an inorganic colloid is used, it should be either insoluble or not easily soluble in dilute aqueous alkali, *e.g.*, hydrated magnesium silicate, colloidal compounds of aluminium, chromium, iron, silicic acid, etc. Solutions of glue, gum, dextrin, albumin, gelatin, or glucose may also be used. The products may be dried, if necessary, after addition of a substance which will facilitate their conversion into paste form, *e.g.*, a carbohydrate, glycerin, or sulphite-cellulose lye. This process prevents the precipitation of the indigo in the form of large crystals; as regards fracture, colour, and specific gravity it closely resembles natural indigo, whilst it is more easily reduced. Instead of drying the precipitated product as described, it can be triturated with a "disglomerating" agent, such as the sodium salt of benzylsulphanilic acid (see also this J., 1911, 1047, 1110, 1372; 1912, 808, 1174).
—T. F. B.

Disazo dyestuffs; Process for preparing substantive ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 257,689, Nov. 10, 1911.

Nitrobenzoyl-*p*-phenylenediaminesulphonic acids are diazotised and combined with pyrazolones or their sulphonic or carboxylic acids, or with the arylides of acetoacetic acid, the nitro group of the resulting dyestuffs is reduced to an amino group, and the products are treated with phosgene. Yellow substantive dyestuffs, fast to light and washing are thus produced.—T. F. B.

Di- and tri-anthrimides of the β-anthraquinone series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 257,811, Nov. 12, 1909.

β-Chloro-anthraquinones are heated with β-amino-anthraquinones in presence of a solvent or diluent and an agent which will combine with hydrochloric acid, salts of heavy metals being excluded. The di- and tri-anthrimides thus formed may be used as vat dyestuffs and for the preparation of other dyestuffs.—T. F. B.

Vat dyestuff of the anthraquinone series; Process for preparing a yellow ——. R. Wedekind und Co. Ger. Pat. 257,832, Feb. 25, 1912.

1-Chloro-2-hydroxyanthraquinone is heated, with or without addition of alkali hydroxide or carbonate or sodium acetate, and the product is chlorinated. The dyestuff is insoluble in alkalis, and dyes cotton from the vat fast bright yellow shades.—T. F. B.

Gallocyanine dyestuff and its leuco compound; Process for preparing a violet ——. Chem. Fabr. vorm. Sandoz. Ger. Pat. 257,833, May 1, 1912.

When quinone dichlorodi-imide is condensed with gallamic acid in presence of a solvent, a gallocyanine is produced which dyes reddish-violet shades. It can be converted into its leuco-compound by reduction.—T. F. B.

Dyestuffs and intermediate products; Process for preparing ——. H. Wichelhaus. Ger. Pat. 257,835, June 25, 1912.

The products are obtained by the action of condensing agents on hydroxyarylmethanesulphonic acids (*e.g.*, from phenol, formaldehyde, and sodium sulphite, or from benzyl chloride and sulphites) or on compounds of the type $Ar.CH_2.NR_2$ (when R is an alkyl radical; obtained, for example, by treating phenols with formaldehyde and secondary amines). Thus, β-hydroxynaphthyl-1-methanesulphonic acid, $HO.C_{10}H_6.CH_2.SO_3H$, when heated with zinc chloride for two hours at 140°—160° C., is converted into a red, amorphous substance which furnishes colour lakes with salts of aluminium, manganese, and zinc.
—T. F. B.

Dyes of the anthracene series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9509, April 22, 1912.

See Ger. Pat. 252,530 of 1911; this J., 1912, 1117.—T. F. B.

Vat dyestuffs of the anthracene series; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 449,076, Oct. 5, 1912. Under Int. Conv., Oct. 13, 1911.

See Eng. Pat. 12,617 of 1912; this J., 1913, 418.—T. F. B.

Indophenol condensation products and their leuco-derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,615, May 28, 1912.

See Ger. Pat. 254,859 of 1911; this J., 1913, 189.—T. F. B.

Indophenols and sulphide dyestuffs derived therefrom; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 449,013, Oct. 3, 1912. Under Int. Conv., Oct. 12, 1911.

See Ger. Pat. 254,328 of 1911; this J., 1913, 189.—T. F. B.

Monoazo dyes. A. Zart, Vohwinkel, and K. Desamari, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,058,562 and 1,058,692, April 8, 1913.

See Eng. Pat. 21,201 of 1910; this J., 1911, 1108.—T. F. B.

Sulphide dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 449,122, Oct. 7, 1912. Under Int. Conv., Oct. 28, 1911.

See Ger. Pat. 254,304 of 1911; this J., 1913, 189.—T. F. B.

Anthracene compounds [dyestuffs] and process of making them. M. A. Kunz, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,058,604, April 8, 1913.

See Fr. Pat. 424,814 of 1911; this J., 1911, 739.—T. F. B.

Anthraquinone-thiazole compounds and their hydrogenated derivatives. Badische Anilin und Soda Fabrik. Fr. Pat. 449,359, Oct. 12, 1912. Under Int. Conv., Nov. 24, 1911.

See Eng. Pat. 1970 of 1912; this J., 1912, 1174.—T. F. B.

Vat dyestuffs of the anthraquinone series; Process for producing ——. L. Cassella und Co. Fr. Pat. 449,194, Dec. 16, 1911.

See Eng. Pat. 28,874 of 1911; this J., 1912, 867.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton goods; The influence of hot caustic lye on the strength of ——. R. Bude. Färber-Zeit., 1913, 24, 159—160.

Grey cotton cloth was treated with caustic lye of 8°, 12° and 18° Bé. (5·29, 8·00 and 12·64 per cent. NaOH), no tension being applied. After washing well the cloth was boiled under pressure and bleached. Strength determinations were made on both warp and weft threads. Duplicate tests were made with a heavier cloth, and also with the same cloth after dyeing and finishing. Increased strength was found in all cases. There is also a decrease in the loss in weight with increasing concentration of the caustic soda. The increase in strength is probably caused by the formation of a cellulose hydrate, the factors which influence the change probably operating through their effect on the osmotic pressure of the solution.—J. B.

Cellulose : The action of ozone on ——. Part III. Action on beech wood (lignocellulose). C. Dorée and M. Cunningham. Chem. Soc. Proc., 1913, **29**, 104—105.

In continuation of previous work on the simple lignocellulose jute (this J., 1912, 278), the action of ozone on the more complex tissues of the woods has been examined. In the presence of moisture, ozone rapidly attacks the wood substance, producing carbon dioxide and acidic substances. As the result of oxidation with ozone a considerable proportion of the wood is converted into derivatives soluble in water; after twelve hours the loss in weight is some 40 per cent. The water-digest contains acetic, formic, and other reducing acids, and yields furfuraldehyde. Vanillin was not detected. The properties of a wood residue obtained after thirty hours' treatment were given in detail. This contained one-half of the furfuraldehyde-yielding groups, but only one-third of the methoxyl groupings of the original wood. The results are well explained by the formulation of the lignone complex given by Cross and Bevan ("Researches on Cellulose," III., 104), but they do not lend support to the coniferyl alcohol formula proposed by Klason.

"Elephant grass" [Pennisetum purpureum, Schum.] as a paper-making material. Bull. Imp. Inst., 1913, **11**, 68—70.

"ELEPHANT GRASS" grows to a height of 6—10 ft. and occurs in a wide zone across tropical Africa, forming extensive reed jungles in some parts. A sample of the grass from Uganda was examined. The air-dried material contained 10·7 per cent. of moisture and yielded 29 per cent. of unbleached pulp of good colour, with ultimate fibres about as long as those of bamboo pulp and somewhat longer than those of esparto pulp. The nodes caused no difficulty in the preparation of the pulp, which furnished a fairly good paper. The grass could not be profitably exported owing to its light and bulky nature, but it might prove remunerative to manufacture paper pulp therefrom on the spot by the caustic soda process and export the pulp.—A. S.

"Cheyi" [Polygala butyracea] seed and fibre. See XII.

Turpentine oil obtained direct from wood by destructive distillation and in the manufacture of cellulose by the soda process. Bergström. *See* IIB.

PATENTS.

Textile fibrous residues; Process of separating —— from foreign substances, colouring matters or impurities mixed with them. J. J. Werst, P. M. H. L. Collee, and J. M. Egmond. Fr. Pat. 449,059, Oct. 5, 1912.

THE fibrous matter, previously digested with chemicals, such as sulphites, thiosulphates, etc., or untreated, is subjected to the detergent action of two or more mobile immiscible liquids, which readily separate into two layers, one impregnating the fibrous matter and the other causing the separation of the impurities. The apparatus consists of a battery of mechanical emulsifiers and separators, through which the material under treatment travels alternately. In the treatment of printed waste papers the material is first digested under pressure with a solution of a sulphite and the washed pulp is treated in the apparatus with a neutral or slightly acid aqueous liquid on the one hand and with benzene on the other.—J. F. B.

Cellulose; New derivatives [mixed esters] of —— and their method of preparation. Act.-Ges. für Anilin-Fabrikation. Fr. Pat. 449,253, Aug. 28, 1912. Under Int. Conv., Sept. 4, 1911.

CELLULOSE derivatives containing small quantities of nitrogen, preferably in the form of nitric ester, and insoluble in acetic acid and acetic anhydride, are treated with any of the suitable organic esterifying mixtures, *e.g.*, acetic anhydride or formic acid in presence of a catalytic agent, and the product obtained may, if desired, be suitably modified by hydrolysis according to any of the known processes. Example: The nitric ester of cellulose employed as a starting point and containing 1·5—3 per cent. of nitrogen is prepared by treating cellulose with a mixture of nitric and sulphuric acids containing a large proportion (25—34 per cent.) of water for a period of 10—20 hours. This product is acetylated by means of a mixture containing 400 parts of glacial acetic acid, 200 parts of acetic anhydride and 3 parts of sulphuric acid. Other catalytic agents may also be employed.—J. F. B.

Artificial silk from viscose; Process of manufacture of ——. Chem. Fabr. von Heyden Akt.-Ges. Fr. Pat. 449,536, Oct. 17, 1912.

IN the manufacture of artificial silk from viscose, the coagulation of the threads and their re-conversion into cellulose are performed in two separate operations, in both of which a solution of a mineral acid is employed. For coagulating the threads, the concentration of the bath of mineral acid and the time of contact (speed of spinning) are so regulated that the threads issuing from the coagulating bath are still substantially soluble in water. These threads are wound up on drums and are converted into insoluble cellulose by a second treatment with dilute mineral acid or with a saline solution. If desired, the coagulated soluble threads may be allowed to carry with them mechanically sufficient of the mineral acid from the first bath to effect their gradual re-conversion into cellulose without the use of a further quantity of acid.—J. F. B.

Ligno- and pecto-cellulose; Process of bleaching ——. A. R. de Vains and J. F. T. Peterson. Fr. Pat. 449,497, Aug. 28, 1912.

IN the bleaching of paper pulp or the like by successive treatments with cold chlorine water, alkali, and a hypochlorite, claim is made for carrying out the operations in a suitable circulating apparatus, together with the use of a counter-current saturator for making the chlorine water and the use of a hydraulic seal of liquid vaseline over the chlorine water.—J. B.

Paper pulp; Process of manufacture of ——. W. C. Chaplin. Fr. Pat. 449,943, Oct. 29, 1912.

WOOD or other fibrous vegetable material is first reduced to convenient dimensions and ground to a pulp without chemical treatment. The material is then charged into breaking engines fitted with drum-washers in order to separate the fibres and remove soluble matters. In the case of resinous woods only, a little caustic soda is used in the breakers and subsequently washed out. The material is next treated with a liquor prepared by mixing 10 kilos. of bleaching powder with 120 litres of water and 750—1000 grms. of oxalic acid. The quantity of this solution added to the pulp in the breaker is about 1 litre per kilo. of cellulose. After treatment for 2—6 hours the bleached mass is drained, and the liquors may be recovered for regeneration.—J. F. B.

Slag and clinker "wools" and "cottons" for the manufacture [loading] of paper, boards and similar products; Utilisation of ——. E. Verbert. Fr. Pat. 450,226, Aug. 28, 1912. Under Int. Conv., Aug. 28, 1911.

INSTEAD of china clay etc., the fibrous waste products of the metallurgical industries known as slag "wools" or "cottons" are employed for the mineral loading of paper pulp. The fibrous form of such materials assists their retention by the pulp.—J. F. B.

Sulphite waste liquor; Process of concentrating ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,057,416, April 1, 1913.

THE waste liquors are freed from a portion of the free sulphur dioxide by air-blowing, the remainder being neutralised with alkali. The alkaline liquor is then heated to promote hydrolysis, concentrated under reduced pressure, and finally freed from insoluble products of hydrolysis. It is recommended to blow air heated to 60° C. through the liquor heated to 40° C., render alkaline with lime, continue the aeration at 60° C., filter, concentrate and again filter.—J. B.

Cotton yarn; Method of treating ——. S. Shimizu, Osaki-Machi, Assignor to M. Murai, Tokyo, Japan. U.S. Pat. 1,058,338, April 8, 1913.

See Eng. Pat. 867 of 1910; this J., 1911, 485.—T. F. B.

Metallised textile and other fibres and fabrics. Peter Spence and Sons, Ltd. Fr. Pat. 449,802, Oct. 24, 1912. Under Int. Conv., Nov. 16, 1911.

See Eng. Pat. 25,534 of 1911; this J., 1913, 19.—T. F. B.

Cellulose esters [acetate]; Process for the manufacture of ——. L. Lederer, Sulzbach, Bavaria. Eng. Pat. 7687, March 29, 1912.

See Fr. Pat. 441,864 of 1912; this J., 1912, 916.—T. F. B.

Solvents for cellulose; Preparation of ——. Peter Spence and Sons, Ltd. Fr. Pat. 449,801, Oct. 24, 1912. Under Int. Conv., Nov. 16, 1911.

See Eng. Pat. 25,532 of 1911; this J., 1913, 18.—T. F. B.

Cellulose solutions. Peter Spence and Sons, Ltd. Fr. Pat. 449,803, Oct. 24, 1912. Under Int. Conv., Nov. 16, 1911.

See Eng. Pat. 25,533 of 1911; this J., 1913, 18.—T. F. B.

Cellulose solutions; Process for preparing —— by means of ammoniacal copper oxide. B. Borzykowski. Fr. Pat. 450,193, Nov. 6, 1912. Under Int. Conv., Dec. 7, 1911.

See Eng. Pat. 24,996 of 1912; this J., 1913, 283.—T. F. B.

Pulping apparatus [for fibrous material]. H. Strieth, Nuremberg, Germany. U.S. Pat. 1,058,641, April 8, 1913.

See Fr. Pat. 444,045 of 1912; this J., 1912, 1120.—T. F. B.

Soda [from treating cellulose, etc.]; Process for purifying waste ——. La Soie Artificielle. Fr. Pat. 449,457, Dec. 23, 1911.

See Eng. Pat. 1573 of 1912; this J., 1912, 431.—T. F. B.

Utilisation of wood waste. Fr. Pat. 449,350. *See* IIb.

Colloidal substances [solutions of nitrocellulose] and their manufacture. Fr. Pat. 449,606. *See* XXII.

Production of dissolved carbon compounds [pyroxylin, etc.]. Fr. Pat. 449,607. *See* XXII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Shoddies and rags; The stripping and dyeing of ——. T. H. Miller. J. Soc. Dyers and Col., 1913, **29**, 101—105.

The extent to which the rags are stripped depends on the shade they have subsequently to be dyed, and hydrosulphite, or bichromate and sulphuric acid. are used accordingly. The choice of stripping agent is also regulated by the original colour of the rags, hydrosulphite, for instance, being less effective than bichromate and sulphuric acid in the case of greys, "steels" and faded blacks. A table shows the shades produced by the above two stripping agents with the various classes of sorted woollen rags. Cotton rags are rarely stripped and then only with sodium carbonate or sodium carbonate and hydrosulphite. Dyeing is complicated by the presence of various mordants in the rags, also by the different degrees of treatment which the rags have undergone in their earlier history. Stripping causes an increase in affinity, hence easy levelling dyestuffs are necessary. Fast acid dyestuffs, mordant dyestuffs and a few direct dyestuffs are used, the chief demands being for brightness and the non-staining of white wool in the subsequent milling. The methods of dyeing union shoddies are: (1) the one-bath method, using a direct dyestuff. This method is only suitable when stripping is unnecessary and when the goods have not to be milled with white cotton; (2) the two-bath method, in which the wool is first dyed with an acid or acid mordant dyestuff and the cotton afterwards with a direct dyestuff. This gives shades fast to milling; (3) the two-bath method in which the cotton is dyed with a basic dyestuff on a tannin-antimony mordant. This gives bright shades which are not fast to light and milling; (4) the three-bath method, which is the same as (3) except that the wool is mordanted and dyed separately, the cotton being finally dyed with a direct dyestuff.—J. B.

Union material; The action of neutral salts on ——. M. Fort. J. Soc. Dyers and Col., 1913, **29**, 120—121.

It is shown that the deterioration of union materials dyed in a neutral bath is due to tendering of the cotton by the acid which is taken up and retained by the wool as a result of a neutral salt reaction between the wool and the sodium sulphate or sodium chloride. This acid is not removed from the wool by washing with water, but is set free on drying. The cotton is evidently attacked during storing. The effect is more noticeable when sodium sulphate is used than with sodium chloride. It is stated that the addition of ½ to 2 per cent. of glue to the dye-bath is of value as a protection against damage. (See also this J., 1912, 1030; and 1913, 359.)—J. B.

Reserves under Indanthrene S or AS by chromates or other oxidising agents. P. Jeanmaire. Sealed note No. 1270, July 9, 1901. Report thereon by L. Bloch. Bull. Soc. Ind. Mulhouse, 1913, **83**, 84—86.

The colour is printed with ferrous tartrate, ferrous sulphate or stannous chloride and after printing, the cloth is passed through caustic soda of 15° to 28° Bé. (sp. gr. 1·116—1·241) at a temperature of 60° to 75° C. After souring to remove iron, etc., the cloth is washed and soaped. Reserve effects are obtained by printing a neutral chromate, for example.—J. B.

Turkey Red; Process of printing Indanthrene Blue over ——. S. Ivanoff. Sealed note No. 1299, Nov. 8, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1913, **83**, 87—89.

The cloth is mordanted with aluminium acetate, treated with sodium arsenite, dunged, washed, dyed with Alizarin SX, washed, dried and then printed with Indanthrene together with caustic soda, starch and British gum. After steaming under pressure for 4½ minutes, soaping lightly and drying, the cloth is oiled with sulpholeate, steamed for an hour and a half and finally washed. The report states that this is the first attempt to print Indanthrene over Alizarin Red. The method has, however, been superseded by that of Zündel using hydrosulphite-formaldehyde.—J. B.

Methods for the analysis of hydrosulphite. Bosshard and Grob. *See* VII.

Patents.

Dyeing machine. Dyeing apparatus. J. H. Giles, Assignor to Klauder-Weldon Dyeing Machine Co., Amsterdam, N.Y. U.S. Pats. 1,057,634 and 1,057.635, April 1, 1913.

(1) The machine consists of a wheel divided by perforated partitions extending from the outer to the inner portion thereof into five symmetrically disposed buckets. The partitions are bent in the middle, the inner portion and outer portion being at such an angle to each other that when the wheel revolves, half immersed in the dye-liquor, the material resting against the outer portion of a partition is allowed to fall by gravity before it can fall on the inner portion. The space between the buckets is unobstructed so that the material can move freely from one partition on to the other. (2) The machine is of the type in which the yarn is carried on sticks mounted in sockets, which are rotated by means of a star-wheel

engaged by a catch once during each revolution of the frame, rotation being made possible in one direction only by means of a pawl and ratchet attached to the socket. According to the present invention the pawl has a counter-weight attached, which, by the operation of gravity, automatically causes the pawl to become disengaged from the ratchet during that part of the revolution when the yarn is in the dye-liquor, thus permitting free movement of the socket.—J. B.

Cloth, etc. ; Apparatus for treating compact and permeable —— [with hot liquids and with gases]. Hydorion. (Soc. anon. de Machines pour Blanchisseries.) Fr. Pat. 449.989, Oct. 29, 1912.

For the purpose of dyeing and cleaning, the material is treated with hot liquids and with gases in a wooden box-shaped truck provided with trays. This receptacle is attached to a circulating apparatus in either of two ways : (1) It may have a close-fitting lid and be attached to the pump at the top and at the bottom by means of temporary connections : (2) it may be open at the top and the whole truck enclosed within a closed chamber provided with a circulating pump. In either case a distributing pipe is provided where the liquid or gas enters at the top of the truck. When the operation is over, the liquid is pumped back into the reservoir and the truck removed in order to be emptied of its contents.—J. B.

Fastness of dyeings to light ; Process for increasing the ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 257,876, July 26, 1912. Addition to Ger. Pat. 255,117 (see this J., 1913, 360).

The action of metaphosphoric acid in increasing the fastness of dyeings is enhanced by addition of a reducing agent, such as glucose or dextrin.—T. F. B.

Printing upon cloth ; Multicolour ——. A. Svoboda, Röchlitz, Bohemia. Eng. Pat. 9747, April 24, 1912. Under Int. Conv., April 24, 1911. (See also Eng. Pat. 7194 of 1911.)

The invention refers to block printing and it enables the simultaneous application of all the colours used. For example in two-colour printing the two blocks are mounted in a common fixed frame with a space between them exactly equal to the width of one block. A continuous strip of cloth is used which is moved onwards after each impression a distance equal to the width of the block. In three-colour printing the three blocks are mounted in the same frame with spaces between them equal to the width of a block. (Reference is directed to Eng. Pats. 1365 of 1863 and 6213 of 1887.)—J. B.

Printing steam-alizarin colours on unoiled fibres ; Process for ——. E. Schmidt. Ger. Pat. 257,877, Dec. 16, 1911.

Thickened pastes containing the dyestuffs and the oils described in Ger. Pat. 245,902 (see this J., 1912, 783) or their sulphonation or chlorination products, are printed on the fibre in the usual way, and fixed by steaming. The chlorinated oils may be prepared, for instance, by agitating the oils described with a hypochlorite solution of 3° to 8° B. (sp. gr. 1·022—1·060), and mechanically separating the aqueous portion.—T. F. B.

Grey to black prints on vegetable fibres ; Process for producing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 258,293, April 26, 1912.

When vegetable fibres are printed with quinizarinsulphonic acids together with chromium salts, grey or black shades, very fast to washing and light, are obtained.
—T. F. B.

Textile fabrics ; Process of treating [mercerising] ——. M. Petzold, Zittau, Germany. U.S. Pat. 1,058,459, April 8, 1913.

See Eng. Pat. 20,656 of 1911 ; this J., 1912, 330.—T. F. B.

Figured effects on pile fabrics ; Production of —— by chemical means. L. Cassella und Co. Fr. Pat. 449,152, Dec. 14, 1911.

See Ger. Pat. 254,090 of 1911 ; this J., 1913, 360.—T. F. B.

Production of fast colours on wood. Ger. Pat. 257,458.
See IX.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Hypophosphorous acid ; Determination of ——. H. North. Amer. J. Pharm., 1913, **85**, 147—148.

About 1 c.c. of hypophosphorous acid is dissolved in 20 c.c. of water recently boiled and cooled. This is titrated with $N/5$ barium hydroxide solution till the liquid is permanently alkaline to phenolphthalein. After standing for an hour in the water-oven the precipitate is collected on a filter, washed with hot water and ignited. The weight of the precipitate in mgrms. divided by the weight in grms. of acid as indicated by the titration gives the "barium number" of the original sample of acid. Specimens containing excessive amounts of foreign acids can be readily detected, as a satisfactory preparation should not have a higher "barium number" than 5.
—F. Shdn.

Chromic acid ; Electrolytic regeneration of —— from solutions of chromium sulphate. P. Askenasy and A. Révai. Z. Elektrochem., 1913, **19**, 344—362.

The authors have observed the process of electrolysis in a diaphragm cell in which the catholytes consisted of chromic acid solutions with additions of sulphuric acid, magnesium sulphate and chromium sulphate, under varying conditions, with a view to identifying the best conditions for the electrolytic regeneration of chromic acid from chromic sulphate. They find that the influence of high current density is favourable (opposes reduction) when the electrolyte contains relatively large quantities of chromic acid and small quantities of chromium salts. When the chromium is mainly in the reduced condition, low current densities may be employed. To achieve this the electrolyte may be passed through a series of cells, connected in series and all carrying the same current, with cathodes gradually diminishing in size. The effect of ordinary temperature fluctuations is insignificant. The addition of magnesium sulphate produces rather complicated effects. In dilute, highly oxidised solutions with low current densities it retards reduction. In more reduced solutions it acts in the opposite direction. In dilute solutions with high current density it has no effect. In the presence of added chromium sulphate it acts favourably on oxidised solutions with both low and high current densities, but unfavourably on solutions containing little chromic acid. The addition of chromium sulphate is desirable in dilute highly oxidised solutions especially in presence of magnesium sulphate, but in solutions containing little chromic acid it always acts unfavourably. The effect of sodium and potassium sulphates is negligible. Dilution retards reduction at all stages of oxidation, particularly at high current densities, and also at low current densities in presence of magnesium sulphate. High concentrations of sulphuric acid delay reduction to a slight extent under all conditions. In carrying out the electrolytic oxidation as a technical process without a diaphragm, it is best to keep the concentration of chromic acid below 100 grms. per litre, and the cathode current density above 200 amps. per sq. dm. Additions to the bath will then be unnecessary. If these conditions cannot be maintained additions should be made with great caution, because although a higher concentration and better yield of chromic acid may be obtained by their use, the current efficiency in the stage when little chromic acid is present is greatly reduced. The paper also contains a survey of the literature dealing with the electrolytic separation of metallic chromium.—W. H. P.

Ammonia; Volumetric determination of ——. L. W. Winkler. Z. angew. Chem., 1913, **26**, 231—232.

In the determination of ammonia by distillation, the author recommends the use of boric acid as absorption medium; the ammonia can then be titrated directly with hydrochloric acid, using Congo Red (or methyl orange) as indicator. This is especially advantageous in carrying out the Kjeldahl method; for 0·1—0·2 grm. of ammonia, 5 grms. of crystallised boric acid and 100 c.c. of water are placed in the receiver, which is cooled by water, and the use of a condenser is dispensed with.—A. S.

Hydrosulphite; Methods for the determination of ——. E. Bosshard and W. Grob. Chem.-Zeit., 1913, **37**, 423—425, 437—439.

The authors have modified the method for the determination of hydrosulphite by titration with ammoniacal copper solution (see Jellinek, this J., 1911, 419), so as to render it simpler and more accurate. Means for carrying out the determination in an atmosphere of pure nitrogen or hydrogen are described. The sample of hydrosulphite is weighed into a dry double-necked Erlenmeyer flask and kept as far as possible on one side: nearly the whole of the required quantity of a standardised ammoniacal copper solution (containing a large excess of ammonia) is then run in at the other side, after which the solution and the hydrosulphite are mixed by shaking, one or two drops of indigo carmine solution are added, and the ammoniacal copper solution run in, drop by drop, till a blue colour persists. By working in this way, no separation of metallic copper occurs and the reaction proceeds according to the equation:

$$2CuSO_4+Na_2S_2O_4+4NH_3+2H_2O= \\ Cu_2SO_4+Na_2SO_3+(NH_4)_2SO_3+(NH_4)_2SO_4.$$

Another method, which gives results agreeing with those obtained as described above, but which is not so simple, depends upon the oxidation of the hydrosulphite with atmospheric oxygen and titration with baryta of the mixture of sodium bisulphite and bisulphate produced (Grob, Dissertation, Tech. Hochschule, Zürich, 1912). A third method which is not quite so accurate but sufficiently so for technical purposes, and which does not require the use of special apparatus, is based on the observation of Brunck (this J., 1903, 710) that mercuric salts are reduced by hydrosulphites. 300 c.c. of a saturated solution of mercuric chloride are treated with 1 grm. of sodium bicarbonate, for the purpose of neutralising any sulphurous acid formed in the reaction or present in the hydrosulphite. A weighed quantity of the hydrosulphite (about 0·2 grm.) is then introduced, the whole shaken, the precipitate of mercury and mercurous chloride collected on an asbestos filter in a Gooch crucible and washed with dilute hydrochloric acid and then with water. The crucible with the precipitate is placed in a beaker, 5 grms. of pure potassium iodide added, then 5 c.c. of water, and, after 5 minutes, excess of $N/10$ iodine solution. When the precipitate has completely dissolved, the excess of iodine is titrated with thiosulphate. If t c.c. of $N/10$ iodine solution be used up, for a grms. of sample, then the percentage of hydrosulphite in the sample is $x=\frac{0{\cdot}8707\,t}{a}$. The authors find that the method of Seyewetz and Bloch (this J., 1906, 394) for the determination of hydrosulphite by means of ammoniacal silver chloride solution is not sufficiently reliable, for sulphites, which are invariably present in commercial hydrosulphite, also reduce the silver solution.—A. S.

Stannous chloride; Oxidation of ——, *by air in presence of ferrous chloride.* T. Warynski and W. Towtkiewicz. Ann. Chim. Analyt., 1913, **18**, 130—132.

Atmospheric oxidation of solutions of stannous chloride is greatly accelerated by the presence of ferrous chloride, the rate varying with the concentration of the latter compound. In the case of an $N/50$ solution of stannous chloride, at atmospheric temperature, a maximum rate of oxidation, about 4 times as great as that occurring in the absence of ferrous chloride, was obtained when the strength of the latter reached $N/5000$, after which the rate declined as the concentration of the ferrous salt increased.—W. E. F. P.

Aluminium nitride; Formation of —— *from alumina, carbon, and nitrogen. I.* W. Fraenkel. Z. Elektrochem., 1913, **19**, 362—373.

A detailed account of the experiments, the more important results of which have been reported previously (see this J., 1913, 361). The statements there given should be modified as follows. The velocity of formation of nitride is diminished by addition of carbon monoxide. An equilibrium is set up: $Al_2O_3+3C+N_2 \rightleftarrows 2AlN+3CO$, corresponding at a total pressure of 1 atmosphere to 25—40 per cent. CO by vol. at 1500° C. and 50—65 per cent. at 1600° C. In an atmosphere of carbon monoxide at 20—65 mm. pressure, alumina is reduced by carbon to Al_4C_3 with appreciable velocity at temperatures a little over 1500° C.—A. S.

Thorium oxalate; Solubility of ——. A. Colani. Comptes rend., 1913, **156**, 1075—1076.

The author has studied the solubility of thorium oxalate in dilute hydrochloric acid at 17° C. and 50° C. At ordinary temperatures equilibrium is attained very slowly, sometimes only after three months. The solubility of the oxalate in pure water at 17° C. and also at 50° C. corresponds to 1 mgrm. of thorium per 100 c.c., whereas 100 grms. of 19·8 per cent. hydrochloric acid dissolve quantities corresponding to 37 and 97 mgrms. of thorium at 17° and 50° C. respectively (intermediate values are given in the paper). In more concentrated hydrochloric acid conversion of oxalate into chloro-oxalate occurs, with liberation of oxalic acid which diminishes the solubility of the chloro-oxalate very considerably; the more solid thorium oxalate there is present, the less thorium and the more oxalic acid pass into solution. The solubility of the oxalate in oxalic acid solutions is very slight; 100 grms. of solutions containing 1·7, 6·5, 9·3 and 23·0 grms. of oxalic acid dissolve only 0·2, 0·7, 1·0 and 3·0 mgrms. respectively of thorium at 17° C. The oxalate is much less soluble in hydrochloric acid containing 1—2 per cent. of oxalic acid, than in hydrochloric acid alone; 100 grms. of 12 per cent. hydrochloric acid containing 1—2 grms. of oxalic acid dissolve less than 3 mgrms. of thorium as oxalate, even at 50° C. The solubility of the oxalate cannot be much further diminished by increasing the quantity of oxalic acid present.—J. H. L.

Thorium; Separation of radio-active substances from ——. F. Glaser. Chem.-Zeit., 1913, **37**, 477—478.

A quantity of monazite sand is mixed with twice its weight of concentrated sulphuric acid and heated to 250° C. for five hours with frequent stirring. When cold the mass is poured into 20 vols. of water and filtered after 24 hours. A precipitate of thorium phosphate can be obtained by either diluting or adding magnesia to this liquid. A better method is to dilute till the proportion of free sulphuric acid is reduced to 2—3 per cent. and then boil the solution, when a voluminous gelatinous precipitate of thorium phosphate and its radio-active derivatives is obtained. This precipitate contains thorium Y which may possibly be identical with thorium X. In order to separate the thorium Y, the moist precipitate is treated with dilute sulphuric acid, or else dried, heated with concentrated acid and poured into water. The thorium goes into solution as sulphate leaving the thorium Y undissolved, in a somewhat impure condition. The half value period is about four days. Thorium preparations which yielded thorium X on treatment with ammonia did not yield thorium Y when treated by the above method.—F. Shdn.

Sulphur trioxide; Action of —— *on silicon tetrachloride.* C. R. Sanger and E. R. Riegel. Z. anorg. Chem., 1913, **80**, 252—276.

Liquid sulphur trioxide and silicon tetrachloride are miscible in all proportions and on long standing, or on heating for 6—10 hours at 50° C., interact according to the equation: $2SiCl_4+2SO_3=Si_2OCl_6+S_2O_5Cl_2$; with an excess of sulphur trioxide, this change is followed by the reaction : $Si_2OCl_6+6SO_3=2SiO_2+3S_2O_5Cl_2$. The silicon compound corresponding to phosgene, which is produced when sulphur trioxide acts on carbon tetrachloride, is not formed. Silicon tetrachloride is most conveniently prepared by passing chlorine over powdered silicon contained in a hard glass tube heated in a combustion furnace ; the product is purified by shaking with mercury and re-distilling ; it melts at — 69° C. —F. Sodn.

Hydrogen peroxide ; Displacement of acids [from salts] by ——. J. Sperber. Schweiz. Woch. Chem. Pharm., 1913, **51**, 166—169. Chem. Zentr., 1913, **1**, 1490—1491.

The author describes experiments which lead him to conclude that hydrogen peroxide is capable of displacing acids from salts. For example, if alkali silicate be dissolved in perhydrol, oxygen is evolved and after some time the liquid sets to a jelly permeated by bubbles. When perhydrol is added to alkali silicate solution (water glass), vitreous silicic acid is momentarily precipitated and then changes into the gelatinous modification ; at — 21° C. the conversion into the gelatinous form takes about 2 hours. Experiments with perhydrol and borax, sodium metaphosphate, and potassium ferrocyanide and ferricyanide respectively were also carried out, and in each case indications of the liberation of the corresponding acid were obtained.—A. S.

Colloids and fine suspensions ; Influence of —— on the solubility of gases in water. Part III. Solubility of carbon dioxide at pressures lower than atmospheric. A. Findlay and T. Williams. Chem. Soc. Proc., 1913, **29**, 115—116.

The solubility of carbon dioxide in solutions of ferric hydroxide, dextrin, starch, gelatin, egg-albumin, and silicic acid, and in presence of suspensions of silica and of charcoal, has been determined at 25° C. for the range of pressure from 250 mm. to 760 mm. of mercury. General confirmation of Findlay and Creighton's results (this J., 1910, 350) has been obtained, and it was also shown that the solubility of carbon dioxide in colloidal solutions is relatively high at low pressures, and that it diminishes with increasing pressure either to a constant value, or to a minimum value, after which the solubility increases again with rising pressure.

Determination of phosphorus in ferrotungsten, metallic tungsten powder, tungsten oxide and tungstic acid. Johnson. *See* XXIII.

Patents.

Sulphuric acid . Manufacture of ——. J. Parent. Fr. Pat. 449,035, Dec. 12, 1911.

Cold acid containing nitrous products from the last chambers of the series or from the Gay Lussac tower is continuously introduced, by means of pulverisers, into the earlier chambers or into small towers (preferably unpacked), situated between the chambers. This is claimed to intensify the process of manufacture and to lower the temperature in the chambers. It also effects a concentration of the chamber acid and a more thorough circulation of the reacting gases, besides reducing the consumption of nitric acid and the loss of sulphurous gases.—F. Sodn.

Acetic acid from calcium acetate ; Process for the continuous production of ——. M. Prager. Fr. Pat. 449,622, Oct. 19, 1912.

Calcium acetate is continuously and progressively treated with sulphuric acid or with (sodium) bisulphate in a series of heated compartments disposed one behind another and together forming the lower part of a reaction chamber, and in each of which the mixture may be agitated by the to and fro movement of arms mounted on a common shaft. The material is introduced at intervals into the first compartment through a valved hopper and is made to pass, as desired, from one compartment to the next by the operation of scoops mounted on the same shaft, a flat horizontal plate (also heated) being interposed between the compartments at such a point that the material is transferred to it before hardening (by hydration of the gypsum) sets in. Mechanism is provided for thoroughly mixing the material on the plate and for subsequently passing it on to the next compartment, and sulphuric acid is continuously added during treatment in the compartments and on the plate, preferably by means of sprinkling devices on the hollow shaft. The acetic acid vapour produced is conducted from the upper part of the apparatus to condensers, and calcium sulphate, free from noxious vapours, is discharged from the last compartment.—F. Sodn.

Hydrochloric acid ; Process of manufacture of ——. K. Friedrich. Fr. Pat. 449,733, Oct. 23, 1912.

Chlorides, oxychlorides, hydrated chlorides, etc., of magnesium or calcium, or of both, are heated in a suitable furnace in such manner that the material is brought into intimate contact with the burning fuel (solid, liquid, or gaseous), and water or steam is injected when necessary. The air supplied is advantageously heated, and may be mixed with furnace gases at a high temperature, so as to effect a corresponding reduction in the amount of fuel to be added. Oxide of magnesium or calcium is obtained as a by-product.—F. Sodn.

Cyanogen compounds from calcium cyanamide ; Manufacture of ——. E. E. Naef, Clydach. Eng. Pat. 14,607, June 22, 1912.

Calcium cyanamide is treated at a high temperature with sulphur or substances capable of yielding sulphur, and the solution obtained by heating the product with water is treated with zinc dust, with or without the addition of small quantities of a caustic alkali. The resulting solution of zinc cyanide is converted into alkali cyanide by known methods. For example : A powdered mixture of 2 kilos. of "nitrolim" and 1·8 kilos. of sulphur is heated to 300°—500° C., the mass being kept stirred and the heating continued (usually for ½—1 hour) until nitrogen ceases to be evolved. The product is stirred with boiling water and filtered from the residue of calcium sulphide and carbon, and the filtrate is gently boiled with 0·5—2 kilos. of zinc dust until a filtered sample gives with silver nitrate a white precipitate, almost free from silver sulphide. The solution is then treated with sodium or potassium carbonate, and, after filtering and evaporating to dryness, almost white alkali cyanide is obtained.
—F. Sodn.

Dicyanodiamide ; Preparation of —— from cyanamide. H. Immendorff and H. Kappen. Ger. Pat. 257,769, Aug. 3, 1911.

A solution of cyanamide is caused to interact with a cyanamide compound of a heavy metal by intimate mixing and warming. The metal cyanamide compound may be produced during the reaction. For example, a cyanamide solution is heated with zinc oxide, hydroxide, carbonate or silicate, whereby part of the cyanamide is converted into zinc cyanamide, which interacts with the remainder to form dicyanodiamide.—A. S.

Dicyanodiamidide salts ; Preparation of ——. H. Immendorff and H. Kappen. Ger. Pat. 257,827, Aug. 8, 1911.

Solutions of dicyanodiamide are intimately mixed with acids in presence of pulverulent or porous substances (manganese dioxide and its hydrate, iron oxide and hydroxide insoluble in acids, stannic acid, charcoal) offering a large surface.—A. S.

Alkali and hydraulic cement of mineral or similar substances ; Process of manufacturing ——. E. W. Jungner, Norrköping, Sweden. Eng. Pat. 28,970, Dec. 16, 1912.

Powdered minerals or rocks, or the products of their partial devitrification, which, in addition to alkali oxides, contain sufficient quantities of silicic acid and argillaceous earth (alumina), are mixed with lime, with or without ferric oxide, and heated at or above the temperature at which the alkalis are liberated and volatilised, the expelled alkali being collected. Calcium compounds (such as the carbonate or hydroxide) which are converted into lime at a temperature below that at which the alkali is volatilised may be substituted for quicklime, and, when the proportion by weight of the sesquioxides (of aluminium and iron) is less than one-fifth of that of the silica, a sufficient quantity of material rich in argillaceous earth (*e.g.*, a suitable clay or the like) may be added. Alkali carbonates, hydroxides, etc., are obtained by introducing an appropriate gas during heating. For example, the distillation may be carried out in a rapid current of combustion gases and the gas subsequently led through apparatus in which the alkali fume is separated and retained (by bringing it, for instance, into intimate contact with water). The residue, after grinding, may be used as a hydraulic cement.—F. Sodn.

Potash ; Process of producing ——. W. Hatch, Terminal Island, Assignor to G. and R. Mason, San Pedro, Cal. U.S. Pat. 1,057,827, April 1, 1913.

Seaweed is mixed with finely divided silicious material and a liquid containing a potassium salt, such as a mixture of leachings of wood ashes and nitric acid ; the mass is allowed to ferment and produce " blooms " or nodules of potassium salts, which are then separated from the remaining material and purified.—O. R.

Saline solutions ; Crystallisation of hot-saturated —— *especially solutions of potassium salts.* G. Sauerbrey Maschinenfabr. A.-G. Ger. Pat. 257,685, May 25, 1911.

The solution is allowed to trickle over a system of vertical or nearly vertical plates disposed in a tower through which a current of air is passed. The system of plates is divided transversely to the direction of flow of the solution into several groups, upon which products of different composition crystallise. Means are provided for collecting the crystals from the different groups of plates separately, or the groups of plates may be suspended from a travelling crane so that the crystals thereon can be transferred directly to the refining apparatus.—A. S.

Ammonia ; Process of production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 449,010, Oct. 3, 1912. Under Int. Conv., Oct. 19, 1911.

The gaseous mixture employed in the synthetic production of ammonia, at temperatures of about 600° C. or below, by contact with metals of which the oxides are reducible by hydrogen, is deprived of water and substances capable of yielding water (suitably by passage over heated palladium asbestos and then over quicklime) before bringing it into contact with the catalyst. The yield of ammonia is thereby increased.—F. Sodn.

Nitrate of lime and dicalcium phosphate in a single operation ; Process of manufacturing ——. S. Peacock, Chicago, Ill., Assignor to The Southern Electro-Chemical Co., New York. U.S. Pat. 1,057,876, April 1, 1913.

Phosphate rock, containing tricalcium phosphate and free lime, is finely powdered and immersed in water ; gases containing nitric acid are blown through the mixture until all the free lime and one-third of the calcium contained in the tricalcium phosphate are converted into calcium nitrate, the latter solutión being then separated from the dicalcium phosphate, which has been formed.—O. R.

Barium chloride from barium carbonate and calcium chloride or magnesium chloride solutions. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 257,277, March 22, 1911.

Barium carbonate is warmed with excess of calcium or magnesium chloride solution, the quantity of water used being at least equivalent to the water of crystallisation of the chloride. With a large excess of a highly concentrated calcium chloride solution, 95 per cent. of the barium carbonate is converted into chloride, and the solubility of the latter is so diminished by the excess of calcium chloride that it separates to a large extent in the solid form.—A. S.

Alkali silicates ; Production of soluble —— *from silica and alkali salts.* E. Natho. Ger. Pat. 257,826, Aug. 10, 1912.

A mixture of silica (fine sand) and an alkali chloride or sulphate is mixed to a paste with a small quantity of water, and heated to 400°—600° C. under pressure in an autoclave.—A. S.

Oxygen from permanganates and per-salts ; Production of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 257,535, June 8, 1911.

Perborates, percarbonates or perphosphates are treated with an equivalent quantity of a permanganate in presence of water, but with exclusion of acid. The available oxygen of both the permanganate and the other per-salt is evolved almost quantitatively.—A. S.

Oxides of nitrogen from atmospheric air ; Method of obtaining ——. F. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,038, July 22, 1912. Under Int. Conv., July 24, 1911.

See Fr. Pat. 446,269 of 1912 ; this J., 1913, 141.—T. F. B.

Phosphate and nitrate of ammonia ; Process of simultaneously producing ——. E. Collett, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,058,037, April 8, 1913.

See Eng. Pat. 26,097 of 1912 ; this J., 1913, 233.—T. F. B.

Ammonia ; Process for producing ——. Badische Anilin und Soda Fabrik. Second Addition, dated Aug. 16, 1912, to Fr. Pat. 425,099, Nov. 24, 1910. Under Int. Conv., Dec. 23, 1911, and May 2, 1912.

See Eng. Pats. 21,151 of 1911 and 3345 of 1912 ; this J., 1912, 1031.—T. F. B.

Potash and cement clinker ; Process of obtaining ——. S. Gelléri, Budapest, Austria-Hungary, Assignor to A. Hambloch, Andernach, Germany. U.S. Pat. 1,058,686, April 8, 1913.

See Ger. Pat. 247,496 of 1911 ; this J., 1912, 686.—T. F. B.

Aluminium, carbon, and nitrogen ; Process for making compounds of ——. S. Peacock. Fr. Pat. 449,150, Sept. 20, 1912. Under Int. Conv., Sept. 23, 1911.

See U.S. Pat. 1,035,727 of 1912 ; this J., 1912, 875.—T.F.B.

Aluminium nitride ; Process for making ——. Soc. Générale des Nitrures. Fr. Pat. 450,140, Jan. 10, 1912.

See Eng. Pat. 8349 of 1912 ; this J., 1912, 875.—T. F. B.

Aluminium nitride ; Process for making ——. Soc. Générale des Nitrures. Fr. Pat. 450,178, Jan. 12, 1912.

See Eng. Pat. 8347 of 1912 ; this J., 1912, 816.—T. F. B.

VIII.—GLASS ; CERAMICS.

Glass ; Contribution towards a bibliography of the art of ——. M. L. Solon. Trans. Eng. Ceram. Soc., 1912-13, **11**, 65—77.

A list of works published on the making and history of glass in all European countries, presented under authors' names arranged in alphabetical order. (See also this J., 1912, 387.)—H. H. S.

Glass ; The alleged permeability of —— *to halogen vapours.* J. B. Firth. Chem. Soc. Proc., 1913, **29**, 111—112.

Landolt (Z. physik. Chem., 1906, **55**, 589), in his experiments on the conservation of weight in chemical reactions, always obtained a slight loss, and concluded that this loss might be due to the escape of vapours through the walls of the containing vessel. Zengelis (Z. physik. Chem., 1909, **65**, 341; also this J., 1910, 628) describes experiments, from which he concludes that various vapours can readily pass through glass, and he explains the loss in Landolt's experiments as being due to the escape of the various vapours through the walls of the containing vessel. Stock and Heyneman (this J., 1910, 657) were unable, in the case of iodine, to confirm Zengelis' results. The author has endeavoured to repeat Zengelis' experiments with a somewhat modified form of apparatus, and his results show that ordinary glass is not permeable to the vapours of iodine and bromine at 360° C. after fifty days, and after two years at the ordinary temperature.

Glass; Permeability of —— to water under the influence of high-tension electricity. F. Meyer. Ber., 1913, **46**, 1110—1115.

An old controversy between Schützenberger and Berthelot referred to an observation of the former, which led him to conclude that glass became permeable by water under the influence of the silent electric discharge. The author has carried out careful experiments in order to test Schützenberger's conclusion, but his results show that the glass is not penetrated to any appreciable extent in 5 hours, with a secondary voltage of about 20,000 volts.—W. H. P.

Clays; Electrical process for purification of ——. W. R. Ormandy. Trans. Eng. Ceram. Soc., 1912-13, **12**, 36—64.

The electro-osmotic treatment of clays depends on the fact that clay-substance is electro-negative, the bulk of the impurities (iron and titanium compounds, etc.) electropositive, and free silica neutral. The clay is made into a slip with water, and a small quantity of an electrolyte is then added. After a few hours the slip is pumped through an "Osmose" machine, which consists of a semicircular trough in the centre of which is a revolving drum made of conducting metal and acting as anode, and, half an inch away, a wire netting cathode brought underneath. Between the drum and the netting the clay suspension runs under the influence of a direct current of 60—100 volts. The impurities collect on or under the netting; the clay comes off the top of the revolving cylinder in the form of a continuous blanket, 4½ ft. wide and ¼ in. thick. Clay so obtained contains less water than the material from a filter-press, viz., 18—20 per cent. By regulating the voltage, the amount of water and also the fineness of grain in the finished product can be increased or diminished. The Osmose process allows the same wash-water to be used repeatedly. The ground-space required is one-fifth of that in the filter-press system. It is claimed that by this process clays of very inferior quality can be converted into high-grade clays. With clay from the same geological level, the finished material is standard and homogeneous. A plant designed to produce 40 tons a day, supposing the water content to be 30 per cent., would cost £5,000. The cost of current might be 1s. 6d. per ton, and the yield would be 87 per cent. of the clay treated. An appendix to the paper gives the physical properties and chemical composition of a large number of clays before and after treatment, and some coloured plates illustrate the improvement that takes place.—H. H. S.

Glazes; Behaviour of some —— in the glost oven. J. W. Mellor. Trans. Eng. Ceram. Soc., 1912—13, **12**, 1—17.

The character of a finished glaze is determined by the ultimate composition, the method of compounding, the average grain size, the nature of the body, the rate at which the temperature rises, and the nature of the oven atmosphere at different stages of the firing. The author studied the behaviour of different glazes by drawing pieces at different stages of firing, and also directly during the firing by means of a microscope with its objective cooled by a water jacket. The simple raw lead majolica glaze of type: $1PbO, 0{\cdot}15\ Al_2O_3, 1{\cdot}75\ SiO_2$, is not suited for earthenware and bone china because it is liable to run, it attacks underglaze colours, and its surface is easily scratched. A satisfactory glaze is of more complex type: $0{\cdot}25KNaO, 0{\cdot}35CaO, 0{\cdot}40PbO, 0{\cdot}2Al_2O_3, 3{\cdot}0SiO_2, 0{\cdot}4B_2O_3$. Accordingly, more work is necessary in the glost oven before the glaze matures. The more fusible constituents first sinter, and gases from decomposing carbonates, etc., are given off, causing the glaze to appear as a bubbling mass. If the molten glaze be not too viscid, the scars finally disappear. In order to lessen the work done in the glost oven, it is usual previously to frit the materials which are liable to give off gases and also those which dissolve in the glaze slowly. It is apparently possible to make a frit too fusible, as the addition of china clay, which keeps the glaze open till all gases have escaped, cures blistering. The author then draws attention to the advantages of "raw" over "fritted" lead glazes. Raw lead can attack the body more quickly; it does not form a skin on the upper surface, but shows more "flash." Rapid cooling should be effected in order to prevent volatilisation of lead and consequent loss of surface. It is usual to "lead wash" the containing saggars in order to create a vapour pressure of lead otherwise than at the expense of the ware. Leadless glazes mature slowly and need a large amount of frit. Borates in large proportion yield the best results. A type, fired at cone 3a, is: $0{\cdot}55\ CaO, 0{\cdot}45\ KNaO, 0{\cdot}55\ Al_2O_3, 3{\cdot}5\ SiO_2, 1{\cdot}2\ B_2O_3$; the alumina present is high in order to prevent devitrification. While a glaze of any kind is maturing it is attacking the body to form a solution of body in glaze which is less concentrated towards the surface. This solution is necessary to avoid peeling and crazing. Delayed crazing is due to residual contraction (*Nachwirkung*), a phenomenon which has been studied by the Berlin Standards Commission and in the Jena Glass Laboratory. The test for a glaze of sufficient residual contraction to cause crazing, is to heat the ware for a long time at a temperature of 250° C. and allow to cool with extreme slowness. The greatest residual contraction occurs when potash and soda are present in nearly equal proportions, and the least, when only one alkali is present.
—H. H. S.

Patents.

Glass; Liquids for cleaning ——. H. Schroer, Düsseldorf, Germany. Eng. Pat. 222, Jan. 3, 1913. Under Int. Conv., Oct. 28, 1912.

1·5 kilos. of quillaia are boiled in 95 litres of water till the liquid turns a dark brown colour. To the cold decoction are added 5 litres of 66 per cent. sulphuric acid and 20 grms. of copper sulphate.—H. H. S.

Window-glass; Continuous drawing apparatus for making ——. W. W. W. Keyes, Alexandria, Ind. U.S. Pat. 1,058,065, April 8, 1913.

From a melting-tank extends upwards a standpipe in communication with a water-supply. Through the standpipe runs an air-supply pipe, and also, detachably connected with its upper end, is a combined expansible guide and plug head. Drawing rollers are arranged in a circle above the tank near the head, and above these are placed guide rollers and a cutting device.—H. H. S.

Enamelling and glazing of porcelain, faience, stoneware, metal and other surfaces. M. L. V. Bertrand. Fr. Pat. 449,208, Oct. 10, 1912.

Lead compounds are replaced by chalk, borax, and the carbonate, chloride and sulphate of sodium.—H. H. S.

Enamels; Manufacture of white ——. Verein. Chem. Fabr., Landau, Kreidl, Heller und Co. Fr. Pat. 450,228, Sept. 7, 1912. Under Int. Conv., Sept. 30 and Nov. 4, 1911. (See also this J., 1911, 1213.)

In place of hydrated zirconium compounds containing alkali, agents conferring opacity are used composed of anhydrous zirconium salts low in alkali. The alkali is derived from the partial disintegration of zircon by alkalis, and it may be removed by combination with aluminium or tin hydroxide and subsequent washing. The content of alkali left should be between 2 to 7, and preferably 3 to 4, per cent.—H. H. S.

Silica glass articles combined with current leads. The Silica Syndicate, Ltd. Fr. Pat. 450,112, Nov. 2, 1912. Under Int. Conv., Nov. 3, 1911.

See Eng. Pat. 24,482 of 1911 ; this J., 1912, 924.—T. F. B.

Production of coatings by the projection of molten glass, metal, and other fusible materials. Fr. Pat. 449,015. *See* X.

IX.—BUILDING MATERIALS.

Application of the dimethyl sulphate test for determining [detecting] small amounts of petroleum or asphaltum products in tars. Reeve and Lewis. *See* III.

Patents.

Cement kilns ; Installation of——. H. Trachsler. Fr. Pat. 449,075, Oct. 5, 1912.

The burning of large quantities of cement is achieved by the installation of several shafts at an equal distance from a common chimney, the shafts being each provided with two air-inlets, one at the bottom and the other at the height of the clinkering zone. Combustion of the fuel is thereby increased, the time of burning diminished, the air receives a second heating and prevents the mass under treatment from sticking to the kiln-walls.—H. H. S.

Hydraulic cement ; Production of —— resistant to sea-water and of a binding material for constructions in reinforced concrete. H. F. Boersma. Fr. Pat. 449,642, Oct. 21, 1912.

Trass and other puzzuolanic materials of volcanic origin are resistant to sea-water. Trass in its natural state is mixed with Portland cement, and the setting is regulated by the addition of soda or alum.—H. H. S.

Bricks and other refractory products ; Manufacture of —— cemented by spinel. C. A. Mankau. Fr. Pat. 449,363, Oct. 12, 1912.

Spinels are formed in the mass by adding, before milling and firing, about 6 per cent. of the necessary oxide. For example, if the body be constructed on a dolomite basis, bauxite is added to introduce the alumina necessary to form spinel. Again, if chrome ironstone be the main constituent of the body, lime or magnesia are added in order to form chrome spinel.—H. H. S.

Roads, pavements, etc. ; Production of —— by treating the road-material with emulsions of binding agents such as tar, tar oil, pitch or the like. A.-G. für Asphaltierung und Dachbedeckung vorm. J. Jeserich. Ger. Pat. 256,573, Feb. 15, 1910.

After the road-material (granite, limestone, rubble, etc.) has been treated with the emulsion, a suitable chemical is added to "break" the emulsion, whereby the pieces of road-material become each uniformly coated with a thin skin or film of the binding material.—A. S.

Wood ; Production of fast colours on——. F. Schneider and R. van der Leeden. Ger. Pat. 257,458, Jan. 23, 1912.

The colours are produced on or in the wood itself by the use of acid diazo-solutions (*e.g.* from *p*-nitraniline or aminoazobenzene) and neutral or weakly alkaline (with sodium carbonate or acetate) solutions of naphthol- or naphthylamine-sulphonic acids or naphthylamine salts, without the use of caustic alkalis. Easily soluble dyes capable of combining or not with diazo-compounds may also be added.—A. S.

Heat insulating materials and method of and apparatus for producing the same. W. Arthur, Schenectady, N.Y., U.S.A. Eng. Pat. 243, Jan. 3, 1913. Under Int. Conv., Jan. 8, 1912.

See U.S. Pat. 1,041,565 of 1912 ; this J., 1912, 1078.—T. F. B.

Manufacture of alkali and hydraulic cement from mineral or similar substances. Eng. Pat. 28,970. *See* VII.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel ; Constitution of the sulphide enclosures in ——, and the desulphurisation process. G. Röhl, Carnegie Scholarship Memoirs, Iron and Steel Inst., 1912, **4**, 28—79.

For differentiating the individual sulphides the specimens were etched with a 1 per cent. alcoholic solution of picric acid and then tempered to dark yellow, the FeS thus acquiring a blue, and the MnS a dull whitish, colour. In the system FeS—MnS the m. pts. of the pure constituents are 1188° C. and 1620° C. respectively : the eutectic (m. pt. 1182° C.) occurs at about 7 per cent. MnS, from which point the m. pt. of the mixture increases with the proportion of MnS. At 60 per cent. FeS the compound $Fe_3Mn_2S_5$ occurs (m. pt. 1365° C.). By the gradual addition of MnS to the Fe—Fe S eutectic, the eutectic $Fe_3Mn_2S_5$—FeS—Fe (containing about 4 per cent. MnS) is first produced, followed by a solid solution of $Fe_3Mn_2S_5$ and the excess MnS. Upon the addition, to electrolytic iron, of 5 per cent. of the various mixed sulphide melts, FeS and MnS occur partially separated in the melts—being hindered from mutually reacting by the intermediate iron. As the MnS content is increased, $Fe_3Mn_2S_5$ first separates after the iron has solidified, and finally a solid solution of $Fe_3Mn_2S_5$ and MnS is produced : the freezing point of this solid solution soon exceeds that of the iron (about 1510° C.), and it then freezes before the latter and contracts in the form of rounded or spherical products. A partial re-sulphurisation of the iron, due to mass action, may occur unless the bath contain 0·8 per cent. Mn. In its physical properties, $Fe_3Mn_2S_5$ closely resembles pure MnS, possessing great tenacity as compared with the brittle FeS and being capable of undergoing deformation without fracturing easily ; to this latter property the improvement effected in the working qualities of sulphurised iron by manganese treatment is largely ascribed. The so-called "pure manganese sulphide" observed by Law and Le Chatelier was probably the compound $Fe_3Mn_2S_5$.—W. E. F. P.

Steels ; Behaviour of hardened and tempered hypo-eutectic ——. R. Kühnel. Int. Zeits. Metallog., 1913, **3**, 225—275.

Experiments were made with seven specimens of steel containing from 0·05 to 0·65 per cent. C. Hardening was effected by quenching in water or in oil from temperatures of 750°, 850° and 950°C. respectively, and the hardened test-pieces were tempered at different temperatures, viz., for 2 hours in water (100° C.), for 1 hour in rape oil (200° C.), for 40 minutes in a fused mixture of sodium and potassium nitrates (300°—500° C.), or for 15 minutes in a Heräus electric furnace (600° C.). The mechanical properties of the different specimens were then determined and the micro-structure examined. The results are given in detail.—A. S.

Metals under stress ; Action of electrolytes on ——. H. Baucke. Internat. Zeits. Metallogr., 1913, **4**, 129—142.

The cracking of steel balls and also of boiler plates in practice are regarded as examples supporting the theory of Cohen (this J., 1910, 94 ; 281) that metals under stress are in a metastable condition and may be restored to the stable condition by the action of an electrolyte.—W. E. F. P.

Chromium in steel ; Colorimetric method for the determination of ——. F. Garratt. J. Ind. Eng. Chem., 1913, **5**, 298—300.

The method is recommended specially for the determination of small quantities of chromium (0·2 per cent. or less) in steel. 0·2—0·4 grm. of the steel is dissolved in 10 c.c. of sulphuric acid (1 : 3), 0·5 c.c. of concentrated nitric acid added, the solution evaporated, treated with 50 c.c. of a 10 per cent. solution of sodium hydroxide and 1 grm. of sodium peroxide, and boiled for 5 mins. After cooling the solution is diluted to 200 c.c., and 100 c.c. are filtered, acidified with 2 c.c. of 85 per cent. phosphoric acid and 8 c.c. of concentrated sulphuric acid, and treated immediately with 2 c.c. of a 1 per cent. solution of disodium 1.8-dihydroxynaphthalene-3.6-disulphonate (see Koenig, this J., 1911, 297). A pink to cherry-red colour develops, and after 15 mins., this is compared with that produced by a standard steel (or a steel free from Cr and potassium bichromate solution) treated in exactly the same way. Vanadium interferes with the method, imparting a brownish tint to the colour produced.—A. S.

Aluminium, cast iron, and bronze : Resistance to bending, extension, specific gravity and hardness of cast rods of ——. W. Wyss. Ferrum, 1913, **10**, 167—184, 207—217.

Rods of aluminium ("alloy") containing 8 per cent. Zn and 1·5 Cu, also rods of cast iron and bronze, were cast in a horizontal mould and mechanical tests were made upon them at various points from the teeming point are tabulated and graphically illustrated. The cooling effect of the mould on the character of the metal was shown to increase with the distance from the teeming point. Tin bronze showed this very strikingly, but it was not so evident in cast iron. The hardness, extension and specific gravity were shown to rise and fall with the distance along the bar from the teeming point. Aluminium was stated to be very sensitive in this respect, while cast iron was not, which can be explained by the relatively high specific heat of the aluminium and its greater volume to equal weights of the two metals. It is suggested that it should be possible to raise the hardness at any particular point by suitably arranging the distances of the funnels and the riser from this point, and the test-piece should be part of the casting so that the buyer may know that it is part of the same material and from what part of the casting it was taken, which latter is of importance.—A. H. C.

Vanadium ; Determination of ——, *in ferro-vanadium.* W. W. Clark. Met. and Chem. Eng., 1913, **11**, 195—197.

The following method is recommended as accurate under all conditions ; the solutions required are N/10 potassium bichromate (4·908 grms. per litre), N/10 ferrous ammonium sulphate in 10 per cent. sulphuric acid (40 grms. of the pure salt per litre), dilute potassium ferricyanide (free from ferrocyanide), approximately N/10 potassium permanganate (not standardised), and dilute sulphuric acid (1 : 2). Standardisation of the bichromate solution is effected by means of pure iron, and that of the ferrous ammonium sulphate solution by means of a blank test in which 0·32 grm. of pure iron is treated in the same manner as the ferro-vanadium up to the point of titration, when 35 c.c. of the ferrous solution are added : this is titrated back with bichromate solution to a definite end point, using the ferricyanide as indicator, and the value of the ferrous solution calculated from the result obtained ; if, for example, the 35 c.c. of ferrous solution required 34·20 c.c. of the bichromate, the former would be weak to the extent of 0·023 c.c. per c.c. and this amount would have to be subtracted from each c.c. used in subsequent determinations. In the analysis of ferro-vanadium a "factor weight" (0·510 grm.) of the finely powdered alloy is dissolved (in a platinum dish) in a mixture of 25 c.c. of dilute sulphuric acid and 10 c.c. of concentrated nitric acid, and the solution evaporated until fumes of sulphuric anhydride appear. (If refractory to these acids, 20 c.c. of hydrofluoric acid are added.) 75 c.c. of dilute sulphuric acid are then added and the mixture heated, and after complete solution, the liquid is boiled for 2 minutes. To the liquid, 75 c.c. of dilute sulphuric acid are now added, the volume being made up to 400—500 c.c. by the addition of hot water. The liquid, at about 65° C., is treated with permanganate solution until it acquires a red colour which is then just discharged by the addition of ferrous ammonium sulphate ; finally, permanganate solution is added drop by drop until the liquid just acquires a pinkish tint and the latter is discharged by the addition of one drop of the ferrous solution. When this "neutralisation point" is reached the liquid is titrated with the ferrous ammonium sulphate solution until a blue colouration is obtained on testing with ferricyanide ; an excess of at least 2 c.c. of the ferrous solution is then added and the liquid titrated back with bichromate to the same end point as obtained in the blank test. The percentage of vanadium in the alloy is obtained by subtracting the volume of bichromate used from that of the ferrous ammonium sulphate employed, the latter being first corrected according to the result of the blank test. The influence of chromium—the only interfering element—is eliminated by obtaining the neutralisation point between the ferrous and permanganate solutions in the cold, and subsequently heating the liquid to above 65° C. for the titration ; the presence of chromium is conveniently indicated by means of an acetic acid solution of diphenylcarbazide.—W. E. F. P.

[*Gold*] *Ores ; Errors in sampling and assaying* ——, *due to the presence of coarse gold.* F. White. Inst. Min. and Met., April 17, 1913. [Advance proof.]

To obviate such errors in the case of ores containing only a comparatively small number of coarse grains of gold the sample for assay may be crushed to pass a 30- or 40-mesh sieve only, and fusions be made in triplicate and repeated when notable variations occur, abnormally high results being rejected.—W. E. F. P.

[*Gold*] *Cyaniding ; Action of oxidisers in* ——. M. Green. J. Chem., Metall., and Min. Soc., S. Africa, 1913, **13**, 355—360.

The good effect produced by the addition of oxidisers in certain cases of cyaniding is attributed to the oxidation of reducing matter in the ore, and not to any improvement in the solvent properties of the cyanide solution.—H. H.

Nickel ores ; Simplification of the treatment of iron- and copper-bearing sulphide —— *and smelting products.* H. Pedersen. Metall u. Erz, 1913, **10**, 384—403.

The metal contents are first concentrated by a preliminary smelting in a shaft furnace, and the ore is then subjected to a restricted roasting. The resulting copper and nickel sulphates are extracted with acidified water, and the residue, which contains nearly all the iron as oxide and small amounts of nickel and copper, is mixed with fresh charges of ore for the first smelting. Any iron contained in the solution is removed by neutralising with nickel oxide and blowing in air. Copper is precipitated from the weakly acid solution by means of hydrogen sulphide, and the solution is evaporated to obtain the nickel sulphate. The nickel sulphate is roasted to oxide, which is then reduced to metal by smelting with carbon in an electric furnace. The copper sulphide is filter-pressed, and then reduced directly to metal, or is first converted into copper sulphate in order to obtain a purer metal.—T. St.

Zinc in ores ; Determination of ——. D. J. Demorest. J. Ind. Eng. Chem., 1913, **5**, 302—304.

By means of the following method zinc may be determined by Low's ferrocyanide process (this J., 1900, 693) no matter what impurities may be present. 1 grm. of the ore is dissolved in aqua regia, treated with 1 grm. of potassium chlorate, evaporated to dryness, the residue treated with 50 c.c. of water and 0·5 grm. of potassium hydroxide, and then heated nearly to boiling for several minutes with 6 grms. of ammonium carbonate, whereby iron, aluminium, manganese, lead and cadmium are precipitated. The precipitate is filtered off, washed with a hot 5 per cent.

solution of ammonium carbonate, then dissolved in hydrochloric acid, with a little potassium nitrite, the solution neutralised with potassium hydroxide, and reprecipitated with ammonium carbonate, the precipitate being washed as before. The filtrates and washings contain copper and zinc. The copper is precipitated as sulphide, and the zinc determined by titration with ferrocyanide, using uranyl nitrate as indicator.—A. S.

Magnesia by aluminium ; Reduction of ——. C. Matignon. Comptes rend., 1913, **156**, 1157—1159.

Powdered aluminium freed from grease is mixed intimately with heavy magnesia in the proportion represented by the formula $MgO+\frac{1}{2}Al_2$, and the mixture compressed into tablets. These are placed in a steel tube closed at one end, which is put inside a porcelain tube. The portion of the latter where the closed end of the steel tube lies, can be heated. The apparatus is exhausted and the material heated to 1200° C. At this temperature metallic magnesium is formed and condenses in fine crystals on the cool portion of the steel tube.—F. Shdn.

Magnesium-aluminium-zinc alloys ; Constitution of ternary ——. G. Eger. Int. Zeits. Metallog., 1913, **4**, 29—128.

The author gives the results of the thermal and micrographic examination of Mg-Al-Zn alloys. The partial mutual solubility of aluminium and zinc in the solid state is probably somewhat greater than has been stated by Shepherd (this J., 1905, 972). In the Mg-Al and Mg-Zn systems there are formed respectively the compounds, Al_3Mg_4 and Zn_2Mg, which melt without decomposition, and of which the first-mentioned forms solid solutions with aluminium (see Grube, Z. anorg. Chem., 1905, **45**, 225 ; this J., 1906, 430). In the ternary system both compounds form binary solid solutions and Al_3Mg_4 forms also ternary solid solutions. A study of the binary system Al_3Mg_4—Zn_2Mg, indicated the probable existence of a compound, $Zn_6Al_3Mg_7$, which decomposes on melting, and which is capable of forming solid solutions. The detailed results of the investigation are given in tables and curve-diagrams and photomicrographs are also given as far as the brittle character of the alloys would allow of their being prepared. Up to the present the only ternary alloys which have been suggested for technical use are those rich in aluminium, but the author states that the alloy of the composition, Zn 93·5, Mg 3·3, Al 3·2 per cent. (m. pt. 337° C., corresponding to one of the eutectic points of the ternary system) has casting properties similar to those of zinc and is harder and tougher. It can be cut and turned, takes a high polish, and unlike most of the ternary alloys rich in zinc, solidifies quite free from blow-holes. —A. S.

Tungsten powder ; Determination of oxygen in metallic —— *and notes on the determination of oxygen in steel.* C. M. Johnson. J. Ind. Eng. Chem., 1913, **5**, 295—297.

The author describes the determination of oxygen in metallic tungsten powder by ignition in a current of hydrogen in a quartz tube in the electrically heated furnace described earlier (this J., 1908, 576) for use in the determination of carbon in iron and steel. Before passing over the sample, the hydrogen is led through a solution of caustic potash, an alkaline solution of pyrogallol, and three towers (1, 2 and 3) packed with the alternate layers of asbestos and (1) calcium chloride, (2) caustic potash, and (3) phosphorus pentoxide respectively. The presence of free carbon has no appreciable influence on the results in the case of tungsten oxide, but when the method is applied to iron oxide, low results are obtained if the carbon content exceeds 5 per cent., owing to the formation of carbon monoxide in addition to water. In five samples of German tungsten powder the oxygen content ranged from 0·18 to 2·26 per cent., and in seven samples of American origin, from 0·07 to 1·24 per cent. The author confirms his earlier statement (this J., 1909, 838) that the carbon content of steel is diminished by heating in a current of hydrogen.—A. S.

Borides ; Synthesis of —— *in the electric vacuum furnace.* E. Wedekind. Ber., 1913, **46**, 1198—1207.

The finely divided metal and amorphous boron are mixed in an agate mortar, and the mixture is pressed into rods in a powerful hydraulic press. By heating in the vacuum furnace to a temperature of about 1000° C. these rods are fritted so that they become sufficiently good conductors to be heated by the passage of the current to the melting point of the boride. The rods are inserted into electrode holders and the furnace exhausted to about 15—20 mm. pressure. The residual oxygen is removed by passing in hydrogen and heating up a platinum spiral in the furnace. The main current is then turned on, and as the boride forms and melts, the drops are allowed to fall into a crucible. In this way the following borides were obtained :—Zirconium gave Zr_3B_4, with silvery lustre, very stable in air. Sp. gr. 5·0. Hardness = 7. In the compact state it is not attacked by any acid except hydrofluoric. In powder it is attacked by dilute hydrochloric acid, but not by nitric acid or alkalis. Vanadium gave VB, also with metallic lustre. It is attacked by hydrofluoric and nitric acids, and also by molten alkali with which it yields hydrogen. Uranium gave UB_2, very similar in properties to VB. Molybdenum and boron yielded products of indefinite composition, while titanium boride could not be fused. Tungsten gave WB_2, only slowly attacked by nitric acid, and not by sodium peroxide or potassium bifluoride. It is attacked readily by a mixture of sodium carbonate and potassium nitrate, as well as by gaseous chlorine.—W. H. P.

Colloidal copper ; Electrochemical production of ——. T. R. Briggs. J. Phys. Chem., 1913, **17**, 281—319.

The author reviews critically the literature on the so-called "allotropic" copper obtained by Schützenberger in 1878 by electrolysis of copper acetate solution (compare Benedicks, this J., 1907, 418). It is shown that this peculiar modification is a colloidal hydrogel of copper, which probably owes its formation to the existence in the copper acetate solution of a gelatinous colloidal substance, probably copper hydroxide formed by hydrolysis of the acetate. The second part of the paper deals with so-called gelatin copper (see this J., 1912, 880).—A. S.

Copper production of the world. H. R. Merton and Co. Mining and Eng. World, April 19, 1913. [T.R.]

The world's output of copper in 1912 shows an increase over 1911 of 15·2 per cent. In spite of this visible supplies in America and Europe decreased over 20,000 tons, indicating a consumption of approximately 1,024,500 tons, an increase over the previous year of 11 per cent. The following table gives the production by countries in 1911 and 1912 :—

	1912.	1911.
United States	554,835	483,865
Spain and Portugal	58,930	50,930
Russia	33,010	25,310
Boleo	12,450	12.165
Other, Mexico	58,395	48,740
Japan	65,500	55,000
Australia	47,020	41,840
Canada	34,710	24,930
Chili	37,305	25,595
Mansfield	20.180	20,520
Miscellaneous	82,150	83,025
Total	1.004,485	871,920

Copper production in Germany. Board of Trade J., April 24, 1912. [T.R.]

The quantity of copper ore mined in Germany in 1911 amounted to 868,600 tons, as compared with 920,600 tons in 1910 ; the average of pure copper in 1910 was 2·51 per cent. Practically the whole of the ore is produced by one company. The greater portion of the ore in Germany is first converted into matte, which is then reduced to blister copper, and finally refined in a reverberatory furnace. By this process 32,331 tons of refined copper were produced from 865,090 tons of copper ore and 2204 tons of matte in 1910, as compared with 29,787 tons of refined copper from 775,716 tons of ore and 2076 tons of matte in 1909. In addition to the above, 5151 tons of electrolytic copper and 4140 tons of cement copper were obtained in Germany in 1910, as compared with 4178 tons of electrolytic copper and 3423 tons of cement copper in 1909.

Determination of carbon by combustion with moist oxygen. Hilpert. *See* XXIII.

Determination of phosphorus in ferrotungsten, metallic tungsten powder, tungsten oxide and tungstic acid. Johnson. *See* XXIII.

Patents.

Steels; Manufacture of high carbon ——. C. P. Williams, Wrexham, and The Brymbo Steel Co., Ltd., Brymbo. Eng. Pat. 14,130, June 17, 1912. Addition to Eng. Pat. 1293, Jan. 16, 1912 (this J., 1913, 93).

The final carburisation of the metal (prepared in a basic open-hearth furnace) is effected by transferring the required amount to a receptacle of known capacity containing the necessary quantity of carburising material, the outflow of metal from the furnace being stopped well below the point at which the slag begins to appear. The contents of the receptacle are thoroughly agitated—preferably by being poured into a casting ladle—and cast as usual.—W. E. F. P.

[*Iron and steel.*] *Case hardening or cementation materials.* Rudge-Whitworth, Ltd., and L. Heathcote, Coventry. Eng. Pat. 185, Jan. 3, 1913.

The carburising agent consists of granular wood-charcoal and/or leather-charcoal impregnated with a fusible "activifying substance" such as the carbonate or hydroxide of sodium or potassium. It is stated that the time required for the iron or steel articles to attain the necessary carburising temperature is much reduced by the use of this material, and that the latter may be used repeatedly without undergoing serious loss of carburising power.—W. E. F. P.

Steel; Process and apparatus for the manufacture of ——. N. E. Maccallum, Assignor to F. P. Norris, Phoenixville, Pa., and The Phoenix Iron Co., Philadelphia, Pa. U.S. Pat. 1,057,564, April 1, 1913.

An open-hearth steel furnace is provided with two pairs of regenerators, which are so arranged that each regenerator may be supplied with either air or gaseous fuel. Air, exhaust gases of combustion, gaseous fuel, and exhaust gases of combustion, are passed consecutively and in the order named through each of the four regenerators, which are worked in pairs.—T. St.

Cast-iron: Manufacture of ——, *of high quality.* Soc. Electro-Métallurgique Française. Fr. Pat. 449,160. Oct. 8, 1912.

Phosphorus and sulphur are eliminated, successively, from ordinary cast-iron by treating the molten metal first with ferruginous basic slag and then with basic slag free from iron oxide, in an electric furnace under non-oxidising conditions.—W. E. F. P.

Iron and steel; Process and apparatus for the production of ——. A. Hiorth. Fr. Pat. 449,212, Oct. 10, 1912.

The following is the cycle of operations:—generating and purifying a gas rich in carbon monoxide; conducting a portion of the gas, together with air, into the upper part of a vertical furnace charged with iron ore (alone or mixed with a very small quantity of carbon); passing another portion of the gas through an electric arc furnace to a hearth connected with the vertical furnace (and adapted to receive molten metal) and thence into the lower part of the latter; conducting part of the gaseous product from the vertical furnace to the gas-generator and utilising the remainder for preheating the gas issuing from the purifier. Before entering the electric furnace the gas is preheated by being caused to pass through an annular space surrounding the vertical furnace. If required, finely powdered charcoal or other carbonaceous matter may be introduced into the gas immediately before the entry of the latter into the vertical furnace.—W. E. F. P.

Tool steel; Production of —— *by melting iron with cyanogen salts.* S. Fisch and G. Orlow. Ger. Pat. 257,614, June 9, 1912.

The iron is melted with Prussian blue or Turnbull's blue (25—50 grms. per kilo. of iron).—A. S.

Iron; Process for melting —— *in cupola furnaces.* O. Rudbach. Ger. Pat. 257,686, March 24, 1912.

Basic Martin slag is used for the purpose of preventing the absorption of sulphur by the iron during the melting process. The slag is stated to possess many advantages over manganese ore for this purpose. Easily fusible slags are produced, and coke or anthracite containing 2 per cent. or more of sulphur may be used as fuel. No addition of limestone is required, the fuel consumption is diminished, and the furnace lining lasts longer.—A. S.

Steel; Production of an oxide coating on vessels or the like made of mild ——. C. K. Haefner. Ger. Pat. 257,299, March 6, 1912.

A mixture of oxides of iron, substances which evolve oxygen on heating, and graphite or other form of carbon is mixed with acids or alkalis to a paste, which is applied to the vessels in a manner similar to that used in enamelling and the vessels are then fired either directly or after placing them in cases of refractory material (saggars).—A. S.

Iron; Process for preventing the formation of oxides on bright surfaces of —— *in contact or connected with other metals.* F. Meyer. Ger. Pat. 257,300, Aug. 8, 1911.

The objects are stored in solutions or suspensions of salts or compounds of zinc, ammonia, alkalis or alkaline-earths, with the exception of the hydroxides or carbonates.—A.S.

[*Zinc, etc.*] *Furnace; Metallurgical* ——. The Morgan Crucible Co., Ltd., H. Davison and L. C. Harvey, London. Eng. Pat. 6808, March 19, 1912.

In a distillation furnace (*e.g.*, for zinc) the retort or crucible and the condenser are connected by means of an intermediate piece or ring; one end of the latter is permanently luted around the mouth of the retort, the other end being provided with a surface against which the condenser is adapted to be clamped to form a tight joint. The furnace is arranged upon rockers to facilitate charging and discharging operations.—W. E. F. P.

Zinc, copper, and nickel; Precipitation of metals, especially of —— *from sulphuric or sulphurous acid solutions.* S. Laszczyński. Ger. Pat. 257,647, Nov. 20, 1910.

The metals are precipitated by means of the bisulphite or bicarbonate of magnesium, and magnesium bicarbonate is subsequently regenerated by treating the solution with milk of lime and then carbon dioxide under slight pressure.—A. S.

Zinc or other metals volatile at the reduction temperature; Charging device for distillation furnaces for the recovery of ——. Rheinisch-Nassauische Bergwerks- und Hütten-A.-G. Ger. Pat. 257,739, Aug. 31, 1911. Addition to Ger. Pat. 236,759.

The claims relate to a charging device for furnaces of the kind described in the chief patent and the previous additions thereto (see Eng. Pat. 27,467 of 1910; this J., 1911, 630; also this J., 1912, 1187; 1913, 295). The charging apparatus is provided with closing devices for the permeable cores (tubes or the like) in the retorts, so that when the charging hopper is placed in position, these devices close the upper ends of the permeable cores, and prevent the charge from falling into them.—A. S.

Flux skimmings from tinning metals; Treatment of ——. S. B. Bowen, Swansea. Eng. Pat. 7945, April 2, 1912.

The flux-skimmings obtained from the tinning pots in the manufacture of tin and terne plates, are destructively distilled, the resulting carbonised mass being subsequently pulverised and extracted with water for the recovery of soluble chlorides. The vapours from the retort are condensed and, after separation of the oil, the watery portion of the distillate is treated with sheet zinc for the production of spongy tin and zinc chloride.—W. E. F. P.

Furnaces; Annealing ——. J. Summers and Sons, Ltd., and J. H. Smith, Shotton, Flintshire. Eng. Pat. 13,513, June 10, 1912.

The entrance for the heating flames and gases is a long narrow opening situated in the roof of the furnace at about the centre, and parallel to the length of the furnace. The gas exit consists of one or more openings in the floor of the furnace at the end where the receptacles containing steel sheets are admitted. After removing a box from the other end of the furnace a fresh one is placed in the gas-exit end, all the boxes in the furnace being pushed along one stage. Each box thus passes by stages to the hottest part of the furnace, and then to a cooler part, where it gives up a considerable part of its heat to the furnace before being removed. The path taken by the gases is stated to result in the uniform annealing of the contents of the boxes, while distortion of the latter is obviated.—T. St.

Furnaces; Regenerative open hearth ——. H. Rehmann, Düsseldorf, Germany. Eng. Pat. 17,131, July 23, 1912.

In order to simplify repairs to regenerative furnaces the ports are made removable, the butting surfaces being provided with a key and groove attachment, and drawn together by tightening devices. The tongue which separates the air- and gas-ports is provided with a movable insertion. When the insertion is removed, the space previously occupied by it is filled up with a block of refractory material. To prevent the crown of the furnace from falling in when repairs are carried out at the crown above the joint between the furnace and the mouth of the air-ports, the crown at this point is made self-supporting by means of a metal beam anchored by metal rods. The beam may have passages for the reception of a cooling medium, and is covered in by brickwork which is made easily removable from above.—T. St.

Furnace; Cupola ——. P. Anderson, Arvika, Sweden. Eng. Pat. 2289, Jan. 28, 1913. Addition to Eng. Pat. 18,414, Aug. 15, 1911 (this J., 1911, 1392).

For the purpose of limiting the combustion of the supporting layer of coke below the melting zone, the tuyères of the furnace are inclined upwardly with respect to the shaft.—W. E. F. P.

Cupola giving complete combustion by means of a differential air-supply. A. Tropenas and E. Tournier. Fr. Pat. 449,663, Oct. 21, 1912.

The cupola is provided with three tiers of tuyères, the two upper ones being designed to complete the combustion of the carbon monoxide formed in the fusion zone. The two lower tiers are supplied with air from the same wind-box, which is divided by a horizontal diaphragm into upper and lower compartments. The air is fed into the lower compartment, connected with the main tuyères, and the upper tiers are connected by valves with the lower compartment. The quantity of air supplied to the intermediate tuyères is a differential function of that supplied to the main tuyères. The upper tier of tuyères is situated sufficiently high to avoid the formation of a second fusion zone.—T. St.

Furnace. W. S. Rockey and H. Eldridge, New York, Assignors to Metallurgical Research Co. U.S. Pat. 1,057,883, April 1, 1913.

A furnace for melting metals has a common outlet for the products of combustion of the heating fuel, and the molten metal. A cap is arranged over the outlet adapted to deflect the issuing gases downwards around the flowing metal. A hood situated in front of the furnace serves to lead the gases away.—T. St.

Furnace for roasting ores. Soc. Minière et Métallurgique de Peñarroya. Fr. Pat. 449,186, Oct. 9, 1912.

In a furnace of the kind in which a continuous layer of ore, disposed upon a perforated grate, is heated from above by a movable flame while a downward current of air is caused to pass through it, the grate is formed by the upper part of a casing enclosing two vertical conduits adapted to communicate alternately with a suction chamber. The upper, movable portion of the apparatus consists of several units suitably connected; and the charging hopper is fed by means of an ore conveyer.
—W. E. F. P.

Electric [metallurgical] furnace and method of operating same. G. H. Benjamin, New York. U.S. Pat. 1,057,213, Mar. 25, 1913.

An electric furnace is formed with three chambers arranged vertically one above another with free communication between them. Two sets of electrodes are fitted, one set entering the middle portion of the lower chamber and the other entering the upper portion of the middle chamber. Air is forced into the lower portions of the middle and upper chambers so that, as a mixture of carbonaceous fuel and metalliferous ore passes downwards through the chambers, combustion takes place at the lower part of the middle chamber, the carbon dioxide produced is converted into carbon monoxide by the arc temperature at the upper part of this chamber, and the carbon monoxide burns at the air inlet of the upper chamber. The temperature of the material is thus raised progressively until it reaches the lower chamber.—H. H.

Furnace; Electric —— *for iron and steel.* A. L. J. Queneau, Philadelphia, Pa. U.S. Pat. 1,057,669, April 1, 1913.

The furnace is provided with a working hearth made up of a rammed body of magnesite and tar with graphite, the proportion of graphite increasing in a downward direction from the surface. A course of carbon blocks supports the hearth, the blocks being laid upon a metal plate which forms one of the leads of the furnace. The furnace is provided with a peripheral shell, subdivided into sections with intervening insulating material, the shell being insulated from the metal bottom. The upper electrode has a holder, consisting of a socket provided with an internal interrupted thread, and a plug for the socket having an external interrupted thread adapted to engage that of the socket, the plug supporting the electrode. The holder is supported by an arm which can be raised and lowered and which is connected with the holder by a joint made up of face plates on the arm and holder with connecting nuts and bolts, and with insulating sleeves and washers.—B. N.

Metal alloy. E. Haynes, Kokomo, Ind. U.S. Pats. 1,057,423 and 1,057,828, April 1, 1913.

(1) An alloy of cobalt, chromium, and another metal of the chromium group, such as tungsten, containing not more than 60 per cent. W., the remainder being cobalt and chromium. (2) Two or more metals of the chromium group, such as tungsten and molybdenum, in quantities of from 5 to 60 per cent. are alloyed with cobalt and chromium.—O. R.

Nickel alloy resistant to chemicals and which can be mechanically worked. Gebr. Borchers. Ger. Pat. 257,380, Aug. 20, 1912. Addition to Ger. Pat. 256,123 (this J., 1913, 295).

In the alloy described previously containing Co more than 50 per cent. and Ag up to 1 per cent., Cu up to 15 (preferably 3—5) per cent. is introduced either in place of or in addition to the Ag.—A. S.

Metals [copper]; Process of fusing and purifying ——. W. S. Rockey and H. Eldridge, New York, Assignors to Metallurgical Research Co. U.S. Pat. 1,057,882, April 1, 1913.

Copper is melted in a fusing chamber by a hydrocarbon fuel flame carrying an excess of hydrocarbon. The products of combustion escape from the front of the furnace by the opening through which the fused copper runs into a ladle, and are then led to the flue by a hood which hangs over the front of the furnace. The molten copper is thus subjected to a reducing atmosphere as it emerges from the furnace and is thereby protected from oxidation, while at the same time any oxide in the copper is reduced.—T. St.

Precious metals; Treatment of copper ores bearing ——. J. C. Clancy, Assignor to Clancy Metals Process Co., New York. U.S. Pat. 1,057,936, April 1, 1913.

The ore is subjected to the action of a cyanide solution containing a soluble cyanamide. The precious metals are then precipitated by the action of zinc or nascent hydrogen, the copper remaining in solution. The copper is recovered from the solution by electrolysis.—T. St.

Glass, metal and other fusible materials; Process for the production of coatings by the projection of molten ——. Soc. de Métallisation. Fr. Pat. 449,015, Oct. 3, 1912.

The fusible material is continuously melted in small quantities at a time and projected upon the object to be coated. For example, a rod of the fusible material may be fed through the central orifice of a "blowpipe" or injector-burner while an annular "jet" of flame is caused to impinge upon the end of it.—W. E. F. P.

Metallic coating; Process for producing a ——, *by the pulverisation of a liquid metal.* Soc. de Métallisation. Fr. Pat. 449,374, Dec. 20, 1911.

A spray of the liquid metal is caused to impinge upon the object to be coated, the spray being produced by purely mechanical means such as vibration or the convergence of two or more jets of the liquid material. —W. E. F. P.

Nickel; Process for obtaining ——, *from its oxidised ores.* J. Babé and M. Collin. Fr. Pat. 449,112, Dec. 13, 1911.

A mixture of the ore with carbon and antimony oxide or metallic antimony is heated to a temperature of 1000°—1200° C., and the resulting impure, fusible nickel-antimony alloy is separated from the pulverised mass by "washing" (concentration by means of water) and, after purification by fusion, is powdered and treated with hydrochloric acid. The solution is subjected to electrolytic or other treatment for the production of metallic nickel, the insoluble residue of metallic antimony being employed for the treatment of a further quantity of ore.—W. E. F. P.

Nickel ores of New Caledonia; Process for the magnetic enrichment of complex ores, more especially the ——. C. E. Hugoniot. Fr. Pat. 449,301, Dec. 19, 1911.

The roasted ore is separated into two products, one rich in nickel and the other in iron, by magnetic treatment at a temperature at which the compounds of nickel cease to be magnetic while those of iron still retain their magnetic properties.—W. E. F. P.

Bismuth; Method of extracting and refining ——. F. G. Charnau and L. A. Barbeau. Fr. Pat. 449,567, Oct. 18, 1912.

The ground ore is roasted in order to convert all the metals present into oxides, and to eliminate sulphur, and is then extracted with hydrochloric acid, and washed, first with dilute acid, then with water, till free from metallic salts. The solution is diluted with water in order to precipitate the bismuth as oxychloride. Copper remains in solution, but antimony and some lead are precipitated with the bismuth. The precipitate is washed free from copper, filter-pressed, and smelted with ground charcoal and lime, to recover the bismuth. This impure bismuth is freed from antimony by melting and agitating in the presence of air. The antimony thus becomes oxidised and volatilises. When lead is known to be present, sulphur is added to the mixture when the oxychloride is reduced, the lead being thus obtained as sulphide. After purifying from the antimony, a separation from the lead sulphide is effected by liquation. The separated lead sulphide is treated with nitric acid and any bismuth present is precipitated as the oxysalt and recovered. Where small amounts of bismuth are associated with an antimony ore, the ore is first treated with sodium sulphide solution, and the residue is then treated as described above.—T. St.

Metals; Annealing of ——. Tréfileries et Laminoirs du Havre, Anciens Etablissements Lazare Weiller, Société Coopérative de Rugles et la Canalisation Electrique Réunis. Fr. Pats. 449,741 and 449,742, Oct. 23, 1912.

(1) The metal is immersed in melted caustic alkali having the desired annealing temperature. After removal, and during cooling, the metal is protected from oxidation by the layer of adhering alkali, which is finally dissolved in water. Direct contact with the alkali may be avoided by placing the metal in a containing vessel, which is immersed in the alkali. (2) In order to protect metals, such as fine wires, from oxidation during the annealing processes, the metal is made to cool in a reducing atmosphere such as coal gas or hydrogen, by using a containing vessel, provided with an orifice, through which the reducing gas may be admitted, when the vessel is removed from the annealing furnace.—T. St.

Metals; Method and apparatus for refining —— *and for casting fused or plastic material.* Brandon Frères. Fr. Pat. 449,814, Oct. 24, 1912.

The fused or plastic material (metal) is charged into a cylindrical vessel which is then rotated about the long axis at a high speed. The metal takes the form of a hollow cylinder of very compact and homogeneous material, and any light particles of solid matter such as slag, as well as air bubbles are forced to the inner surface. The rate of cooling may be controlled by blowing air on the inner surface, and by suitably lagging the cylindrical vessel. By providing the inner surface of the cylindrical vessel with suitable projections, the outer surface of the solidifying material may be moulded to any desired form. —T. St.

Fritting metallurgical products and the like, particularly ores in a fine state of division, roasted pyrites residues, and dust from blast-furnaces; Method of ——. J. Savelsberg. Fr. Pat. 449,896, Oct. 26, 1912. Under Int. Conv., Nov. 23, 1911.

In order to bring the finest dust into contact with the combustible material in the process of fritting, water vapour is added to the compressed air supplied to the material under treatment. By this means the dust is damped, and adheres to the combustible material. Also, water-gas is formed which by the heat of its combustion, assists in promoting fritting.—T. St.

Metals; Electrodeposition of ——. A. Nodon and A. Lecadre. Fr. Pat. 450,065, Jan. 8, 1912.

The electrolyte consists of a solution containing a free acid, and one or several alkali salts, particularly ammonium compounds, with the object of preventing secondary oxidation at the moment of deposition of the metal on the electrode.—B. N.

Aluminium, nickel or other metal; Process for obtaining a deposit of ——, upon iron or other metal. P. de la Fresnaye and E. Cadoret de la Gabinière. Fr. Pat. 450,131, Nov. 4, 1912.

The process is based upon the electrochemical sequence of the metals. To obtain a deposit of aluminium upon iron, the latter is immersed in a solution of the mixed sulphates, nitrates or other salts of aluminium, zinc, copper and tin obtained by dissolving an alloy of these metals in the acid selected.—W. E. F. P.

Minerals; Method of separating ——. Maschinenbau-Anstalt Humboldt and W. J. Bartsch. Fr. Pat. 450.144, Nov. 4, 1912. Under Int. Conv., Jan. 22, 1912.

The apparatus consists of a series of compartments, each of which is a little higher than the preceding one. The ground ore is introduced by a stream of water which flows above the compartments along the length of the series. A classification of the various minerals follows, that with the highest specific gravity being deposited in the first and lowest compartment, and so on. The deposited minerals are then drawn off from below.—T. St.

Manganese steel; Methods of producing wrought shapes of ——. W. S. Potter, New York. Eng. Pat. 2324, Jan. 29, 1912. Under Int. Conv., Dec. 28, 1911.

See U.S. Pat. 1,017,906 of 1912; this J., 1912, 286.—T.F.B.

Steel; Process for making refined ——. Dellwik-Fleischer Wassergas-Ges. m. b. H. Fr. Pat. 449,323, Oct. 11, 1912.

See Ger. Pat. 250,999 of 1911; this J., 1913, 29.—T. F. B.

Tin from base bullion; Process of extracting —— as oxide or metal. B. C. Besley, Howell, N.S.W. Eng. Pat. 14.755, June 24, 1912. Under Int. Conv., July 19, 1911.

See Fr. Pat. 445,540 of 1912; this J., 1912, 1187.—T. F. B.

Wire; Apparatus and process for making —— electrolytically. W. E. Gibbs, Pittsburg, Pa., Assignor to Gibbs Co., Plainfield, N.J. U.S. Pat. 1,058,047, April 8, 1913.

See Eng. Pat. 19,593 of 1910; this J., 1911, 430.—T. F. B.

Copper wire; [Electrolytic] method of and apparatus for producing ——. W. E. Gibbs. New York, Assignor to Gibbs Co., Plainfield, N.J. U.S. Pat. 1,058,048, April 8, 1913.

See Fr. Pat. 420,249 of 1910; this J., 1911, 430.—T. F. B.

Channel-furnaces for burning ore-bricks; Method of working ——. A. Ramén, Helsingborg, Sweden. U.S. Pat. 1,058,099, April 8, 1913.

See Eng. Pat. 20,247 of 1910; this J., 1911, 1147.—T. F. B.

Cleaning articles of silver and other metals and articles coated with metal; Electrolytic process for ——. A. Rosenberg. Fr. Pat. 449,571, Oct. 18, 1912.

See Eng. Pat. 17,150 of 1911; this J., 1912, 1185.—T. F. B.

Electrolytes for use in depositing a metal or metallic alloy; Process for preparing ——. P. Marino. Fr. Pat. 449,822, Oct. 24, 1912. Under Int. Conv., Nov. 4, 1911.

See Eng. Pat. 24,562 of 1911; this J., 1913, 93.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Electrolytic regeneration of chromic acid from solutions of chromium sulphate. Askenasy and Révai. *See* VII.

New electrode for electrolytic analysis. Bertiaux. *See* XXIII.

Patents.

Gases; [Electrical] Treatment of ——. H. D. Rankin, Joliet, Ill., Assignor to American Nitrogen Co. U.S. Pat. 1,056,830, Mar. 25, 1913.

An apparatus for treating gases comprises a chamber to which the gases are supplied in a preheated condition and under pressure and in which the gases are subjected to the action of an electric arc passing between two electrodes, one of which is water-cooled while the other is adapted to become molten. The gases are water-cooled as they leave the chamber.—H. H.

Electric separation of bodies in suspension in insulating fluids and particularly in gases; Process and apparatus for ——. E. Möller. Fr. Pat. 449,337, July 31, 1912.

The distribution of the current delivered into the fluid containing the suspended bodies is regulated by the adjustment of an ionising medium or groups of ionising elements, either by an outside electric field or by another ionising medium. The regulation of the ionising medium with the outside field or another ionising element is effected mechanically, or by division of the surface of the electrodes and by supplying the elements with electricity at different tensions. The maintenance of the distribution of the electricity once regulated is assured against the objectionable influence, arising mainly from the liquid to be treated, by insulation of the electrodes by an insulating liquid contained in an intercepting siphon, the liquid being renewed by an auxiliary channel by means of a circuit through a purifying apparatus. The ionising medium, for charging the bodies in suspension in the fluid, may be a flexible one, such as a wire of small diameter stretched by a weight or spring, and placed opposite the collecting surface.—B. N.

Resistance element; Electrical ——. A. L. Marsh, Assignor to Hoskins Manufacturing Co., Detroit, Mich. U.S. Pats. 1,057,753—1,057,756, April 1, 1913.

The element, which is adapted to withstand a high temperature, is formed: (1) of an alloy of iron with 5 to 10 per cent. Al, (2) of an alloy of iron with at least 20 per cent. Cr, (3) of an alloy of a metal of the nickel group in Mendeléjeff's periodic law with approximately 5 per cent. Si, (4) of an alloy of iron with approximately 25 per cent. Cr, to which is added an Al-Si alloy in the proportion of about 5 per cent. of the total of the other ingredients. —B. N.

Resistance; New electric —— with a boron or carbon base. Comp. Franc. pour L'Exploitation des Procédés Thomson-Houston. Third Addition, dated Oct. 25, 1912, to Fr. Pat. 421,392, Oct. 13, 1910 (this J., 1911, 433).

The resistances of boron, with or without carbon, are joined to their metallic ends, preferably of tungsten, by welding with the use of the electric arc.—B. N.

Gas reactions; Process for carrying through chemical —— by means of an enlarged electrical discharge. H. Andriessens, Munich, Germany. U.S. Pat. 1,058,653, April 8, 1913.

See Eng. Pat. 16,296 of 1912; this J., 1912, 1083.—T.F.B.

Endothermic reactions in gases; Electrical apparatus for producing ——. W. S. Lee. Fr. Pat. 449,817, Oct. 24, 1912.

See U.S. Pat. 1,051,131 of 1913; this J., 1913, 200.—T.F.B.

Colloidal and finely-divided substances; Process for treating [separating] ——. G. B. Schwerin. First Addition, dated Oct. 22, 1912, to Fr. Pat. 448,230, June 18, 1912. Under Int. Conv., Aug. 22, 1912.

See Eng. Pat. 24,666 of 1912; this J., 1913, 432.—T. F. B.

Electro-osmotic extraction of water under pressure from vegetable, animal, and mineral substances ; Process for ——. Ges. f. Elektro-Osmose m.b.H. Fr. Pat. 449,358, Oct. 12, 1912. Under Int. Conv., July 17, 1912.

See Eng. Pat. 23,545 of 1912 ; this J., 1913, 200.—T.F.B.

Induction furnaces [*; Electric* ——]. Helfenstein Elektroden-ges. m. b. H. Fr. Pat. 449,860, June 8, 1912.

See Eng. Pat. 14,164 of 1912 ; this J., 1913, 432.—T. F. B.

XII.—FATS ; OILS ; WAXES.

Oil seeds from the Anglo-Egyptian Sudan. Bull. Imp. Inst., 1913, 11, 56—63.

Samples of sesamum, castor, senat, and *Salvadora persica* seed were examined. The senat plant (*Cucumis Chate*, L.) grows as a weed and is also cultivated in many parts of the Sudan, under the names : "Hameid," "Fagus," "Ajurr," and "Tibish." Six different samples of the seeds yielded from 29·5 to 38·4 per cent. of a pale yellow oil, free from smell and unpleasant taste, and suitable for use as an edible oil. The oil had the following characters, the figures in brackets indicating the number of samples examined : sp. gr. at 15°/15° C. (3), 0·923—0·925 ; acid value (3), 0·7—1·0 ; saponif. value (5), 187·0—192·0 ; iodine value (5), 117·0—128·5 ; solidif. pt. of fatty acids, titer test (1), 30·3° C. ; Hehner value (1), 96·6 ; unsaponifiable matter (1), 0·7 per cent. ; Reichert-Meissl value (1), 0. The senat seed husks are of little value as a feeding stuff for cattle, but might be used as a manure, the ash containing 42·69 per cent. K_2O. *Salvadora persica*, L. is a shrub which grows wild throughout the Sudan, being known as the "mustard tree." The seeds yield 44·6 per cent. of a hard, bright yellow fat, having a faint, slightly unpleasant odour, and the following characters : sp. gr. at 99°/15° C., 0·867 ; acid value, 9·3 ; saponif. value, 245·2 ; iodine value, 5·9 ; solidif. pt. of fatty acids (titer test), 30·4° C. (approx.) ; m. pt. 38° C. The fat could be used in the manufacture of candles, and if freed from its unpleasant odour and taste might be of use in the preparation of vegetable butters and "chocolate fats." The exports of oil seeds from the Sudan for the last three years for which figures are available are shown in the following table :—

	1909.		1910.		1911.	
	cwt.	£	cwt.	£	cwt.	£
Sesamum seed ...	122,640	64,709	116,213	67,717	97,134	73,427
Cotton seed	36,342	9267	33,643	10,749	139,810	32,406
Ground nuts ...	5804	3688	18,172	8959	22,100	13,400
Senat seed	—	—	3463	1046	447	311

—A. S.

Pine nut oil. M. Adams and A. Holmes. J. Ind. Eng. Chem., 1913, 5, 285—287.

The authors have examined the oil extracted from the seeds which are found on the middle scale of the cones of the pinon or grey pine (*P. monophylla* or *P. Fremontiana*). The air-dried kernels of the seeds contain : water, 7·88 ; ash, 2·60 ; ether extract, 22·77 ; crude fibre, 0·65 ; crude protein, 8·94 ; nitrogen-free extract, 57·21 ; nitrogen, 1·43 per cent. The oil obtained by extraction with ether is light yellow, but becomes colourless on prolonged exposure to light. It melts at —15° C., begins to decompose at 320° C. under atmospheric pressure, but under a pressure of 60 mm. begins to distil without decomposition at 305° C. It has the saponif. value 189, iodine value 108, and refractive index 1·4747 at 10°, 1·4698 at 25°, and 1·4543 at 40° C. It contains 9·2 per cent. of glycerol, no phytosterol, and the mixed acids (yield 90 per cent.) when separated by means of their lead salts give 82 per cent. of unsaturated and 8 per cent. of saturated acids. Chemical examination of the separated acids indicates that the oil consists chiefly of olein together with small amounts of the glycerides of stearic, palmitic, lauric, linolic, and other unsaturated acids.—A. S.

"*Cheyi*" [*Polygala butyracea*] *seed and fibre.* Bull. Imp. Inst., 1913, 11, 62—65.

"Cheyi" is the name applied by natives of Northern Nigeria to a herbaceous plant (*Polygala butyracea*, Heck.) occurring commonly in tropical West Africa. A sample of the seed yielded 37·9 per cent. of a soft yellowish fat of pleasant taste, having the following characters : m. pt., 36° C., sp. gr. at 100°/15·5° C., 0·866 ; acid value, 1·24 ; saponif. value, 251·0 ; iodine value, 52·5 ; solidif. pt. of fatty acids (titer test), 37·85° C. ; Hehner value, 85·6 ; Reichert-Meissl value, 45·6 ; unsaponifiable matter, 0·55 per cent.

The sample of fibre was of a pale yellow to brown colour and gave the following results when examined chemically : moisture, 8·5 ; ash, 3·5 ; α-hydrolysis, loss, 21·7 ; β-hydrolysis, loss, 27·6 ; acid purification, loss, 5·7 ; cellulose, 69·9 per cent. ; length of ultimate fibres, 0·6—1·3 in. The fibre is equal in value to fine Bombay hemp.—A. S.

Kukui oil. E. V. Wilcox. Oil, Paint, and Drug Rep., March 24, 1913. [T.R.]

The nuts of the kukui tree, which is found in several of the Oceanic Islands and also in parts of the West Indies, Brazil, and Florida, yield an oil known variously as kukui oil, kekune oil, candlenut oil, walnut oil, and artists' oil. Probably about 15,000 acres in Hawaii are covered with the trees. If the nuts were systematically gathered, an annual yield of some 2,375,000 gallons of oil should be possible.

Raisin seed utilisation. F. Rabak. Bureau of Plant Industry, U.S. Dept. of Agric. [T.R.]

Waste raisin seeds can be utilised for the production of oil and tannin extract. The oil has given satisfactory results in paint making and soap-making trials, and also appears suitable for use as a varnish oil. It dries somewhat more slowly than linseed oil. From 90,000 to 120,000 gallons are available annually. In addition to this, some 700,000 or 800,000 lb. of dry tannin extract, containing 28 to 38 per cent. of tannin, could be obtained from the seeds. Further the "syrup" from the seeds contains considerable quantities of fermentable sugar, and is stated to yield 23·4 per cent. of alcohol on fermentation. The residue after the extraction of the oil and tannin might well be used as cattle food.

Chinese wood oil ; Gelatinisation of ——. H. Wolff. Farbenzeit., 1913, 18, 1171—1173. Chem. Zentr., 1913, 1, 1372.

The stiff jolly-like mass produced when Chinese wood oil is heated rapidly to about 250° C., is not a homogeneous product ; only a small proportion of the oil is altered and then forms with the unaltered oil a colloidal solution, the gelatinisation of which is the cause of the setting of the mass. The unaltered oil can be extracted by ether, chloroform, or benzene. The portion insoluble in these solvents is a stiff mass, small quantities of which are able to cause gelatinisation of large quantities of Chinese wood oil or linseed oil in a relatively short time on heating. If the insoluble portion be treated with cold *N*/5 sodium carbonate and then acidified, a liquid fatty acid (or acids) of iodine value 11·5—19·8, neutralisation number 351·6—398, can be extracted by ether (yield, about 20 per cent.). The fatty acids from the portion not saponified by cold sodium carbonate solution have the iodine value 81·8—105·6, neutralisation number 128—147·2. The original oil is practically unaffected by cold sodium carbonate solution.—A. S.

Chinese wood oil. S. Fokin. J. Russ. Phys.-Chem. Soc., 1913, 45, 283—285.

The polymerisation of this oil when heated, the increased refraction and the transformation of the elæomargaric acid under the influence of light into a product with a higher melting point are explainable on the assumption that the acid contains either conjugated double linkages or, as in allene, a carbon atom with two double linkages. The products obtained when the acid is oxidised with potassium permanganate in alkaline solution indicate its structure to be :

$CH_3·[CH_2]_3·CH : CH·CH : CH·[CH_2]_9·CO_2H$.—T. H. P.

Unsaturated acids [*and oils containing them*] ; *Behaviour of certain —— with selenious acid.* S. Fokin. J. Russ. Phys.-Chem. Soc., 1913, **45**, 285—286.

Various unsaturated fatty acids and, more especially, the oils containing them as glycerides undergo marked changes when heated with concentrated solutions of selenious acid at 100° C. under ordinary pressure. This action is most characteristic in the case of castor oil. After 1—3 hours' heating the oil becomes converted into a caoutchouc-like mass of a faint red colour. This product is insoluble in alcohol, ether, benzene, pyridine, etc., but it dissolves with decomposition in boiling acetic acid and is saponified and darkened by alcoholic potassium hydroxide. When treated with alcohol or ether, it swells to a jelly, which can be readily pounded to a paste and, after evaporation of the alcohol or ether in the cold, powdered. After being washed to remove any excess of selenious acid or castor oil, the powder was found to have an iodine value, 59·0, and a saponif. value, 168·5, the corresponding values for castor oil being 86 and 180 respectively. The substance contains selenium and the presence of double linkages and the small difference between its saponification value and that of the original oil, indicate it to be different from the "factis" obtained by the action of sulphur chloride on linseed and other oils.—T. H. P.

Rosin, Determination of —— in soap by a modification of Twitchell's method. A. A. Besson. Chem.-Zeit., 1913, **37**, 453—454.

From 2 to 2·5 grms. of the fatty acids are dissolved in 20 c.c. of absolute alcohol, the solution saturated with dry hydrochloric acid gas, and the flask closed and allowed to stand for about 30 minutes. A little pumice and 150 c.c. of water are then introduced, and the liquid boiled until fatty acid esters and rosin acids separate. After cooling, the mixture is shaken with ether, after the addition of a little methyl orange, and the separating funnel is left for 2 hours, when the hydrochloric acid layer is drawn off, and the ethereal layer shaken with 100 c.c. of dilute alkali solution (5 grms. KOH, 50 c.c. of alcohol, 500 c.c. of water) and phenolphthalein. After standing for two hours, the alkali solution is drawn off, and the shaking process twice repeated, the separating funnel being allowed to stand for 2 hours after each extraction. The ethereal layer is then evaporated, and the residue of rosin acids weighed. An addition of about 2 grms. of fatty acids (which have been tested by Twitchell's method) is now made to this residue, and the mixture dissolved in 20 c.c. of absolute alcohol, and again esterified and shaken with ether in the manner described. The hydrochloric acid is drawn off as before, the ethereal layer washed with 100 c.c. of water containing methyl orange, and the acid aqueous layer neutralised with alkali solution and allowed to stand for 2 hours. It is then drawn off, and the ethereal solution titrated with $N/2$ or $N/10$ alkali with phenolphthalein as indicator. The results will agree within about 0·3 per cent. of the actual amount of rosin, but if still greater accuracy is required a third esterification is necessary.—C. A. M.

Patents.

Oil presses. L. Hoffmann, Vienna. Eng. Pat. 13,256, June 15, 1912.

The side plates of the press are provided with holes or slots which are made to coincide with the ends of the grooves in the press-plates. This enables the side plates to be fixed rigidly in the press without interfering with the escape of the oil.—C. A. M.

Oil presses. G. van Geenhuizen. Fr. Pat. 449,880, Oct. 26, 1912.

Means are provided for holding up several of the upper plates in the top of the cylinder of the press. When the lower plates have been charged, the catches are released, so that the upper plates fall and by their weight compress the material and thus leave room for the filling of the press to be completed. More material can thus be dealt with in one charge than is possible by the ordinary method of filling the press.—C. A. M.

Oils and the like ; Clarifying system for ——. W. L. Morris, Chicago, Ill., Assignor to S. F. Bowser and Co., Inc., Fort Wayne, Ind. U.S. Pat. 1,056,928. March 25, 1913.

The clarifying system consists of a reservoir, an oil main leading from the reservoir, a drip return pipe, a precipitation tank, a filter, a refuse tank, means for discharging the impurities from the precipitation tank to the refuse tank, an overflow for discharging the clarified oil from the precipitation tank to the filter, means for removing the impurities from the refuse tank from a point near the bottom thereof, a drip receiving tank, an overflow near the top of the refuse tank for discharging the clarified oil to the drip receiving tank, means for discharging the oil from the filter to the drip receiving tank, means for discharging the clarified oil from the drip receiving tank to the reservoir, means for withdrawing the impurities from near the bottom of the drip receiving tank and discharging them into the refuse tank, and means for withdrawing the impurities from near the bottom of the refuse tank.—E. W. L.

Fats ; Hydrogenation of ——. C. Ellis. Fr. Pat. 449,668, Oct. 22, 1912. Under Int. Conv., Oct. 23, 1911.

An oil containing unsaturated compounds is caused to flow continuously through a long conduit containing a suitable catalytic substance (nickel, copper, iron, palladium, etc.) and a current of hydrogen, or a gas (*e.g.*, water-gas) containing hydrogen, is caused to flow through the conduit in an opposite direction, in contact with the oil. The conduit is provided with a heating jacket, which is divided into compartments by transverse partitions, and different temperatures are maintained in these compartments. By this method of working, the fresh oil comes in contact with gas poor in hydrogen, whilst the hydrogenation is completed by gas rich in hydrogen, and different temperatures may be maintained in different parts of the conduit as required to facilitate hydrogenation. In the conversion of oleic acid or olein into stearic acid or stearin respectively, for instance, by means of nickel, the first section of the conduit is heated to 150° C., the intermediate section to 165° C., and the last section to 180° C.—A. S.

Saturated fatty acids and their glycerides ; Process for the manufacture of ——. Naamlooze Vennootschap Ant. Jurgens Vereenigde Fabrieken. Ger. Pat. 256,500. Jan. 27, 1911.

In the conversion of unsaturated fatty acids and their glycerides into the corresponding saturated compounds according to the process described in Ger. Pat. 236,488, the palladium or palladium hydroxide used as hydrogen-carrier may be replaced by platinum or its hydroxide, or other platinum metals or mixtures of the same. The hydrogen-carrier is used in the form of a deposit on an inert substance. Suitable inert substances are metals such as magnesium, nickel or cobalt, and materials containing oxides, hydroxides, carbonates, tertiary phosphates, sulphates, silicates, amorphous silica, powdered carbon, or cellulose.—A. S.

Lubricant. R. van Datte. Fr. Pat. 449,758, Aug. 9, 1912.

Grease suitable for lubricating at temperatures from − 25° C. to +180° C. is made by mixing 67 parts of hydrocarbons C_nH_{2n+2}, 3 parts of caustic soda, and 30 parts of the compound $C_{18}H_{34}O_2$. The lubricant is mixed with animal hair and used in a grease-box.—A. T. L.

Soap in the form of tablets or the like; Making ——. M. Castenholz, Cologne, Germany. U.S. Pat. 1 057,931, April 1, 1913.

Tablets readily dissolving are made by adding to "dephlegmated alkaline soap" at least an equal weight of "dephlegmated powdered borax," and a small quantity of a vegetable oil. The mixture is heated to the boiling point to form a paste, which is dried and finely powdered, the powder being compressed in moulds into tablets, "which immediately disintegrate under light pressure when being used."—B. N.

Calcium soaps; Process of obtaining fatty acids from ——. G. Bottaro. Fr. Pat. 449,392, Oct. 14, 1912. Under Int. Conv., Oct. 26, 1911.

The soaps obtained in the saponification of oils and fats with lime are decomposed by means of a current of hot sulphur dioxide or a hot solution of the gas at the ordinary or increased pressure or *in vacuo*. The resulting fatty acids are of good colour. In the usual process of hydrolysis with sulphuric acid, the nitrous compounds always present in the latter attack the fatty acids; loss due to this cause is obviated by the present process, and the glycerin is easily extracted from the calcium sulphite. The same process may be used for the treatment of the soaps of any other metals, or of soaps of ammonia or organic bases.—C. A. M.

Soaps containing soluble fluorides; Manufacture of ——. M. Ullmann. Ger. Pat. 256,886, Feb. 25, 1912.

A reaction mixture of silicofluorides and alkali for the production of a soluble fluoride is added to the soap during or after its manufacture. For example, a silicofluoride may be added to the fat, and the latter then treated with the requisite quantity of alkali and converted into soap in the usual way.—A. S.

Solutions of organic compounds forming emulsions with water; Liquid or solid ——. R. Vidal. Second Addition, dated Dec. 11, 1911, to Fr. Pat. 445,053, July 8, 1911.

The organic compounds mentioned in the principal patent (this J., 1912, 1190), and also "liquid chlorine or sulphur compounds of carbon," are dissolved in aqueous solutions of alkali compounds of castor oils containing complex phenols, such as eugenol, isoeugenol, thymol, carvacrol, or salicylic aldehyde (see also this J., 1913, 150).—T. F. B.

Lubricants and the mode of applying the same. R. van Datte, Antwerp. Eng. Pat. 18,295, Aug. 8, 1912.

See Fr. Pat. 449,758 of 1912: preceding.—T. F. B.

Fats, oils, and waxes; Process for dissociating ——. H. von Schönthan, Schöneberg, Assignor to Verein. Chem. Werke A.-G., Charlottenburg, Germany. U.S. Pat. 1,058,633, April 8, 1913.

See Eng. Pat. 749 of 1912; this J., 1912, 545.—T. F. B.

Fatty saponaceous product and method of manufacturing same. B. Benedix, Hamburg, Germany. Eng. Pat. 16,413, July 13, 1912.

See Fr. Pat. 446,009 of 1912; this J., 1913, 150.—T. F. B.

Soap; Process for making ——. T. Anyon. Fr. Pat. 449,632, Oct. 21, 1912. Under Int. Conv., Nov. 2, 1911.

See Eng. Pat. 24,304 of 1911; this J., 1912, 936.—T. F. B.

Apparatus for combining gases with liquid or with soft or granular masses. Eng. Pat. 5773. *See* I.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Oil of turpentine; Autoxidation of ——. A. Blumann and O. Zeitschel. Ber., 1913, **46**, 1178—1198.

A sample of Greek oil of turpentine which had resinified on exposure to the air showed a greatly increased optical activity and specific gravity, and had a b.pt. above 200° C., and a sweet odour recalling that of celery. It reduced Fehling's solution and ammoniacal silver solution and gave other aldehydic reactions, which supported Schiff's conclusion that an aldehyde, $C_{10}H_{16}O_3$, was present in resinified oil of turpentine (Ber., 1883, **16**, 2010). The reducing body separated by the authors, however, had the composition $C_{10}H_{14}O$, and gave the reactions, not of an aldehyde, but of an alicyclic ketone. It melted at 6·5° C., boiled at 227° to 228° C., had a sp. gr. of 0·981 at 15° C., and $\alpha_D = +64{\cdot}95$ in 100 mm. tube at 18° C., and yielded a semicarbazone crystallising in plates melting at 208° to 209° C. These and other characteristics showed that it was identical with the *d*-verbenone isolated by Kerschbaum (this J., 1900, 686) from Spanish verbena oil. A lævo-rotatory French oil of turpentine which had become oxidised in the same way yielded a similar compound, $C_{10}H_{14}O$, which was identified as *l*-verbenone. This yielded a semicarbazone melting at 185° to 190° C., and had a sp. gr. of 0·9820 at 15° C., and $\alpha_D = -144°$ in 100 mm. tube. It had a sweet odour of celery. An inactive preparation of the two verbenones was obtained, and this yielded a semicarbazone melting at 180° to 181° C.—C. A. M.

Turpentine oil obtained direct from wood by destructive distillation and in the manufacture of cellulose by the soda process. Bergström. *See* IIb.

Patents.

Gold pigment; Process of making ——. J. W. Hasburg, Chicago, Ill. U.S. Pat. 1,057,422, April 1, 1913.

An alkali hydroxide, carbonate, or bicarbonate is added to a solution of gold chloride, precipitation is effected by the addition of a metallic salt, the precipitate is washed, treated with acid to dissolve the oxide of the base metal, washed again, dried, and mixed with a flux containing lead borate.—O. R.

Water colours; Process of manufacturing —— *by means of kaolin and albuminoid substances.* J. Giband and O. I. Bang. Fr. Pat. 449,204, Oct. 2, 1912.

The colouring matter is mixed with albuminoid substances and a solvent for these substances, such as alkali carbonates and especially a mixture (*e.g.*, ammonium sulphate and powdered lime) which gives off ammonia in the presence of water.—C. A. M.

Turpentine-condenser. J. R. Walker, Jacksonville, Fla. U.S. Pat. 1,057,788, April 1, 1913.

The apparatus consists of a primary water-cooled coil connected with a secondary water-cooled condenser; the latter comprises a superimposed, main condensing compartment containing a number of horizontal dome-shaped baffle-plates, surrounded by a water-jacket, a cooling tank being disposed below the main condenser compartment. A water jacket surrounds the cooling tank, which itself contains a central, vertical water column and communicates with an external, water-cooled, storage reservoir.—O. R.

Plastic compounds or compositions. L. Collardon, London. Eng. Pats. 1598 and 1599, Jan. 20, 1912.

(1) Condensation products of formaldehyde with phenol or cresol are mechanically mixed, while in paste-like form, with cellulose xanthate or sulphohydrocellulose or both, and the mass steamed and washed to remove alkali and sulphur compounds. Or the cellulose xanthate may be steamed and washed prior to its incorporation with the condensation product. A small amount of resinous rubber

or resins or both may also be introduced to render the composition more elastic and flexible. (2) Products suitable for electrical insulation and similar purposes are obtained by mixing cellulose xanthate or sulphohydrocellulose with a small proportion of resinous rubber so as to make the composition waterproof and fairly flexible. The mixture is then steamed and washed. An addition of sulphur, zinc oxide, zinc sulphide, or filling materials may be made to the other ingredients of the product. —C. A. M.

Chlorinated products [artificial resins] from fats, oils and waxes, balsams and resins, petroleum and its distillates, paraffin, mineral wax, and montan wax; Preparation of ——. C. F. Boehringer und Söhne. Ger. Pat. 256,856, Nov. 19, 1910.

The material, dissolved or suspended in carbon tetrachloride, is treated with chlorine until the product contains at least 30 per cent. of chlorine and has a resinous character. The products are suitable as substitutes for natural resins.—A. S.

Rosin soap and rosin from resinous woods; Preparation of ——. J. Aktschourin. Ger. Pat. 257,015, Jan. 12, 1912.

The extraction of the wood with alkali and the subsequent decomposition of the rosin soap, or the extraction of the wood with solvents such as petroleum spirit, is carried out in presence of reducing agents (sulphites, hydrosulphite, or sulphur dioxide). It is stated that in presence of reducing agents, the lignin remains in a form insoluble in alkalis. —A. S.

Resin-wax mixtures; Preparation of —— *for subsequent purification, separation into their constituents, etc.* C. Melhardt. Ger. Pat. 257,060, July 27, 1912.

The material is melted in water or a neutral aqueous solution and intimately stirred therewith until its volume is increased to many times the original value whereby the mass is brought to a condition of extremely fine subdivision. In this condition it is treated with an alkali carbonate or other alkali salt capable of dissolving the resin, and the alkaline resin solution recovered by lixiviation, preferably with water.—A. S.

Amber; Manufacture of a mass similar to —— *from copal.* J. Bahret. Ger. Pat. 257,065, Feb. 16, 1911.

The copal is dissolved in acetone, and after addition of colouring matters if desired, the solution is heated until the acetone is expelled and the residue melts. The fused mass is pured into moulds and allowed to cool therein under pressure.—A. S.

Paints; Methods of producing ready-mixed ——. F. F. Bradley, Chicago. Eng. Pat. 27,408, Nov. 28, 1912. Under Int. Conv., June 12, 1912.

See U.S. Pat. 1,032,652 of 1912; this J., 1912, 828.—T.F.B.

Paint for protecting iron, wood, and similar materials against marine growths or animals. M. Rappard. Fr. Pat. 449,195, Oct. 9, 1912. Under Int. Conv., Oct. 16, 1911.

See Eng. Pat. 22,802 of 1911; this J., 1912, 347.—T. F. B.

Viscous stringy adhesive substances from resins or resinous products for use in the asphalt industry and the like; Process for making ——. J. Goepper and O. Geiger, Obertürkheim, Germany. Eng. Pat. 17,532, July 29, 1912. Addition to Eng. Pat. 6019 of 1912, dated Sept. 6, 1911.

See Addition of July 26, 1912, to Fr. Pat. 434,065 of 1911; this J., 1913, 144.—T. F. B.

Gums and resins; Process and apparatus for purifying ——. T. G. Tye. Fr. Pat. 449,176, Oct. 9, 1912. Under Int. Conv., Dec. 8, 1911.

See Eng. Pat. 27,579 of 1911; this J., 1912, 651.—T. F. B.

Production of azo colouring matters suitable for lakes. Eng. Pat. 15,146. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Insoluble constituent of ——. W. Schmitz. Gummi-Zeit., 1913, **27**, 1085—1087, 1131—1133.

The author discusses the work of Spence on the insoluble constituent of rubber (this J., 1907, 1287), and points out that, while Spence suggested multiplying the percentage of nitrogen found, by the factor 6·25, to give the percentage of protein, yet the highest percentage of nitrogen found by him was 5·4. The author has obtained the nitrogenous insoluble constituent by treating the rubber with "pentaline" (penta-chloroethane), diluting with chloroform and filtering. The insoluble constituent is often exceedingly finely divided and in order to obtain an absolutely clear filtrate it is necessary to regulate the time of heating with "pentaline" and the size of pores of the filter paper. The product thus obtained contained about 15 per cent. of nitrogen and was not gelatinous at all. The colour of the rubber did not appear to reside wholly in the insoluble constituent. This was soluble in caustic soda, but did not give the usual protein tests. The author considers that centrifuging is an unreliable method of separating the insoluble constituent as compared with careful filtration through paper, but agrees that the usual factor of 6·25 is probably fairly accurate.—H. E. P.

Behaviour of certain unsaturated acids [and oils containing them] with selenious acid. Fokin. *See* XII.

Patents.

Rubber; Method of attaching —— *to metals.* L. Daft, Rutherford, N.J., Assignor to Electro-Chemical Rubber and Manufacturing Co. U.S. Pats., 1,057,333 and 1,057,334, March 25, 1913.

(1) The article to which the rubber is to be attached is electroplated in an electrolyte containing several metals of which one is arsenic, or of which two are arsenic and copper, or of which three are arsenic, copper and zinc, and the rubber is attached to the surface thus formed, by vulcanisation. (2) Other complex electrolytes used for the purpose may contain bismuth, or bismuth and copper, or bismuth, copper, and zinc; or bismuth and arsenic, or bismuth, arsenic, and copper.—E. W. L.

Rubber; Process for improving the lower grades of ——. The Diamond Rubber Co. Fr. Pat. 448,974, Aug. 12, 1912.

Lower grades of rubber are improved in quality by treatment with the alkali metals or their alkaline derivatives. For example: (1) 100 parts of low-grade rubber, containing 6 per cent. of acetone-soluble impurities are mixed on the masticating rolls with sodium, 5 parts, the rolls being maintained at a temperature of 60°—70° C. In a few minutes the mass begins to harden and is transformed into a very tough product resembling high-grade rubber, which does not stick to the rolls and can be manipulated with ease. When the sodium is sufficiently distributed throughout the mass it is put aside to "incubate" for 24 hours in a suitable receptacle at a temperature of about 60° C. The metal is then removed by appropriate treatment. (2) 100 parts of "tacky" Pontianac rubber, containing 20 per cent. of acetone-soluble products, are mixed on hot rolls with sodium hydroxide (fused and powdered) 8½ parts. The mass is rapidly transformed into a tough product of superior quality, which is easy to manipulate. The transformation is completed by "incubating" (as above) at about 60° C. for 48 hours, after which the alkali is removed by washing or other suitable means. (3) 100 parts of low-grade, tacky rubber are dissolved in 750 parts of xylene and heated with sodium, 5 parts, at 100° C. in an autoclave for 24 hrs., the mass being well agitated in order to distribute the sodium. The product is a gelatinous mass from which the solvent and alkali can be removed by suitable means, and which yields under this treatment a tough elastic substance of superior quality. In the case of rubber containing high percentages of resins, it is desirable to remove the resins from the rubber before treatment. The products obtained by this process are much less soluble in the ordinary solvents than the parent substances. They vulcanise readily yielding products of increased value.—E. W. L.

Rubber; Plastic compositions and objects containing ——, *and their process of manufacture.* F. E. Barrows. Fr. Pat. 449,811, Oct. 24, 1912. Under Int. Conv., Oct. 30, 1911.

The plastic compositions and objects are obtained by intimate admixture of synthetic rubber (from hydrocarbons such as isoprene, erythrene, diisopropenyl and other substituted erythrenes) with the ordinary compounding ingredients of rubber manufacture, and by the impregnation of fabrics and fibres with such synthetic rubber. The method adopted is to mix the compounding ingredients, or to saturate the fabrics and fibres, with the hydrocarbons before, during, or after polymerisation (but before the liquid, volatile products are removed by distillation). By this means a very intimate admixture is ensured, and such masses can be vulcanised in the ordinary way by means of sulphur or sulphur chloride.—E. W. L.

Caoutchouc substances and process of making same. C. Harries, Kiel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,058,056, April 8, 1913.

See Eng. Pat. 1125 of 1911; this J., 1912, 241.—T. F. B.

Process for preparing 2·3-dimethylbutadiene (1.3). Ger. Pat. 256,717. *See* XX.

Process for preparing isoprene from terpenic hydrocarbons. Ger. Pat. 257,640. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin and the synthesis of similar substances. III. High-molecular compounds. E. Fischer and K. Freudenberg. Ber., 1913, **46**, 1116—1138. (See also this J., 1912, 503, 1043.)

By subjecting an acetone solution of gallic acid in presence of alkali to the action of phosgene, with exclusion of air, carbonylogallic acid (hydroxy-3-[oxomethylenedioxy]-4·5-benzoic acid), $\mathrm{CO}{<}^{\mathrm{O}}_{\mathrm{O}}{>}\mathrm{C_6H_2(OH)COOH}$, is produced. By the interaction of this acid and tricarbomethoxygalloyl chloride in acetone solution, in presence of alkali, and with cooling, and then splitting off carbon dioxide from the reaction product by means of hydrochloric acid, *m*-digallic acid is obtained, which is purified by treatment with animal charcoal and re-crystallisation. It forms colourless microscopic needles grouped in aggregates. The air-dried substance loses 15—16 per cent. of water on drying at 100° C. under 15 mm. pressure over phosphorus pentoxide. The anhydrous substance melts at about 271° (280° C. corr.) with decomposition and its properties are very similar to those of the compound prepared earlier and considered to be probably *p*-digallic acid (this J., 1911, 1224), but differ in many respects from those of the so-called *m*-digallic acid prepared by Nierenstein (this J., 1910, 440).

Experiments on the preparation of substances of very high molecular weights have also been continued, and starting from *p*-iodophenylmaltosazone (from maltosone and *p*-iodophenylhydrazine), the authors have succeeded by methods similar to those described previously, in synthesising hepta-(tribenzoyl-galloyl)-*p*-iodophenylmaltosazone, $C_{220}H_{142}O_{58}N_4I_2$, with a molecular weight of 4021.—A. S.

Tannin; A new synthetic ——. E. Stiasny. Collegium, 1913, 142—145.

If that view of the tanning process be correct according to which the semi-colloidal tannin is primarily adsorbed by the hide and then undergoes secondary changes on the hide fibre without actually combining with it, then an artificial tannin must be similar in physical properties and especially in its semi-colloidal character, as well as in chemical constitution to the natural product. By the action of formaldehyde on phenolic substances, in an acid solution, under such conditions that only water-soluble products are produced, substances (artificial tannins) are obtained containing a carbon bridge combining two phenolic nuclei, *i.e.*, the same structure as is probably present in some of the natural catechol tannins. The following method of working (Austrian Pat. 58,405) is given as an example: A phenol, *e.g.*, crude cresylic acid, is heated with the equivalent amount of sulphuric acid for a few hours to 100°—120° C., cooled, and formaldehyde added slowly, while cooling and stirring, in the proportion of 1 mol. of formaldehyde to 2 mols. of phenol. The resulting product is of a pasty nature and after neutralising the free mineral acid forms the synthetic tannin "Neradol." The product is easily and completely soluble in water and its semi-colloidal character is seen in dialytic experiments and by its non-crystallising nature. Gelatin solutions and lead salts yield a precipitate and ferric salts, a blue colour with it. It resembles wood-pulp extract in giving a precipitate by the Procter-Hirst aniline hydrochloride test, but contains no trace of lignin matter. It may be distinguished from wood-pulp extract by the following test. One or two drops of a 1 per cent. alum solution and about 5 grms. of solid ammonium acetate are added to 10 c.c. of a 5 per cent. solution of the doubtful extract. "Neradol" remains clear even after 24 hours' standing while mixtures of "Neradol" and wood-pulp give a precipitate which, in the case of a small quantity of the latter being present, takes a few hours' standing to become distinct and flocculent. In the gravimetric estimation of "Neradol," the total soluble matter must be dried below 100° C. in a vacuum, as decomposition takes place at 100°—105° C. "Neradol" produces a perfectly white leather and when used in combination with other tanning materials (vegetable or chrome) has a brightening and bleaching effect.—D. J. L.

Caesalpinia digyna. T. A. Faust. J. Amer. Leather Chem. Assoc., 1913, **8**, 154—158.

Caesalpinia digyna is a bush growing wild in Burma and yields tannin-bearing pods known commercially as Tari pods which belong to the same class as divi-divi and algarobilla. The pods are dark-brown in colour, almost round, about ¾ in. diam., and generally contain one or two large brown seeds. The pod cases are thin and contain practically all the tannin, which may be present to the extent of as much as 60 per cent. The leather produced by the material is equal in colour to that made from the best sumac. The cultivation of the plant is easy and, if undertaken, would no doubt prove successful. In samples examined by the author, the entire pods contained: Total extract, 60·0; soluble solids, 57·2; non-tannins, 20·0; and tannin, 37·3 per cent.; whilst the pod cases contained: total extract, 63·4; soluble solids, 61·0; non-tannins, 18·4; and tannin, 42·6 per cent. Colour tests on sheepskin were made with both solutions; the former did not give a uniform colour owing no doubt to the oil in the beans, but the latter gave leather of a light uniform colour. After rough grinding and separation of the dust, fibrous matter and beans, the following proportions of each with their tannin content were found. Dust, 46·1 per cent. with 46·6 per cent. of tannin; beans 16·1 per cent. with 10·3 per cent. of tannin, and fibrous matter 37·7 per cent. with 18·6 per cent. of tannin. On extraction with petroleum ether the beans yielded 2·56 per cent. of oil which did not confirm the results of other investigators, who have found 25—30 per cent. The light colour of leather tanned with the material was very little darkened by exposure to light for four weeks in which respect the material shows an advantage over allied products of the same class. The material should be of considerable commercial value but it would not be profitable for the tanner to separate the beans. The pods, however, could be leached whole as the tannin in the cases is extracted very rapidly and the oil in the bean would not be removed. The material could be obtained at about £9 10s. per short ton, which price compares favourably with that of other materials of the same tannin strength.—D. J. L.

Skins for colour testing; New method of preparing ——. P. M. Armstrong. J. Amer. Leather Chem. Assoc., 1913, **8**, 159—161.

SKIVERS are taken directly fom the lime, cut into pieces of the desired size for the tests and shaken with a 0·1 per cent. solution of ammonium chloride. The solution should be alkaline to methyl red but not to phenolphthalein and there should be at least one litre for each square foot of skin. If the solution becomes slightly alkaline to phenolphthalein, a few drops of dilute hydrochloric acid are added, but not enough to make the solution more than faintly acid to methyl red. After standing overnight the skin is washed with warm water until free from chlorides. The skivers are then transferred to two changes of alcohol and finally two changes of ether. The pieces are kept in ether or dried in a vacuum but in the latter case are soaked again in ether before use. To make a colour test a "ten degree liquor" (sp. gr. 1·010) is warmed to 110° F. (43° C.) and the skiver piece placed direct in it from the ether. In ten or fifteen minutes the skiver will be tanned on the grain but, if it is to be tanned through, a longer time must be taken. The skin is then rinsed in warm water, oiled lightly on the grain with cod oil and tacked out to dry. —D. J. L.

Sugar content of vegetable tanning materials and extracts. J. Paessler. Ledertechn. Rundschau, 1912. Nos. 46—48. Collegium, 1913, **88**, 156—160. (See also this J., 1912, 736.)

ANDREASCH was the first to show the importance of di-saccharides as "acid formers" in the fermentation of tan-liquors and estimated mono- and di-saccharides together by inverting the latter, calling the result "glucose content." Experiments were carried out at the Freiberg Versuchsanstalt to determine the content of mono- and di-saccharides in the principal tanning materials, both the filter and shake method being used. Von Schroeder's method (this J., 1894, 1101, 1227) was used for determining the sugar, and it was found necessary that all tannins should be removed before heating with Fehling's solution and that this heating should continue for exactly 30 minutes. Mono-saccharides are not the only "acid-formers" and this term must also include di-saccharides and the total soluble non-tannins. Acetic acid is produced from the sugars and lactic acid partly from the sugars and partly from the other fermentable non-tannins. The following results were obtained by the shake method, the amounts being calculated for 100 parts of tannin:—

	Non-tannins.	Mono-saccharides	Di-saccharides	Total sugars.
Pine-bark	93	33	14	47
Oak-bark	74	30	0	30
Sumach	74	17	2	19
Myrabolans .... (seeded)	49	18	0	18
Myrabolans	48	17	0	17
Divi-divi	55	11	4	15
Mimosa-bark ...	39	6·0	8·5	14·5
Valonia	49	12	0	12
Trillo	44	7·5	1·5	9
Mallet bark	29	3·5	2	5·5
Mangrove bark..	30	2	1	3
Quebracho wood.	14	1	1	2

The ratio tannins : non-tannins was lower in manufactured products than in laboratory extracts, the longer boiling in commercial extraction probably causing the solution of some of the more difficultly soluble non-tannins. The following results were obtained with chestnut wood extracted at different pressures, the results being calculated to a water content of 14·5 per cent. and analyses made by the shake method:—

Pressure in atmospheres............	1	3	3	4	5	7
Duration of extraction in hours	—	1	2	1	1	1
Tannin (per cent.) ..	11·2	11·2	10·7	10·9	9·6	7·6
Non-tannins	3·4	4·2	5·9	7·1	11·5	17·1

The tannins are diminished by increase of pressure or duration of boiling, but not so rapidly as the non-tannins increase, and though the total soluble matter in the extract increases, the value becomes less. Samples of chestnut-wood extract adulterated with molasses showed a high di-saccharide content with a normal mono-saccharide content. The influence of pressure and duration of extraction on the composition of oak-wood extract is shown in the following table:—

Pressure in atmospheres ...	1	3	3	5	7
Duration of extraction (in hours)	—	1	2	1	1
Tannin (per cent.)........	7·1	7·0	7·1	6·4	4·4
Non-tannins	3·9	5·4	7·5	11·9	20·1

Pressures up to three atmospheres and boiling for not more than two hours does not lower the value of an oak-wood extract. Quebracho extracts are not so sensitive as oak-wood and chestnut-extracts to alterations in pressure during extraction.—D. J. L.

PATENTS.

Bating with extract of pancreas in combination with acids; Method of ——. Rohm und Haas. Fr. Pat. 449,416, Dec. 22, 1911.

BORIC acid is used as deliming agent in artificial bates containing extract of pancreas.—D. J. L.

Leather; Artificial ——. M. Chaumont. Fr. Pat. 449,554, Oct. 18, 1912.

A THICK and resistant material, such as cloth, is saturated with gelatin, which is rendered impermeable and imputrescible by treatment with alum, ferric chloride, potassium bichromate or formaldehyde. The grain surface of leather is imitated by covering the surface with a thin skiver or vegetable parchment and the whole incorporated by pressing, graining, etc.—D. J. L.

Leather; Process for impregnating ——. K. L. F. Friedemann. Ger. Pat. 257,236, Jan. 23, 1912.

THE oxidation products of linseed oil are dissolved with concentrated acetic acid, the acid is evaporated off, the residue dissolved in a solvent (*e.g.*, alcohol) and the leather treated with this solution.—A. S.

Glue manufacture; Preparation of chrome-tanned leather for ——. W. Prager. Ger. Pat. 257,286, June 15, 1912.

THE leather waste is de-tanned by heating with solutions of acid salts at temperatures below that at which conversion into glue takes place.—A. S.

Cooling coagulable liquids such as gelatin and its equivalents; Machine for —— *and for cutting them after their coagulation.* M. Kind. Fr. Pat. 450,027, Oct 30, 1912. Under Int. Conv., Nov. 2, 1911.

SEE Eng. Pat. 24,838 of 1912; this J., 1913, 438.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soil; Effect of partial sterilisation of —— *on the production of plant food. II. Limitation of bacterial numbers in normal soils and its consequences.* E. J. Russell and H. B. Hutchinson. J. Agric. Sci., 1913, **5**, 152—221.

THE conclusions reached previously (this J., 1911, 471; 1912, 1045) have been confirmed and extended. Besides bacteria the soil contains another group of organisms, provisionally identified as protozoa, which are detrimental to bacteria; they multiply more slowly and have a lower power of resistance to heat and antiseptics, hence the number of bacteria present in the soil is not a simple function of the temperature, moisture content and other conditions. Indeed, it often has no connection with these factors, but depends on the difference in activity of the bacteria and the protozoa. In partially sterilised soil only the bacteria are left. In such soil bacterial multiplication is favoured by an increase of temperature or by variations in the moisture content in the normal manner. The protozoa are killed by any antiseptic vapour or by heating the soil at 55°—60° C.; they suffer considerably at 40° C. and their activity is depressed on cooling the soil to low temperatures. Sterilisation by volatile antiseptics causes an increase in the rate of ammonia production until a certain amount has accumulated, when the rate falls. Sterilisation by heat effects a decomposition of the organic matter and simplifies the bacterial flora by exterminating some of the varieties. These effects become more pronounced as the temperature at which sterilisation is effected is raised. Maximum bacterial numbers are found in soils which have been heated to the minimum temperature necessary to kill the protozoa (about 60° C.): the number then corresponds with that present in soils sterilised by means of antiseptics. In soils heated to 100° C. although the number of bacteria is at a minimum the decomposition effected is at a maximum. The addition of unsterilised soil to partially treated soil leads to an increase in bacterial numbers and a still further production of ammonia and nitrate unless too large a quantity of these substances is already present. But the subsequent depression in bacterial numbers consequent on the development of the protozoa is generally without effect on the rate of decomposition, apparently because it does not set in until too late.—E. F. A.

Patent.

Superphosphates; Manufacture of ——. A. J. Boult, London. From T. L. Willson, Ottawa. Eng. Pat. 19,572, Aug. 27, 1912.

See U.S. Pat. 1,040,081 of 1912; this J., 1912, 1046.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Reducing sugars; Behaviour of —— *in the cane sugar factory.* H. Pellet. Intern. Sugar J., 1913, **15**, 171—175.

It has been repeatedly stated that in the cane sugar factory the amount of reducing sugars in the syrups (thick-juices) is less than in the juice before concentration; and the destruction of the reducing sugars during evaporation has been stated to amount to 30—50 per cent. of the quantity originally present. After long investigations carried out in factories operating different methods of clarification, the author states that this is never so (except, of course, when the carbonatation process is employed). In careful working the reducing sugars are practically the same before and after concentration, although when evaporation is slow, and the contents of the effect too acid, there may may be an increase. Results indicating the destruction of reducing sugars during concentration have been probably due to faulty methods of analysis, the juice and syrup not being diluted to the same point, and basic instead of normal lead acetate used for defecation. In a special series of experiments made during the 1911 and 1912 seasons at Pekalongan (Java), following the directions prescribed by the author, the following average results for the glucose ratio were obtained for (*a*) raw juice, (*b*) clarified juice, and (*c*) syrup; 1911 (*a*) 6·60, (*b*) 6·10, (*c*) 6·20; 1912 (*a*) 8·90, (*b*) 8·80, (*c*) 8·70. While in the beet sugar factory the quotient of purity of the different products, that of the sulphited clarified juice for example, varies very little throughout the campaign, this is by no means so in the cane sugar-house, for which the following values for (*a*) the purity, and (*b*) the glucose ratio are representative: commencement of the campaign (*a*) 83, (*b*) 4·4; middle of the campaign (*a*) 86, (*b*) 3·9; and end of campaign (*a*) 77; (*b*) 6—7. These large variations are due to the differences in the cane worked, its degree of maturity, the time elapsing between cutting and crushing, and the length of the season.—J. P. O.

Tragacanth; Testing ——. H. R. Jensen. Chem. and Drug., 1913, **82**, 576.

Attention is called to the tests proposed by Payet (this J., 1906, 92) for the presence of acacia gum in admixture with tragacanth, based upon the fact that acacia gums give indications of oxydase content while the finest grades of Syrian flake tragacanth do not; the author, however, finds that "cruder samples" of tragacanth give indications of the presence of oxydase in these tests. Among the adulterants of true tragacanth are the Indian gums derived from *Cochlospermum Gossypium* and *Sterculia urens* which give no indications of oxydase, but the presence of these gums may be detected by the stringy nature of the "borax jelly" or more certainly by the yield of acetic acid (on distillation after treatment with phosphoric acid) which is about seven times as great as that from true tragacanth. The saponification value—determined by boiling 1·5 grms. of the gum ground to very fine powder (90 or 160) with 30 c.c. of $N/2$ alcoholic potash for 1 hour—also affords useful information; acacia gum gave a saponification value of about 10 (calculated on dry gum); four samples of true tragacanth of finest quality gave saponification values from 139·5 to 186 and negative results in oxydase tests, while eight samples of second quality gave figures varying from 60 to 109·5 and positive results in the oxydase tests. The results of the tests with the lower grades seem to show the possibility of the presence of foreign gums, and this method of investigation should prove of value in the examination of ground gums and mixtures.—R. G. P.

Patents.

Starch; Process of treating amylaceous materials to separate the ——. Soc. Française des Distilleries de l'Indo-Chine. Fr. Pat. 449,155, Dec. 16, 1911.

The amylaceous material is subjected to the action of some organism capable of disintegrating the intercellular membranes which enclose the starch. Thus, raw rice is moistened with water at 50° C. and seeded with the spores of a mucor called *Mucor Boulardii* which occurs on rice and most cereals. The mass is stirred and sprayed with water as required, the temperature being maintained at say 50°—60° C. Under these conditions, the mucor at once gains the upper hand and prevents the injurious action of other organisms. After the lapse of 20—24 hours the process is complete. The product is extremely friable and the starch which it contains can be very easily separated.—L. E.

Gum or mucilage from carob seeds; Process for manufacturing ——. A. Pinel. Second Addition, dated Dec. 22, 1911, to Fr. Pat. 443,275, July 10, 1911 (this J., 1912, 1002, 1089).

After the seeds have been freed from husks, macerated, powdered, and washed as described in the principal patent, the product is made into a paste, not with water, but with a solution of a neutral salt such as the sulphate or chloride of an alkali or alkaline earth metal, or the drained or pressed product is treated with the dry neutral salt mixed with the necessary sugars. The object of this modified treatment is to facilitate the thinning and solution of the paste.—L. E.

Saturation apparatus used in sugar factories; Gas-distributing tubes for ——. H. Müller. Fr. Pat. 449,764, Sept. 7, 1912.

See Ger. Pat. 253,115 of 1912; this J., 1913, 102.—T. F. B.

Gums; Process for preparing solutions of so-called "insoluble" ——. E. Siefert-Schwab. Fr. Pat. 449,649, Oct. 21, 1912. Under Int. Conv., Nov. 23, 1911.

See Eng. Pat. 23,629 of 1912; this J., 1913, 302.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Wines; A ferment producing bitterness in ——. E. Voisenet. Comptes rend., 1913, **156**, 1181—1182. (See this J., 1911, 1026.)

The ferment in wines producing bitterness (*amertume*) is due to a specific organism styled *Bac. amaracrylus.* Portions of the culture were placed in various wines and it was found that, whenever development of the organism took place, acrolein was formed in the wine. Amongst the substances produced by its action on glycerol, there are, besides acrolein, an unstable aldehyde, carbon dioxide, hydrogen, ethyl alcohol, formic, acetic, acrylic, and possibly caprylic acids, also lactic and succinic acids. Mannitol and the sugars are rapidly attacked. The action on dextrin is only moderate, whilst erythritol, dulcitol and starch are unattacked. Sucrose, lactose, maltose, dextrose, lævulose and galactose are completely fermented in the presence of calcium carbonate, without simultaneous hydrolysis, and without the formation of acrolein.—F. Shdn.

Lactic acid; Alcoholic fermentation of ——. Mazé. Comptes rend., 1913, **156**, 1101—1104.

The author has studied the fermentation of lactic acid by a film-forming, motile bacillus, capable of fermenting sugars and polyhydric alcohols, and resembling physiologically the *Bac. ethacetosuccinicus* of P. Frankland (this J., 1892, 449). When grown in mineral nutrient liquids containing lactic acid, it produces acetic and formic acids and very small quantities of alcohol. From the numerical results obtained, the author concludes that the following two parallel reactions occur: (1) $C_3H_6O_3+O=CH_3{\cdot}COOH+H{\cdot}COOH$, and (2) $C_3H_6O_3=C_2H_5OH+CO_2$, and that the alcohol is mainly further oxidised to acetic acid, for the proportion of the latter to formic acid is much higher than corresponds to equation (1). The bacillus grows well in mineral nutrient media containing alcohol, and then produces small quantities of acetic acid but no formic acid.—J. H. L.

Patents.

Yeast; Process for the manufacture of ——. J. A. Liebert, Vienna. Eng. Pat. 7272, March 25, 1912.

Five kilos. of rye flour and 5 kilos. of potato flour (or potatoes) are stirred into an approximately saturated solution of 20 kilos. of unrefined sugar in warm water, and the mash is cooled to 30° C. 100 kilos. of mother yeast from a preceding fermentation, and 70 kilos. of commercial pressed yeast or pressed beer yeast are successively stirred into the mash, and fermentation is allowed to proceed until the yeast is fully developed. 200 kilos. of mother yeast are thus produced: one-half is retained for use, whilst the remainder is added, in successive portions of 70 and 30 kilos. to a fresh mash, a further addition of 70 kilos. of commercial pressed yeast then being made.—L. E.

Hops; Process for the complete extraction of —— especially in the manufacture of beer. Maschinenfabr. F. Weigel Nachf. A.-G. Fr. Pat. 448,989, Sept. 26, 1912. Under Int. Conv., Sept. 13 and 21, 1912.

A mixture of hops and primary wort or last runnings or water is heated to boiling in a steam-jacketed vessel, at first under ordinary pressure, and subsequently under a pressure corresponding to a temperature of 115°—120° C. (239°—248° F.). With this pressure still maintained in the vessel, the mixture is pumped into the copper. The sudden decrease of the external pressure on the hops as they are introduced into the copper, ruptures the cellular tissues but does not otherwise disintegrate the hops; a thorough extraction of the bitter substances is thus insured without affecting the efficiency of the hops as a filter bed. Alternatively, after the mixture of hops and liquid has been boiled under ordinary pressure for a suitable time, compressed gas may be introduced into the vessel so that the hops are subjected to increased pressure without increase of temperature. Or, the hops may be boiled under ordinary pressure and then introduced into a partially exhausted vessel.—L. E.

Glycerin; New process for extracting —— from distillery vinasses. E. A. Barbet. Fr. Pat. 449,961, Jan. 6, 1912.

The distillation of concentrated vinasse under ordinary pressure for the recovery of glycerin is attended with troublesome frothing, and owing to the high temperature, the nitrogenous organic matter decomposes and the glycerin is rendered very impure. According to the present invention, the concentrated vinasse is incorporated with a mixture of calcined plaster and some inert powder or with a mixture of lime and kieselguhr. The mass, dried in an oven if necessary, is broken into small pieces and then packed in an iron vessel having a perforated bottom, which is placed in a still connected with an air-pump and heated by hot air or steam to 200°—240° C. When the temperature of the still has been raised to about 200° C., the supply of hot air is restricted, distillation being conducted under a reduced pressure which should be as low as 60—110 mm. at the end of the operation. The distillation residue constitutes an excellent fertiliser. The crude glycerin obtained is purified by distillation in steam under ordinary pressure, any ammonia or acetic acid which it may contain being recovered at the same time.—L. E.

Fermented malt beverages; Manufacture of——. A. J. Boult, London. From Wahl-Henius Institute of Fermentology, Chicago. Eng. Pat. 7869, April 1, 1912.

See U.S. Pat. 1,023,448 of 1912: this J., 1912, 507.—T.F.B.

Fermentation vat. U. Deinhardt. Fr. Pat. 450,164, Nov. 5, 1912.

See Eng. Pat. 25,275 of 1912; this J., 1913, 444.—T F.B.

XIXa.—FOODS.

Edible oils; Occurrence of large amounts of lead in ——. P. Schindler. Z. öffentl. Chem., 1913, **19**, 132.

Samples of edible oil showed pronounced turbidity which did not disappear on warming. One of the most turbid yielded 0·72 per cent. of ash consisting of lead oxide, but after filtration the oils were quite free from lead. The origin of the metal, which was in the form of a lead soap, was traced to the storage vessels the interior of which had been coated with an alloy of lead and antimony. Experiments showed that lead was rapidly attacked by sesamé oil which was free from rancidity, but that the same oil when left in contact with granulated antimony remained clear.—C. A. M.

Separation and determination of subsidiary dyes in the permitted food colours. Mathewson. *See* IV.

Patents.

Milk separating machines; Centrifugal ——. S. C. Hauberg, Copenhagen. Eng. Pat. 19,154, Aug. 21. 1912.

A revolvable ring is situated between the neck of the centrifugal drum and the neck of the cream-removing plate. This ring is provided with oblong recesses or apertures (preferably two) so placed in relation to curved ducts on the cream-removing plate that the cross-sectional area of these ducts may be increased or decreased by turning the ring. Since the ducts serve for the passage of the skimmed milk to outlets in the drum, the ratio between the quantities of skimmed milk and cream can be regulated by adjusting the position of the ring.—L. E.

Centrifugal [milk] separator driven by a low-pressure turbine. Aktiebolaget Baltic. Fr. Pat. 449,542, Oct. 17, 1912.

The exhaust of the low-pressure turbine, which drives the centrifugal separator, is connected with a condenser coil, the exterior of which is cooled by the milk flowing to the separator. The milk becomes heated and a vacuum is produced in the condenser, which causes the turbine to withdraw the steam required for its operation from the steam generator.—W. H. C.

Yoghourt : Preparation and preservation of ——. Milchtechnisches Laboratorium Thomas, Delcré und Ridder. Fr. Pat. 450,246, Oct. 9, 1912.

Milk is sterilised and a portion inoculated with about 1 per cent. of a pure culture of the *B. paralacticus* and incubated at 45° C. until coagulated. Another portion is inoculated with about 1 per cent. of a pure culture of the *B. bulgaricus* and incubated similarly. The two cultures are then completely cooled and mixed in the proportions of about 10 to 1. This mixture keeps well for some time without change of flavour.—J. H. J.

Coffee ; Removal of the toxic properties of ——. Gebr. von Niessen. Fr. Pat. 449,343, Oct. 12, 1912.

The coffee grains, roasted or unroasted, are softened by steam or cold water and treated with a substance such as clay or kaolin, mixed to a paste, and then dried. The dried kaolin or the like is then separated. This process frees the coffee from its toxic products, and the roasting is then completed. In order to neutralise the toxicity of these products which are of an acid nature, there is added to the kaolin a basic substance, such as magnesia. —J. H. J.

Fruits, vegetables and other foods ; Decolourisation of ——. Bardouin et Heiriès. Fr. Pat. 449,647, Oct. 21, 1912.

The fruit is covered with a 5 per cent. solution of sodium hydrosulphite until completely decolourised, and is then washed for a long time in a current of water to remove the sulphite formed and the excess of hydrosulphite. The washing is completed with a very dilute ammonia solution. Finally the fruit is washed once more in running water. Thus treated the fruit retains its natural taste and keeps well for some time.—J. H. J.

Dryer ; Industrial ——, *especially suitable for food pastes.* G. Falchi. Fr. Pat. 449,806, Oct. 24, 1912.

The paste to be dried, for instance macaroni, is placed in a series of trucks arranged in a circle inside a building. In the centre of the circle is a fan drawing in air from outside, which may be heated, and passing it into a vertical pipe which opens in a bell mouth over the top of a truck. The pipe revolves automatically and so passes over each of the trucks in turn. In this way the paste is dried intermittently.—J. H. J.

Milk ; Sterilisation of ——. A. Helbronner, M. von Recklinghausen, and V. Henri, Paris. Eng. Pat. 14,958, June 26, 1912. Under Int. Conv., July 1, 1911. Addition to Eng. Pat. 14,833 of 1912, dated June 28, 1911.

See Fr. Pat. 442,924 of 1911 ; this J., 1912, 1004.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

Carbonic acid in water ; Determination of ——. J. Tillmans. J. Gasbeleucht., 1913, **56**, 348—351, 370—374.

This is a long paper containing a criticism and bibliography of the more recent methods of determining carbonic acid in natural waters, together with some further experiments in support of the conclusion previously published (this J., 1912, 1049) that bicarbonates in waters are in a state of dissociation. For the estimation of the total carbonic acid, the method of Winkler (Z. anal. Chem., 1903, **42**, 735) of absorbing and weighing the carbon dioxide evolved with acid was found to be the best. The Pettenkofer-Trillich method (compare this J., 1912, 554) for free and half combined carbonic acid gave high results, and it was considered better to determine the bicarbonate in presence of methyl-orange. If other weak acids are present, the bicarbonate is obtained by the difference between the total carbonic acid and the free carbonic acid. The latter is determined with accuracy in waters up to 10 degrees of hardness by titrating 200 c.c. of the water in a flask with caustic soda in presence of 10 drops of phenolphthalein solution (1 : 1000). Harder waters must be proportionately diluted with neutral distilled water. Iron and manganese are allowed for if much is present, or the free carbonic acid is obtained by difference as above. Only a part of the free carbonic acid is active in acting on other carbonates, as each molecule of bicarbonate requires a definite amount of carbonic acid to hold it in solution. A table and curve are given showing the relation between the combined carbonic acid (the half of the bicarbonate carbonic acid) and the free carbonic acid belonging to it. Waters which are incapable of acting on calcium carbonate, also do not act on iron and lead piping. —J. H. J.

Patents.

Sewage ; Apparatus for the purification and disposal of ——. D. A. Helmich, Birmingham, Ala. U.S. Pat. 1,057,642, April 1, 1913.

A septic tank, having concrete walls, is built below the ground level, and is surrounded by a chamber having perforated outer walls and filled with filtering material. The tank is closed by a cover, and ventilating shafts extend from the filter-chamber to above the surface of the ground. Means are provided for introducing the sewage to the tank, and for withdrawing the liquid from the same and distributing it over the surface of the filtering material. —W. P. S.

Septic tanks. A. J. L. Girard. Fr. Pat. 448,973, Aug. 3, 1912.

The new apparatus is fixed in the closed portion of a septic tank above the liquid. It consists of a tube passing through the dividing wall of the tank, one end being closed and having a slit in its side covered with a sleeve kept in position by a spring and carrying a tube passing under the liquid, the open end of which is attached to a float. This device enables the gas to escape from the closed tank when under increased pressure, without admission of air or risk of explosion.—J. H. J.

Water ; Method of treating —— *for steam-boiler purposes.* W. C. Stuckel, Newark, N.J. U.S. Pat. 1,058,113, April 8, 1913.

The water is passed through a chamber containing a mass of granular copper and zinc particles which set up a galvanic action in the water. The water is led into the bottom of the chamber so that it passes upwards through the granular metal and agitates it, causing the particles to rub against one another.—A. T. L.

Liquids ; Apparatus for the sterilisation of —— [*by ultraviolet rays*]. V. Henri, A. Helbronner, and M. von Recklinghausen. Second Addition, dated Dec. 21, 1911, to Fr. Pat. 424,369, March 12, 1910 (this J., 1911, 978, 1183).

The lamp used is now made in the form of a U-tube with the sides close together and the electrodes side by side. This enables two lamps to be inserted into the isolation tube, one from each end, and to be easily withdrawn for inspection. The baffle-plates directing the flow of water around the tank are made in two sets, one set being fixed at the centre of the tank, and the other set attached to the outside wall but made so that they can be pushed farther in or out as required. The entry and exit of the water is controlled electro-magnetically from the lamp current.—J. H. J.

Water ; Industrial sterilisation of —— *by mercury vapour lamps.* P. G. Triquet. Fr. Pat. 449,713, Dec. 30, 1911.

Certain improvements are claimed in mercury vapour lamps for rendering them independent of holder and cover, and thus making them easier to carry and manipulate. These improvements consist in making two entrances for the current in the wall of the lamp, and in having a combination of lenses placed in the water to be sterilised and serving to cool the lamp.—J. H. J.

X-Rays ; Production of a continuous supply of —— of regulated strength and their application to sterilisation. J. E. Lilienfeld. Fr. Pat. 449,305, Oct. 8, 1912. Under Int. Conv., Oct. 10 and Dec. 21, 1911, Jan. 5 and April 23, 1912.

An apparatus is described in which the fall of potential at the cathode is rendered as great as that corresponding to the strongest rays produced, and in which the conductivity necessary for lessening this fall is brought about by providing another electrode which is utilised as a primary cathode independently of the other. For sterilisation of liquids, the apparatus is placed in a box and the latter placed in the liquid, which traverses a receptacle of such dimensions as to expose a sufficiently thick layer of the liquid to the rays. The walls and cover of the receptacle are lined with some substance producing a secondary radiation. The temperature inside the apparatus controls the supply of liquid by means of an electrical device. Solid substances can be sterilised also.—J. H. J.

Liquids such as sewage and the like ; Process for treating ——. J. M. Neil. Fr. Pat. 450,041, Oct. 30, 1912.

See U.S. Pat. 1,045,096 of 1912 ; this J., 1913, 105.—T.F.B.

Process for increasing the fungicidal and insecticidal properties of bases from tar or tar oils. Ger. Pat. 257,848. *See* III.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Codeine, thebaine and narcotine ; The polymorphism of ——: and a new type of spherolite. P. Gaubert. Comptes rend., 1913, **156**, 1161—1163.

Anhydrous crystals of codeine, thebaine or narcotine were placed on a glass slide, covered with a cover-slip, and heated on the Maquenne block. Superfusion phenomena were observed on melting the substances. In each case polymorphic spherolites were noticed, the form depending to some extent on the temperature. Between 50° and 80° C., narcotine forms a new type of spherolite, which is blue by reflexion, but colourless by transmitted light. —F. Shdn.

Euphorbia pilulifera ; Chemical examination of ——. F. B. Power and H. Browning, jun. Pharm. J., 1913, **36**, 506—510.

The entire plant of *Euphorbia pilulifera* L., which had been obtained from the Fiji Islands, was examined. The air-dried material was extracted with alcohol, and the extract distilled with steam, when about 0·02 per cent. of an essential oil was obtained. The following substances were isolated from that portion of the alcoholic extract soluble in water: gallic acid, quercetin, and a new phenolic substance, $C_{23}H_{18}O_{15}$. The aqueous liquid also contained amorphous glucosidic material, and a lævo-rotatory sugar which yielded *d*-phenylglucosazone. The soft resinous material left after treating the alcoholic extract with water amounted to about 3·2 per cent. of the original air-dried material. This yielded the following substances: triacontane and apparently a little ceryl alcohol ; a new monohydric alcohol, *euphosterol*, $C_{25}H_{39}OH$, m.pt. 274°—275° C., giving an acetyl derivative m.pt. 295°—297° C., and a bromoacetyl derivative m.pt. 183°—186° C. ; a phytosterol, m.pt. 132°—133° C. ; a phytosterolin ; jambulol, $C_{16}H_3O_4(OH)_5$; melissic acid and a mixture of higher fatty acids. Euphosterol is evidently closely related to taraxasterol and homotaraxasterol (this J., 1912, 1199).—F. Shdn.

Camphor oil and crude camphor from the Federated Malay States. Bull. Imp. Inst., 1913, **11**, 46—48.

The samples of camphor oil and crude camphor examined were obtained from plants grown on the experimental plantations of the Agricultural Department, Kuala Lumpur, Federated Malay States. The oil was cloudy and by cooling to —10° C., 19·3 per cent. of camphor was separated from it. The residual oil had the sp. gr. 0·913 at 15°/15° C., and optical rotation at 18° C. (100 mm. tube), +41° 1′. It was free from safrole, probably because it had been prepared from the prunings of young trees, and hence could not compete with Japanese camphor oil, which is valued chiefly on account of its safrole content. The crude camphor consisted of very pale brown crystals. On pressing to remove oil and moisture it lost 11—12 per cent. of its weight. The specific rotation of the crude camphor was +40° 50′, that of the camphor after pressing, +42° 20′, and that of the camphor obtained by re-crystallisation of the crude product from benzene, +41° 25′. The crude camphor was valued at £6 to £6 5s. per cwt. in London (Nov., 1912), with the better quality of Japanese monopoly B. camphor at £7 2s. 6d. per cwt. —A. S.

Eucalyptus citriodora ; Oil of —— from Mauritius. Bull. Imp. Inst., 1913, **11**, 48—50.

The two samples of oil examined had the following characters: sp. gr. at 15°/15° C., 0·877, 0·879 ; optical rotation at 21° C. (100 mm. tube), +0° 4′, +1° 16′ ; acetylisable constituents, 81·1, 87·1 per cent. ; solubility in 70 per cent. alcohol, 1 in 3 or more vols., 1 in 2·6 or more vols. The oils are of satisfactory quality, the second being the better in consequence of the higher content of acetylisable constituents.—A. S.

Terpenes and essential oils. 115th Communication. The dependence of the boiling point of cyclic ketones on their constitution. Some six-membered saturated and unsaturated ketones. O. Wallach. Annalen, 1913, **397**, 181—219.

Up to the present there has been no systematic investigation of the influence of the position of the oxygen atom in cyclic ketones upon the boiling point and other physical properties. Examples are given to show that with isomeric saturated cyclic ketones in which the same substituent groups are present, the compound with the heaviest group close to the oxygen boils at the lower temperature. An ethylenic linkage in a conjugate position to the oxygen causes a marked rise in the boiling point when comparison is made with an isomeric compound in which the oxygen atom and the ethylenic linkage are separated. The hydrogen of a conjugate system ·CO·CH : C· can be replaced by a group R so as to get a compound of the type ·CO·CR : C· ; a compound isomeric with the latter but containing the group R in some other position boils at a much lower temperature. For instance, Δ^4-menthenone-(3) boils at 211° C., whilst Δ^1-menthenone-(3) boils at 235° C. Singly unsaturated extra-cyclic six-membered ring ketones boil at higher temperatures than the corresponding reduced ketones. The preparation and physical properties of a number of saturated and unsaturated six-membered ring ketones are then described.—F. Shdn.

Esterification ; Catalytic —— in dilute solutions. Preparation of ethyl acetate. F. Bodroux. Comptes rend., 1913, **156**, 1079—1081.

When a mixture of acetic acid and propyl alcohol is distilled in presence of a concentrated solution of aluminium iodide, large quantities of propyl acetate are formed. In the absence of the salt the yield of ester is very small, but is considerably greater in presence of a dilute solution of an aluminium salt or sulphuric acid. A number of experiments were carried out by distilling glacial acetic acid

with ethyl alcohol (95 per cent.) and dilute sulphuric acid of various concentrations. For given quantities of acetic acid and alcohol, the yield of ester was found to increase with the amount of sulphuric acid present. The highest yield (92·1 per cent.) was obtained from a mixture of 50 c.c. of acetic acid, 70 c.c. of alcohol, and 50 c.c. of 10 per cent. aqueous sulphuric acid. It is possible, therefore, to use dilute alcohol for the production of ethyl acetate. Dilute solutions of other acids were found to exert a similar catalytic influence on esterification, in different degrees. (See Senderens and Aboulenc, this J., 1911, 830, 922.)
—J. H. L.

Glycerophosphates ; Crystalline ——. Rogier and Fiore. Bull. Sci. Pharmacol., 1913, **20**, 7—25, 72—86. Chem. Zentr., 1913, **1**, 1330—1332.

Commercial sodium glycerophosphate, $Na_2PO_3.OC_3H_7O_2$, is usually obtained in the form of small crystals with 5 mols. of water of crystallisation, but at times also as large plates with $6H_2O$. The latter salt loses 1 mol. H_2O in dry air, 5 mols. *in vacuo* or on heating to 150° C., and 6 mols. on heating to 180° C. An aqueous solution saturated at 18° C. contains 27·38 per cent. of the anhydrous salt. Cryoscopic determinations gave about one-third of the calculated molecular weight. The aqueous solution can be heated to 120° C. without decomposition. The following compounds were prepared from the sodium salt. *Calcium glycerophosphate*, $CaPO_3.OC_3H_7O_2$ (from the sodium salt and calcium chloride) separates in large crystals when a saturated solution is evaporated slowly *in vacuo* ; at temperatures below 25° C. it crystallises with 1 mol. H_2O. The solubility of the anhydrous salt in water is 1 per cent. at 0° C., 1·68 per cent. at 18° C., and 0·43 per cent. at 60° C. *Barium glycerophosphate*, $BaPO_3.OC_3H_7O_2,H_2O$ (from the sodium salt and barium acetate) dissolves to the extent of 4·5 grms. in 100 grms. of water at 21° C. *Strontium glycerophosphate*, $SrPO_3.OC_3H_7O_2,2H_2O$ (from the sodium salt and strontium bromide) forms leaflets insoluble in alcohol and acetone and soluble in water to the extent of 2·09 per cent. at 19° C. and 0·8 per cent. at 60° C. *Quinine glycerophosphate*, $(C_{20}H_{24}O_2N_2)_2PO_3.OC_3H_7O_2,4H_2O$ (from the sodium salt and quinine hydrochloride) forms white needles which become somewhat yellow on exposure to light. It melts at 180°—181° C., and is soluble in 78 parts of boiling water ; $[\alpha]_D^{21} = -133^\circ\ 33'$ (0·2474 grm. of anhydrous salt in 20 c.c. of 90 per cent. alcohol), $[\alpha]_D^{17} = -140^\circ\ 24'$ (0·2093 grm. in 20 c.c. of absolute alcohol). *Acid strychnine glycerophosphate*, $C_{21}H_{22}O_2N_2.PO_3H.OC_3H_7O_2,H_2O$ (from glycerophosphoric acid and strychnine) melts at 260° C., is easily soluble in water, moderately soluble in alcohol, insoluble in ether ; $[\alpha]_D^{23} = -25^\circ\ 40'$ (0·5002 grm. of air-dry salt in 50 c.c. of water). By the interaction of sodium glycerophosphate and strychnine hydrochloride, free strychnine separates. *Brucine glycerophosphate*, $(C_{23}H_{26}O_4N_2)_2PO_3.OC_3H_7O_2,11H_2O$ (from the sodium salt and brucine hydrochloride) forms prisms melting at 192° C., slightly soluble in cold, easily soluble in hot water and alcohol, insoluble in acetone and ether, slightly soluble in chloroform ; $[\alpha]_D^{22} = -29^\circ\ 35'$ (0·4224 grm. of anhydrous salt in 50 c.c. of 80 per cent. alcohol). By the interaction of sodium glycerophosphate and copper acetate there is obtained either an abnormal copper salt,

$$C_3H_7O_2.OPO_3(CuOH).Cu(CuOH)PO_3.OC_3H_7O_2,6H_2O$$

as a dark blue crystalline powder or pale blue needles, slightly soluble in water, or the normal copper salt, $CuPO_3{\cdot}OC_3H_7O_2,H_2O$, as pale blue needles slightly soluble in water.—A. S.

Assay of hypophosphorous acid. North. *See* VII.

Patents.

Blood-serums, etc. ; Process for the removal of inert substances from ——. J. T. A. Sames, Dusseldorf, Germany. U.S. Pat. 1,057,673, April 1, 1913.

Blood serum, or similar fluid, is treated with a quantity of a feebly acid organic substance sufficient to precipitate all the albumin but to leave the active principles (toxins, antitoxins, and the like) in solution. Or, the serum may be treated with sodium carbonate and a quantity of an aluminium salt sufficient for the purpose mentioned.
—W. P. S.

Non-toxic serum and immune blood preparations ; Production of ——. Kalle und Co. A.-G. Ger. Pat. 257,977, April 26, 1911.

The preparations containing albumin, such as immune blood, immune sera, and similar passive immune preparations, are mixed with a small quantity of an organic acid (*e.g.*, 0·1 to 2 per cent. of lactic acid), and the solutions are allowed to precipitate spontaneously at temperatures between about 37° and 70° C. It is stated that by this process all the toxic constituents are eliminated.—T. F. B.

Ointment-like lymphs or sera ; Process for preparing ——. P. Beiersdorf und Co. Ger. Pat. 257,978, Jan. 11, 1912.

Lymphs or sera containing glycerin are combined with a mixture of hydrocarbons and unsaponifiable animal or vegetable fats, oils, or waxes which are insoluble in water.—T. F. B.

Odoriferous oils ; Preparation of ——. Terpol Franco-Suisse S.A. Fr. Pat. 449,214, Oct. 10, 1912. Under Int. Conv., Oct. 11, 1911.

A finely-divided mixture of oil and steam is injected into a chamber in which a vacuum has been produced and in which the temperature does not exceed 100° C. The volatile products are then drawn off and condensed. Odoriferous substances such as turpentine can be added to the mixture before injection.—F. Sodn.

Dimethylaminophenylarsinic acid 1.4 ; *Preparation of nitro derivatives of* ——. Les Etabl. Poulenc frères, and K. Oechslin. Fr. Pat. 449,373, Dec. 20, 1911.

1.4-Dimethylaminophenylarsinic acid, which may be obtained by oxidising the product of the action of arsenic trichloride on dimethylaniline, can be easily nitrated, and furnishes, according to the conditions, two mononitro and two dinitro derivatives. By the action of dilute nitric acid, in the amount required by theory, a mixture of the two mono-nitro derivatives is obtained, with the nitro groups in the positions 2 and 3 ; this mixture can be separated by utilising the differences in solubility. The 3-nitro derivative may also be obtained in theoretical yield by nitration with concentrated nitric acid in presence of sulphuric acid. The two dinitro derivatives are produced by the action of excess of dilute nitric acid, with or without sulphuric acid ; fractional crystallisation separates the mixture into a yellow product and a red product less soluble in hot water. All these nitro compounds lose the dimethylamino group when treated with alcohols, resulting in the formation of nitro-hydroxyphenylarsinic acids.—T. F. B.

Esters of phenylmethylglycine-arsinic acid ; Process for obtaining ——. Les Etabl. Poulenc frères, and K. Oechslin. Fr. Pat. 450,214, Jan. 13, 1912.

When the esters of chloroacetic acid are heated with dimethylaniline and the products distilled in a vacuum, the esters of phenylmethylglycine are formed. The ethyl ester boils at 171° C. (30 mm.) and the propyl ester at 174° C. (20 mm.). By heating these esters with arsenic trichloride or tribromide, they are converted into the halogen-hydrates of the esters of phenylmethylglycine-arsinic acid, $H_2O_3As.C_6H_4.N(CH_3).CH_2.COOH$, which may be transformed into the free esters by treatment with the theoretical quantity of hydrogen peroxide. The propyl ester is sparingly soluble in water and mineral acids, easily soluble in alcohol, acetone, and acetic acid, and insoluble in water. It melts at 153°—154° C. and chars when heated to 190° C.—T. F. B.

Aromatic arseno compounds; Process for preparing nitroso derivatives of ——. P. Karrer. Ger. Pat. 256,963, March 20, 1912.

The amino group of aminoarylarsinic acids may be oxidised to a nitroso group by treatment with sulphomonoper-acid, without the arseno group being affected.—T. F. B.

Condensation products [of aldehydes]; Manufacture of ——. E. I. Du Pont de Nemours Powder Co. Fr. Pat. 449,604, Oct. 19, 1912.

A carbon compound such as acetaldehyde is mixed with a cold anhydrous solution of an alkaline substance, such as an alcoholic solution of potassium hydroxide. After being kept cool for some time the alkali is neutralised and the condensation product, in this case acetaldol, is separated. —F. Shdn.

Organic solvents [acetaldol]; Manufacture of ——. E. I. Du Pont de Nemours Powder Co. Fr. Pat. 449,605, Oct. 19, 1912.

A carbon compound, such as an aldehyde, is dissolved in some anhydrous solvent in which the condensation product is insoluble. This is treated with a metallic hydroxide insoluble in the same solvent. For instance, acetaldehyde can be dissolved in light petroleum, and solid potassium hydroxide suspended therein at a temperature of 10° C., when acetaldol begins to separate out. —F. Shdn.

Acid chlorides of hydroxy-acids; Process for preparing ——. E. Kopetschni and L. Karczag. Fr. Pat. 450,227, Sept. 6, 1912. Under Int. Conv., Sept. 8 and Dec. 23, 1911.

Salts of aromatic or aliphatic hydroxycarboxylic acids, in which only the hydrogen of the carboxyl group is replaced by a metal, react readily with thionyl chloride, forming the corresponding acid chlorides. The reactions take place at the ordinary temperature, and in many cases it is necessary to cool the mixture to avoid too violent a reaction. An inert diluent may be added if desired. *Example.* Sixteen parts of monosodium salicylate are gradually added to 25 parts of thionyl chloride, the temperature being kept below 30° C.; when evolution of sulphur dioxide has ceased, the excess of thionyl chloride is removed by distillation *in vacuo*, and the salicyl chloride is extracted by means of solvents of low boiling point, such as carbon bisulphide or petroleum spirit. After evaporation of the solvent, the chloride remains as a colourless oily liquid, which solidifies by cooling, furnishing crystals of m. pt. 9°—11° C. It is decomposed by heat, and reacts readily with alcohols, aniline, etc., forming salicylic esters, anilide, etc. The chlorides of *m*- and *p*-hydroxybenzoic acids, prepared in a similar manner, are oils of pungent odour, which only solidify at temperatures of —15° to —20° C. These chlorides may also be obtained by substituting phosgene for thionyl chloride. The preparation of glycollyl chloride, a colourless, oily liquid of penetrating odour, is also described.—T. F. B.

2.3-*Dimethylbutadiene*(1.3); *Process for preparing* ——. Badische Anilin und Soda Fabrik. Ger. Pat. 256,717, May 15, 1912.

Pinacone or pinacoline is converted into 2.3-dimethyl-1.3-butadiene by heating with a catalyst under diminished pressure.—T. F. B.

Isoprene from terpenic hydrocarbons; Process for preparing ——. H. Staudinger. Ger. Pat. 257,640, Sept. 4, 1910.

Diluted vapours of terpenic hydrocarbons of the dipentene type, or mixtures of these, are heated to high temperatures, *e.g.*, by means of electrically heated wires. The dilute hydrocarbon vapours may be produced by suitable pressure reduction. The yields of isoprene are stated to be good.—T. F. B.

Aromatic amino-alcohols; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 256,750, July 16, 1911. Addition to Ger. Pat. 254,438 (see this J., 1913, 213).

The metals of the platinum group may be used in a finely divided condition instead of in colloidal solution.—T. F. B.

Methylolcarbazole; Process for preparing ——. M. Lange. Ger. Pat. 256,757, May 10, 1912.

Methylolcarbazole, a comparatively stable compound which can be crystallised from alcohol without decomposition, is obtained by the action of formaldehyde on carbazole in presence of an alkali hydroxide or carbonate. By boiling with water it is reconverted into formaldehyde and carbazole. Its m. pt. is 127°—128° C., and this, as well as its solubility in alcohol and other solvents, and its instability towards various reagents, differentiates it from the methylene-dicarbazole obtained by heating carbazole with formaldehyde at 100° C. under pressure. —T. F. B.

Tobacco; Process for the preservation of ——. A. Krause. Ger. Pat. 256,949, Dec. 12, 1911.

Finely-powdered magnesium peroxide is dusted over the surface of the tobacco after the main fermentation process or both before and after this process, in order to destroy injurious micro-organisms or render them inactive.—A. S.

Hydrolecithin; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 256,998, Nov. 18, 1911.

A solution of lecithin is reduced by means of hydrogen or a mixture containing hydrogen, in presence of a catalyst, such as a colloidal or finely divided platinum metal, or a platinum metal salt which is reducible by hydrogen. It is stated that the physiological properties of the resulting hydrolecithin are analogous to those of lecithin itself, whilst the new product is quite stable towards air.—T. F. B.

Condensation products from homopiperonylamine and aldehydes; Process for preparing basic ——. H. Decker. Ger. Pat. 257,138, June 27, 1911.

Homopiperonylamine is caused to react with an equimolecular amount of an aliphatic or aromatic aldehyde, with or without the aid of a neutral solvent, and the product thus formed is heated in presence of hydrochloric acid, hydrobromic acid, sulphuric acid, phosphorus oxychloride, or other catalytically acting substance. The new products, which may be used in medicine, are strongly basic, and are volatile in steam without decomposition; when they are treated with alkalis or acids, homopiperonylamine is regenerated.—T. F. B.

Mercury preparation easily soluble in chalky waters and not attacking metals; Process for producing a ——. M. Emmel. Ger. Pat. 257,315, Oct. 26, 1911.

By mixing five parts of mercury cyanide with about three parts of a tartrate and about one part of an alkali hydroxide or carbonate, a product is obtained which may be made into tablets, etc., for use in sterilising surgical instruments and for like purposes.—T. F. B.

Curative agents for cancer; Process for preparing ——. E. Merck. Ger. Pats. 257,473 and 257,474, Dec. 16, 1911, and Jan. 18, 1912.

(1) The internal organs (spleen, suprarenal glands) of animals which have been treated in known manner with Röntgen rays are extracted by means of the serum drawn from such animals; the extracts are used as a cure for cancer. (2) Radium or thorium emanations are used in place of Röntgen rays.—T. F. B.

Creosol (1-*methyl*-3-*methoxy*-4-*hydroxybenzene*) ; *Process for preparing* ——. Saccharinfabr. A.-G. vorm. Fahlberg, List und Co. Ger. Pat. 258,105, Nov. 28, 1911.

p-Cresol is converted by bromination and sulphonation into *o*-bromo-*p*-cresol-*o*-sulphonic acid ($OH : CH_3 : Br : SO_3H = 1 : 4 : 2 : 6$) : on heating this with milk of lime in presence of bronze powder and copper oxide to 170° C. under pressure, homocatechol, 3.4-dihydroxytoluene, is formed. When this is treated with dimethyl sulphate or a salt of methylsulphuric acid, the 3-monomethyl ether, creosol, is produced (b. pt. 216°—218° C.) together with about 5 per cent. of the dimethyl ether, which can be saponified to creosol by treatment with alkalis at high temperatures.—T. F. B.

Amido-azo-benzene series ; *Manufacture of acetyl compounds of the* ——. Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 16,698, July 17, 1912. Under Int. Conv., Jan. 11, 1912.

See Ger. Pat. 253,884 of 1912 ; this J., 1913, 79.—T. F. B.

Fatty acids containing arsenic and phosphorus ; *Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 449,014, Oct. 3, 1912. Under Int. Conv., Nov. 29, 1911.

See Eng. Pat. 18,732 of 1912 ; this J., 1913, 109.—T. F. B.

Camphor from borneol or isoborneol ; *Process for preparing* ——. Dr. C. Ruder und Co. Fr. Pat. 449,744, Oct. 23, 1912. Under Int. Conv., Dec. 7, 1911.

See Ger. Pat. 250,743 of 1911 ; this J., 1912, 1054.—T. F. B.

Alkaloids or alkaloidal salts ; *Process for extracting, purifying, or separating* ——. J. U. Lloyd. Fr. Pat. 450,204, Nov. 6, 1912. Under Int. Conv., Feb. 23, 1912.

See U.S. Pat. 1,048,712 of 1912; this J., 1913, 161.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour screen plate for the production of photographs in natural colours. R. Ruth and A. Schuller. Fr. Pat. 449,080, Oct. 5, 1912.

The colour screens which serve for the constitution of screen-plates, *i.e.*, as filters, are too deeply coloured to be serviceable for use in producing colour prints on paper. To prepare a screen plate which can serve both purposes, it is proposed to stain the gelatin or other colloid with a mixture of two dyestuffs, one of which is more easily removed from the gelatin than the other. Thus, a mixture of an acid and a basic dyestuff may be used, and the basic dyestuff may be washed out of the gelatin after the negative has been taken, leaving it coloured only with the acid dyestuff, when it may be applied to a paper support in the usual manner.—T. F. B.

Colour photography ; [*Bleaching-out*] *process of* ——. Union Photographique Industrielle Etabl. Lumière et Jougla Réunis. Fr. Pat. 449,694, Oct. 18, 1912. Under Int. Conv., Dec. 5, 1911.

The time of exposure in preparing colour prints by the "bleaching-out" process, is reduced very considerably (*e.g.*, to a few minutes when printing from an autochrome plate) by using as sensitiser hypochlorites, hypobromites, or hypo-iodites, alone or mixed with a chloride, bromide, iodide, or base. The image is fixed by treating it with a reducing agent, such as a sulphite, bisulphite, or thiosulphate, or with ammonia.—T. F. B.

Positive photographic images on paper, plates, or films ; *Production of direct* ——. J. Gout. Fr. Pat. 449,419, Dec. 20, 1911.

A silver-salt emulsion is exposed and developed in the usual manner, immersed for 5 to 60 seconds in a solution of barium, ammonium, or sodium sulphide, and then treated with a solution containing alkali bromide (50—200 grms.), chromic acid or "ferrochromic salt" (5—20 grms.), nitric acid (5—20 c.c.), and water (1000 c.c.). When the positive image has formed, the print is fixed by means of the usual thiosulphate solution containing a sulphite, bisulphite, or metasulphite.—T. F. B.

Emulsions which reduce the time of exposure of photographic or radiographic plates, and process for making them. E. C. Saleil. Fr. Pat. 450,199, Nov. 6, 1912.

To increase the rapidity of emulsions, it is proposed to mix with them phosphorescent or fluorescent compounds ; for example, for radiographic work the emulsion for each plate 13×18 cm. may contain one grm. of fluorescent calcium tungstate, whilst for photographic purposes a similar quantity of zinc sulphide gives satisfactory results.—T. F. B.

Colour screens for colour photography ; *Manufacture of* ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9167, April 18, 1912.

See Ger. Pat. 254,180 of 1910 ; this J., 1913, 214.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

White phosphorus in match compositions ; *Detection of* ——. F. Schroeder. Arbb. Kais. Gesundh.-Amt, 1913, 44, 1—29. Chem. Zentr., 1913, 1, 1540—1541.

Mitscherlich's luminescence test is not applicable to the detection of white phosphorus in presence of phosphorus sulphides. If benzene solutions of phosphorus sulphides be allowed to evaporate spontaneously on filter-paper, the paper shows no luminescence at the ordinary temperature, even if rubbed with the finger ; white phosphorus under similar conditions gives a positive result. If the benzene be volatilised by warming, luminescence may be obtained with P_4S_3 and P_2S_3, but not with P_3S_6 and P_2S_5. If the benzene solution be evaporated at exactly 50° C. (full details of procedure are given in the original), it is possible to detect white phosphorus in presence of phosphorus sulphides and also in sulphophosphite and in scarlet and ordinary red phosphorus in this way, 3 grms. of substance and 150 c.c. of benzene being used ; in the case of match compositions, also, 3 grms. of substance are used, but only 15 c.c. of benzene. The test for white phosphorus in red phosphorus by means of ammoniacal silver solution (see Siemens, this J., 1906, 1044) is not applicable to scarlet phosphorus owing to its greater solubility in benzene.—A. S.

Gaseous mixtures ; *Influence of incombustible dusts on the inflammation of* ——. *See* IIa.

Patents.

Colloidal substances [*solutions of nitrocellulose*] *and their manufacture.* E. I. Du Pont de Nemours Powder Co. Fr. Pat. 449,606, Oct. 19, 1912.

A colloidal substance can be produced by the combination of a carbon compound such as nitrocellulose with an alcohol aldehyde, which is preferably non-volatile and capable of polymerising, as acetaldol (see Fr. Pats. 449,604 and 449,605, page 507) for instance. A solution of camphor in a volatile solvent may also be incorporated. The colloid produced has a lower fusion temperature than that of a mixture of camphor and nitrocellulose.—F. Sodn.

Carbon compounds [pyroxylin]; Production of dissolved ——. E. I. Du Pont de Nemours Powder Co. Fr. Pat. 449,607, Oct. 19, 1912.

Useful solutions of carbon compounds such as nitrates of carbohydrates and pyroxylin can be obtained by taking an alcohol aldehyde such as acetaldol as solvent.—F. Shdn.

Nitrated hydrocarbons in the manufacture of safety explosives. E. Raynaud. Fr. Pat. 449,785, Oct. 7, 1912.

The aromatic hydrocarbons from coal tar, known as "Lusol," having a sp. gr. of 0·88 are nitrated, with the production of compounds melting at 64° C., which are somewhat plastic, and are said to be of special value in the manufacture of safety explosives.—G. W. McD.

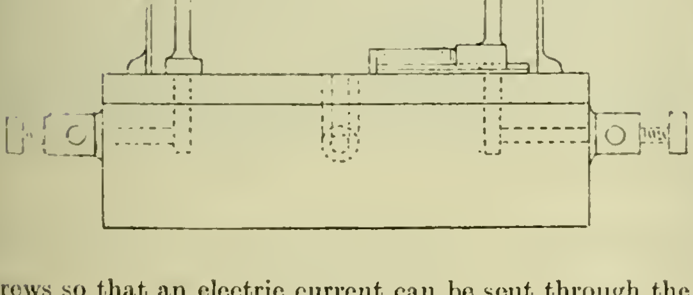
Explosives; Method of treatment of ——. P. Maury. Fr. Pat. 449,858, Jan. 4, 1912.

The use of "aquadag" (a colloidal suspension of graphite in water) is claimed in admixture with gelatinised propellants. Besides acting as a moderant, it is stated that the graphite lubricates the barrel and also serves to stabilise the explosives.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

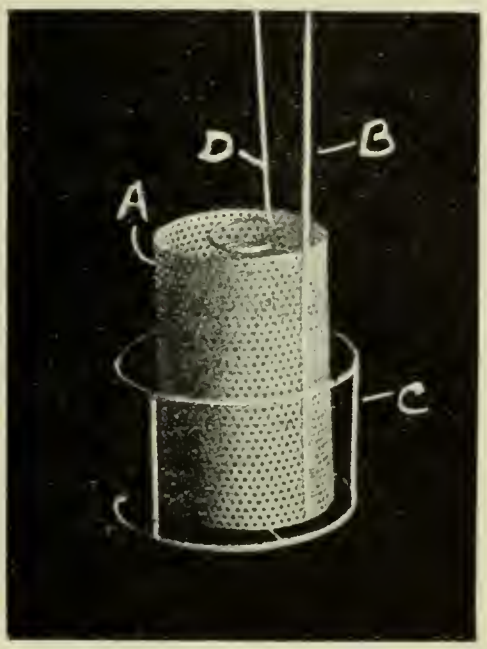
Apophorometer; The ——. [*Sublimation apparatus.*] J. Joly. Phil. Mag., 1913, **25**, 301—311.

The apophorometer (see fig.) consists essentially of a ribbon of thin platinum, about 6 cm. long and 4 or 5 mm. wide, stretched between two forceps, A, B, provided with binding screws so that an electric current can be sent through the platinum. One of the forceps is movable and is acted upon by a light spring so as to keep the ribbon stretched. Beneath the ribbon is a watch-glass, C, held on a support which can be raised or lowered or turned to one side. From 5 to 30 mgrms. of the substance under examination are spread on the ribbon, the watch-glass is moved upwards into contact with the ribbon and then a second inverted watch-glass, D, is placed over the first one as a cover. A current is now passed through the ribbon and gradually increased until the sublimation temperature is attained. The temperature can be estimated with fair accuracy by means of an amperemeter. The whole apparatus may be placed under a belljar if it be desired to work *in vacuo* or in an atmosphere of an inert gas. When necessary strips of thicker platinum or moulded strips of carbon may be used instead of the thin platinum ribbon. Sublimation experiments with this apparatus may with advantage be used instead of blowpipe tests for the identification of minerals, and details of experiments made with various minerals are given.—A. S.



Electrode for electrolytic analysis; New ——. L. Bertiaux. Ann. Chim. Analyt., 1913, **18**, 129—130.

The electrode (see fig.), which is stated to possess all the advantages and none of the inconveniences of the platinum gauze electrode, consists of a cylinder, A, of perforated platiniridium foil (containing 10 per cent. Ir) to which a rigid wire, B, of the same alloy is autogenously soldered; the thickness of the perforated metal is 0·15 mm., the perforations being 1 mm. in diameter and 1 mm. apart. The cylinder rests within a frame, C, of platinum wire and is provided internally with a cylindrical platinum spiral, D, the wire of which is 1 mm. thick. The following dimensions are given (in mm.) for the large and small size of the apparatus respectively. *Perforated electrode:* total height, 235 and 210; height of cylinder, 60 and 42; diameter of same, 40 and 30; thickness of wire, 1·5 and 1·25. *Spiral:* total height, 243 and 220: height of internal cylindrical spiral, 70 and 45; external diameter of same, 14 and 12; diameter of outer wire frame, 55 and 38; height of same, 35 and 25.—W. E. F. P.



Carbon; Determination of —— *by combustion with moist oxygen.* S. Hilpert. Ber., 1913, **46**, 949—952.

Although the fact that water vapour accelerates combustion has been long known, it does not appear to have been utilised for analytical purposes. The author has found that in the analysis of the carbides of manganese and magnesium, the combustion is rapid and complete when moist oxygen is used, although slow and incomplete with dry oxygen even after prolonged heating to bright redness. Further in the determination of carbon in iron and steel (including alloy steels) by direct combustion, complete oxidation can, in most cases, be effected below 950° C. with moist oxygen, whereas with dry oxygen, a temperature of about 1200° C. is required. Only in the case of an 80 per cent. ferromanganese containing 6·16 per cent. C. was it found necessary to raise the temperature to 1050° C. when moist oxygen was used. The use of moist oxygen is also advantageous in organic analysis, especially in the case of explosive substances and substances which are not readily oxidised completely by the usual method.—A. S.

Phosphorus in ferrotungsten, metallic tungsten powder, tungsten oxide and tungstic acid; Determination of —— *by direct solution.* C. M. Johnson. J. Ind. Eng. Chem., 1913, **5**, 297—298.

The author has found that methods for the determination of phosphorus in substances containing tungsten in which the material is fused with a mixture of alkali carbonate and nitrate always give results much below the truth. The following method is stated to give results sufficiently accurate for technical purposes. *Ferrotungsten.* 1 grm. is warmed in a covered platinum dish with 30 c.c. of concentrated nitric acid and 3 c.c. of hydrofluoric acid, the solution is evaporated just to dryness, and then again evaporated with 50 c.c. of concentrated hydrochloric acid. The residue is dissolved in 20 c.c. of concentrated hydrochloric acid, 50 c.c. of water added, and the mixture heated and filtered, the precipitate being washed with dilute hydrochloric acid (1 : 20). The filtrate and washings are concentrated to 10 c.c., treated with 20 c.c. of water, filtered, and the precipitated tungstic acid washed as before. The solution is again concentrated to 10 c.c., then heated in a covered dish with 75 c.c. of concentrated nitric acid, concentrated to 20 c.c., treated with 50 c.c. of nitric acid, concentrated to 15 c.c., treated with 20 c.c. of water, heated and filtered. The precipitate is washed with dilute nitric acid (2 : 100), the solution concentrated to 40 c.c., boiled for 3—4 mins. with a slight excess of a 5 per cent. solution of permanganate, the manganese dioxide dissolved by means of a little ferrous sulphate, and the phosphorus precipitated with molybdate solution. *Tungsten ores.* The ore is decomposed by means of hydrochloric acid and potassium chlorate, and the solution is further treated in much the same manner as described above. *Tungsten powder, tungsten oxide, and tungstic acid.* The tungsten powder is converted into the yellow oxide by ignition at red heat. The resulting oxide, and also tungsten oxide and tungstic acid are treated as described under tungsten ores for the determination of phosphorus.—A. S.

Manganese; Volumetric determination of —— by the Volhard-Wolff method. Chemical Commission of the Union of German Iron-workers. Stahl u. Eisen, 1913, **33**, 633—642.

IN an investigation of the Volhard-Wolff method for the determination of manganese, comparative tests, the details and results of which are given, have shown that it is preferable to use the manganese in potassium permanganate instead of that in any other manganese salt in order to determine the titre of the standard potassium permanganate solution. The influence of small quantities of other metals has also been investigated.—A. H. C.

Titanium and vanadium; Simultaneous determination of small quantities of —— colorimetrically. J. W. Mellor. Trans. Eng. Ceram. Soc., 1912—13, **12**, 33—35.

THE precipitate produced by ammonia in the usual course of analysis is washed, calcined and weighed. The mass is then fused with eight times its weight of sodium pyrosulphate, and the resulting cake, when cold, is treated by Gooch's process or by the ether process to remove iron. The solution is then acidified with sulphuric acid in order that vanadium may subsequently develop its proper colour with hydrogen peroxide. An aliquot portion is treated with hydrogen peroxide, and the colour measured in Lovibond's tintometer. To another aliquot portion, Fenton's acid (dihydroxymaleic acid, $C_4H_4O_6,2H_2O$; Chem. Soc. Trans., 1908, **93**, 1064) is added instead of hydrogen peroxide; the solution is allowed to stand for an hour, and the colour then read off on the tintometer. Hydrogen peroxide colours both titanium and vanadium; Fenton's acid, only titanium. As the eye requires more practice to detect differences in yellow light, it is better to confine attention to the intensity of the red ray.
—H. H. S.

Palladium; a-Nitroso-β-naphthol as a precipitant of ——. W. Schmidt. Z. anorg. Chem., 1913, **80**, 335—336.

WHEN a saturated solution of a-nitroso-β-naphthol in 50 per cent. acetic acid is added to a solution of a palladium salt, the metal is quantitatively precipitated as the compound, $(C_{10}H_6NO_2)_2Pd$, in the form of a very voluminous reddish-brown precipitate, readily filtered, and yielding metallic palladium on ignition. The other platinum metals are not precipitated, and the reagent may therefore be used in testing for very small quantities of palladium (being found to give a distinct precipitate on standing, even with a solution containing 0·001 mgrm. of palladium ammonium chloride per c.c.) and also for the determination of palladium in the presence of allied metals.—F. SODN.

Fatty acids; Analysis of mixtures of lower ——. K. Langheld and A. Zeileis. Ber., 1913, **46**, 1171—1177.

A METHOD of approximately determining lower fatty acids in mixtures is based upon their fractional oxidation at different temperatures and measurement of the quantities of carbon dioxide evolved. For example, acetic acid yields 2 mols. of carbon dioxide when oxidised with chromic acid at 170° C.; isobutyric acid, one mol. at 65° C. one at 100° C., and two at 170° C.; isovaleric acid yields 2 mols at 65° C., one at 100° C. and two at 170° C.; and methylethylacetic acid yields one mol. at 65° C., one at 100° C., and three at 170° C. Provided that the behaviour of each lower fatty acid is known it is possible to calculate its proportion from the amounts of carbon dioxide obtained in the three oxidations, considered in conjunction with the total acidity of the mixture. Thus in the case of the acids mentioned the following formulæ may be used, in which a, b, and c represent the respective amounts of carbon dioxide obtained at the three temperatures and t the number of c.c. of $N/10$ potassium hydroxide solution required to neutralise the mixture:—

$$\text{Acetic acid } \left(t - \frac{10000\ b}{44}\right)\ 0{\cdot}006 \text{ grm.}$$

$$\text{Isobutyric acid } \frac{88}{44}\left(2b - a - c + 2\frac{44t}{10000}\right) \text{ grm.}$$

$$\text{Isovaleric acid } \frac{102}{44}(a-b) \text{ grm.}$$

$$\text{Methylethylacetic acid } \frac{102}{44}\left(c - 2\ \frac{44t}{10000}\right) \text{ grm.}$$

The mixture of the acids (0·5 to 0·6 grm.) is first neutralised with $N/10$ alkali solution, the liquid is concentrated to about 25 c.c., cooled with a freezing mixture, treated with 100 c.c. of concentrated sulphuric acid, and gradually allowed to rise to the ordinary temperature. A current of air (free from CO_2) is then passed through the apparatus, after which the absorption vessel is attached. The reaction flask is immersed in water at 65° C. and a solution of chromic acid (7 grms. in 200 c.c. of 1 : 1 sulphuric acid) is dropped in. After about 30 minutes, the gas remaining in the apparatus is removed by a current of air (free from CO_2) and the absorption apparatus disconnected and weighed. The same process is then repeated for the second and third oxidations at 100° and 170° C. As a rule about 3 hours are required for the complete oxidation of acetic acid and propionic acid. The results obtained in test determinations agreed with the theory within —2·5 per cent in the case of acetic acid, + or —2·6 per cent. with isobutyric and isovaleric acids, and —3·5 to —4·5 per cent. with methylethylacetic acid.—C. A. M.

Determination of paraffin wax in petroleum oils. Scheller. *See* IIA.

Application of the dimethyl sulphate test for determining [detecting] small amounts of petroleum or asphaltum products in tars. Reeve and Lewis. *See* III.

Separation and determination of subsidiary dyes in the permitted food colours. Mathewson. *See* IV.

Identification of small amounts of dyestuffs by oxidation with bromine. Mathewson. *See* IV.

Assay of hypophosphorous acid. North. *See* VII.

Volumetric determination of ammonia. Winkler. *See* VII.

Methods for the analysis of hydrosulphite. Bosshard and Grob. *See* VII.

Alleged permeability of glass to halogen vapours. Firth. *See* VIII.

Permeability of glass to water under the influence of high-tension electricity. Meyer. *See* VIII.

Colorimetric method for the determination of chromium in steel. Garratt. *See* X.

Determination of vanadium in ferro-vanadium. Clark. *See* X.

Errors in sampling and assaying [gold] ores due to the presence of coarse gold. White. *See* X.

Determination of oxygen in metallic tungsten powder, and notes on the determination of oxygen in steel. Johnson. *See* X.

Determination of zinc in ores. Demorest. *See* X.

Determination of rosin in soap. Besson. *See* XII.

Testing tragacanth. Jensen. *See* XVII.

Determination of carbonic acid in water. Tillmans. *See* XIXb.

Detection of white phosphorus in match compositions. Schroeder. *See* XXII.

Patents.

Fuel calorimeters. W. W. F. Pullen, Stockport. Eng. Pat. 24,196, Oct. 23, 1912.

The combustion chamber of the calorimeter consists of a glass cylinder with removable ends, and the sample of fuel is contained in a conical crucible, supported on a short perforated tube, resting on the bottom of the cylinder and communicating with a tube passing through it. The sample is burned in a current of oxygen, which enters through a straight or cranked tube, passing through the upper cover of the cylinder. The cylinder is immersed in an outer vessel containing water and the products of combustion pass through the perforated tube, which is continued below the bottom of the cylinder as a coil ending in a perforated portion. through which the gases bubble up through the water. The ends of the inner cylinder are held together by adjustable clamps provided with hooks, which serve to support the vessel during the assembling of the apparatus.—W. H. C.

Gas calorimeter. F. A. Stamps, Niagara Falls, N.Y. U.S. Pat. 1,058,483, April 8, 1913.

The gas is burned so that the products pass up through a wide vertical metallic chimney having radiating ribs, and the calorific power of the gas is indicated by the expansion of the chimney. The multiplying and recording or indicating mechanism comprises a lever pivoted on the free upper end of the chimney, and bearing at one end, near the pivot, against a fulcrum carried by vertical compensating bars of the same metal as the chimney but situated at a distance from it.—A. T. L.

Gas-analysing apparatus and process. H. C. Parker, Holyoke, Mass. U.S. Pat. 1,057,767, April 1, 1913.

A stream of the gas to be analysed is driven by means of a constant-flow pump through the absorbing reagent, and the residual gas is driven into the atmosphere by means of a second constant-flow pump driven synchronously with the first pump. The inlet to the second pump communicates also with the atmosphere through a small orifice, through which, consequently, air equal in volume to the absorbed gas is drawn. Means are provided for recording the drop in pressure between the atmospheric side and the inner side of the orifice, and thus a record of the volume of the in-drawn air, that is, of the absorbed gas, is obtained.—T. St.

Test-burner. G. M. S. Tait, Montclair, N.J., Assignor to Tait Producer Co., New York. U.S. Pat. 1,058,702, April 8, 1913.

The burner is made entirely of heat-conducting material and is in two parts which fit together with a ground conical joint so as to grip a piece of wire gauze between them. The lower part of the burner is fitted to the gas-supply pipe and the gas burns within the upper part of the burner. This part comprises a small chamber just above the gauze, and a vertical pipe leading the gas from this chamber to the top of a second dome-shaped chamber above the first. The outlet for the flame or combustion products is a large opening in the side of the dome-shaped chamber.—A. T. L.

XXIV.—MISCELLANEOUS ABSTRACTS.

Recent viscosity investigations; A criticism of some ——. E. C. Bingham. Chem. Soc. Proc., 1913, **29**, 113.

The use of viscometers of the Ostwald type for measuring the viscosity of liquids where the viscosities extend over a considerable range of values has led observers to unsatisfactory results. The reason is that in this form of apparatus the pressure is not variable at will, and therefore the neglected kinetic energy correction becomes very large with very fluid substances; with more viscous substances the time of flow is inconveniently great, and, as a result of the sluggish flow, the danger of partial clogging of the capillary becomes imminent. The prevalent idea that a kinetic energy correction is not applicable to viscometers of the Ostwald type is erroneous. In interpreting the results of viscosity measurements, the old assumption is still being made without supporting evidence that the viscosities of homogeneous mixtures of liquids are additive. Since this omission is made in the face of abundant evidence that fluidities—and therefore necessarily not viscosities—are additive, the subsequent reasoning loses its cogency.

Nucleases; Effect of high temperatures on dried vegetable ——. E. C. Teodoresco. Comptes rend., 1913, **156**, 1081—1083.

The author has previously stated (Comptes rend., 1912, **155**, 154) that in aqueous solutions the nucleases of Cryptogams lose their activity only at temperatures above 90° C. It is now shown that the dried plants may be heated much above this temperature for half an hour without destruction of their nucleolytic power. The following are the temperatures at which the dried nucleases of the plants named are destroyed:—*Evernia prunastri* above 145° C., *Lycoperdon gemmatum* between 141° and 156° C., beer yeast above 153° C., and *Sticta pulmonacea* above 162° C.—J. H. L.

Books Received.

Final Report of the Departmental Committee on Petroleum Spirit. [Cd. 6,565.] Wyman and Sons, Fetter Lane, E.C. Price 1d.

This is the final report and contains the recommendations of the Departmental Committee appointed 19th December, 1908, to inquire into the sufficiency of the existing regulations relating to the storage, use and conveyance of petroleum spirit; and to report what further precautions, if any, were in their opinion desirable as tending to diminish the dangers attendant thereon. This report deals with the conveyance of petroleum spirit by road, the powers of harbour authorities, and the question of ocean tank steamers in harbours and docks.

Handbuch der Arbeitsmethoden in der anorganischen Chemie. Herausgegeben von Dr. A. Stähler, Privatdozent an der Universität Berlin. Erster Band. Verlag von Veit und Co., Leipzig, 1913. Price M. 25; bound M. 28.

Volume, 9½ by 6½ ins., containing 742 pages of subject matter, with 1064 illustrations, and alphabetical indexes of authors' names and subjects. This first volume contains the following sections: Structural arrangement of inorganic chemical laboratories (A. Stock). Laboratory fittings (A. Stähler). Vessels for general chemical use (E. Groschuff). Storage, etc., of reagents (A. Stählor). Electrical fittings (G. Schulze). Power apparatus (A. Stähler). Heating, cooling and temperature regulation (E. Schirm, A. Stähler, J. v. Wartenberg, J. Bronn, L. Weiss). Mechanical operations and construction of apparatus (A. Stähler). Separation of solids and of solids from liquids, decantation (A. Stähler) Filtration (T. W. Richards). Filtering apparatus (A. Stähler). Centrifuging (A. Stähler, T. W. Richards). Separation of liquids from one another; preparation of mechanical mixtures (A. Stähler).

Liquid Air, Oxygen, Nitrogen. By G. Claude, Engineer Laureate of the Institute of France. English edition corrected and brought up to date by the author. Translated by H. E. P. Cottrell. With preface by D'Arsonval, Member of the Institute of France. J. and A. Churchill, London. 1913. Price 18s. net.

This volume, 10¼ by 7 ins., contains 418 pages of subject matter, with 151 illustrations. The subject matter is arranged as follows: Part 1. Liquefaction of gases. I. First steps. II. The critical point. III. Liquefaction of permanent gases. Part 2. Commercial liquefaction of air. IV. Expansion and Siemens' exchanger of temperature—From Siemens to Linde. V. Imperfections of the gaseous state and the work of Van der Waals. VI. Expansion by simple outflow. VII. Expansion with external work that can be recuperated. Part 3. Preservation and properties of liquid air. VIII. Preservation of liquid air. IX. Properties and physical effect of liquid air. X. Chemical properties of liquid oxygen. Part 4. Separation of the air into its elements. XI. Diverse processes. XII. Evaporation of liquid air. XIII. Recuperation of cold. XIV. Progressive evaporation. XV. Accelerated liquefaction of the oxygen of the air. XVI. Liquefaction of gaseous mixtures. XVII. Application of the antecedent liquefaction of the oxygen of the air. XVIII. Rectification. XIX. Grouping of apparatus—Existing plants.

Dairy Technology. By C. Larsen, M.S.A., Prof. of Dairy Husbandry, S. Dakota State College, and W. White, B.S. J. Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1913. Price 6s. 6d. net.

Volume, 8¼ by 5⅝ ins., containing 287 pages of subject matter, with 48 illustrations, and an alphabetical index. The book is divided into four parts, with 32 chapters, viz., Part I. Milk as a food. (1) Milk, its properties and composition. (2) Normal milk and its products as food. (3) Abnormal milk. Part II. City milk supply. (4) Extent and importance of the industry. (5) Improvement of the milk supply. (6) Certified milk. (7) Pasteurised milk. (8) Modified milk. (9) The village milk plant. (10) The city milk plant. (11) Standardisation of milk and cream. (12) Sanitary examination of milk. (3) Whipping of cream. Part III. (14) Ice cream making. (15) Cream for ice cream making. (16) Preparing the mix; fillers and binders. (17) Freezing the mix. (18) Formulas. (19) Ice cream machinery. (20) Ice cream factories. (21) Scoring ice cream. (22) Ice cream standards. (23) Mechanical refrigeration. Part IV. By-products of the creamery and cheese factory. (24) Cottage cheese; buttermilk cheese. (25) Whey butter. (26) Milk sugar. (27) Casein. (28) Fermented milks. (29) Condensed and evaporated milk. (30) Milk powder. (31) Renovated butter. (32) Oleomargarine.

Lectures on Chemistry in Gas-Works. By W. J. A. Butterfield, F.I.C. Institute of Chemistry of Great Britain and Ireland, 30, Bloomsbury Square, London, W.C. 1913. Price 2s. 6d.

A reprint (8½ by 5⅝ ins.) of two lectures delivered before the Institute of Chemistry at University College, London, on Dec. 8, 1912, and Jan. 31, 1913. There are 69 pages of subject matter and 6 illustrations.

Chemical News. Edited by Sir W. Crookes, F.R.S. General Index. Vols. 1 to 100 (1086—1909). 16, Newcastle Street, Farringdon Street, London, E.C. Price £2.

This volume (10⅜ by 7¾ ins.) comprises collective indexes both of authors' names and of subjects, covering altogether 712 pages.

Elektrochemisches Praktikum. Von Dr. Erich Müller. Ord. Professor für Physikalische Chemie an d. Tech. Hochschule, Dresden. Mit einem Begleitwort von Dr. Fritz Foerster. Theodor Steinkopff's Verlag. Dresden und Leipzig. 1913. Price M. 8.

Volume (8⅞ by 6¼ in.), containing 221 pages of subject matter, with 102 illustrations, and an alphabetical index. The subject matter is classified as follows:—I. The need of an electrochemical laboratory. II. Problems for exercise. (*a*) On certain fundamental laws. (*b*) On the separation of metals from their solutions. (*c*) Important inorganic preparations. (*d*) Preparation of important organic substances. (*e*) Electrolysis of fused substances. (*f*) Electrothermic processes.

Der Kolloide Zustand der Materie. Von Dr. Leonardo Cassuto. (Pisa). Uebersetzt von Johann Matula. (Wien). Theodor Steinkopff's Verlag. Dresden und Leipzig. 1913. Price M. 7.50.

Volume (9¼ by 6¼ in.), containing 247 pages of subject matter with 18 illustrations, and an alphabetical index. The subject matter is arranged under the following heads: I. General. II. Optical phenomena. III. The ultramicroscope. IV. Estimating degrees of dispersion. V. Dispersion and electrical energy. VI. The Brownian movement. VII. Osmotic pressure. VIII. Coagulation. IX. Swelling and gelatinisation. X. Adsorption. XI. Factors governing the stability of colloidal systems. XII. Methods for preparing colloidal systems. XIII. Theories of the colloidal state. XIV. General review of the theories of colloids. XV. Systematising the colloids.

Handbuch der Mineralchemie. Herausgegeben mit Unterstützung der K. Akademie der Wissenschaften in Wien. von Hofr. Prof. Dr. C. Doelter. Band III. 1. Vier Bände. Theodor Steinkopff's Verlag. Dresden und Leipzig. 1913. Price M. 6.50.

(See this J., 1913, 216.) Part I of volume III., of this work. It measures 10⅛ by 7⅛ in. Devoted to a description of titanium and its compounds; determination and separation of niobium and tantalum; silicotitano-niobates; germanium; determination and separation of zirconium oxide; silico-zirconiates, etc.

Quantitative Analysis of Medicinal Preparations. By H. C. Fuller, B.S. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1912. Price 6s. 6d. net.

A volume, 7⅝ by 5⅛ ins., containing 121 pages of subject matter, and an alphabetical index. The subject matter is arranged as follows:—I. Scheme of analysis: separation of substances into groups; tests for individuals; tables of reactions of anæsthetics and opium alkaloids. II. Methods of analyses: fluid extracts and tinctures; elixirs, wines, syrups, etc.; emulsions; liniments; toothwashes and gargles; solid and powdered extracts, and concentrations; pills, tablets, etc.; pastils; powders, cachets, and hard capsules; globules and soft capsules; effervescent preparations and artificial mineral water salts; pastes, ointments, and emollients; inhalants; suppositories, crayons, and bougies; plasters; digestives. Scheme of analysis for rapid detection of inhibited drugs.

Die Fabrikation der Tonerde. [Monographien über chemisch-technische Fabrikations-Methoden.] Band XXX. Von Dr. A. Berge. Wilhelm Knapp's Verlag. Halle a. S. 1913. Price M. 3.80.

Volume (9⅞ by 6¾ in.), containing 67 pages of subject matter with 20 illustrations, and alphabetical index. The subject matter is classified as follows:—I. Historical account of the development of the alumina industry. II. Recent methods for producing alumina. III. Process by fusing bauxite with sodium carbonate, with other methods more or less in vogue. IV. Employment and uses of alumina and aluminium salts. V. Statistical.

Jahrbuch der Elektrochemie und Angewandten Physikalischen Chemie. Begründet und bis 1901 herausgegeben von Prof. Dr. W. Nernst und Prof. Dr. W. Borchers. Berichte über die Fortschritte des Jahres, 1906. Unter Mitwirkung der Herren K. Elbs, G. Grube, F. Harms, J. Hess, H. Ley, H. Pick, M. Spitzer-Jajce, Stockmeier, and A. Wacker, herausgegeben von Dr. H. Dannel und Dr. Julius Meyer. XIII. Jahrgang. Wilhelm Knapp's Verlag. Halle (Saale), 1913. Price M. 32.

Volume measuring 9⅞ by 6¾ ins., and containing 823 pages of subject matter, with 98 illustrations, and alphabetical indexes of names and subjects, forming an Annual Report on the advance of electrochemistry and applied physical chemistry in 1906. The subject matter is arranged under tho following heads:—Pure Science. I. General. II. Educational and apparatus. III. Atomic weights; periodic system; valency. IV. Phase rule. V. Speed of reactions, and law of mass action. VI. Thermochemistry. VII. Theory of solutions, etc. VIII. Osmotic pressure. IX. Colloids. X. Applications of physical chemistry to biology, physiology, and medicine. XI. Conductivity and state of solutions. XII. Chemical and electrical energy, etc. XIII. Polarisation and electrolysis. XIV. Electrical phenomena in gases. Radioactivity. Applied Electrochemistry. I. Production of current. II. Inorganic electrochemistry and physicochemical processes and products. III. Metalloids and inorganic compounds. IV. Metals. V. Organic compounds. VI. Galvanotechnology, etc. VII. Electrolysis of alkali chlorides. VIII. Utilisation of chlorine and preparation of hydrochloric acid. IX. Sulphur and its compounds, especially sulphuric acid. X. Contact chemistry and law of mass action. XI. Apparatus for electrochemical technology.

Traité Complet d'Analyse Chimique Appliquée aux Essais Industriels. Par J. Post et B. Neumann. Deuxième edition française entièrement refondue. Traduite d'après la troisième édition allemande et augmentée de nombreuses additions, par G. Chenu et M. Pellet. Tome Troisième. Second fascicule. Goudron de Houille. Matières colorantes. Librarie Scientifique A. Hermann et Fils 6 rue de la Sorbonne, 6. Paris. 1913. Price 15 fr.

Volume measuring 10 by 6¼ ins., and commencing with page 465 and ending on page 902. The volume contains 8 illustrations, and a table of contents. Part II. commences with the subject of coal tar and its commercial products, and ends with that of the coal tar dyestuffs and colours, with the related industries.

Chemistry of Dyeing. By John K. Wood. Lecturer in Chemistry, University College, Dundee. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1913. Price 1s. 6d.

This forms No. II. of a series of Chemical Monographs, edited by A. C. Cumming, D.Sc. It is a volume (7½ by 5 in.), containing 74 pages of subject matter, 2½ pages of bibliography, and an alphabetical index. The classification of text gives the scheme of the work. I. Chemical composition and properties of the textile fibres. II. Dyes and their properties. III. Nature of the dyeing process.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

I. *Berthier*, A.: Production économique de la vapeur. L'alimentation méthodique des foyers, chargeurs méthodiques, stokers, 110 fig., in-8°. Paris. H. Desforges. 1913. 4 fr

Wansborough, W. D.: Modern Steam Boilers: The Lancashire Boiler. A Practical Manual. 8vo, pp. 168. C. Lockwood. London. 1913. Net 4s. 6d.

Brandis, Dr. J.: Messung von Gasmengen. Genaue Messg. d. durch e. Leitg. ström. Gas-(Luft-) menge mittels Drossel-Messscheibe (Staurand) (VIII, 87 S. m. 34 Abbildungn. auf 26 Taf.) Lex 8°. Berlin. M. Krayn. 1913. M. 2.50.

Clerk, D., and G. A. *Burls*: The Gas, Petrol, and Oil engine. v. 2. N.Y., Wiley. 9+838 p. figs. 8°. 1913. $7.50.

Stetefeld, R.: Die Eis- u. Kälteerzeugungs-Maschinen. Ihr Bau u. ihre Verwendg. in der Praxis. Ein Kompendium der gesamten Kälteindustrie. 2. neubearb. u. erweit. Aufl. 2. Bd. (VII. u. S. 265—520 m. Abbildgn. u. Taf.) gr. 8°. Stuttgart, M. Waag. 1913. Cloth M. 11.

IIA. *Braunkohlenindustrie*, Die deut. I. Bd. 6. Lfg. Halle. Knapp. 1913. M. 2.

Gouvy, A.: Les gaz de fours à coke, leur utilisation, leur application, 19 fig., in-8°. Paris. Dunod et Pinat. 1913. 2 fr.

Hirschfeld, C. F., and *Ulbrecht*, T. C.: Gas Power. Cr. 8vo. Chapman and Hall. London. 1913. Net 5s. 6d.

Ventou-Duclaux, L.: Utilisation de la naphtaline comme combustible dans les moteurs à explosion, 15 fig., in-8°. Paris. Dunod et Pinat. 1913. 1 fr.

Wenger, L.: Le pétrole, production, industrie, commerce, grav., in-8°. Paris. A. Rousseau. 1913. 6 fr.

IIB. *Grellert*, M.: Ueber die Berechnung v. Gasheizbrennern. Mit 12 Abbildgn., 4 Tab. u. zahlreichen Beispielen. [Aus: "Wasser u. Gas."] (62 S.) gr. 8°. Oldenburg, G. Stalling's Verl. 1913. M. 1.50.

V. *Beauverie*, J.: Les textiles végétaux, préf. de H. Lecomte, 290, fig., in-8°. Paris. Gauthier-Villars. 1913. 18 fr.

Copeland, M. T.: The Cotton Manufacturing Industry of the United States. 8vo, pp. 428. H. Frowde. London. 1913. Net 8s. 6d.

Faux, L.: Travail des laines à peigne. Principes et théorie de la transformation des laines brutes en fils peignés, 203 fig., 3 pl., in-4°. Paris. Ch. Béranger. 1913. 35 fr.

VI. *Walland*, Prof. H.: Kenntnis der Wasch-, Bleich- u. Appreturmittel. Ein Lehr- u. Hilfsbuch f. techn. Lehranstalten u. f. die Praxis. (VIII. 326 S. m. 46 Fig.) gr. 8°. Berlin. J. Springer. 1913. Cloth M. 10

VII. *Boismenu*, H. de: Fabrication synthétique du diamant, grav., in-8°. Paris. B. Tignol. 1913. 5 fr.

Lachmann, Dr. R.: Der Salzauftrieb. Geophysikalische Studien üb. den Bau der Salzmassen Norddeutschlands. 3. Folge. (2. Heft.) [Aus: "Kaii."] (108 S. m. 21 Fig. im Text u. auf 3 Taf.) 8°. Halle, W. Knapp. 1912. M. 4.80.

VIII. *Bollenbach*, Dr. H.: Keramische Rechentafeln zum Gebrauch in den Laboratorien der Ton-. Glas- u. Email-Industrie. (VI, 105 S.) 8°. Halle, W. Knapp. 1913. M. 4.60.

Hayden, A.: Kopenhagener Porzellan. Entwickelungsgeschichte der königl. Porzellanmanufaktur in Kopenhagen vom 18. Jahrh. bis zur Gegenwart. Deutsch v. Dr. C. F. Reinhold. (XXI, 234 S. m. 76 Abbildgn. u. 124 [5 farb.] Taf.) Lex. 8°. Leipzig. K. W. Hiersemann. 1913. Half-mor., M. 48.

IX. *Baumann*, R.: Versuche üb. die Elastizität u. Festigkeit v. Bambus, Akazien-, Eschen- u. Hickoryholz. (70 S. m. Abbildgn. u. 1 Taf.). Hrsg. vom Verein deutscher Ingenieure. Lex. 8°. Berlin, J. Springer. 1913. M. 2.

Burchartz, H.: Hydralische Kalke u. Bindemittel anderer Art als Kalk u. Zement (81 S.) gr. 8vo. Berlin, Tonindustrie-Zeit. 1912. Cloth M. 5.

Escard, J.: Le travail mécanique de la pierre dans l'industrie, 126 fig. in-4°. Paris. Dunod et Pinat. 1913. 4 fr. 50.

Keller, M.: Der Beton-Baublock. (109 S. m. Abbildgn.) Lex. 8°. Berlin, Tonindustrie-Zeitg. 1913. M. 3.

Matthies, K.: Eisenbetontreppen u. Kunststeinstufen. (78 S. m. 49 Abbildgn. im Text u. auf 3 Doppeltaf.) 8°. Berlin, Tonindustrie-Zeitg. 1913. M. 2.25.

Kühl, Dr. H.: Zementbrevier. Ein kurzgefasster Leitfaden f. Zementverbraucher. (71 S.) kl. 8°. Berlin, Tonindustrie-Zeitg. 1913. 30 Pf.

Passow, Dr. H.: Hochofenzement. Kurzer Leitfaden f. die Erzeugg. u. Verwendg. v. Hochofenzement. 2. Aufl. (66 S. m. Abbildgn.) 8°. Berlin, Tonindustrie-Zeitg. 1913. M. 1.50.

X. *Beckman*, B.: Ueber den Einfluss des Druckes auf die elektrische Leitfähigkeit bei Metall-Legierungen. [Aus: "Arkiv f. matematik, astronomi och fysik."] (18 S. m. 7 Fig.) 8°. Uppsala. 1912. Berlin, R. Friedländer und Sohn. M. 1.

Georgi, F., u. A. *Schubert*: Die Blechbearbeitungs-Technik. Das Schneiden, Lochen (Perforieren), Biegen, Falzen, Pressen, Ziehen u. Prägen der Metalle, ihre Hilfsmaschinen u. Werkzeuge. Lehr- u. Hilfsbuch f. den prakt. Gebrauch, sowie e. allgemeinverständl. Darstellg. der Grundzüge u. Entwickelg. bis zur Gegenwart unter Benutzg. der besten Quellen u. nach gesammelten Erfahrgn. aus der Praxis. (VIII, 160 S. m. Abbildgn. im Text u. auf 2 Taf. u. eingedr. Tab.) 8°. Bibliothek der gesamten Technik. Leipzig, Dr. M. Jänecke. 1913. M. 4.50.

Gower, A. R.: A Text-Book of Experimental Metallurgy and Assaying. Cr. 8vo, pp. 178. Chapman and Hall. London. 1913. Net 3s. 6d.

Gulliver, G. H.: Metallic Alloys: Their Structure and Constitution. 2nd ed. Revised, largely rewritten, etc. Cr. 8vo, pp. 438. C. Griffin. London. 1913. Net 10s. 6d.

Ledebur, Prof. A.: Die Legierungen in ihrer Anwendung f. gewerbliche Zwecke. Ein Hand- u. Hülfsbüchlein f. sämtl. Metallgewerbe. 4. neu bearb. u. erweit. Aufl. Bearb. u. hrsg. v. Prof. O. Bauer. (VI, 214 S. m. 45 Abbildgn.) 8°. Berlin, M. Krayn. 1913. Cloth M. 4.

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PROF. W. R. E. HODGKINSON IN THE CHAIR.

ORE DEPOSITS OF HU-NAN AND HU-PEH.

BY W. R. SCHOELLER.

These two provinces of Central China are situated the former to the south, the latter to the north, of Tung-ting lake (Tung-ting hu), as indicated by their names. (Hu-nan : South of the Lake ; Hu-peh : North of the Lake.)

The following description of the mineral deposits of the two provinces includes nearly all those that have come under my notice, and while many more are still awaiting discovery this list is, I believe, the most complete yet published, and may help to give an idea of the vastness of the natural resources of the country. All the analytical data quoted are original ; some have been obtained by the examination of specimens, while in the case of stibnite, galena, realgar, and mixed sulphides the figures represent the composition of large quantities of ore, sometimes exceeding five hundred tons.

Foreigners are not permitted to acquire mining rights in China, nor are they allowed to reside outside treaty ports ; it is even difficult to secure a passport enabling them to visit the country districts. The opposition of the Government and the intense anti-foreign feeling will probably delay the development of the mining industry for a long time to come. With a few exceptions, the Chinese refuse to accept European guidance in their industrial enterprises, though attempts to do without it have always resulted in failure. China is thus a storehouse of mineral wealth available for the future

As regards means of communication in the two provinces, the Hankow-Peking railway carries no ore, as there are no mines along the line ; the colliery railway from Ping-hsiang to the Siang river brings down coal and coke for transhipment into lighters. All other transport is done by water, and full advantage is taken of the natural waterways. Hankow can be reached by large ocean-going vessels for 7—8 months in the year (April—November). Shallow-draught river steamers, chiefly British and Japanese, ply between the following ports :—

1° Shanghai—Hankow. All the year round.
2° Hankow—Ichang. All the year round.
3° Hankow—Siang-tan. April—November.
4° Hankow—Chang-te. May—November.

In addition to these steamers, innumerable junks trade on all rivers down to the smallest creek. Above Ichang, the Yang-tsze winds its way through some hundred miles of narrow gorges, and navigation becomes impossible except for specially constructed craft, owing to dangerous rapids.

For the description of the various ore deposits, it will be convenient to group them under several heads.

Antimony ores of Central Hu-nan.

The Siang-kiang would appear to form the eastern boundary of the antimony belt. The district situated between that river and the Yuen-kiang and of which the city of Sin-hoa may be said to be the centre, produces the purest and richest stibnite ore, a typical ore assaying 57·64 per cent. Sb, and 0·127 per cent. As, with traces Pb and Cu. However, the arsenic is usually well below 0·1 per cent. The gangue amounts to about 15 per cent. and consists of quartz, occasionally mixed with schistose rock. The mineral is most frequently coarse-crystalline, showing long stout prisms, of strong lustre. Massive stibnite is not uncommon, and the richest ores are of this variety, with an antimony content of 60 to 65 per cent.

With the exception of one or two mines owned by the Hua-Ch'ang Co. of Chang-sha, there are no mines in the European sense of the term. The workings are merely man-holes made in the mountainside ; as soon as a certain depth is reached, ground water or the want of ventilation make work impossible, and another hole is dug near by. In this manner only the surface of the ore body is scratched. The miners sell the ore by the picul to local dealers, who send it to the nearest river, whence it reaches Chang-sha or Yi-yang. At both these places the ore is liquated for crude antimony, while regulus is also made at Chang-sha and Han-yang. The liquation residues, containing 20—30 per cent. of metal, have accumulated since smelting began, but are being used of late in the manufacture of regulus by the volatilisation process. The antimony sulphide in the residues coating the gangue and forming a glaze after solidification, it is not possible to concentrate them by mechanical means, as the brittle sulphide slimes after crushing. The slimes from a 27 per cent. residue assayed 56·4 per cent.

To the north of the Sin-hoa district the deposits become poorer : near An-hoa there occur ores averaging 48 per cent. Sb, with 0·06 per cent. As and negligible quantities of lead, copper, and zinc. They are of granular texture and present a dull lead-grey appearance.

Low-grade ores are also known to occur. A 25 per cent. ore showed beautiful isolated crystals several inches long embedded in a slaty gangue. Another ore (28·94 per cent. Sb) of extraordinary hardness consisted of an intimate mixture of quartz and stibnite in fine-grained masses. Both ores were practically free from arsenic.

Passing into S.W. Hu-peh the ore deposits show an increased proportion of arsenic, a sample giving 51·75 per cent. Sb and 0·43 per cent. As.

The same may be said of stibnite and crude from the province of Kweichow, some of which finds its way down the Yuen-kiang. Specimens were examined with the following results :—

1° Ore. Sb 62·99%—As 0·846%—Pb 0·18%—Cu, Zn : traces.
2° Crude. Sb 69·85%—As 0·46%
3° Crude. As 0·303%

The export of stibnite and crude antimony dates back about eight years when the inflated price of the metal made mining very profitable.*

The "Mineral Industry," vol. XX. (1912), p. 45, mentions that China is first in the production of antimony ; and that the ore comes from a number of places to the north-west of Tung-ting lake. South-west is more correct. The same year-book also states that "at Hankow, Carlowitz and Co. are engaged in the smelting of antimony and lead." No smelting was in progress at Hankow at the time the book was written. (For additional information concerning antimony ores, see this Journal, 1913, p. 260.)

Lead-zinc sulphide deposits of Southern Hu-nan.

Deposits of this kind abound in the southernmost part of the province, between the Kwang-tung boundary and Heng-chow. In the neighbourhood of that city some non-argentiferous galena is mined which, as is frequently the case with ore of this description, is almost free from other metals : Pb 74·7 per cent. ; Zn 1·5 per cent. Farther south, near Cheng, are found deposits of complex sulphides. These ores are intimate mixtures of galena, blende and pyrites carrying silver. A mine sample gave the following figures :—Pb. 10·7 per cent. Zn, 11·4 per cent. ; Fe, 23·2 per cent. ; Ag, 9·8 oz. per ton of 2240 lb.

No mining is done in this locality, though the presence of old workings and slag dumps show that the deposits were worked at some former period. Examination of a specimen of slag proved it to be a ferrous silicate free from lime containing ½ per cent. of lead and 5 oz. of silver.

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* Mining Journal, Sept. 15th, 1906, p. 305 ; June 11th, 1910, p. 740.

The important Sui-ku-shan mine worked by the Hu-nan Board of Mines is the only one in the district in active operation. The ore is argentiferous galena associated with blende, pyrites and calcite. Where the blende predominates, the ores become auriferous. Their composition is shown in the following table, A—C:—

Constituents.	A	B	C	D
	Galena.	Blende.	Mixed.	Lead Concentrates.
oz. per long ton. Silver.	28·74	11·21	12·60	37·11
Gold..	nil	0·16	0·01	nil
Lead	59·56	12·60	23·05	76·97
Silver + gold ..	0·08	0·04	0·01	0·12
Arsenic	0·11	0·66	0·25	0·04
Antimony	0·22	0·24	0·46	0·22
Copper	0·76	1·02	2·42	0·20
Bismuth	0·01	0·03	0·04	0·03
Iron	1·44	9·97	6·03	1·30
Alumina	1·28	1·64	1·80	0·80
Manganese	0·27	0·38	0·49	0·06
Zinc	12·90	38·99	24·34	2·38
Lime	1·10	nil	3·40	nil
Magnesia........	0·33	nil	0·39	nil
Insol. gangue	4·47	4·62	12·70	0·95
Baryum sulph. ..	nil	nil	nil	nil
Sulphur	17·25	29·99	22·16	15·46
CO_2 and loss....	0·22	—	2·43	1·47
	100·00	100·18	100·00	100·00

A considerable proportion of the ore mined is dressed at the mine, giving lead concentrates the composition of which is also given in the table under D. The total annual production is about 8000 tons, that of lead concentrates 3000 tons. The latter is chiefly exported to Germany, also to Japan and the United Kingdom. The blende and mixed sulphides are sold to a German firm having an ore dressing plant at Woo-chang where the material is further separated previous to exporting.

Some of the galena produced at Sui-ku-shan is sufficiently pure to be shipped without previous separation. The difference in quality between this class of ore and the lead concentrates is shown by the following assays:—

Concentrates: Silver 40·9 oz.; Lead 74·36 per cent.; Zinc 3·05 per cent.
Undressed lumps: Silver 32·4 oz.; Lead 64·35 per cent.; Zinc 7·55 per cent.

Spelter is also made at the mine after native processes by reducing the ore in small pots, the zinc condensing inside the cup-shaped cover. Half the zinc present in the ore is lost in the operation, but the spelter is remarkably pure, containing 99·56 per cent. Zn, 0·20 per cent. Pb, 0·18 per cent. Fe.

The Chinese extract silver from galena, though they do not appear to suspect the presence of noble metals in copper ores. The lead ore mixed with coal is subjected to an oxidising roast in stall-like furnaces, blast being supplied by bellows. Part of the lead is volatilised, and the fused litharge runs off the surface of the metal until the pure silver remains. All the lead is lost.

A modern blast-furnace plant was erected by the Hu-nan Board of Mines at Chang-sha for reducing Sui-ku-shan galena. After a few months' run in 1910 the American staff was discharged. Difficulties arose in smelting, and the plant being unable to cope with the ore was shut down.

The Realgar deposits of Northern Hu-nan.

A deposit of very pure realgar of considerable magnitude occurs near Li, Northern Hu-nan. The ore is crystalline and of a beautiful red colour. As mined, it averages 95 per cent. of arsenic bisulphide, the following analysis showing its composition:—

Arsenic	66·60
Sulphur	28·56
Al. silicate	1·78
Organ. matter	0·42
Carb. of lime..................	0·93
Carb. of magnesia	0·50
Iron	0·22
Zinc	0·10
	99·11

Sb, Cu, Pb: nil.

The Chinese use realgar in moderate amount for agricultural and medicinal purposes, but are unwilling to export it in large quantities as it commands a higher price at home.

An arsenic plant was put up at Han-yang for the manufacture of arsenious oxide. After a few unsuccessful trials, plant and machinery were left to their fate.

Miscellaneous deposits of Hu-nan.

A rich gold mine situated between Chang-sha and An-hoa is being worked at the present time. The ore, which is quartz carrying pyrites and visible gold, is milled and then washed, but the tailings are by no means free from gold. A wooden cradle is used in Hu-nan for washing ores. The operator works it floating on water, in which he stands up to his knees. It may here be mentioned that Hu-nan antimony ore is free from, or very poor in, gold.

Some mixed lead-zinc sulphide deposits occur in North-Eastern Hu-nan, also a very dark blende free from lead. A specimen assayed 49·6 per cent. Zn, 4·8 per cent. Fe, 0·28 per cent. As.

Pyrolusite (46·0 per cent. Mn) and pyrites (49·74 per cent. S; Cu nil; large well-developed pentagondodecahedra) are found along the Siang-kiang, and an oxidised copper ore assaying 40 per cent. on the Yuen-kiang.

I have no precise information as to the locality of these deposits. Very probably some stream-tin is washed in Hu-nan itself, on the Kwang-si border.* A specimen of sand-grain size was found to contain 72·10 per cent. tin.

Copper deposits of Hu-peh.

A few miles N.W. of Ching-kuo (Eastern Hu-peh) there extends a short and narrow valley between rocky hills, the sides of which present numerous outcrops of copper-bearing veins, some of which show patches of gossan brightly coloured with carbonates of copper. The surface deposits show all the effects of leaching and weathering, and rich sulphides predominate. Thus one vein showed a core of chalcopyrite surrounded by chalcocite which in its turn was coated with malachite, in a casing of clayey material. The analysis given under A

Constituents.	Vein (A).	Gossan (B)
Total copper	36·19%	29·78%
oz. per ton Silver	16·07	1·96
Gold	0·26	nil
	per cent.	per cent.
Insol. gangue....................	30·36	20·30
Sulphur	8·55	0·52
Copper oxide	11·62	37·22
Ferric oxide	3·94	12·55
Copper as sulphide	26·89	—
Iron as sulphide	4·18	—
Sol. alumina	4·15	4·20
Lime	0·81	5·52
Magnesia.........................	0·09	0·54
Lead	0·02	trace
Bismuth	0·06	0·01
Arsenic, antimony	nil	nil
Zinc	nil	0·30
Nickel	nil	0·24
Carb. acid, oxygen, etc.	9·33*	19·34†
	100·00	100·74

* By difference. † Loss on ignition.

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* Compare Mining Journal, April 10th, 1913, p. 377.

represents the composition of the vein-stuff; that under B, a sample of soft, porous, hand-picked gossan. In other places, amorphous hæmatite accompanies the sulphides, while magnetite has been found in at least one place; the material contained: Cu 7·6 per cent.; Fe_2O_3 31 per cent.; Fe_3O_4 28 per cent.

Other varieties of ore from the same district are cupriferous pyrites (1 per cent. Cu) and complex sulphides, a specimen showing 8·8 per cent. Cu, 5 per cent. Zn, and nearly as much lead. All these ores contain silver and generally gold. The maximum amounts observed were 1·09 oz. Au and 26·9 oz. Ag. per ton of 2240 lb.

The deposits have been worked in the past, but nothing is done at present. The place is of easy access, coal and metamorphic limestone are plentiful in the neighbourhood, while the river is quite near; but the villagers of the valley are fiercely anti-foreign, and oppose the intrusion of any outsiders, even Chinese. However, small quantities of ore are smelted locally by heating a few pounds at a time in pots, when the oxide and sulphide of copper react on one another. The metal so obtained is made into tools and various implements.

Not far from the spot where the Hankow-Peking railway crosses the mountain range along the N.E. border of Hu-peh, cupriferous pyrites is met with. Specimens assayed 4 per cent. Cu and 1 oz. of gold per ton. Nothing has yet been done in that district.

A unique native copper ore occurs near Choo-shan, N.W. Hu-peh, in what is said to be a most inaccessible spot in the mountains. I had a specimen weighing 80 lbs.; its colour was almost pure white except for the short thick ramifications of metallic copper visible on the surface. When treated with dilute hydrochloric acid, the entire non-metallic part which consists of calcite containing some soluble copper dissolves, leaving a sponge-like skeleton of metal:—Native copper, 65·8 per cent.; Soluble CuO, 4·1 per cent.; $CaCO_3$ by difference 30·1 per cent.

Miscellaneous deposits of Hu-peh.

Complex sulphide ores are found near Foo-chih, on the border of Kiang-si province. Metals were found to be present in the following proportions:—Pb, 23·4 per cent.; Cu, 2·0 per cent.; Zn, 19·3 per cent.; As, 1·08 per cent.; Sb, nil.

A specimen of galena from the district S.W. of I-chang assayed 66·8 per cent. Pb and 36·9 oz. Ag. The eastern and western parts of the province south of the Yang-tsze are almost certain to abound in mineral deposits, though little is known concerning them.

Coal and Iron.

In conclusion I will briefly mention the occurrence of coal and iron ore. Anthracite and bituminous coal are plentiful in Hu-nan, and numerous small mines have been worked for a long time by the natives. Specular iron is also found.

An important colliery is in operation at Wong-tsze-kong, near Ta-yeh. Here is also found a mountain of iron ore which is quarried and smelted in the Han-yang Iron and Steel Works; the coke used in smelting is derived from the coal mined at the Ping-hsiang Colliery which although situated in Kiang-si province is only accessible from Hu-nan.

The Ta-yeh iron mine, the Ping-hsiang colliery, and the Han-yang smelting works are under one management, assisted by a European staff. A more detailed description of this important concern will be found in the "Mining Journal," October 8th, 1910, Supplement, p. iv.

Meeting held at Burlington House on Monday, 5th May, 1913.

MR. W. F. REID IN THE CHAIR.

SOME REACTIONS OF HYDRAZINE NITRATE.

BY W. R. E. HODGKINSON.

About 1902 a series of experiments was commenced to overcome a difficulty in connection with the employment of copper driving-bands on gun projectiles and the cupro-nickel envelope of bullets for rifled small arms. Guns especially become fouled on parts of the rifling of the bore—coated with copper—which may increase to an extent sufficient to interfere with accurate shooting and may have serious effects on the gun.

In these early experiments, guided by theory, a solvent for copper and nickel but inactive towards iron, was sought for. Ammonia in the presence of air suggested itself, but an ammonacial solution of an amide—formamide or the like—seemed likely to be and proved a better solvent than ammonia alone, but also depended on its action either on the absorption of atmospheric oxygen or on the presence of a small amount of a carrier such as cuprous chloride. Quicker effects were obtained by the use of some oxy-salts, as nitrate, permanganate, persulphate, chromate, some peroxides, picric acid, or nitrophenol in conjunction with the ammoniacal solution of the amide. Practically any amide, if soluble enough, can act as a solvent of copper under these circumstances.

As the activity of these oxy-salt solutions ceases with the exhaustion of the oxy-salt, an electrolytic process was devised in which an ammoniacal amide solution was the electrolyte, and later it was found that an ammonium salt of certain organic acids might be used in the presence of excess of ammonia and the complete absence of halogens, alkalis, and some other substances as solvent for copper and nickel but completely without action on iron.

In the course of these experiments it was noticed that ammonium nitrate in water solution and also in a melted state exerted a strongly solvent action on a number of metals. Zinc, cadmium, magnesium—in this order—were found to dissolve with moderate rapidity in a cold (10°—16° C.) nearly saturated solution of ammonium nitrate with scarcely any gas evolution. Iron, aluminium, lead, tin, bismuth, silver, and mercury showed no or very little action after days of contact. Copper, nickel, cobalt, and some of their alloys were slowly attacked during the same time.

Ammonium nitrate in the melted state at a temperature of about 160°—165° reacted with zinc, cadmium, copper, cobalt, and nickel, and the reaction became violent if the metal was in a fine state of division or the temperature rose 10° or 20° above the melting-point.

Whether in the melted state or in solution the first stage of the reaction consists in the liberation of a small amount of ammonia.

The next stage is possibly the displacement of nitric hydrogen which is then taken up by adjacent molecules of nitrate, resulting in the formation of some nitrite. A third stage, produced by heating the solution of nitrate with the metal, is the reaction between the nitrite so produced and the ammonia of the original salt. that is, the evolution of nitrogen. This might also be due to the decomposition of ammonium nitrite by the heating.

The final products in solution when the substances were not heated consisted of nitrite of the metal as well as nitrate and excess of ammonia salt unacted upon. Possibly a double salt of the type

$$HNO_3,NH_2.Zn.\ NH_2,HNO_2,$$

is produced.

Analyses of these products showed that approximately the acidic portion was half nitric and half nitrous. It was very difficult to obtain anything like a pure salt by recrystallisation, either from alcohol, acetone or water.

All the compounds obtained by the action of metals on the aqueous solution of ammonium nitrate rapidly absorbed CO_2 from the air. This was especially noticeable in the case of the zinc and cadmium products.

A strongly ammoniacal solution of ammonium nitrate has been used for the evaluation of galvanised iron from which all the zinc is dissolved, that in the facing layer and that in the zinc iron alloy; the alloyed-iron being converted on air contact or by later addition of a persulphate, into ferric hydroxide.

Nitrates of bases as aniline, toluidine, behave both in solution and when fused with most of the metals mentioned, but more especially with zinc, in a manner perfectly analogous to ammonium nitrate.

With *p*-toluidine nitrate and zinc, there were produced toluene, cresol, zinc nitrate, and very little tarry unseparated matters. With aniline nitrate and cadmium below 10° C. aniline, benzene, and a little diazoaminobenzene.

It seemed probable from the foregoing that hydrazine nitrate might be more active than the ammonium salt and give some azides as by-products. In 1907 some hydrazine was made and absorbed in excess of nitric acid. Two salts were found to exist. The acid one was extremely deliquescent and decomposed slowly at ordinary temperatures in air, giving off nitric acid. The mono-nitrate resulting was found to crystallise well, although very soluble in water and deliquescent, but not so markedly so as the ammonium salt under similar conditions.

When Dr. Raschig visited this Society about two years ago I induced him to make for me some quantity of the mono-nitrate. This salt was purified by the addition of alcohol to a strong aqueous solution, the salt then crystallising out in an almost perfectly pure state.

Hydrazine nitrate melts without any decomposition at 70° C. and may be kept at 100° C. for a long time without change. When heated to about 200° C. in a vacuum tube the gases collected agreed almost exactly with the scheme, $4NH_2.NH_2.HNO_3 = 5N_2 + 2NO + 10H_2O$.

Heated in a closed vessel the nitrate explodes very violently, but under ordinary pressure merely burns rapidly. Contact with many kinds of oxidising agents, as permanganate, chromate, peroxides, causes inflammation.

A solution of this nitrate was found not to be active in contact with those metals which in the case of ammonium nitrate showed most marked activity. In fact, in most cases little or only very slight action has been observed. Possibly this slight action noticed in a few cases, as with zinc, may be due to the formation of a small quantity of ammonium nitrate.

The fused salt was found to be more active than ammonium nitrate but scarcely in the same manner. Zinc, copper, and most other metals causing a flaming decomposition at temperatures little above the melting-point of the salt—70° C.

Oxides, sulphides, nitrides, and carbides were found to behave in a similar manner, that is, simple inflammation with some oxidation of the substances in most cases. The two metals, cobalt and nickel, are to be obtained in two forms; one in which they have been completely melted and then worked in some manner, and in rough cubes or irregularly shaped pieces not completely fused through, just as they have been left by reduction from their oxides by some carbonaceous material.

Cobalt or nickel that had been thoroughly melted and worked into wire or plate behaved when added to melted hydrazine nitrate like all the other metals tried, viz., became a little oxidised and the hydrazine salt flared off.

On melting some of the nitrate and adding fragments of "commercial cube cobalt" a very violent action commenced, followed almost immediately by a severe explosion. This experiment has been repeated many times and it has been observed that not all the pieces or cubes in a 2 lb. lot of cobalt would explode, but a considerable percentage (about 40 per cent.). With similar nickel cubes the percentage showing this action was less—about 20 per cent. Lots obtained at different times showed like behaviour and variation. Pieces showing a light grey coloured fracture seemed as a rule the most active.

Nickel and cobalt reduced from the oxides by heating in hydrogen failed to produce any explosion.

One explanation of this action appears reasonable, that owing to some peculiar structure or state of division of the metal in the interior of these "cubes" some small amount of azide is formed, which on decomposing detonates some of the remaining hydrazine nitrate. Still this cannot be considered quite conclusive, for many times some unchanged nitrate was found spotted on the surrounding steel cylinder.

Also in many cases the effect was out of proportion to the quantity of nitrate employed and was, in fact, more violent when larger quantities of "active" metal was used.

I am much indebted to Lieut. Gibson, R.A., for many analyses and other help.

Discussion.

Mr. W. F. **Reid** said that the new reaction which had been shown to them was certainly one of a most mysterious nature and one that presented a great future. As one who had had a great deal to do with explosives, he would advise them not to try it in their laboratory until they had gained some experience in those matters. It was apparently very easy to make an experiment of that kind; but they wanted to know exactly the force of the material they were dealing with before they could safely carry out such an experiment.

Dr. E. **Feilmann** said that there might be a possibility that the curious behaviour of the lump of nickel was due to occluded gas. He knew from experience how very common it was for such metals produced at high temperatures to contain a considerable amount of gas. It might be that acetylene or some other occluded gas would account to some extent for the mystery.

Mr. T. C. **Cloud** said that nickel cubes consisted of a square shell of somewhat densely compact nickel enclosing a more or less spongy mass of the metal. It might be that the large amount of surface exposed in the interior brought about a very rapid decomposition with a large and sudden evolution of gas. That would not happen in the case of the rolled and dense form of the metal.

Mr. T. **Tyrer** said he thought the observations of the previous speaker accounted very largely for some of the phenomena they had seen.

Professor **Hodgkinson**, in reply, said that, judging from his experiments, he did not think the cube form of nickel and cobalt contained any more gas than usual. It contained a little carbon in the form carbide, perhaps 1 per cent.; but he had tried carbide of nickel and it had no more action than the zinc. Nitrides of many metals could be made by heating them in ammonia. Nitrides when brought in contact with hydrazine nitrate, were merely converted into oxides. The metal was more porous than finely divided. At first he had seen it was porous, so he had reduced oxide of cobalt and oxide of nickel with hydrogen and cooled them carefully and they also had not exploded.

Manchester Section.

Joint Meeting with the Faraday Society held on Friday, April 4th, 1913.

ELECTROLYTIC METHODS FOR PREVENTING THE CORROSION OF METALS.

BY PROF. W. W. HALDANE GEE, M.SC.TECH., B.SC.

(Abstract.)

The corrosion of metals can be lessened or prevented in two ways: (1) By connecting the metal to be protected to a more electro-positive metal, so that a primary cell is produced; (2) by making the metal to be protected the cathode in an electrolytic cell supplied by an external electrical pressure. Various types of primary cell arrangements that could be employed in practice were classified. The efficiency of the cell for protection will depend on the current density at the cathode, and this will be controlled by the resistance of the cell and the effective voltage. The importance of overvoltage in determining the effective voltage was discussed. The history of Sir Humphry Davy's application of zinc and iron protection for the prevention of the corrosion of the copper sheathing of ships, and subsequent inventions for the protection of condensers and pipes were detailed. The patents of Harris and Anderson, in which aluminium alloys are used for the prevention of the corrosion of condenser tubes, were shown to be primary cell methods. The use of zinc in boilers involves a knowledge of the electrolytic resistance of the boiler waters and the effective voltage at temperatures from 150°—200° C., concerning

which there is great need of experimental data. The amount of zinc used in some marine boilers is as great as from 400—600 lb. of rolled zinc per annum. If the zinc is efficient in producing electrical currents then the average current may be from 17 to 25 amperes. It is obvious that such currents would be obtained much more economically by the use of a dynamo. The direct use of electrical currents has been the basis of a number of patents. Those of Mr. Elliott Cumberland were especially described. Iron anodes are placed in the water of the boiler, which latter is made the cathode. A low voltage of supply provided by a small motor-generator is used. The method has proved effective not only in preventing corrosion, but also in removing scale from the heating surface and preventing its formation. Experiments carried out at the Manchester School of Technology have shown that the current densities neecessary to protect iron, copper, and other metals from the corrosion of fresh and salt water are of low value, and hence in the cases of boilers and condensers the annual cost of the electrical energy required is a small item. The chief cost will be in the renewal of anodes. Harris and Anderson have also applied electrical currents for the prevention of the corrosion of condensers. They find that a condenser with a cooling surface of 1025 sq. ft. requires only 2 volts and 2 amperes, and the special anodes used by them cost from £3 5s. per 1000 sq. ft. per annum. The use of electrical currents may also be applied in chemical works to prevent the corrosion of metallic screens and vessels from acid liquids.

THE NATURE OF OVERVOLTAGE.

BY J. I. CRABTREE, M.SC., A.I.C.

(Abstract.)

It is well known that the voltage necessary to decompose a dilute acid electrolytically varies with the nature of the electrodes employed, that is, the metals involved possess different decomposition voltages for that acid, which are invariably in excess of that of platinised platinum. Let E_m and E_p be the decomposition voltages of a given acid with electrodes of a metal, m, and platinised platinum respectively. Then $E_m = E_p + \eta$. This excess value of the decomposition voltage η, over and above that observed with a platinised platinum electrode, is termed the "overvoltage" of that particular electrode. According as the gas separated occurs at the anode or cathode, we speak of the "anodic" or "cathodic" overvoltage. Le Blanc defines overvoltage as the excess of the back e.m.f. set up at the electrode over that given by a platinised platinum plate under identical conditions.

According to Tafel, the values for the cathodic overvoltage given by the different metals may be arranged in the following order of magnitude :—

Hg ⟶ Pb ⟶ Cd ⟶ Sn ⟶ Bi ⟶ Au ⟶ Ni -- Pt.

Cathodic overvoltage is influenced largely by the physical condition of the metal, the degree of hardness, and previous treatment, such as electro-deposition at different current densities.

The physical nature of the metal appears to affect other properties which appear to be allied to overvoltage. Thus Graham found that the amount of hydrogen occluded by platinum depends on the texture of the sample employed, and on its previous treatment. Platinum sponge adsorbs ten times the quantity of gas which an equal amount of massive platinum adsorbs.

The effect of thickness on overvoltage has been investigated by Pring by depositing films of metal of varying thicknesses on cathodes of different metals, and finding the overvoltage of the duplicate plate thus formed. Taking any one case, say lead deposited electrolytically on a nickel cathode, it was found that the overvoltage rose with increasing thickness of lead until a maximum was reached. This was assumed to be that thickness up to which the gas adsorbed by the electrode exerted an effect on the polarisation voltage. In the case of platinum this depth of metal appears to be approximately 4×10^{-6} mm.

In this connection the author made a series of experiments by "sputtering" a metal on to a glass electrode, by placing the same near the anode (of the same metal as was required on the glass) in an exhausted cathode ray tube and passing a strong discharge.

Excellent deposits of microscopic thickness were obtained, but these invariably peeled off the glass when employed in the electrolytic vessel.

Application of overvoltage.—Of the numerous instances where a particular property of a metal may be attributed to its overvoltage may be mentioned the effect of the nature of the electrode employed on the efficiency of an electrolytic oxidation or reduction process; and the possibility of separating two metals in solutions, whose decomposition voltages are almost equal, by choosing as cathode a metal which gives to hydrogen a decomposition voltage intermediate between that of the two metals to be separated.

In the case of the corrosion of a metal its overvoltage may be of importance as either: (a) Having a tendency to retard the deposition of hydrogen or oxygen on its surface, which might either assist or prevent corrosion; (b) By setting up a high back e.m.f., which would diminish the effect of a decomposing current in cases of corrosion due to electrolysis; (c) by assisting or preventing the solution of a metal. The part played by overvoltage in this case is made clear by considering the condition which must hold in order that a metal may dissolve in an acid and evolve hydrogen. If the overvoltage is large, no solution of the metal can occur. This is apparent with amalgamated zinc, where, owing to the high overvoltage of the mercury, no solution of the zinc takes place, the alloy assuming the overvoltage of the external metal. Similarly iron covered with zinc or tin does not rust, since the overvoltage is raised.

Zinc covered with platinum dissolves readily, since the overvoltage is lowered. As a means of preventing corrosion, and therefore of raising the overvoltage of the metal in question, it is necessary to coat this with either lead, tin, cadmium, or zinc, which metals have high overvoltages. The reason for the extensive employment of zinc and tin for this purpose is therefore apparent.

AN ELECTROLYTIC THEORY OF THE CORROSION OF IRON.

BY B. LAMBERT.

(See this Journal, April 30th, 1912, page 428.)

Discussion.

Mr. J. H. **Silverwood** explained, by means of lantern slides, the advantage of protector blocks in water tube ends of condensers, every tube being in electric contact with the tube plates. By this means corrosive action, instead of attacking the tubes, travelled to the tube plate, and so on to the protector block which, being an alloy electropositive to the material of which the tubes were made, took the corrosion instead of the tubes. The cost of upkeep of the tube protector was about 2d. per indicated horse power per annum. In the case of a steamer plying between St. John's, Halifax, and Manchester, the owners were re-tubing the condenser, top half one year, and the bottom half the following year, there being some 800 tubes in each half, and five to six tubes corroding each journey. A protective system had been installed for about two years, and so far he had not heard that a single tube had failed. Another protective system, working on the River Mersey, gave a saving of about 93 per cent. of the tubes. Corrosion took place chiefly on steamers plying on estuary water, or in the case of surface condensers in electricity works or others which were using estuary water, but some cases were difficult to explain. The steamers "Strathmore" and "Minerva," plying on the Clyde, practically performed the same duties, so that apparently the conditions were similar. In the case of the "Strathmore," after she had been in service for six months, half a dozen tubes failed, and then the rest followed very quickly, so a protective system was applied, and a certain amount of corrosion was arrested. None of the "Minerva's" tubes failed, and in order to ascertain the reason about 40 tubes were borrowed from the "Minerva" and placed in the

"Strathmore," and in six weeks the first of the borrowed tubes "holed"; and in about three months, half of them had to be plugged up. The tubes were made of exactly the same metal as those in the "Minerva," came from the same place, and were drawn at the same time. Another illustration of corrosion was supplied by three condensers belonging to the Dublin Corporation, two being badly affected, and the third remaining immune.

Mr. S. B. Freeman exhibited certain specimens of corroded condenser tubes taken out of steamers plying in both deep water and in estuary water, and showed that the resulting effect was to so weaken the tubes that they could be easily broken by the hand. The tubes were thoroughly good tubes when installed in the vessels. The ends of the tubes showed a dusty red colour indicating that the zinc had oxidised out. In some instances corrosion had taken place in the inside of the tubes, the outer surface being unaffected owing to not coming in contact with the salt water. The greatest mischief took place when vessels were lying in port and there was a certain amount of still water lying in the tubes and pipes. In some cases, perhaps, owing to a difference in manufacture, corrosion took place in spots instead of large areas of the pipes. Manchester Ship Canal water was excellent to preserve iron and steel, for a steel pontoon, which had lain for 17 years in it, at the end of that period was only slightly corroded. It was quite practicable to use the canal water as feed for ships' boilers, though on the other hand it had very deleterious effects when used as circulating water through condensers and the like.

Mr. E. L. Rhead also exhibited some specimens of corroded wrought iron. Dr. Rosenhain, he said, had already remarked upon the possibility of the corrosion of wrought iron proceeding as far as the slag film which coated the fibres of the metal. In the production of wrought iron the material was obtained in a spongy form consisting of separate grains adhering together, the whole of the sponge being filled with slag consisting of silicate of iron. The material was hammered in order to expel the slag and to weld the grains of iron together, but it was possible for a portion of the slag to remain and, when the iron was rolled, form a coating on the fibres. The corrosion, therefore, might possibly proceed as far as the coating, and then be arrested by the more or less continuous film of slag that was then met. He produced two specimens taken from wet gas meters illustrating this action and demonstrating the superiority of iron under these conditions.

In most cases the difficulties encountered were not those in which the corrosion was uniform, but those in which it was confined to very small local areas. These were the most difficult cases and he would like to know if possible how far electrolytic protection was likely to prevent local corrosion.

Mr. W. Thomson suggested that the presence of soda as caustic or carbonate in a boiler had a considerable effect in preventing rust. He had a sample of a bright cube of iron put into a bottle containing a solution of sodium carbonate by his late partner, Dr. Crace-Calvert about 30 or 40 years previously. The sample was as bright after that time as the day on which it was put in. Was it not possible that the preservative action of the electric current on the iron of boilers was due largely to the caustic or carbonate of soda which resulted therefrom? Another point which he would suggest was to find why silicon iron did not rust at all. This alloy was about as brittle as pot and was not of much use where strength was required, but a study of it might be useful in arriving at some satisfactory conclusion as to the nature of rusting and corrosion.

Dr. S. Wolff inquired whether the effect of strain on the various metals used in the engineering industries would tend to promote corrosion. He also produced some samples of corroded copper Grinnell sprinklers which had been forwarded to him from India, where they had been used in sheds erected for the purpose of storing jute and tea. The sheds were built on the seaside, and during the day the atmosphere was very hot whereas at night it became cold. It was possible that the difference in temperatures might aid the corrosion shown, but he ascribed it to atmospheric influence. There were about 4,000 sprinklers used in the sheds in question and the corrosion only attacked the vital parts where different metals were in contact, namely, fusible metal and copper together with a name plate made of gun metal and a diaphragm. He had come to the conclusion that the salt in the atmosphere was the cause of the corrosion, as the interior portions of the sprinkler were unaffected.

Dr. W. Rosenhain said that except in very special cases metal was never strictly speaking, physically homogeneous. It did not follow that the presence of impurities must produce want of homogeneity. The great majority of metals possessed a considerable power of holding in solid solution, small quantities of nearly every other metal, metalloid, and gas. Therefore, he could not support the opinion that the explanation of corrodibility as due to want of homogeneity in slightly impure metals.

The difference in corrodibility between steel and wrought iron might be due to the state of molecular aggregation of iron reduced in the solid state being different from that of iron which had been melted.

Professor Haldane Gee had referred to the peculiarity of aluminium and of some aluminium alloys in forming a protective film which gave rise to a temporary reversal of their position in the electro-chemical series. He thought, however, that it would be rash to conclude that all aluminium alloys possessed this property; in fact, he had recently found that alloys of aluminium, zinc, and copper, for instance, behaved in a way which did not suggest the formation of such protective films, while on the other hand, alloys of aluminium and copper, with a small amount of manganese, did tend to form a protective coating.

Some alloys containing about 10 per cent. of aluminium, the rest being copper, exhibit a remarkable resistance to corrosion; samples of these alloys had been exposed to the sea for many years without suffering any appreciable loss. Since aluminium itself was regarded as exceptionally corrodible its presence as an impurity in copper on the basis of the theory that impurities facilitated corrosion would lead one to expect a very different result. On the other hand, zinc in solid solution in copper was sometimes removed completely with the result that the material became rotten.

Mr. E. Ardern said that accepting the electrolytic theory of corrosion, it would appear that the remarks of Mr. Freeman, in regard to the effect of the variation of the composition of the metals, touched upon the crux of the question. His own experience supported this idea, *e.g.*, he had under observation two condensers in the same steamship, one of which was tubed with brass tubes of the following composition: 68·3 per cent. copper and 31·5 per cent. zinc and the other with brass tubes containing 67·8 per cent. copper, 31·2 per cent. zinc, and 0·8 per cent. iron. In the case of the former condenser, practically no trouble had been experienced, while in the latter the tubes had frequently to be replaced owing to leakage caused by pitting of the metal. In this case, therefore, the presence of less than 1 per cent. of iron had apparently very considerable influence on the question of corrosion. Experiments made some years ago indicated that nickel tubes were most resistant to corrosion, but, of course, they were rather expensive. Mr. Ardern exhibited a seriously pitted steel boiler tube (taken from a locomotive) which had only been in use four months, working with pure towns water The explanation given by the makers of the tube was that the trouble was due to the segregation of manganese sulphide.

Professor Haldane Gee said that the more complete account of the properties of the aluminium alloys given by Dr. Rosenhain would be a valuable guide in selecting the kind of alloy that should be used as a protector against corrosion. In reply to Mr. Rhead, experiments had been in progress at the School of Technology for some time directed to the question of how far a composite metal (that is made up of positive and negative substances in good electrical contact) could be protected from corrosion when made the cathode in various electrolytes. In chemical works there was much corrosion, which might be avoided or diminished, by applying some of the principles that had been explained.

Yorkshire Section.

Meeting held at the Queen's Hotel, Leeds, on Monday, April 14th, 1913.

MR. G. WARD IN THE CHAIR.

RAPID METHOD OF TESTING SUCTION GAS FUELS FOR LIABILITY TO CLOG GAS ENGINE VALVES.

BY WILLIAM McD. MACKEY, F.I.C., M.I.M.E.

There are two sources of trouble experienced with fuel used for suction gas: (1) that the ash clinkers; (2) that a tarry deposit forms on the valves; it is to test for liability to the second that the following rapid method has been devised.

Almost any solid fuel, and many substances that are not fuels properly so called, can be used for the production of suction gas, but the fuels usually employed are anthracite and coke or a mixture of the two. Though, no doubt, with an extension of the scrubbing plant attached to a gas engine the difficulty as regards tarry deposit can be overcome, yet in practice suction gas engines have become to a large extent standardised in their parts and in the scrubbing plant attached to them, so that a fuel to be sold generally must fulfil certain conditions, one of which is that it should not, under ordinary conditions, give a deposit on the valves of the engine. The danger from such a deposit is that when the engine stands, say overnight or over the week end, the tar solidifies and gives trouble, sometimes even resulting in the breaking of some of the gear if the man in charge is at all careless in trying his valves before starting.

No doubt by a rather elaborate examination of the tar given off when a fuel is heated it would be possible to form an opinion as to the suitability or otherwise of a fuel for suction gas purposes, but no rapid method was available. It is not the quantity of volatile matter (exclusive of water) that a fuel gives on heating that is of importance, but its nature. Thus a badly burnt coke with three or four per cent. of volatile matter will give trouble whereas an anthracite with double the amount may not.

Working on fuels that had been proved good or bad in practice the following test was devised. It is really a modification of the method recommended by the American Committee on coal analysis for the determination of volatile matter. In this case a platinum crucible 1½ inch high, 1⅜ inch diameter at top, and 1 inch diameter at bottom was used; in this, 3 grms. of the powdered fuel was placed and the top of the crucible covered by a clock glass (4 inches diameter) containing 20 c.c. of water. The crucible was heated by an ordinary Bunsen burner, but to prevent the flame touching the clock glass the crucible was supported in a hole made in a piece of asbestos cardboard. The position of the crucible in the flame was such that the bottom was just above the tip of the inner flame. Time of heating, seven minutes.

Working under these conditions, in the case of a good fuel no tarry deposit is obtained, only a little whitish powder or stain on the glass (probably mostly sulphur) whilst in the case of a bad fuel a distinct tarry deposit is obtained.

To give the results of some experiments (the percentage of volatile matter given in each case is exclusive of water):—

(1) Coke, badly burnt, which had given bad results in practice. Volatile matter, 3·98 per cent. Thick tarry deposit on watch glass. (2) Well-burnt coke, which had given good results in practice. Volatile matter, 1·06 per cent. No tarry deposit.

In the case of No. 1, the percentage of volatile matter would in itself be an indication that the coke would give trouble (probably any coke showing only one per cent. of volatile matter may be considered safe), but it is to be noted that the quantity of volatile matter in the bad coke is less than that in an anthracite which gives no trouble whatever in respect of tar in the valves.

I should have liked to make experiments on more samples of coke, but I had to confine myself to cokes (and anthracites also) of which I knew the behaviour in practice.

Going on to anthracites:—

(3) An anthracite which had given trouble. Volatile matter, 9·18 per cent. Decided tarry deposit.

The anthracites containing the percentages of volatile matter mentioned below, were reported as giving no trouble, and with the exception of No. 6 gave no tarry deposit on the clock glass:—

(4) 5·37; (5) 5·48 (Welsh); (6) 6·50 (Scotch); (7) 7·28 (Welsh); (8) 6·38 (Welsh); (9) 5·60 per cent. (Welsh). (I believe Nos. 3 and 4 were Scotch anthracites.)

No. 6 gave a slight, but distinct tarry deposit on the clock glass, whilst No. 7, which contained more volatile matter, gave none, and though both anthracites were reported as giving no trouble in practice, yet there can be no doubt that No. 7 is the safer anthracite to use.

The 3 grms. of powdered fuel used for the experiment may be dried, but I prefer to make the experiment on the fuel as received; for one reason, it saves trouble, and also the 20 c.c. of water placed in the clock glass is heated almost to boiling before the experiment is finished; it thus fulfils a double object, in the first instance condensing the tarry matter (which seems to come off during an early stage of the heating) and afterwards serving to evaporate off the small quantity of water which condenses along with the tar on the lower surface of the clock glass.

My thanks are due to Messrs. The Campbell Gas Engine Co., Ltd., and James Hargreaves and Sons for providing me with samples of known behaviour in practice.

Discussion.

Mr. G. Ward said that one would expect the highest tarry matter to be given by the coke with the highest volatile matter, and it was strange that No. 6 should prove to be so good.

Mr. T. Fairley asked if these results had been correlated with estimations of the calorific values. It was possible that some relationship might exist. The approximately constant ratio of 1 : 1 between the volatile and total sulphur in coals from this district, made the estimation of the latter sufficient for most purposes. He had noticed an arithmetical relationship between the amounts of arsenic and sulphur in coals at the time when so much attention was directed towards the presence of arsenic in many materials. This arsenic was derived from pryites in the coal and amounted to approximately one per cent., of the total sulphur.

Mr. G. Ward supposed that the relation of volatile sulphur to total sulphur depended on the constituents of the ash.

Mr. T. Fairley said the relationship would probably be different in coals from other parts of the world.

Mr. Mackey gave figures for a Kent coal showing ash, 23 per cent.; sulphur, 1 per cent.; the ratio of ash to sulphur in West Yorkshire coals being usually about 10 : 1.

Mr. T. Fairley pointed out that the Kent coal lay under chalk and so the ash would probably be more basic.

Mr. F. W. Richardson asked if any attempt had been made to distil these cokes or anthracites *in vacuo* or in an inert gas. Probably the quality of the volatile matter was more important than the quantity, and if distilled, say in nitrogen, some idea might possibly be obtained as to the real nature of the volatile matter.

Mr. W. Marsden had had to deal with trouble in suction gas plants and engines. Coals which were recommended frequently did not give clean gas. Unless some evidence, of the kind given by Mr. Mackey's test, were obtainable, it was impossible to find out what was wrong when trouble occurred or to get distinct warning of trouble and so provide against it in the design of the plant. Sulphur only caused trouble when mixed in some way with water, and difficulty was avoided so long as the temperature was kept up. It was often the custom to turn water into the exhaust of a gas engine to deaden the sound, for which purpose it could be made very effective, but if sulphur were present this caused corrosion of the pipes in a very short time. Tar was the great trouble. If one could get indication that a coal was beyond the danger limit it would be very valuable, for frequently, of two coals with the same percentage of volatile matter, one would give no trouble at all, whilst the other choked up the valves.

Mr. Mackey said the calorific values had not been found. He thought those with higher percentages of tarry matter would have higher calorific values. Mr. Richardson's suggestion had no doubt been carried out by other investigators. What he had required was a rapid, reliable test and not anything elaborate. The one described in the paper met these needs, and he now felt confidence in giving an opinion on an anthracite or coke as to whether or not it would give trouble as regards tar when used for suction gas engine fuel. Sulphur caused no trouble in engine plant so long as the latter was kept dry and warm. These conditions were supplied when running, but plant which stood idle was liable to deteriorate owing to the moisture taken up from the air. The sulphur probably gave sulphuric anhydride and then sulphuric acid and it was these products which really caused the trouble.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Separation of gases or volatile substances from liquids. O. Söderlund, London. Eng. Pat. 28,609, Dec. 19, 1911.

The liquid is subjected to the action of a circulating current of a gas, such as air, to displace the dissolved gas or volatile substance and carry it to an absorber, in which precautions, such as control of the temperature and of the concentration of the absorbent, are taken to avoid removal of the vapour of the liquid from the circulating gas current. The process may be used in conjunction with an apparatus such as that described in Eng. Pat. 12,462 of 1911 (this J., 1912, 971).—H. H.

Distillation, fractionation or refining of liquids [*petroleum, tar, etc.*]. S. Everett, London. Eng. Pat. 7422, March 27, 1912.

The still into which the liquid to be distilled flows, and which consists of a series of superposed convex chambers, each provided with central openings surmounted by a convex hood, is enclosed in a casing from which it is spaced apart. The whole is enclosed in a second outer casing, heated by a gas-fired furnace. The vapour or gas, which it is intended to pass up the column, to carry away the vapours, is first circulated round the space between the still proper and the casing, so that both the sides and ends of the still are maintained at a constant temperature. —W. H. C.

Coal, ore and other granular and like materials; Machines for washing or separating ——. R. S. Benson, Middleton St. George, Durham, and Head, Wrightson and Co., Thornaby-on-Tees, Yorks. Eng. Pat. 10,929, May 8. 1912.

In machines of the type described in Eng. Pats. 21,253 of 1909, 24,269 of 1910, and 22,813 of 1911 (this J., 1911, 1004; 1912, 1071), in which an inclined trough is reciprocated so as to work the material towards the upper end, and a stream of water is caused to flow down the trough, an inclined perforated feeding trough is arranged above the washing trough, and is reciprocated so that the material is worked towards its upper end. The perforations serve to grade the material, which falls on to the washing trough. A series of water-feeds, adjusted to suit the grades of material, are arranged between the feeding and washing troughs.—A. T. L.

Ice-making and refrigerating plant. J. L. Musgrave and R. Crittall and Co., Ltd., London. Eng. Pat. 18,182, Aug. 7, 1912.

An ammonia absorption cooling plant is fitted with two chambers serving alternately for generating and receiving the ammonia vapour, and with an intermediate cooling chamber containing three coils communicating respectively with the chambers and with an expansion coil by which cooling of external objects is effected. The generating and receiving chambers are both fitted with heating and cooling coils having automatically controlled valves arranged in such a manner that the chamber acting as a generator is being heated while the other chamber is being cooled, the vapour passing from one to the other through the cooling coil in the intermediate chamber and then through the expansion coil. As soon as the pressure falls in the generator chamber owing to the reduced evolution of ammonia, an automatic electrical device reverses the valves so that the receiver now becomes the generator and *vice versa*, the action thus being continuous.—H. H.

Furnaces, kilns, or like apparatus; Heating of ——. Georgs-Marien-Bergwerks- und Hütten Verein, Akt.-Ges., Osnabrück, Germany. Eng. Pat. 26,695, Nov. 20, 1912. Under Int. Conv., Dec. 1, 1911.

In furnaces, kilns, etc., which are heated by means of waste gas from blast furnaces, an auxiliary heating arrangement fed with liquid or gaseous fuel is provided, in addition to the main or waste gas burners, in order that the temperature may be equalised when the supply of waste gas is deficient.—H. H.

Furnace; Rotary ——. K. Dieterichs. Fr. Pat. 450,146, Nov. 4, 1912. Under Int. Conv., Nov. 4, 1911.

The heated material discharged from rotary furnaces is cooled, and the air supply heated, by means of a number of discharge tubes arranged outside the furnace and parallel to the axis thereof, and connected with the furnace by short bent tubes arranged in such a manner that the material in the discharge tubes does not tend to fall back into the furnace as the furnace rotates. The discharge tubes are fitted with Archimedian screws to carry away the heated material.—H. H.

Centrifugal separators. J. Meys, Hennef an der Sieg, Germany. Eng. Pat. 29,983, Dec. 30, 1912.

The rotary member of centrifugal milk and like separators is formed of a large number of thin vertical curved plates threaded upon two horizontal rings having removable sections to facilitate the attachment of the plates.—H. H.

Centrifugal separator. H. C. Groves, Woodward, Okla. U.S. Pat. 1,057,237, March 25, 1913.

The material is fed by a hopper at the top of the apparatus on to a rotary distributor, which projects it with a whirling motion into a space between two fixed conical surfaces, the inner surface being fitted with blades to delay the downward movement. At the periphery of the inner cone the material meets a blast of air produced by a central fan situated beneath the cone, causing a separation of the heavier and lighter materials which fall respectively into an inverted cone situated beneath and overlapping the inner cone, and into an annular space between this inverted cone and the outer casing of the apparatus. —H. H.

Separation of liquid and solid bodies; Turbine for the continuous ——. W. H. Uhland Ges. m. b. H. Fr. Pat. 449,616, Oct. 19, 1912.

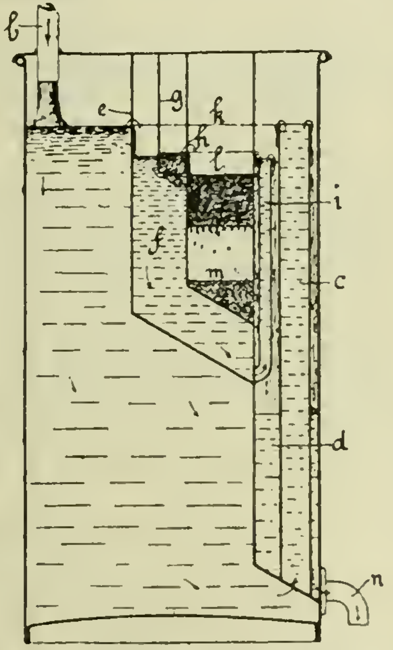
A centrifugal separator is constructed in the form of a double truncated cone having a screw blade fitted in the annular space between the cones. The material enters the inner cone and passes into the annular space, the liquid being delivered through openings at the smaller end of the outer cone and the solid material collecting round the larger end from which it is discharged by the periodical opening of ports therein. The ports, which are controlled by valve plates carried on the end plate of the cone, and operated by cams or tappets, are only opened momentarily so that the liquid does not have time to escape with the solid.—H. H.

Dryer. C. E. Geiger, Assignor to W. E. Koop and G. W. Fiske, Louisville, Ky. U.S. Pat. 1,052,660, Feb. 11, 1913.

The material is introduced at one end of a cylinder rotating on a nearly horizontal axis and containing a number of steam-heated pipes, which are arranged parallel to the axis of the cylinder and rotate therewith. The smaller particles pass through between the pipes and are discharged from openings at the end of the cylinder, while the larger particles are discharged through openings in the hollow disc or head carrying the steam pipes by means of deflector blades mounted thereon.—H. H.

Separating liquids of different specific gravity, especially oil and water; Device for ——. O. Bühring und Wagner Ges.m.b.H. Ger. Pat. 256,972, Nov. 2, 1911.

The mixture is fed continuously into the apparatus (see fig.) through the pipe, *b*. The greater part of the heavier liquid rises through the pipe, *c*, and overflows into the space, *d*, whilst the remainder, together with the lighter liquid, flows through the opening, *e*, the lower edge of which is at the same height as, or a little higher than, the upper end of the pipe, *c*. A similar separation occurs in the compartment, *f*, the heavier liquid rising through *i* and overflowing into *d*, whilst the lighter liquid accumulates behind the plate, *g*, the opening, *h*, being at a higher level than the upper end of *i*. The lighter liquid finally overflows through *h* into the compartment, *k*, and passes through the filter, *l*, into the receiver, *m*.—A. S.

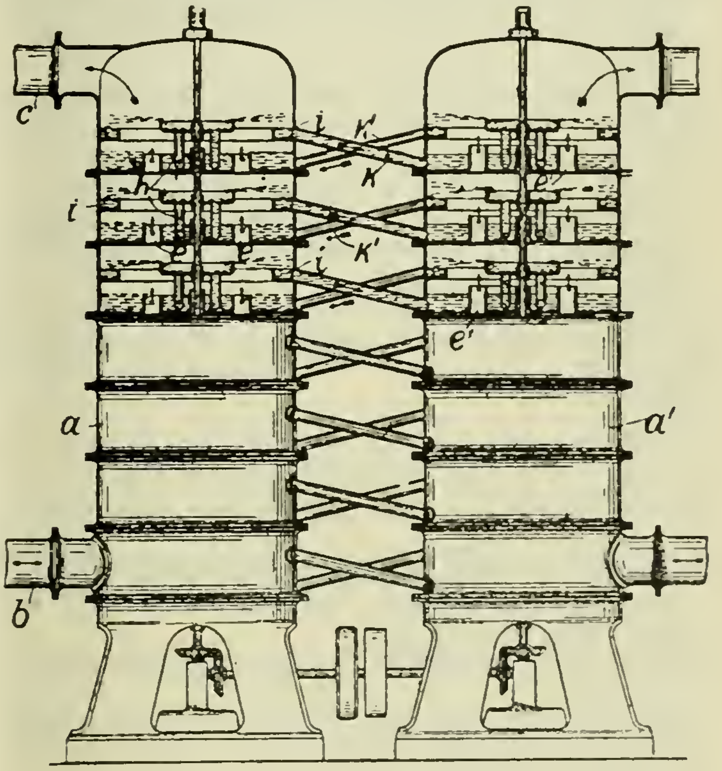


Concentration, drying or crystallisation of materials; Apparatus for the ——. M. Prager. Fr. Pat. 449,572, and First Addition thereto, Oct. 18, 1912.

(1) The material is introduced at one end of a horizontal cylindrical vessel, the lower portion of which is divided by a series of transverse partitions into open-topped chambers A shaft passing axially through the vessel carries a double series of agitators and scoops arranged in pairs, each agitator being radially opposite a scoop. The outer edges of the scoops are preferably inclined, and the outer surfaces of the transverse chambers have a corresponding inclination, so that when the shaft is rotated the scoops enter the chambers and transfer the contents from one to the next. The mechanism driving the shaft is such that it imparts a given number of oscillations followed by a complete revolution, with the result that the material in the chambers is first beaten up or stirred by the pendulum-like movements of the agitators and is then transferred to the next succeeding chambers by the scoops. (2) In a modification of the above the chambers are arranged independently, and the scoops, which in this case do not have inclined surfaces, deliver the material into a trough passing lengthwise through the upper part of the vessel and provided with an endless screw conveyer by which the material is discharged at the end of the vessel. The agitators are dispensed with in this case.—H. H.

Gaseous media; Apparatus for the alternate washing of —— *with the same washing liquid.* H. Koppers. Ger. Pat. 257,012, Dec. 19, 1911.

The washing liquid in the first washer, *a*, is raised in the known manner by the rotary device, *h*, and sprayed out horizontally into intimate contact with the gas, which enters at *b* and leaves at *c*. The liquid collects in the annular trough, *i*, whence it flows through the tube, *K*, into the second washer, *a′*. Here a similar sequence of operations is performed, and the liquid returns to the first washer through the tube, *K′*. In order that the washing liquid may descend from one compartment to the next lower one only in one of the washers, the tubes, *e*, which serve both as gas passages and overflow tubes, are made shorter than the corresponding tubes, *e′*, in the second washer. —A. S.



Gaseous media; Apparatus for the alternate washing of —— *with the same washing liquid.* H. Koppers. Ger. Pat. 257,727, Feb. 6, 1912. Addition to Ger. Pat. 257,012 (preceding).

In the apparatus described in the chief patent, reservoirs are interposed in the pipes through which the washing liquid flows from one washing tower to the other, in order to provide against fluctuations in the working of the apparatus. For instance, there may be one reservoir interposed between a pair of the upper compartments of the towers and another between a pair of the lower compartments, with means of communication between the two reservoirs.—A. S.

Filtering element. J. ten Doornkaat-Koolman. Ger. Pat. 257,461, Nov. 2 1911.

In filter-presses of the kind in which compressed filtering material held between grids is used, the distributing and collecting channels formed by ribs on the grids are made to open at both ends into a broad channel leading from the supply opening or discharge opening to a vent opening and intersecting the distributing and collecting channels. The liquid from the supply opening rises in the distributing channels, and any air or gas, which would otherwise interfere with the smooth working of the filter, is forced through the central channel to the vent opening.—A. S.

Chemical reactions between liquids and gases ; Production of ——. J. Walter. Ger. Pat. 257,825, July 27, 1911.

In the production of chemical reactions between liquids and gases under the influence of a contact substance or of chemically active rays, porous or roughened bodies, which may serve as contact substance, are supported on movable carriers and are caused alternately to dip into the liquid and then rise into the gas above the liquid, whereby fresh quantities af the liquid are continually brought into contact with the gas, over a large surface. Several reaction chambers are preferably used, through which the gas and liquid pass in a definite order.—A. S.

Powder from liquid, soft, or pasty substances ; Production of a dry —— *by means of an absorptive powder.* Ges. für Elektroosmose m.b.H. Ger. Pat. 258,189, Jan. 9, 1912.

Claim is made for the use of aluminium hydroxide or other substance which behaves as an electro-positive colloid. —A. S.

Evaporators and coolers for vegetable juices and the like. F. Hallström and O. F. Brandt, Nienburg on Saale, Germany. Eng. Pat. 8249, April 4, 1912. Under Int. Conv., July 21, 1911.

See Fr. Pat. 437,997 of 1911 ; this J., 1912, 523. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 24,829 of 1894.—T. F. B.

Drying apparatus ; Rotary ——. S. W. Bonsall, New York. Eng. Pat. 10,552, May 3, 1912.

See Fr. Pat. 443,498 of 1912 ; this J., 1912, 972.—T. F. B.

Drying kilns ; Apparatus for controlling the working of ——. G. A. Mower, and Sturtevant Engineering Co., Ltd. Fr. Pat. 450,803, Nov. 20, 1912. Under Int. Conv., Jan. 17, 1912.

See Eng. Pat. 1341 of 1912 ; this J., 1912, 972.—T. F. B.

Filters for liquid. J. ten Doornkaat-Koolman, Cassel, Germany. Eng. Pat. 23,867, Oct. 18, 1912. Under Int. Conv., Nov. 1, 1911.

See Ger. Pat. 257,461 ; preceding.—T. F. B.

Filtering apparatus. M. Deacon and W. Gore. Fr. Pat. 451,441, Nov. 29, 1912. Under Int. Conv., Dec. 29, 1911, and June 28, 1912.

See Eng. Pat. 29,301 of 1911 ; this J., 1913, 221.—T. F. B.

Gases ; Apparatus for purifying, cooling, and washing ——. H. E. Theisen, Munich, Germany. Eng. Pat. 1382, Jan. 17, 1913. Addition to Eng. Pat. 22,433, Sept. 27, 1910.

See U.S. Pat. 1,052,188 of 1913 ; this J., 1913, 278.—T.F.B.

Boiler-scale ; Apparatus and process for preventing the formation of ——. T. Brázda, Pilsen, and E. Richter and A. Schückher, Vienna. U.S. Pats. 1,059,430 and 1,059,431, April 22, 1913.

See Fr. Pat. 440,763 of 1912 ; this J., 1912, 837.—T. F. B.

Separator ; Centrifugal ——. H. de Raasloff and T. E. Brown. Fr. Pat. 450,716, Nov. 18, 1912.

See U.S. Pat. 1,044,570 of 1912 ; this J., 1913, 11.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Mexican petroleum industry in 1912. Board of Trade J., May 14, 1913. [T.R.]

The total production of crude oil in Mexico in 1912 amounted to 16,704,734 barrels (of 35 U.S. gallons) or 2,493,244 metric tons. There is a possibility of these figures being increased by 100 per cent. during 1913. Few new fields have been developed during 1912, the chief discovery being the Chila Salinas Field (about 15½ miles south-west of Tampico). The construction of a refinery at Tampico with an initial capacity of 12,500 barrels a day will shortly be commenced ; the paraffin wax plant at Manatitlan Refinery is expected to begin operations soon. It is probable that during 1913 further developments will take place in the Tamaulipas region (*i.e.*, the districts to the north-west of Tampico), and that greater activity will be displayed in the Panuco region in the State of Veracruz. There will be a very marked increase in the exportation facilities, as one company alone will be adding to its fleet 19 steamers with a total carrying capacity of over 233,000 tons. Mexican oil will be sent to the South American markets in considerable quantities.

Petroleum refining in Japan in 1912. Board of Trade J., May 15, 1913. [T.R.]

The following are particulars of the production of the Japanese petroleum refineries in 1912, the figures for 1911 being added for purposes of comparison :—

——	1911.	1912.
	American gallons.	American gallons.
Naphtha	208,916	333,818
Kerosene	21,523,434	21,674,660
Neutral oil	7,921,401	6,494,591
Lubricating oils	7,591,105	7,409,606
Fuel oils	30,051,498	26,771,382

United States gallon=0·833 Imperial gallon, or 6 United States gallons=5 Imperial gallons.

Examination of lubricating oils for use in the cylinders of steam engines. Cormorant. *See* XII.

Patents.

Coal-dust and fire-damp explosions ; Method of, and apparatus for preventing the spreading and effect of ——. G. Kahler and F. Junker, Gelsenkirchen, Germany. Eng. Pat. 16,440, July 13, 1912. Under Int. Conv., Aug. 17, 1911.

In order that water may be sprayed as a precautionary measure whenever a shot is fired, a vane sufficiently sensitive to be actuated by the firing of an ordinary blasting charge is arranged in the path of the air displaced by the explosion. The movement of the vane releases a falling block which disengages a locking device and so permits the opening of an automatic water valve. This valve mechanism also diverts the pressure water supply from the ordinary sprinkling devices to a spraying installation, so that the supply does not fail even if the sprinklers are damaged by an explosion.—A. T. L.

Fuel for domestic and other fires. W. Garner, Sheffield. Eng. Pat. 7635, Sept. 26, 1912.

Coke or coal dust is mixed with not more than 6 per cent. of coal-tar pitch ground to fine powder, and the mixture is pressed into briquettes in warm moulds in the dry state. The moulds are not larger than 2 × 2 × 5 ins., and are kept at about 212° F. (100° C.). It is essential that the mixture shall not be warmed before being placed in the warm moulds, and that the moulds shall be constructed to open so as to release the briquette on all sides. Eng. Pats. 19,625 of 1904, 17,074 of 1903, 23,079 of 1896, 18,605 of 1892, 3475 of 1891, 18,465 of 1888, 1745 of 1872 and 3244 of 1867 are referred to.—A. T. L.

Oven ; Upright-chamber ——. A. Gohmann, Assignor to Stettiner Chamotte-Fabrik Act.-Ges. vorm. Didier, Stettin, Germany. U.S. Pat. 1,058,744, April 15, 1913.

The oven chambers are separated by walls having superposed horizontal heating flues. These flues are tapered alternately in opposite directions, and air and fuel are supplied at the wide ends, the narrow ends being connected with waste-gas flues. For this purpose, an air-supply and an exhaust flue are arranged at each side of the oven, and the heating flues form two sets, the flues of each set being connected with a common air-supply flue at one end and with a common exhaust flue at the other end. —A. T. L.

Gas producers; Working of ——. N. Testrup, London, and T. Rigby, Dumfries. Eng. Pat. 5024, Feb. 28, 1912.

A mixture of press-cake of wet carbonised peat and of briquettes, made from such press-cake, is used as fuel. The briquettes may be used either before or after charring or coking.—W. H. C.

Gas producers. A. Simonenko and A. Hendunen, Moscow. Eng. Pat. 25,778, Nov. 9, 1912.

The producer is adapted for making gas free from tar from bituminous coal, and is of the type in which air is admitted both at the top and at the bottom of the fuel column, gas being drawn off at an intermediate point. In order to permit of adjusting the height of the gas outlet to suit the nature of the fuel, the outlet comprises a central vertical fixed pipe enclosed by a movable pipe or hood which is closed at the top and open at the bottom. The actual gas outlet from the fuel-column is at the open lower end of this adjustable pipe.—A. T. L.

Gas purification; Manufacture of a material, consisting chiefly of oxides, hydroxides, sulphides, and other compounds of iron, for ——. G. Weyman, Newcastle-on-Tyne and T. Hardie, Gateshead-on-Tyne. Eng. Pat. 10,793, May 7, 1912.

Ferrous sulphate solution is treated with ammoniacal gas liquor or with the gases evolved on heating such liquor, to precipitate the iron, the last traces of iron being precipitated by passing hydrogen sulphide, obtained from an ammonium sulphate plant, through the liquor. The precipitated mass is dried and oxidised by air or other suitable means.—W. H. C.

Gas either in a heated or cooled state for purification; Apparatus for treating [removing tar, etc., from] ——. S. Chandler, London, and B. B. Waller, Stroud, Glos. Eng. Pat. 12,007, May 21, 1912.

The gas passes through a series of concentric cylinders, which are perforated alternately in their lower and upper parts, so that the gas takes a zig-zag path. The size of the perforations is smaller the nearer they are to the gas-exit. The lower ends of the cylinders dip into a sealing liquid.—W. H. C.

Mineral oil emulsions; Manufacture of ——. A. J. Boult, London. From A. Heumann und Co. and M. Melamid, Zurich, Switzerland. Eng. Pat. 8077, April 3, 1912.

A sulphonated vegetable oil is saponified with soda lye, and evaporated with stirring to obtain a dry soap powder. 130 kilos. of mineral oil are mixed with 15 kilos. of this soap powder, 10—12 kilos. of oleic acid and 10 kilos. of formaldehyde, and the mixture is heated until a clear liquid is obtained, which is said to be permanently miscible with water.—W. H. C.

Distilling petroleum and other hydrocarbons; Process and apparatus for ——. C. W. Turner. Fr. Pat. 451,162, Nov. 28, 1912.

See U.S. Pat. 1,046,683 of 1912; this J., 1913, 78. A portion of the vapourised oil is decomposed by means of oxygen under pressure, and the hydrogen formed is used to convert the mineral oil into a product of lower specific gravity.—T. F. B.

Hydrocarbons; Process for separating the solid —— *obtained according to Ger. Pat. 226,136, into constituents of different melting points.* Kerozit, Chemische Ges. m. b. H. Ger. Pat. 256,725, April 7, 1910.

The solid hydrocarbons obtained as described in Ger. Pat. 226,136 (see Fr. Pat. 409,516; this J., 1910, 747) are dissolved in an equal quantity of carbon tetrachloride or analogous halogen substitution derivative of a hydrocarbon by heating to 80° C., and the solution is cooled to 40° C., whereby a product of m. pt. 65°—70° C. separates. On further cooling a product of m. pt. 55°—60° C. is obtained, whilst a residue of low melting point remains dissolved in the solvent.—A. S.

Crude petroleum, petroleum distillates, tars or the like; Process for separating water from ——. L. Dittersdorf. Ger. Pat. 257,194, July 13, 1911.

The emulsion of oil or tar and water is "broken" by mixing it with sharp-edged particles, such as sand, fragments of glass, cuttings of iron, or the like, preferably with warming and agitation by means of a current of air. The mixing may be effected in a warmed filter-chamber filled with sharp-edged material.—A. S.

Steam for gas generators; Process for the production of ——. H. Främbs, and Bender und Främbs G.m.b.H., Hagen, Germany. Eng. Pat. 5852, March 8, 1912. Addition to Eng. Pat. 17,770, Aug. 4, 1911.

See Addition of March 13, 1912, to Fr. Pat. 432,950 of 1911; this J., 1912, 806.—T. F. B.

Hydrocarbon gases; Process and apparatus for purifying or desulphurising ——. J. A'H. Fearon. Fr. Pat. 451,146, Nov. 28, 1912.

See Eng. Pat. 23,447 of 1911; this J., 1913, 13.—T. F. B.

Motor spirit. R. de Fazi. Fr. Pat. 451,382, Nov. 6, 1912.

See Eng. Pats. 25,177 of 1911 and 27,679 of 1912; this J., 1913, 187.—T. F. B.

Mineral oils; Process for converting —— *into volatile spirit.* New Oil Refining Process, Ltd. Fr. Pat. 451,471, Dec. 5, 1912. Under Int. Conv., Dec. 18, 1911.

See Eng. Pat. 28,460 of 1911; this J., 1913, 414.—T. F. B.

Distillation, fractionation, or refining of liquids [petroleum, tar, etc.] Eng. Pat. 7422. *See* I.

Machines for washing or separating coal, ore, and other granular and like materials. Eng. Pat. 10,929. *See* I.

Apparatus for the continuous and automatic analysis and indication of gases. Eng. Pat. 5601. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Dry distillation; The knowledge of ——. C. Thomae. J. prakt. Chem., 1913, **87**, 423—424.

The impenetrability to water of vegetable and animal cuticles and tissues is stated to be due to the presence of such substances as fat, wax, resin, etc., which can be removed by heating the fresh or dried material at atmospheric or reduced pressure; *e.g.* at 15 mm. pressure by an air or oil bath at 235° C. and upwards: the fat or wax is melted and either carried over by the steam or sublimed. A number of materials such as hay, feathers, flower-petals, paper, etc., when treated in this way yielded fat or wax; thus filter paper or linen yielded white crystalline wax. Apple-peel also yielded, as well as fat and wax, a crystalline substance of high melting point, apparently of a resinous nature. The author suggests that fat and resin are the primary products of dry distillation and that on violent heating they yield acetic acid, acetone, tar, etc.—R. G. P.

Patents.

Metallic filaments for incandescent electric lamps: Manufacture of ——. J. A. Scoular and Dick, Kerr and Co., Ltd., London. Eng. Pat. 11,455, May 14, 1912.

Finely powdered metallic tungsten having an oxygen-absorption of 24·8 to 25·3 per cent. is mixed with about one-fifth of its weight of water-glass and the resulting paste is squirted into filaments. The filaments are dried and baked in a furnace at 900° C. for 20 minutes, in the presence of an inert gas, for example in hydrogen at a pressure of only a few millimetres. The filaments are then sintered by the passage of a current through them for about 3 secs. in hydrogen at 610 mm. pressure and for 1 sec. in hydrogen at 110 mm. pressure.—A. T. L.

Filament holders for metal-filament electric incandescent lamps. M. Baum, Hanau a/M., Germany. Eng. Pat. 16,865, July 19, 1912.

The holders are made of a metal such as nickel, iron, copper or an alloy having a low fusing point and are coated electrolytically with oxides of chromium. The metal wire is first annealed at a high temperature in a current of hydrogen so as to remove all oxide, and is then placed in a bath consisting of a 10 per cent. solution of chromic acid containing 0·5 to 1 per cent. of boric or tartaric acid. A current is passed so as to deposit a coating of metallic chromium and chromous hydroxide on the wire, and the wire is again annealed in hydrogen at a high temperature.—A. T. L.

Arc lamps ; Electrodes for ——. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 16,707, July 17, 1912.

An electrode consisting of an iron tube filled with magnetite, titanium carbide, or other suitable mixture is subjected to a rolling, swaging or drawing process, until a very dense, compact and uniform electrode is produced, which may be sufficiently flexible to be wound on a drum and fed continuously to the arc. The diameter may be so far reduced that a flexible wire is obtained which is stranded together to form a flexible rope for use as an electrode.—A. T. L.

Filaments for incandescent lamps ; Process of preparing ——. W. G. Houskeeper, Philadelphia, Assignor to Westinghouse Lamp Co. U.S. Pat. 1,059,366, April 22, 1913.

See Eng. Pat. 17,480 of 1911 ; this J., 1911, 1201.—T.F.B.

III.—TAR AND TAR PRODUCTS.

Patents.

Indole ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,943, June 26, 1912.

Indoxyl or indoxylcarboxylic acid is treated with alkali hydroxide or a mixture thereof with an alkaline-earth hydroxide, in presence of water, at a temperature of 150° C. or upwards, preferably at above 200° C., until the greater part of the indigoid colouring matter at first formed has been decomposed ; the indole may be separated from the product by distillation under reduced pressure, or by other suitable means.—T. F. B.

Aromatic nitro-amino compounds ; Process for preparing ——. H. Bart. Ger. Pat. 258,059, April 20, 1912.

Azo dyestuffs containing nitro groups not in the *o*-position to the azo group, are heated with hydriodic acid, with or without addition of sulphurous acid or phosphorus, and preferably under pressure. The dyestuffs may be in suspension or in solution. The azo group is ruptured, without the nitro group being reduced, resulting in the formation of the nitro-amino compound.—T. F. B.

Hydroxycarbazole ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 258,298, Jan. 23, 1912.

A new hydroxycarbazole (probably the 1-hydroxy-compound) is obtained by eliminating the sulpho groups from the monohydroxycarbazole-disulphonic acid obtained by "partially melting" carbazoletrisulphonic acid. The new substance differs from the known 3-hydroxycarbazole in its melting point (163° C.) and in being stable to light. —T. F. B.

Anthraquinone derivatives containing halogen ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 258,556, Sept. 19, 1911.

p-Diamino- or *p*-aminohydroxyanthraquinones are treated with a chlorate and hydrochloric acid. The products are free from nitrogen, and appear to be dihalogen-diquinones or tetrahalogen-triquinones.—T. F. B.

Coal tar, petroleum residues, creosote and schist oils and the like ; Conversion of —— *into pitch.* Soc. Anon. des Combustibles Industriels, Paris. Eng. Pat. 8712, April 12, 1912. Under Int. Conv., July 8, 1911.

See Fr. Pat. 443,207 of 1911 ; this J., 1912, 978.—T.F.B.

Quinizarine ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,619, May 28, 1912.

See Ger. Pat. 255,031 of 1912 ; this J., 1913, 189.—T.F.B.

Distillation, fractionation, or refining of liquids [petroleum, tar, etc.]. Eng. Pat. 7422. *See* I.

Process of separating water from crude petroleum, petroleum distillates, tars, or the like. Ger. Pat. 257,194. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

Triphenylmethane dyestuffs ; Action of formic acid on —— A. Guyot and A. Kovache. Comptes rend., 1913, **156**, 1324—1327.

The authors have shown previously (Comptes rend., 1912, **154**, 121 ; **155**, 838) that simple triarylcarbinols (not containing auxochrome groups) are reduced by formic acid according to the equation: $R_3C.OH+H.CO_2H=R_3CH+CO_2+H_2O$. They now find that when Methyl Violet is boiled with formic acid and sodium formate, the quantity of carbon dioxide evolved increases with the amount of sodium formate used. With a small proportion of sodium formate the dyestuff is reduced normally with the production of hexamethyltriaminotriphenylmethane, but the latter in presence of larger quantities of sodium formate is decomposed according to the equation: $(R_2N.C_6H_4)_3CH+HCO_2H=(R_2N.C_6H_4)_2CH_2+C_6H_5NR_2+CO_2$. This latter reaction probably takes place in two stages, tetramethyldiaminodiphenylcarbinol and dimethylaniline being first formed by hydrolysis of the hexamethyltriaminotriphenylmethane, for experiment showed that the first-mentioned compound is reduced quantitatively to tetramethyldiaminodiphenylmethane by formic acid and sodium formate. Malachite Green behaves in an analogous manner to Methyl Violet, the leuco-base first formed being decomposed into dimethylaniline and *p*-dimethylaminodiphenylmethane, but the decomposition is not quantitative in this case.—A. S.

Patents.

Dyestuffs ; Process for the manufacture of water soluble ——. A. Turner, Ashton on Mersey. Eng. Pat. 12,095, May 22, 1912.

A saponifiable wax, such as beeswax, carnauba wax, etc., is boiled with a solution of a neutral soap, with or without addition of alkali, until solution is effected ; an aqueous solution of a suitable dyestuff is added, and the coloured wax is precipitated, *e.g.*, by pouring into salt solution, dried, and powdered.—T. F. B.

1.4-*Diaminoanthraquinone compounds and sulphonic acids thereof ; Manufacture of* ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 13,019, June 3, 1912.

1.4-Diaminoanthraquinones in which the position 2 may be occupied by a methyl, halogen, carboxyl, or like group, are obtained by heating with dehydrating agents 2.5-diaminobenzoyl-*o*-benzoic acid, or the corresponding 2-amino-5-acidylamino compound, or the lactam of this acid (see Eng. Pat. 22,440 of 1912; this J., 1913, 130), any of which may contain one of the substituents mentioned above, in the 4-position. 1.4-Diaminoanthraquinone-2-carboxylic acid is a blue-violet dyestuff. If the condensation is effected by means of concentrated or fuming sulphuric acid, especially in presence of boric acid, varying quantities of the diaminoanthraquinonesulphonic acids, which may be used as wool dyestuffs, are formed; the sulphonic acid of 1.4-diaminoanthraquinone-2-carboxylic acid dyes wool blue shades from acid baths.—T. F. B.

Anthraquinone derivatives; Process for preparing vat-dyeing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 258,808, Dec. 3, 1910.

Vat dyestuffs, which may be described as coeramidonine-anthraquinone-acridones or -thioxanthones, are obtained by the action of concentrated sulphuric acid at elevated temperatures on anthraquinone-acridonylaminoanthraquinones or anthraquinone-thioxanthonylaminoanthraquinones (see Fr. Pats. 427,479 and 428,819; this J., 1911, 1111, 1205).—T. F. B.

Benzoquinone derivatives; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 257,834, Dec. 2, 1911. Addition to Ger. Pat. 253,091 (see Eng. Pat. 8886 of 1912; this J., 1912, 766).

When the sulphonic acids of dinaphthylaminobenzoquinone derivatives are treated with condensing agents, products are obtained which dye wool and silk red-violet to blue shades. The sulphonic acids for use in the process may be obtained by heating quinone with naphthylaminesulphonic acids in presence of sodium acetate and alcohol.—T. F. B.

Vat dyestuffs; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 258,161, Sept. 5, 1911.

New dyestuffs containing sulphur, which dye animal and vegetable fibres from the hydrosulphite vat, are obtained by heating gallocyanines or their leuco-compounds with polysulphides. Especially suitable are the condensation products from nitrosodialkylanilines with gallic acid, pyrogallol, gallamic acid, etc. The dyestuffs are either insoluble or soluble with difficulty in sodium sulphide solution.—T. F. B.

Anthraquinone derivative; Process for preparing an ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 258,439, Dec. 20, 1911.

When α-aminoanthraquinone is treated with chloric acid in presence of sulphuric acid, a substance is obtained which is stable towards alkalis and bisulphite. It dissolves in nitrobenzene to a blue solution, and when sulphonated it dyes wool blue-black shades from acid baths. Other oxidising agents do not give rise to this compound, whilst when 1.5-diaminoanthraquinone, for example, is treated with chloric acid, a product is obtained which is converted into an alkali-soluble substance on treatment with bisulphite.—T. F. B.

Vat [indigoid] dyestuffs; Process for preparing red ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 258,258, March 28, 1912.

Indoxyl derivatives containing a substituent in the 6-position, or their acetyl derivatives, are condensed with 5.7-dihalogen-isatins, with the formation of bright red dyestuffs of the indigoid series.—T. F. B.

Diarylanthraquinonylmethane dyestuffs; Process for preparing chrome ——. Farbenfabr. vorm. F Bayer und Co. Ger. Pat. 258,517, Feb. 13, 1912.

Aldehydo-anthraquinones are condensed with two molecules of the same or different aromatic hydroxycarboxylic acids, and the leuco-compounds are oxidised, or the aldehyde is first condensed with one mol. of the hydroxycarboxylic acid to form a hydrol, which is then condensed with a mol. of the same or another hydroxycarboxylic acid to form the leuco-compound.—T. F. B.

Basic dyestuffs; Process for preparing brown ——. L. Cassella und Co. Ger. Pat. 258,560, April 5, 1912.

An aromatic *m*-diamine containing a methyl group in an *o*-position to one of the amino groups, is heated with an aromatic nitro compound in presence of hydrochloric acid, with or without addition of a solvent or oxygen-carrier, such as ferric chloride. Yellowish-brown basic dyestuffs, extremely fast to light and to alkalis, are produced; they are said to be very suitable for use in leather dyeing.—T. F. B.

Disazo dyestuffs; Process for preparing red-brown ——. Badische Anilin und Soda Fabrik. Ger. Pat. 258,653, March 2, 1912.

The tetrazo compounds of ethers of 2.4-diaminophenol are combined with two mols. of a *m*-diamine of the benzene series. The products dye tannin-mordanted cotton level reddish-brown shades, fast to light; they are discharged white by formaldehyde-sulphoxylates. The dyestuffs can also be used for producing fast red-brown shades on paper or leather.—T. F. B.

Sulphurised [sulphide] dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 6080, March 11, 1912. Under Int. Conv., March 13, 1911.

See Fr. Pat. 440,879 of 1912; this J., 1912, 809.—T. F. B.

Wool-dyestuffs; Yellow to brown —— *and process of making same.* R. Schmidlin, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,059,571, April 22, 1913.

See Fr. Pat. 443,809 of 1912; this J., 1912, 979.—T. F. B.

Basic colours of the Coerulein series; Manufacture of ——. G. B. Ellis, London. From Chemical Works, formerly Sandoz, Basle. Eng. Pat. 10,732, May 6, 1912.

See Fr. Pat. 443,377 of 1912; this J., 1912, 979.—T. F. B.

Sulphur [sulphide] dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,775, May 17, 1912.

See Ger. Pats. 254,304 and 254,328 of 1911; this J., 1913, 189.—T. F. B.

Anthraquinone series; Manufacture of nitrogenous derivatives of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,618, May 28, 1912.

See Ger. Pat. 252,529 of 1911; this J., 1912, 1117.—T.F.B.

Anthraquinone derivatives containing nitrogen; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 450,761, Nov. 19, 1912. Under Int. Conv.. Nov. 23, 1911.

See Ger. Pat. 252,529 of 1911; this J., 1912, 1117.—T. F. B.

Azo dye. K. Desamari, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,059,599, April 22, 1913.

See Eng. Pat. 23,791 of 1911; this J.. 1912, 634.—T. F. B.

[Azo] dyestuffs for wool: Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,192, Nov. 29, 1912. Under Int. Conv., Dec. 15, 1911.

See Ger. Pat. 255,590 of 1911; this J., 1913, 356.—T. F. B.

Dye. G. Holste, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co.. Elberfeld, Germany. U.S. Pat. 1,059,670, April 22, 1913.

See Eng. Pat. 18,205 of 1911; this J., 1912, 678.—T. F. B.

Carboxydiarylhydrols ; Process for producing——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 450,979, Nov. 23, 1912. Under Int. Conv., Nov. 30, 1911.

See Ger. Pat. 254,122 of 1911 ; this J., 1913, 189.—T. F. B.

Vat dyestuff of the anthracene series ; Process for making a yellow ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 451,093, Oct. 12, 1912.

See Ger. Pat. 255,641 of 1912 ; this J., 1913, 356.—T. F. B.

Process for preparing colour lakes. Ger. Pat. 258,392. *See* XIII.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Wood pulp and paper ; Duty-free admission of —— into the United States. Board of Trade J., May 15, 1913. [T.R.]

The United States Court of Customs Appeals has decided that the exemption from Customs duty granted, under Section 2 of the Act of July 26th, 1911, to wood pulp and certain kinds of paper, being the products of Canada and imported therefrom directly into the United States, is applicable also to similar articles produced in those countries (including the United Kingdom) which, in virtue of existing Treaties with the United States, are entitled to most-favoured-nation treatment in respect of their exports to that country.

South African Sheep Dips. [*Wool.*] Chem. Tr. J., May 10, 1913. [T.R.]

The Bradford Chamber of Commerce has recently received a letter from the Chief of the Agricultural Department of the Union of South Africa at Pretoria asking for information regarding the grounds of the objections of wool-users to the use of caustic soda and sulphur, and lime and sulphur for sheep dips. The Chamber was requested to recommend an unobjectionable dip which would be likely to give equal satisfaction to the farmers.

On behalf of the Bradford Chamber of Commerce, Mr. Fawcett, president, replying to the letter, gave the following reasons for the objection of the Chamber to the use of caustic soda and sulphur, and lime and sulphur dips :—(1) Because any wool so treated will be damaged, and will fetch a lower price. Caustic soda and sulphur is used as sodium sulphide for fetching wool off the dead fleeces. (2) Wool so treated being partially dissolved, the resultant weight of the fleece is considerably less. (3) It makes the wool more difficult to scour. On solution in water the caustic soda is set free and acts on the wool, causing it to shrink. (4) The effect of alkaline soda salts destroys the spinning qualities of the wool, decreases its elasticity, and causes pieces made from such yarn to take a ruddy colour in the dyeing. Wool so treated will not spin to fine counts. (5) Wool treated with alkalis has a stronger affinity for colouring matters than wool not so treated. (6) The use of sulphur not only renders the wool difficult to wash, but while in the first instance it produces a good colour on the fibre later the colour deteriorates and becomes worse than before the sulphur was applied. (7) There is no necessity to use dips which are injurious to the fleece, as there are other dips upon the market, as recommended in the Report of the Departmental Committee of the Board of Agriculture and Fisheries, which are quite as efficacious in the curing of scab without having any injurious effect on the wool. (See this J., 1907, 1266.)

Patents.

Cotton and other fibres and fabrics ; Treatment of —— to render them permanently flame-proof or non-flammable. F. Seaton-Snowdon, London. Eng. Pat. 21,880 of 1911, date of appl., Apr. 4, 1912.

The fabric is impregnated with a mixture of borax and boric acid, preferably 1 part of the latter to 2 parts of the former, equal in weight to about 10 per cent. of the weight of the cotton. The material may be steeped in the hot solution, which is afterwards allowed to cool, or the treatment may be effected cold and assisted by vacuum, followed by pumping in more of the solution until a pressure of 40 lb. per sq. in. is attained. After treatment, the cotton is drained or squeezed and dried. The impregnating substances are then " fixed " by steeping in a solution, at the ordinary temperature, which will produce insoluble borates in the mass of the material. Suitable " fixing " reagents are salts of lead, manganese, magnesium, zinc, etc.—J. F. B.

Drying machine [*for fabrics*]. G. A. Cutter, Taunton, Mass., Assignor to Cell Drier Machine Co. U.S. Pat. 1,052,896, Feb. 11, 1913.

Fabric or similar material is dried by passing it backwards and forwards over a series of steam-heated surfaces formed by superposing a number of flat steam-heated cells suitably spaced apart. Each cell is fitted with internal baffles for the steam, and is provided at two of the corners with hollow bosses which form the steam inlet and outlet pipes in conjunction with similar bosses on adjacent cells, and also serve to space the cells apart. The fabric is carried backwards and forwards by rollers at the sides actuated by a continuous belt or chain, and in order to cause the material to come into actual contact with the heated surfaces the walls of the cells may be slightly curved. The cells are held together by bolts, no external casing being required, but, if necessary, an uptake chamber may be fitted at one side to produce an air draught.—H. H.

Cellulose and its products of transformation ; Process for acetylating ——. Chem. Fabr. auf Actien, vorm E. Schering and A. Loose, Berlin. Eng. Pat. 27,228, Nov. 26, 1912. Under Int. Conv., Dec. 18, 1911.

Small proportions of hydrazine or hydroxylamine sulphate are employed as catalytic agents in the acetylation of cellulose or its immediate transformation products. Examples : (1) 20 parts of cellulose are impregnated with a solution of 2 parts of hydrazine sulphate, dried and acetylated with a mixture of 100 parts of glacial acetic acid and 100 parts of acetic anhydride. (2) 0·5 part of finely powdered hydroxylamine sulphate is suspended in a mixture of 100 parts each of glacial acetic acid and acetic anhydride, 20 parts of cellulose being then introduced. In both cases reaction starts at the ordinary temperature and is completed in 2—6 hours.—J. F. B.

Acetylcellulose ; Process for preparing alcoholic solutions of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 256,922, Aug. 3, 1911.

Acetylcellulose is dissolved in alcohol in presence of zinc chloride or a thiocyanate, with or without addition of other substances. The solutions may be used as varnishes or for the production of artificial threads ; in the latter case water is used as the coagulating bath, from which the alcohol and the salt can be easily recovered.—T. F. B.

Paper webs ; Smoothing or equalising colour on —— and apparatus therefor. H. Schmeil, Dresden, Germany. Eng. Pat. 12,141, May 22, 1912. Under Int. Conv., May 23, 1911.

In the coating of webs of paper with liquid colour or enamel on one or both sides, the colour is spread and equalised by directing jets of compressed air against the moist surface through nozzles arranged in proximity to the web, such nozzles performing the function of " pneumatic brushes." In the case of double-sided coating machines the streams of air from both sides should preferably intersect one another in the plane of the paper. As the paper ascends vertically from the coating rollers, it may be caused to pass across several of these " pneumatic brushes," and the latter may be so adjusted as to deliver air at increasing or decreasing pressures as the web ascends.—J. F. B.

Paper ; Method of making —— and product thereof. R. A. Marr, Blacksburg, Va., U.S.A. Eng. Pat. 12,597, May 28, 1912.

See U.S. Pat. 1,046,475 of 1912 ; this J., 1913, 80. Glycerin and tannin may be added to the zinc chloride solution, and the paper stock may be bleached, *e.g.*, with sodium peroxide.—T. F. B.

Sulphurous acid or sulphites; Method of treating liquors containing ——. W. H. Dickerson, Muskegon, Mich. U.S. Pat. 1,059,716, April 22, 1913.

In order to prevent the decomposition of waste sulphite liquors during evaporation, a part of the basic constituents is precipitated with sulphuric acid and the solution kept acid. Another method is to concentrate in an acid state in the presence of soluble barium salts.—J. B.

Artificial hair; Manufacture of ——. C. M. Sanlaville, Coteau, France. Eng. Pat. 21,889, Sept. 26, 1912. Under Int. Conv., Oct. 31, 1911.

See Fr. Pat. 435,989 of 1911; this J., 1912, 381.—T. F. B.

Artificial threads; Machine for spinning ——. Gebr. Franke, and O. Müller. Fr. Pat. 450,696, Nov. 18, 1912.

See Eng. Pat. 4078 of 1911; this J., 1912, 328.—T. F. B.

Cellulose or the like from vegetable fibres; Manufacture of solutions and other products of ——. C. A. Müller and D. Wolf, Turn-Teplitz, Bohemia. Eng. Pat. 10,430, May 2, 1912.

See Fr. Pat. 443,133 of 1912; this J., 1912, 1026.—T. F. B.

Cellulose from wood, wood-chips, straw, reed, and like materials; Process for the manufacture of ——. J. E. Pfiel, Vienna, Assignor to Julius Schreyer, Bremen, Germany. U.S. Pat. 1,058,898, April 15, 1913.

See Fr. Pat. 431,044 of 1901; this J., 1911, 1375.—T. F. B.

Cellulose and its transformation products; Process for acetylating ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 450,890, Nov. 18, 1912. Under Int. Conv., Dec. 18, 1911.

See Eng. Pat. 27,228 of 1912; preceding.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Black; Diazo —— *developed on the fibre in combination with Prussian blue.* R. Buratti. Rev. Gen. Mat. Col., 1913, **17**, 128—129.

A fast black possessing depth and good overhand appearance can be obtained by combining a diazotised black with Prussian blue formed on the fibre. For example, cotton is mordanted in the cold with a solution of $Fe_4(SO_4)_5(OH)_2$ of 1·5° to 3·0° Bé. (sp. gr. 1·011—1·022) during 1 to 1½ hours, and oxidised with sodium chlorate solution of ½° to 1° Bé. (sp. gr. 1·004—1·007) in the cold. After rinsing it is dyed with 5 per cent. of Chloramine Black BH in the usual way, and diazotised during half an hour in a bath made up of 1·5 parts of nitrite, 0·5 to 1·0 part of potassium ferrocyanide, 3·5 to 3·8 parts of hydrochloric acid of 20 Bé. (sp. gr. 1·162) and 2000 parts of water. The cloth is rinsed and passed into a developing bath containing 1·2 parts of *m*-toluylenediamine and 2000 parts of water, and, after half an hour, rinsed and dried. —J. B.

Patents.

Mordants; Auxiliary —— *containing* (1) *titanium and glycollic acid and* (2) *antimony and glycollic acid.* O. Liebknecht, Frankfort-on-Maine, and F. Blumenthal, Wiesbaden, Germany. U.S. Pats. 1,059,740 and 1,059,741, April 22, 1913.

(1) A titanium mordant is obtained by treating a salt of glycollic acid with a titanium salt or with titanic acid. (2) An antimony mordant is obtained by treating a glycollic acid compound with a compound of antimony. —J. B.

Nets; Apparatus for drying —— *in dyeing and like processes.* R. Shaw, Nottingham. Eng. Pats. 8824, April 15, and 17,969, Aug. 3, 1912.

Net-like material is dried by passing it over two parallel hollow rollers which are in the same vertical plane, and some distance apart, one or both of the rollers being heated by means of an internal gas flame. A padding trough may be combined with the machine.—J. B.

Dyeing apparatus. P. G. Vollert, Reichenberg, Bohemia. Eng. Pat. 27,074, Nov. 25, 1912.

In the main receptacle two chambers are formed by building up a series of frames adapted to hold the material—cops, for instance, in which case perforated plates are provided to hold the spindles. The space between the two chambers serves to hold the dye liquor which is heated by means of a steam coil. The two chambers are connected with a circulating pump, and the frames are lined with ceramic material. The number of frames in use can be varied to suit the amount of material to be dyed.—J. B.

Dyeing machine. C. P. Delahunty, West Pittston, Pa. U.S. Pat. 1,059,845, April 22, 1913.

The material is packed in a vat which is in communication with an overflow tank and with a valve casing having four outlet ports, the valve within the casing being adapted to bring any two of the said ports into communication, and to seal the remaining two. One of the ports is connected with a fresh water supply and the remaining three are connected with the vat, the tank and the pump respectively. The overflow tank has a connection to the drain.—J. B.

Dyeing hairs and furs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. First and Second Additions, dated Nov. 22 and 30, 1912, to Fr. Pat. 438,476, Dec. 29, 1911. Under Int. Conv., Dec. 27, 1911, March 16 and May 1, 1912.

See Ger. Pats. 250,463 and 256,794; this J., 1912, 1121; 1913, 423. Unsubstituted 2.6-diaminophenol may also be used.—T. F. B.

Dyeings fast to washing, which can be discharged; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 258,384, April 19, 1912.

The dyestuff obtained by treating diazotised 2.5.7-aminonaphtholsulphonic acid with alkali, is developed on the fibre by means of a diazo compound. The dyeings can be discharged pure white.—T. F. B.

Printing textile fabrics such as velvet, carpets such as Axminster, or the like; Apparatus for ——. P. Höpner, Chemnitz, Saxony. Eng. Pat. 16,548, July 15, 1912.

The print is obtained by means of pins stuck in a stationary perforated plate, the surface of the material being pressed down on to the pins by suitable mechanism. The pins have cup-shaped depressions on their tops to hold the colour, which is supplied by means of a trough made to move vertically upwards, thereby immersing the pins, or the trough may be stationary under the pins, the surface of the colouring medium being raised by means of plungers until the pins are immersed.—J. B.

Printing of vat dyestuffs of the anthraquinone series. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,201, Sept. 30, 1912. Under Int. Conv., Dec. 23, 1911.

Vat dyestuffs of the anthraquinone series are converted into vats by means of alkali hydroxide in the usual manner, and the excess of free alkali is "neutralised" by addition of sodium or potassium bicarbonate, aluminium acetate or hydroxide, a bisulphite, boric acid or an organic acid; the paste thus obtained is printed in the usual way after addition of sulphoxylates or similar reducing agents, and the dye is fixed by steaming. An alkali carbonate may also be added if desired. The reduction of the dyestuff and the subsequent neutralisation of the alkali may be carried out in the paste itself, or the dye may be reduced separately and the alkali neutralised in the paste after addition of the reduced dye.—T. F. B.

Fibre; Production of [brown] shades on ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 18,964, Aug. 19, 1912.

See Fr. Pat. 447,991 of 1912; this J., 1913, 423.—T. F. B.

Dyeing textiles in the loose state, especially from a vat; Process and apparatus for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 451,601, Feb. 15, 1912.

See Eng. Pat. 2547 of 1912; this J., 1912, 770.—T. F. B.

Chromium compounds of hydroxyanthraquinonesulphonic acids, and their use in printing and for the production of lakes. Badische Anilin und Soda Fabrik. Fr. Pat. 451,503, Dec. 5, 1912. Under Int. Conv., Jan. 9 and 11, Aug. 5, and Sept. 24, 1912.

See Eng. Pat. 7892 of 1912; this J., 1913, 226.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphurous acid; Method for the titration of ——, as also of sulphurous acid in the presence of thiosulphuric acid. E. Bosshard and W. Grob. Chem.-Zeit., 1913, **37**, 465—466.

Sodium bisulphite is determined by adding an excess of mercuric chloride to the solution and titrating with alkali, using methyl orange as indicator; under these conditions the bisulphite behaves as an acid salt. A mixture of sulphite and bisulphite is first titrated with hydrochloric acid, using methyl orange, and then 300 c.c. of a saturated solution of mercuric chloride and some pure sodium chloride are added, and the solution is titrated with sodium hydroxide, using the same indicator; the normal sulphite present is found by the first titration, and the alkali corresponding to the original bisulphite by subtracting from the total required that neutralised by the bisulphite formed in titrating with acid. If thiosulphate be also present, the sulphite is determined by titrating with hydrochloric acid, using methyl orange, and then the bisulphite produced, together with that previously present, is titrated with $N/5$ sodium hydroxide, after adding phenolphthalein; finally, the thiosulphate is determined in another portion of the solution by adding an excess of mercuric chloride, together with 1 grm. of pure sodium chloride and 30 c.c. of $4N$ ammonium chloride solution, and titrating with alkali; the amount of thiosulphate is calculated (after subtracting the alkali corresponding to the bisulphite) from the equation, $Na_2S_2O_3+2HgCl_2+H_2O=2HCl+Na_2SO_4+S+Hg_2Cl_2$.—F. Sodn.

Persulphuric acid; Iodometric determination of ——. E. Müller. Z. anal. Chem., 1913, **52**, 299—303.

The following method is simpler and cheaper than that previously suggested (this J., 1913, 286). It is based on the fact that when persulphuric acid is added to an alkaline solution of potassium iodide this is converted into iodate, and the subsequent addition of dilute sulphuric acid liberates an amount of iodine corresponding with the equation, $K_2S_2O_8+2KI=2K_2SO_4+I_2$. Two grms. of potassium iodide are dissolved in 25 c.c. of $2N$ sodium hydroxide solution, the substance to be examined (containing not more than 0·67 grm. of persulphate, reckoned as the potassium salt) is added, the whole gently boiled and agitated for 3 minutes, and cooled; 30 c.c. of $2N$ sulphuric acid are then added, and the iodine titrated with $N/10$ thiosulphate. Accuracy is not affected by the presence of Caro's acid, but the method cannot be employed when hydrogen peroxide is contained in the solution and is therefore less suited to the examination of acid than of neutral solutions of persulphate.—F. Sodn.

Russian chemical industry. Oil, Paint, and Drug Rept., April 28, 1913. [T.R.]

The U.S. Consul-General at Moscow states that the chemical industry in Russia is developing so rapidly that imports of many foreign products are decreasing, and the manufacture of soda offers a striking example of this progress. In 1905, 50,000 tons of calcined soda were required by Russia. In 1911 it amounted to 90,000 tons, while the imports have not exceeded 1,600 tons per year during the last five years. The production of caustic soda has also increased; 40,000 tons were manufactured in 1908, and 50,000 tons in 1911. During the last five years Russia's imports of caustic soda did not exceed 600 tons. Nearly the whole supply of bicarbonate of soda on the market is manufactured in Russia.

In 1898, 100,000 tons of sulphuric acid were manufactured in Russia, 165,000 tons were manufactured in 1908, and in 1911, according to the statement of the Ministry of Finance, the manufacturing of chamber acid amounted to 235,000 tons. The yearly importation of sulphuric acid, amounting formerly to 17,000 tons, increased from 1907 to 1911, but still it is not large compared with the quantities manufactured in Russia.

Manganese industry in the Caucasus. Board of Trade J., May 8, 1913. [T.R.]

A remarkable increase in the quantity of manganese ore exported from Batoum took place in 1912, the figures for 1911 being more than doubled. The following table shows the amounts exported to the various countries in each year:—

To—	1911.	1912.
	Tons.	Tons.
Netherlands	27,999	79,503
United States	10,694	56,880
Germany	25,536	44,325
Belgium	12,994	37,965
United Kingdom	31,869	28,443
France	15,885	20,137
Austria-Hungary	4,256	10,246
Total	129,233	277,499

Carbonic acid; Reaction between —— and bases. A. Thiel. Ber., 1913, **46**, 867—874. (See also this J., 1913, 193.)

Sodium hydroxide, and the hydroxides of calcium, strontium, and barium, behave almost identically with carbon dioxide and phenolphthalein, but ammonia requires much more time for its neutralisation, so that the strength of the base has some influence in the matter, and the author's former conclusion (Ber., 1913, **46**, 241) that the time-reaction is caused by the slow hydration of carbonic anhydride, must be modified. There is a sudden rise in the time required for neutralisation, when the amount of base rises beyond a certain point: this point corresponds with about 2 per cent. of the total carbon dioxide in the author's experiments, and indicates probably that that percentage was present as carbonic acid. A corresponding phenomenon occurred in Henry's experiments on the conversion of lactones into hydroxy-acids (Z. physik. Ch., 1892, **10**, 96).—J. T. D.

Thiosulphates; Colour reaction for the detection of ——. E. Pozzi-Escot. Bull. Soc. Chim., 1913, **13**, 401—402.

Five c.c. of concentrated sulphuric acid are added carefully to a mixture of 1—2 c.c. of the solution under investigation, and an equal volume of a 10 per cent. solution of ammonium molybdate. The presence of thiosulphate is shown by a blue colour above the zone of separation of the liquids; 0·00005 grm. of sodium thiosulphate can be easily detected in this way.—L. E.

Strontium carbide; Action of nitrogen on ——. S. A. Tucker and Y. T. Wang. Trans. Amer. Electrochem. Soc., 1912, **22**, 67—72.

Strontium carbide prepared in a vertical arc electric furnace from strontium carbonate and coke, when heated in an atmosphere of nitrogen to about 1000° C., yields a product containing up to about 9 per cent. N. This nitrogen exists to an appreciable extent in the form of cyanide, the remainder being mainly as cyanamide.
—W. H. P.

Ferric salts; The reaction between —— and thiocyanates. J. C. Philip and A. Bramley. Chem. Soc. Proc., 1913, **29**, 123—124.

The colour of the red solution obtained by mixing a ferric salt and a thiocyanate gradually diminishes in intensity, and this is associated with the progressive reduction of the ferric iron to the ferrous condition. The present investigation deals with (1) the products of the reaction, (2) the velocity of the reduction, as this is affected by altering the concentration, temperature, and other factors. Corresponding with the reduction of the iron, there is an oxidation of thiocyanic acid, the sulphur appearing as sulphuric acid, and the carbon as carbon dioxide, whilst the nitrogen of the oxidised acid is converted, partly at least, into ammonia. The velocity of reduction of the ferric iron is quite appreciable at the ordinary temperature, and increases rapidly as the temperature rises. At a given temperature the change is very much slower when ferric salt is in excess than when thiocyanate is in excess. In the latter case addition of acid retards the reaction to a notable extent.

Lead sulphate; Decomposition of —— by ferric oxide. O. Proske. Metall u. Erz, 1913, **10**, 415—420.

When lead sulphate is heated in a current of air, decomposition is insignificant below 900° C. Above this temperature active decomposition sets in, and at 1100° C. the whole of the sulphur trioxide is driven off. The presence of ferric oxide causes a greater decomposition at a given temperature, but not to the same extent that silica does, and ferric oxide which has been heated to 1200° C. is more effective than ordinary red oxide. Ferrous oxide when mixed with lead sulphate is oxidised only by the air at temperatures below 800° C., but at higher temperatures is oxidised partly by oxygen derived from the lead sulphate. —T. St.

Lead dioxide; Colloidal ——. A. Gutbier and E. Sauer. Z. Chem. Ind. Kolloide, 1913, **12**, 171—177.

It is known that compounds containing the complex anion $[PbCl_6]''$, when treated with a large quantity of water, yield a clear deep brown solution. The authors show that this is a colloidal solution of lead dioxide or its hydrates. The experiments were made with ammonium hexachloroplumbate $(NH_4)_2PbCl_6$, and the most stable colloidal solutions were obtained by dissolving gum arabic in the water and adding a quantity of ammonia insufficient to neutralise the acid produced. For 0·5 grm. of the hexachloroplumbate, 250 c.c. of a 0·1 per cent. gum solution and 10 c.c. of $N/5$ ammonia solution are recommended. Colloidal solutions of higher concentration can be prepared by increasing the concentration of the gum solution.—A. S.

Rare earths; Application of the ——. C. R. Böhm. Chem. Ind., 1913, **36**, 120—130, 153—160, 189—201, 232—212.

A review of the uses to which the rare earths, especially those contained in the residues from the manufacture of incandescence mantles, have been put, or which have been suggested, arranged under the following headings:—I. Biology. II. Therapeutics: Röntgenology, radiology. III. Technical applications: porcelain colours, glass, enamels, preventing devitrification of quartz glass, refractory melting vessels, furnace linings, etc., polishes, substitutes for diamond for cutting glass, pigments, siccatives, dyeing and mordanting, photography, oxidising agents in electrolytic processes, catalytic agents, thermo-elements, pyrophoric alloys, reduction of metallic oxides, fireworks, etc., metal-filament lamps, steel, and other alloys.—A. S.

Gaseous compounds; Decomposition of —— by light [from a mercury vapour lamp]; hydrogen compounds of nitrogen and of carbon, etc. D. Berthelot and H. Gaudechon. Comptes rend., 1913, **156**, 1243—1245.

The law of inverse stability of compounds in relation to their increase in molecular weight has been verified by experiments on the compounds of the nitrogen and carbon groups when under illumination. With a large 220-volt mercury lamp an almost complete decomposition of ammonia was obtained in two hours. With hydrogen phosphide in a quartz tube at 20 mm. from the lamp, decomposition was evident in a few minutes whilst in glass tubes it was not quite complete in 30 min. Hydrogen arsenide in glass tubes was unaffected after two hours, but in a quartz tube a deposit of arsenic was formed in 15 secs. and decomposition was complete in 10 min., a mirror of arsenic being formed. Methane was not decomposed by the most intense illumination. Zinc ethyl gave zinc and pure ethane free from ethylene in 5 min. Carbonyl chloride was decomposed when in a quartz tube in less than 5 secs., but when in a glass tube no decomposition could be detected after two hours. Sulphur fluoride in a quartz tube was not decomposed by three hours illumination.—A. H. C.

Tetraphosphorus trisulphide and a new phosphorus oxysulphide $P_4S_3O_4$. A. Stock and K. Friederici. Ber., 1913, **46**, 1380—1387.

The authors have obtained P_4S_3 (see this J., 1910, 210) with a melting point a little higher than that previously given (173°—174·5° C. (corr) instead of 171°—172·5° C.). In the absence of oxygen and moisture the sulphide is very stable. It may be heated to 700° C. without decomposition, and its vapour density at this temperature agrees with the formula P_4S_3. In air, the change in weight of the solid substance is only a few tenths of one per cent. in several months. A solution of the sulphide in benzene or carbon bisulphide, however, becomes cloudy very rapidly in the air, and then deposits a yellowish white voluminous precipitate, which is an oxysulphide, $P_4S_3O_4$. The oxysulphide is very sensitve to moisture and inflames when moistened with a few drops of water. With caustic soda it gives a yellowish solution which is decolourised on warming, with the evolution of phosphine and hydrogen. —W. H. P.

Diamond and graphite. Heat of combustion and of allotropic change of certain elements. W. A. Roth and H. Wallasch. Ber. 1913, **46**, 896—911.

Diamond and various specimens of graphite, both natural and artificial, were burnt in a bomb calorimeter, with paraffin oil to aid the combustion. For 1 grm. of diamond the figure 7869 cals. was obtained, agreeing with that of Berthelot and Petit. Graphite gave as a mean figure 7854 cals. per grm., though some specimens gave a lower result, 7830—7835 cals., a difference which the authors cannot explain. Blast-furnace graphite gave 7855—7865 cals., much lower than Berthelot and Petit's figure of 7901—7902 (which, if more recent values for the heat of combustion of naphthalene be taken, becomes 7923 cals.). The authors consider Berthelot and Petit's figure to be erroneous.—J. T. D.

German Bromine Convention; Prize offered by the ——. Chem. and Drug., May 17, 1913. [T.R.]

A prize of £500 is offered by the German Bromine Convention to the discoverer of a process or compound leading to a new and increased consumption of bromine. For many years past the production of the existing German bromine factories has far exceeded the consumption, so that a fresh field of use is urgently required.

The following are some of the conditions attached to this competition: The new discovery must represent a technical innovation, and must not adversely affect existing uses of bromine. The process must be applied in practice at the latest one year after the awarding of the prize. The process must, in the opinion of the jury, lead to a considerable increase in the European consumption of bromine at a suitable price. Competitors must send in their processes at the latest by January 1, 1914, to the Deutsche Bromkonvention G.m.b.H., Leopoldshall-Stassfurt.

Bromine; The preparation of pure ——. A. Scott. Chem. Soc. Proc., 1913, **29**, 124.

The author recommends as the source of the purest bromine commercial potassium bromide, which has been boiled with small quantities of bromine water in order to eliminate any trace of iodine which may be present. The bromide, after recovery from the solution, should be fused with potassium bichromate in quantity somewhat less than that required for the liberation of all the bromine on treatment with sulphuric acid. The bromine thus obtained is free from chlorine, iodine, and all organic compounds. The bromine of commerce may be completely freed from the other halogens by shaking it with small quantities of pure sodium hydroxide solution, when the chlorine is removed as chloride and the iodine as iodate. It is easy to detect 1 part of iodine in 100,000 of bromine in this way by means of nitrosulphonic acid and chloroform, using only 10 c.c. of bromine.

Determination of nitrogen [in gaseous mixtures] by means of calcium carbide. Natus. *See* XXIII.

Patents.

Alkali; Process for obtaining —— from alkaliferous felspars or mica or minerals similar to felspars or rocks containing such minerals. E. W. Jungner, Kneippbaden, Norrköping, Sweden. Eng. Pat. 26,497, Nov. 18, 1912. Under Int. Conv., Jan. 30, 1912.

The mineral is finely powdered, mixed with lime, calcium hydroxide, or calcium carbonate, and heated to 1700°—2000° C. or above in a current of superheated steam or carbon dioxide in an electric furnace: double decomposition takes place, a calcareous mineral, such as lime felspar being formed, and the oxides, hydroxides, or carbonates of alkali metals being volatilised and condensed. —O. R.

Sulphate of ammonia; Manufacture of ——. G. N. Vis, Cuise, France. Eng. Pat. 2002, Jan. 24, 1913. Addition to Eng. Pat. 9699, April 20, 1911 (this J., 1912, 72).

The use of a saturated solution of ammonium sulphate is specified to act as medium for the interaction of ammonia, carbon dioxide, and calcium sulphate.—O. R.

Hydrofluoric acid; Manufacture of ——. H. B. Bishop, Brooklyn, N.Y., U.S.A. Eng. Pat. 15,227, June 29, 1912.

See Fr. Pat. 445,749 of 1912; this J., 1913, 23.—T. F. B.

Radium and other radio-active substances; Process for the preparation, isolation, and enrichment of ——. E. Ebler, Heidelberg, Germany. U.S. Pat. 1,059,531, April 22, 1913.

See Fr. Pat. 440,236 of 1912; this J., 1912, 723.—T. F. B.

Persulphates; Manufacture of ——. G. Adolph and A. Pietzsch, Munich, Germany. U.S. Pat. 1,059,809, April 22, 1913.

See Eng. Pat. 23,551 of 1910; this J., 1911, 85.—T. F. B.

Ammonium sulphate; Process for making ——. Soc. Industrielle de Produits Chimiques. Third Addition, dated Jan. 30, 1912, to Fr. Pat. 427,065, May 18, 1910.

See Eng. Pat. 2002 of 1913; preceding.—T. F. B.

Ammonium phosphate and ammonium nitrate; Process for the simultaneous preparation of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 450,449, Nov. 12, 1912. Under Int. Conv., Nov. 18, 1911.

See Eng. Pat. 26,097 of 1912; this J., 1913, 233.—T. F. B.

Ammonia: Process for making —— from its elements. Centralstelle f. Wissensch.-Technische Untersuchungen. Fr. Pat. 450,465, Nov. 11, 1912. Under Int. Conv., April 30, 1912.

See Ger. Pat. 252,997 of 1912; this J., 1912, 1178.—T. F. B.

Chrome alum; Electrolytic process for making ——. H. Chaumat. Fr. Pat. 450,677, Jan. 24, 1912.

See Eng. Pat. 1636 of 1913; this J., 1913, 364.—T. F. B.

Hydrogen; Apparatus for the manufacture of ——. Process for the manufacture of hydrogen from metals and water. F. Bergius, Hanover, Germany. U.S. Pats. 1,059,817 and 1,059,818, April 22, 1913.

See Ger. Pat. 254,593 and Fr. Pat. 447,080; this J., 1913, 195, 364.—T. F. B.

VIII.—GLASS; CERAMICS.

Silica in porcelain; Behaviour of different forms of ——. F. Baüml. Sprechsaal, 1913, 46, 272—274.

Porcelains of formula $1K_2O$, $4{\cdot}71Al_2O_3$, $24{\cdot}07SiO_2$, and rational composition: kaolin 44·7, felspar 26, and quartz 29·3, per cent., were made up in a variety of ways by introducing the silica as water-glass, as silicic acid, hydrated and amorphous, as quartz glass, and as kieselguhr, raw or burnt. The results are tabulated with regard to shrinkage in burning at various cones from 010a to 13, also with regard to Atterberg's plasticity numbers (see this J., 1910, 629 and 1911, 682) and to the porosity and sintering-point of the trials. Plasticity of body is greatest with amorphous silicic acid and least with kieselguhr. Silicic acid, hydrated or amorphous, causes a higher shrinkage than quartz, and induces earlier sintering, besides lowering the melting-point. Amorphous silicic acid is 30 per cent. more soluble in melted felspar than is quartz. The author then proceeds to replace the potash of felspar by lime, working on the formula CaO, $1{\cdot}16Al_2O_3$, $8{\cdot}98SiO_2$, the silica again being introduced in a variety of ways. A marked increase of contraction is caused by the substitution of amorphous silica or kieselguhr for quartz. The body made from kieselguhr melted at two cones lower than any other. In a concluding series of trials, the free silica of both the preceding series was replaced by titania, zirconia or thoria. Above cone 10, titania increased in specific gravity from 3·92 to 4·23 and lost 6·6 per cent. on ignition. As in the case of silica, all these oxides cause a smaller shrinkage when they have themselves been previously ignited. The plasticity of the mass was greater when ignited oxides were used, especially in the case of titania. —H. H. S.

Zinc oxide; Application of —— in ceramics, especially to glazes. J. Wolf. Sprechsaal, 1913, 46, 237—239, 256—259.

The crystallising propensities of glazes containing zinc oxide are well known. After a survey of the work of previous investigators in Germany, America and England, the author proceeds to the following conclusions. Zinc oxide is unsuitable for hard-porcelain manufacture as it does not yield a pure white in the reducing atmosphere; for this purpose magnesia is preferable. On ordinary pottery zinc is a valuable glaze-ingredient, with or without colouring oxides. It gives clear, crystallised or matt glazes according to the firing temperature and the chemical composition. Matt effects are best obtained in lead-zinc glazes, low in alumina; crystalline effects, in alkali-lime-zinc glazes. For mattness, the oxygen ratio should lie between 1 : 1 and 1 : 2. The molecular proportion of zinc oxide present should be equal to half the silica in low-aluminous glazes, and to one-third of the silica when the alumina content is higher. For crystalline effects, the oxygen ratio should be 1 : 1—4, and the zinc oxide equivalent to at least one-third of the non-silicious ingredients. —H. H. S.

Zinc oxide; Use of —— [in ceramics]. R. Seidel. Sprechsaal, 1913, 46, 271—272.

Works practice bears out Wolf's advocacy of zinc oxide (see preceding abstract) and the author recommends that zinc be used in bodies as well as glazes, whether the body be cast or thrown. The proportion recommended is 0·4 per cent. of zinc oxide, which amount improves translucency and surface. Zinc glazes act on cobalt stain, deepening and giving brightness to its blue. —H. H. S.

Patents.

Glass drawing apparatus. W. A. Jones, Columbus, Ohio, U.S.A. Eng. Pat. 628, Jan. 8, 1913.

In order to avoid the use of a ladle for removing cooled refuse, the drawing pot is disposed within a heating chamber independent of, but adjacent to, the glass tank, the drawing pot having a removable wall portion independent of the housing and having its upper and lower edges above and below the normal level of glass in the tank so that draining of the glass from the pot may be achieved.—H. H. S.

Drying pottery and the like; Apparatus for ——. J. Bührer, Konstanz, Germany. Eng. Pat. 15,249, June 29, 1912.

In a system which consists of drying chambers arranged around a central hot-air chamber and also around a moist-air chamber leading to a chimney or exhaust fan, the drying chambers are connected thereto by conduits arranged beneath them and opening in close proximity to each other into the central chambers, thereby reducing the necessary size of the latter. Each hot-air conduit may open into its drying chamber at different points of the length, and the chambers may themselves be connected successively by valved openings at alternate ends or by bridge pipes.—H. H. S.

Engobing earthenware; Process of ——. M. Kopp and H. Kienberger, Modlan, Austria. Eng. Pat. 25,729, Nov. 9, 1912.

The process refers to ware cast in a mould. The mould is first filled with the white engobe "slop," which is then quickly run off, and the mould filled again with the poor-coloured body material, the latter being thereby coated with the engobe of better quality and colour. (Reference is directed to Eng. Pats. 1538 of 1867 and 16,141 of 1898.)—H. H. S.

Glass gathering furnaces. H. L. Dixon and A. L. Schram. Fr. Pats. 451,333 and 451,334, Dec. 4, 1912. Under Int. Conv., Dec. 15, 1911, and March 22, 1912.

See Eng. Pats. 27,742 and 27,743 of 1912; this J., 1913, 427.—T. F. B.

White enamel and the like; Manufacture of ——. Verein. Chem. Fabr. Landau, Kreidl, Heller und Co., Vienna. Eng. Pat. 1136, Jan. 15, 1912. Under Int. Conv., Sept. 30, 1911.

See Fr. Pats. 438,908 and 450,228 of 1912; this J., 1912, 643; 1913, 488.—T. F. B.

Ceramic mass; Process for the manufacture of a —— as metal substitute for laboratory implements and apparatus. H. Kunz-Krause, Dresden, Germany. Eng. Pat. 8498, April 10, 1912. Under Int. Conv., April 12, 1911.

See Fr. Pat. 442,094 of 1912; this J., 1912, 957.—T. F. B.

Drying apparatus for ceramic products. J. Bührer. Fr. Pat. 451,347, July 26, 1912.

See Eng. Pat. 15,249 of 1912; preceding.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Wood; Process for preserving, seasoning and fireproofing —— and the like, and products obtained thereby. J. A. Deeew, Montreal. Eng. Pat. 5411, March 4, 1912.

See U.S. Pat. 1,010,122 of 1911; this J., 1912, 29. Creosote oil, zinc chloride, mercuric chloride, or copper sulphate may be added to the sulphite liquor.—T. F. B.

Artificial stone. E. Doggett, Gravesend, and S. Durling, Meopham Green, Kent. Eng. Pat. 8399, April 9, 1912.

"Silicate of iron," (2 parts), white shellac solution (2 parts), and "soda and alum" (1 part) are boiled together, mixed with Portland cement (15 parts), finely ground Perrie Le Vaudoné stone (80 parts) and water, until the desired consistence is obtained, and the mixture left in moulds until it is hard enough to be worked.—O. R.

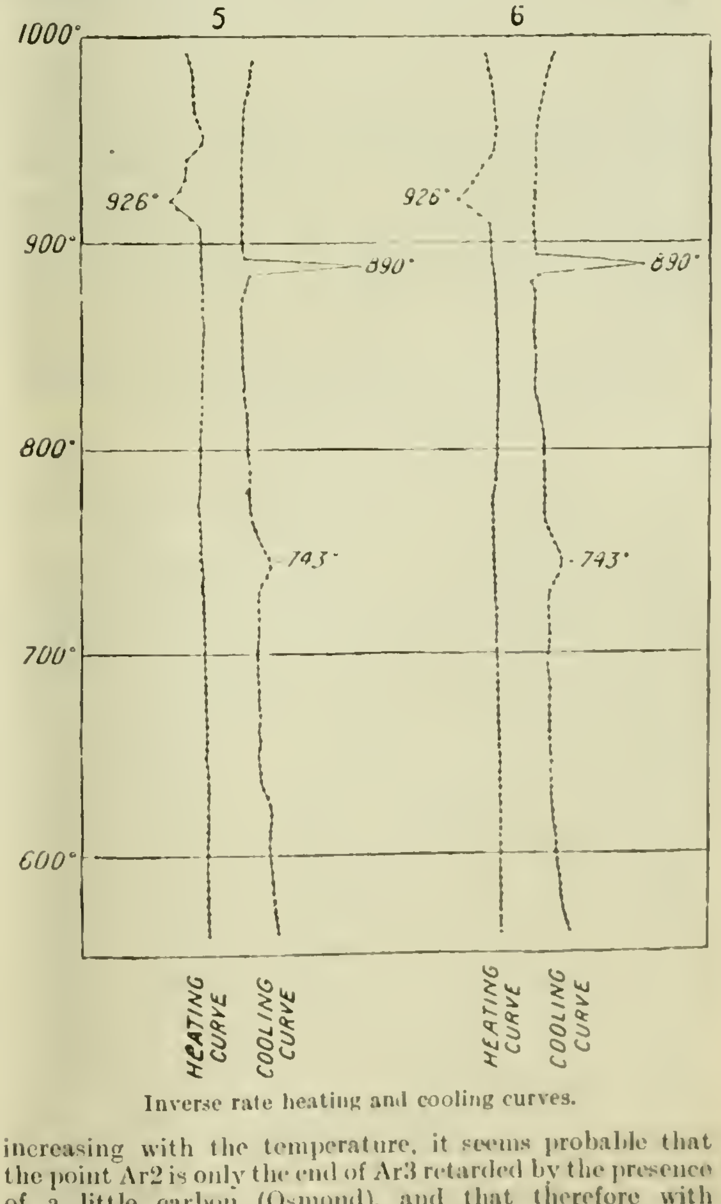
Pumps for raising and forcing cement and other semi-liquids. Sir W. H. and A. J. Bailey, Salford. Eng. Pat. 17,796, Aug. 1, 1912.

Pumps requiring to be flushed with water in order to prevent setting of the liquid cement after work are provided with means for lifting from their seats each of the suction and delivery valves, so that water may be pumped right through into the suction tank. The lifting of the valves is effected by any convenient arrangement. For example, a passage in the casting is drilled at a suitable angle to the valve and in this passage is fitted a spindle, the inner end of which will be in contact with the ball or other valve. An outer portion of the passage is provided with a screw thread into which is screwed a corresponding portion of the spindle which may be rotated by a hand wheel or other means.—H. H. S.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; Critical ranges of pure ——. H. C. H. Carpenter. Iron and Steel Inst., May, 1913. [Advance proof.]

It is pointed out that if, as thought by Benedicks (J. Iron and Steel Inst., 1912, 242), the nature of β-iron is to act as α-iron containing γ-iron in solution to a limited extent increasing with the temperature, it seems probable that the point Ar2 is only the end of Ar3 retarded by the presence of a little carbon (Osmond), and that therefore with decreasing carbon content the point Ar2 should decrease in intensity until it disappears in the absence of carbon, and on heating the point Ac2 should be absent. This



Inverse rate heating and cooling curves.

latter would not occur if the points Ac2 and Ar2 had any real existence. Electrolytic iron as sheet containing C 0·008, Mn 0·009, Si 0·014, P 0·002 per cent., and a trace of sulphur, was rolled into a tight cylinder enclosing a thermo-couple and then heated in a vacuum electric resistance furnace, a series of six heating and cooling curves being obtained. In the sixth heat when all the hydrogen had been evolved Ac3 only appears at 926° C., and on cooling Ar3 occurs at 890° C., Ar2 at 743° C. being only just visible (see fig.). It is concluded that the conception of A2 as an independent allotropic change must be abandoned, that Ar2 is simply the termination of Ar3 retarded by impurities present even in the purest forms of iron hitherto prepared, and were it possible to remove the last trace of impurity iron would cease to show even these faint indications of Ar2. Reference is also made to Andrew's "degasified and almost carbonless iron" (this J., 1912, 986) which shows only the faintest indications of Ar2.—A. H.C.

[*Steel.*] *Iron carbide; Influence of sulphur on the stability of ——, in the presence of silicon.* W. H. Hatfield. Iron and Steel Inst., May, 1913. [Advance proof.]

As the result of an investigation in which three series of steels (containing: combined C 2·85—3·2, Si 0·29—1·09, S 0·01—0·85 and Mn 0·0—0·18 per cent.) were employed, it was concluded that sulphur increases the stability of iron carbide, the action being of a chemical nature (not mechanical as suggested by Levy) and probably effected by a small percentage of sulphur associated with the carbide crystals; yet the action of sulphur is neutralised by manganese and also to a large extent by silicon.

—W. E. F. P.

Chromiferous iron ores of Greece and their utilisation. H. K. Scott. Iron and Steel Inst., May, 1913. [Advance proof.]

A DETAILED account is given of the distribution, mode of occurrence, methods of mining, etc., of the ores in question, which contain: Fe 46—52, Al_2O_3 6—14, SiO_2 5—11, Cr 2—3, Ni and Co 0·1—1·2, P trace—0·03, S 0·02—0·05 and Ti trace—0·3 per cent. Hitherto the ores have been employed (in admixture with other iron ores) for their iron content alone; but it is now suggested that they be utilised for the direct production of chromiferous pig iron, as in the case of similar ores occurring at Mayari and other localities in Cuba. A brief historical survey relative to such direct smelting is given, reference being made to the application of the Mayari product for special castings and the manufacture of steel rails.—W. E. F. P.

Cast-iron; Influence of the metalloids on the properties of ——. H. I. Coe. Iron and Steel Inst., May, 1913. [Advance proof.]

AMERICAN washed iron was melted under charcoal in a graphite crucible, and when melted suitable alloys of the metalloids were added to form a series of fifty-four alloys containing C 3·0, Si from 0·40 to 2·24, Mn from 0·14 to 2·22, S 0·11 to 0·45, P 0·30 to 2·88 per cent. Transverse strength, deflection, tensile and hardness tests were made and the results tabulated. It is concluded that (1) Silicon decreases the strength and hardness of cast iron owing to its effect in promoting the decomposition of iron carbide. (2) Manganese to the extent of 0·5 per cent. softens silicious grey irons, owing to its effect on the condition of the carbon; the strength is increased by the addition of manganese. (3) The influence of sulphur is largely determined by the silicon present. Carefully controlled, it should be of considerable value to the iron-founder in mixing his irons for any particular purpose. (4) In the absence of manganese, and in the presence of about 2 per cent. Si, very strong grey irons may be obtained if the percentage of sulphur be judiciously raised. (5) Phosphorus to the extent of about one per cent. is useful. It confers fluidity, slightly increases the strength, and also slightly diminishes the hardness of the metal. A higher percentage gives a hard brittle material. The influence of the metalloids on the pearlite formation was also investigated, and the cooling curves of six phosphoric irons are given. The paper is illustrated by nine microphotographs.—A. H. C.

Steel; Production of sound —— by the lateral compression of the ingot while its centre is liquid. B. Talbot. Iron and Steel Inst., May, 1913. [Advance proof.]

It is suggested that in order to obtain an ingot free from blowholes and piping, it should be treated with a deoxidiser, preferably aluminium, which it is stated not only prevents the formation of blowholes in the outer shell, but causes the metal to solidify earlier, which treatment produces a piping steel. The ingot is then in accordance with a definite time-table stripped, charged into the soaking pit, and then cogged whilst the interior is still liquid and thus by reducing the cross-sectional area by lateral pressure compensate for the contraction due to solidification and cooling, and produce a pipeless sound ingot which may be returned to the pit or kept sufficiently hot for finishing. Photographs of a number of ingots both untreated and treated as above are given to show the beneficial effect of the treatment. The influence of this treatment on the segregation of the metalloids is also discussed and it is stated that wherever pressure has been applied before the solidification of the central portion has taken place, segregation has occurred upon and in the inner wall of the steel envelope in the shape of a deposit higher in carbon and sulphur of somewhat regular composition. The details of the drop tests applied to a number of rails rolled from ten ingots are tabulated, the cogging mill scrap averaging 4·68 per cent. on the ingot and the rail crop 4·06 per cent. on the bloom.

—A. H. C.

Steel; Piping and segregation of ingots of ——, and ductility tests for open hearth steel rails. P. H. Dudley. Trans. Amer. Inst. Min. Eng., 1913, 677—705.

THE reasons for the production of pipes and shrinkage cavities in rail steel containing from 0·55 to 0·75 per cent. C are discussed and the three following methods of procedure to prevent their formation or to provide for their subsequent elimination are given:—(1) The mill practice required is to strip the ingots, reheat at once, and then bloom them under their own initial equalised heat. (2) To compress the walls of the ingot in order to close the slight interior shrinkage cavity, and then to reheat and bloom the ingot. (3) To feed the lessening volume of the ingots with molten metal and then reheat and bloom. Attention is called to the use of deoxidisers to efficiently purify the steel (the use of aluminium being deprecated), and then the importance of retarding the development of the cavity under the cap in the setting steel by stripping the ingot and promptly charging it into the reheating furnace. The time limit from teeming, stripping, weighing and charging into the reheating furnace involves definite relations to the mass of metal, its chemical composition, and length and size of the ingots, and must be well understood to secure pipeless rails.—A. H. C.

Soft steel at high temperatures: Tenacity, deformation, and fracture of ——. W. Rosenhain and J. C. W. Humfrey. Iron and Steel Inst., May, 1913. [Advance proof.]

A SPECIALLY designed apparatus is figured and described in which the tensile strength *in vacuo* of mild steel strips, containing C 0·106, S 0·075, P 0·050, Mn 0·395 per cent. and a trace of silicon, could be observed at temperatures between 612° and 1080° C. The test-pieces were cut from the strip by the use of a hard steel template, and after being polished on one surface for micro-examination were accurately measured, and then normalised by being heated *in vacuo* to 1000° C. and allowed to cool at a uniform rate. The mechanical results were recorded by the apparatus as autographic stress-strain diagrams and the numerical results obtained from these tabulated and graphically illustrated as a temperature-tenacity curve in which are two well-marked discontinuities corresponding to the critical points A3 and A2 respectively. Of these the one showing the largest change of tensile strength occurs at the transition from γ into β-iron. The smaller one corresponding to Ar2 is perfectly definite, and it is stated that its existence must be taken into account in any discussion concerning the existence of β-iron. The effect of the rate of straining on the tensile strength was also determined and diagrams are given showing this influence at varying temperatures, and it appears that for a given intensity of stress the metal undergoes extension at a given rate, and to produce a higher rate of extension a greater stress is required. For a higher rate of straining, therefore, a high stress is required to produce rupture whereas at a lower rate the metal extends and finally fractures under a lower stress. Curves showing the influence of crystal size on the tenacity-temperature curve are given and show that this influence diminishes with diminishing temperature, the most powerful influence being in the middle of the β-range. Twenty-three microphotographs illustrate the results obtained and are discussed in light of the conception that the crystals of a pure metal are surrounded and cemented together by a very thin layer of the same metal in an amorphous condition, the properties of the crystal and the cement material varying with the temperature. It is finally concluded that in iron one important transformation occurs at about 900° C., which results in the formation of a harder and stronger body usually called γ-iron. A smaller change occurs at the temperature of Ar2 and the observations, apart from the mechanical discontinuity, do not indicate any very striking difference between β and α-iron, but the authors find it difficult to reconcile the occurrence of the discontinuity with Benedick's theory by which β-iron is regarded as a solution of γ-iron in α-iron.—A. H. C.

Iron-silicon alloys; Transformations of ——. G. Charpy and A. Cornu. Comptes rend., 1913, **156**, 1240—1243.

The dilatation of iron-silicon alloys containing C 0·10, Mn 0·30, and Si from 0·20 to 4·50 per cent., and C 0·35, Mn 0·80 per cent. with similar amounts of silicon, was determined at varying temperatures and some of the results graphically illustrated. The anomalous dilatation observed between 800° and 900° C. in low-carbon iron is only affected in amplitude as the silicon content is increased, and in alloys containing more than 1·30 per cent. Si the curve of dilatation becomes a straight line. A similar result is obtained by the addition of nickel to iron with the difference that the anomalous dilatation for silicon is gradually effaced at a fixed temperature whilst that for nickel is displaced in the range of temperature without sensibly altering its amplitude. In the case of alloys containing about 3·5 per cent. C an addition of 4·5 per cent. Si was necessary to obtain the same result. The curves of dilatation are compared with the recalescence curves and it is shown that while the points A1 and A3 disappear the point A2 is still present in the silicon alloys and the authors conclude that it has a definite existence and is not a residue of the points A1 and A3.—A. H. C.

Iron and steel; Rate of rusting of ——. J. Aston and C. F. Burgess. Eighth Int. Cong. Appl. Chem., 1912. Sect. Xa. Orig. Comm., **26**, 453—469.

Samples of commercial open-hearth iron of high purity, Swedish iron, open-hearth mild steel, Bessemer rail steel and grey cast iron, in some cases polished and in others with the rolling or annealing scale left on, were exposed on the one hand to the atmosphere and on the other hand to the atmosphere and also to the fumes escaping from the ventilator outlet of a chemical laboratory. The condition of the test pieces was examined after periods of 75, 150, and 300 days respectively. The detailed results are given in tables, and photographs of corroded specimens and photomicrographs of the structure of some of the test-pieces are also given. Ordinary black scale appears to retard atmospheric corrosion. Heterogeneity of structure as a factor favouring corrosion does not appear to possess the importance frequently attributed to it; in the authors' experiments it was of secondary significance and overshadowed by other factors.—A. S.

Silicon; The influence of —— *on the corrosion of cast iron.* J. N. Friend and C. W. Marshall. Iron and Steel Inst., May, 1913. [Advance proof.]

Corrosion tests with fresh water, salt water and dilute sulphuric acid were made on seven samples of cast iron, of Si-content varying from 1·24 to 2·28 per cent. Practically no difference was observed among the samples in any of the tests.—T. St.

Nickel, chromium, and nickel-chromium steels; The corrodibility of ——. J. N. Friend, W. West and J. L. Bentley. Iron and Steel Inst., May, 1913. [Advance proof.]

The same ten steels that were used in a former investigation (this J., 1912, 493) have been subjected to a similar set of corrosion tests extending over six months. A new test was also made in which discs of the steels were immersed in water, kept at 86° C. during the day, and allowed to cool at night. The corrosion in this case was fairly rapid, and after 35 days the discs were removed. The results are considered to indicate that in long exposure tests the influence of nickel is not so beneficial as shorter tests would suggest. The experiments with the chromium steels appear to agree very well with previous results. The steels containing both nickel and chromium were more corroded than steels containing similar amounts of these elements alone.—T. St.

Iron; Influence of various elements on the corrodibility of ——. C. F. Burgess and J. Aston. Trans. Amer. Electrochem. Soc., 1912, **22**, 241—258.

Experiments with alloys of electrolytic iron (practically free from C, S, P, Si, and Mn) with various elements (Al, As, Co, Cu, Pb, Mn, Ni, Se, Si, Ag, Sn, and W) showed that with regard to atmospheric corrosion very many alloys (practically all except those with Si and Se) show a smaller corrodibility than electrolytic iron. The copper series is interesting on account of the effects produced by very small quantities of copper.—W. H. P.

Corrosion of iron and steel; Electrolytic method for the prevention of ——. J. K. Clement and L. V. Walker. Trans. Amer. Electrochem. Soc., 1912, **22**, 193—208.

For preventing the corrosion of iron by opposing a counter E.M.F., making the iron the cathode and a carbon rod the anode (cf. Harker and McNamara, this J., 1911, 1286), the current density required depends on various factors such as acid concentration, amount of dissolved oxygen and degree of circulation of the electrolyte. The authors describe experiments carried out to study the influence of these factors, and the current densities required under various conditions are given in curves. The current density required can be calculated from the loss in weight of the unprotected metal under the given conditions. —W. H. P.

Metals used in marine construction; Preservation of ——. F. Lyon. Engineering, April 25, 1913, 151.

The cause of corrosion is considered to be the difference of electrical potential between the metal and the liquid or moisture that wets its surface. Where bronze castings are secured to the steel hull, plates or rings of rolled zinc are very often fastened to the steel in order to prevent the corrosion of the steel because of their higher potential than the steel. The author discredits this assumption because:—(1) Zinc becomes covered quickly with oxide which is electronegative to steel. (2) In no case has a piece of steel connected with a zinc plate corroded less in the same time than a piece of steel cut from the same plate and unconnected with zinc. (3) The steel around the sea-chests of the bottom blow discharges, if properly painted, does not show more corrosion than does that around the other discharges. (4) On many occasions the only steel attacked in the vicinity of the zinc plates was that of the steel screws securing the zincs. The use of zinc and other metals electropositive to steel is stated to be a dangerous one and not to be recommended for the following reasons:—(1) The metal covering must be electropositive to the steel, or metal to be protected, and therefore will dissolve more quickly. (2) A covered steel once exposed to the action of the water corrodes rapidly over the exposed surface, and if not stopped by some covering, will pit through before other surfaces are uncovered. (3) For hull and ship fittings generally, a surface once exposed cannot be again covered. (4) The stable oxides of all metals are lower in potential than the pure metals, and therefore the oxide of the coating is at a lower potential and does harm instead of good where the steel is exposed. It is suggested that for the protection of hull construction it is necessary:—(1) To provide the most homogeneous metals possible. (2) Paint the completed structure with a complete film of the best anti-corrosive paint after having cleaned the surfaces from all rust and thoroughly dried them. (3) Dock frequently, removing any rust, and repaint as may be necessary.—A. H. C.

Oxygen in iron and steel; Determination of —— by reduction in an electric vacuum furnace. W. H. Walker and W. A. Patrick. Trans. Amer. Electrochem. Soc., 1912, 22, 149—158.

In the Ledebur method for determining oxygen in iron, oxygen combined with silicon, etc., may escape measurement. The authors suggest heating the specimen of iron with carbon in an electric vacuum furnace with a graphite resistance. All gases are removed from the furnace by heating to 500°—600° C. and exhausting as completely as possible. Pure dry nitrogen is then admitted and the exhaustion repeated. The furnace is now heated so that the metal melts in 3 or 4 minutes. At this high temperature the oxides are quantitatively reduced by the carbon, forming carbon monoxide which is dried, and passed over iodine pentoxide heated to 130° C., the iodine liberated being absorbed in potassium iodide solution and titrated. This method yields results for various kinds of iron which are much higher than those obtained by the Ledebur method.—W. H. P.

Phosphorus [in iron and steel]; A new method for the accurate determination of ——. C. H. and N. D. Ridsdale. Iron and Steel Inst., May, 1913. [Advance proof.]

The sample is dissolved in nitric acid (sp. gr. 1·22), and all the phosphorus converted into orthophosphoric acid by the addition of potassium permanganate, without baking. Ammonium salts are then added and the phosphorus and arsenic at once precipitated by ammonium molybdate. The precipitate is washed, and dissolved in sodium hydroxide solution. Hydrochloric acid is then added and metallic zinc. When the zinc has dissolved, zinc sulphide is added, which precipitates all the arsenic and some molybdenum. These are filtered off and hydrogen sulphide expelled by boiling, after which the solution is reoxidised by means of potassium chlorate. Solid sodium acetate is then added to neutralise the free hydrochloric acid, and the phosphorus is reprecipitated by the addition of strong nitric acid, followed by a solution of ammonium nitrate and ammonium molybdate. The precipitate is washed free from acid with a solution of potassium nitrate, and the phosphorus determined by titration with standard sodium hydroxide solution and nitric acid. The time taken is one to one and a half hours, and the working error rarely exceeds 0·001 per cent. The success of the final precipitation depends on the addition of just the right amount of nitric acid prior to the addition of the ammonium salts which actually bring about the precipitation. Two tables are given, the first being a comparison, stage by stage, of the new method with molybdate methods now in use, and the second giving the working details of the new method.—T. St.

Manganese; Note on the determination of —— in cast iron and steel by G. von Knorre's process. M. Huybrechts and N. Joassart. Bull. Soc. Chim. Belg., 1913, 27, 130—137. (See this J., 1903, 1104.)

The precipitation of manganese in solutions of steel, etc., by ammonium persulphate is incomplete in the presence of excess of acid, but if only the requisite acid is used to dissolve the sample, and the sulphuric acid formed in the reaction with the persulphate is neutralised, the manganese is always completely precipitated. The sample is dissolved in dilute nitric acid, 12·5 c.c. of 1·2 sp. gr. acid being taken for each grm. of sample, and 250 c.c. of cold water added. 50 c.c. of an 8 per cent. solution of ammonium persulphate are then added, the solution boiled for 15 to 20 minutes, then treated with a mixture of 50 c.c. of the persulphate solution and 50 c.c. of an 8 per cent. solution of sodium carbonate, and boiled for a further 20 minutes. The precipitate of hydrated manganese dioxide together with some iron is collected and treated with a mixture of 15 c.c. of $5N$ hydrochloric acid and 15 c.c. of hydrogen peroxide, the solution is boiled for several minutes to destroy the excess of hydrogen peroxide, cooled, made up to 500 c.c., and aliquot portions filtered off for titration by the Guyard-Volhard method. Results demonstrating the accuracy of the process are given for steels, cast irons, and spiegels.—T. St.

Black sand and floating particles of metallic minerals; Recovery of ——. J. M. Neill. J. Chem., Met. and Min. Soc., S. Africa, 1913, 13, 418—421.

"Black sand" as known on the Rand mainly consists of iron sulphide containing a large quantity of gold, small quantities of iridium, osmiridium, and in some cases platinum, and other metals of the same group. Owing to its friable nature, the black sand is largely reduced to very fine particles during crushing and in the mortar boxes, and tends to be floated over the amalgamated plates. To overcome this tendency the author uses a floating apron of strips of thin cork sheet extending across the plate about halfway down. The recovery of the black sand in this way is dependent on the mill being run with alkaline water. Figures are given showing the advantage of recovering the black sand and treating it separately, as against allowing it to go forward with the pulp for cyanide treatment.—T. St.

Silver bismuth alloys; Electrolytic refining of ——. W. N. Lacey. Trans. Amer. Electrochem. Soc., 1912, 22, 301—312.

Laboratory experiments showed that the best results were obtained with an electrolyte prepared by adding a 5 per cent. solution of potassium cyanide to a 5 per cent. solution of silver nitrate till the precipitate produced re-dissolved. A deposit containing less than 1 per cent. of bismuth may be obtained with a current density of about 0·14 ampère per sq. dm. The current density gradually decreases during electrolysis, and the potential difference between the electrodes gradually increases slightly, but it may safely be as high as 6 volts. The power required is about 0·25 kilowatt-hour per lb. of silver at 1·5 volts, and increases by 0·11 kilowatt-hour per volt increase in the P.D. The deposit is quite adherent and the use of anode bags is not necessary.—W. H. P.

Copper; Colouring —— brown with chlorate solution. E. Groschuff. Deutsch. Mechan.-Zeit., 1912, 145—148, 153—157. Chem. Zentr., 1913, 1, 1733—1734.

The following mode of producing a brown colour on copper was developed as the result of numerous experiments upon the influence of various factors on the process. The copper article is immersed for 5—10 mins. in a solution of 10 grms. of sodium chlorate, 10 grms. of ammonium nitrate and 1 grm. of crystallised copper nitrate in 100 c.c. of water heated to 100° C. Passive copper or copper which has been boiled with sodium hydroxide solution is not coloured brown by this method. Tin, zinc and lead are dissolved by the solution and aluminium becomes coated with a film of oxide; moreover these metals when present along with the copper, prevent the formation of a brown colour on the latter.—A. S.

Zinc ore; Electric smelting of ——. W. R. Ingalls. Trans. Canadian Min. Inst., 1912, 15, 101—113.

The reduction of zinc oxide being an endothermic process it is necessary for heat to be supplied either externally to the retort as in ordinary smelting practice or by internal heating by the electric current. The latter method by the use either of an arc or a resistance has the advantage that the heat is developed in the midst of the charge, but to be successful must permit of being conducted continuously and not intermittently as in smelting. The formation of carbon dioxide, the speed of reduction, effect of temperature, smelting at Trolhättan, recovery of lead, condensation, the formation of blue powder, and the cost of electric smelting are discussed from the results of recent work. The following conclusion made six years ago are still held to hold good : (1). Electric smelting will never displace ordinary smelting, if it be necessary to generate the power from coal. (2). It may be economically conducted at places where cheap hydro-electric power is available. (3). Up to the present time certain peculiar and serious metallurgical difficulties in electric smelting have not been satisfactorily overcome. —A. H. C.

Zinc ; Proposed standard method for the determination of ——. F. G. Breyer. Eighth Int. Cong. Appl. Chem., 1912. Sect. I. Orig. Comm., **25**, 7—37.

In a report to the Sixth Int. Cong. Appl. Chem., Rome, 1906, Nissenson concluded that there was little if any difference in value between the following four methods for the determination of zinc in ores, etc. : the gravimetric hydrogen sulphide method, the electrolytic method, Schaffner's sodium sulphide method, and Galletti's ferrocyanide method. This conclusion has been shown not to hold good in the case of the magnetic separator product, franklinite, the crude ore from Franklin Furnace, N.J., U.S.A., and other ores of a low degree of purity, and the author recommends a standard method (a combination of known methods) which is satisfactory for such ores as well as for the common sulphide and carbonate ores. In the proposed method, full details of which are given, the heavy metals, with the exception of cadmium, are separated by means of aluminium, the cadmium is precipitated electrolytically or with hydrogen sulphide, and the zinc is then precipitated with hydrogen sulphide, redissolved and titrated with ferrocyanide.—A. S.

Aluminium ; Density of ——. F. J. Brislee. Faraday Soc., May 7, 1913. [Advance proof.] (See also this J., 1912, 30.)

The density of aluminium varies considerably with the nature of the previous treatment and under certain conditions the density of the cast metal may exceed that of the worked metal, though the density of the worked metal increases again on annealing. The worked metal etched with hydrofluoric acid shows under the microscope a structureless surface, the only feature being flow lines in the direction of work. Cast aluminium under similar conditions is very distinctly crystalline.—W. H. P.

Nickel and cobalt ; Determination of ——. R. L. Hallett. Eng. and Min. J., April 26, 1913, 857—858.

From 0·5 to 1·0 grm. of the finely divided ore is decomposed by nitric acid and potassium chlorate, the insoluble residue removed in the usual manner, and after a hydrochloric acid solution has been obtained 15 c.c. of bromine water are added and then ammonia in excess and the iron hydroxide removed. The filtrate is acidified with hydrochloric acid adding 5 c.c. in excess, boiled, diluted to 250 c.c. with hot water and saturated with hydrogen sulphide; it is then filtered and the precipitate washed with hydrogen sulphide water. Ammonium chloride is then added to the filtrate, and excess of a one per cent. alcoholic solution of dimethylglyoxime added to the boiling hot solution. It is now made just ammoniacal, allowed to stand for half an hour, filtered on a Gooch crucible, washed, dried for one hour at 110° C. and the $NiC_8H_{14}N_4O_4$ weighed. In the presence of only a little nickel and much cobalt the hydrochloric acid solution is neutralised with potassium hydroxide, made just acid with hydrochloric acid, boiled, the dimethylglyoxime added, and sodium acetate until the red precipitate is just formed, and then one gram of sodium acetate added in excess, finally filtered and completed as above. The filtrate from the nickel is made strongly acid with sulphuric acid (sp. gr. 1·84), and evaporated over a flame until fumes of sulphuric acid appear. This treatment destroys all organic matter. It is then cooled, 30 c.c. of water and 5 c.c. of hydrochloric acid are added and heated until all is in solution when it is kept at 50° C. and a freshly prepared hot solution of nitroso-β-naphthol in 50 per cent. acetic acid added as long as a precipitate is formed. It is allowed to stand for one hour at 50° C., filtered and the precipitate washed with cold and then hot 12 per cent. hydrochloric acid, finally with hot water, ignited in a platinum crucible and weighed as Co_3O_4. The method has been tested with varying amounts of pure nickel and cobalt in the presence of large amounts of zinc, calcium, magnesium, and alkalis and stated to have been found extremely accurate. —A. H. C.

Tin ; Action of tartaric acid on —— *in the presence of oxygen.* A. C. Chapman. Chem. Soc. Proc., 1913, **29**, 122—123.

When tin is partly immersed in a 5 per cent. aqueous solution of tartaric acid, no action occurs unless air is present. In these circumstances oxidation takes place at the surface of the liquid, and stannous tartrate is formed. If the action is allowed to proceed at the ordinary temperature, well-formed crystals of stannous tartrate slowly separate, the solutions in the case of the author's experiments having been allowed to remain undisturbed for three years. Contrary to existing statements, stannous tartrate readily undergoes dissociation even in the presence of tartaric acid, yielding under some conditions a colloidal solution. In the presence of a restricted supply of oxygen the stannous oxide undergoes slow oxidation, forming a brown-coloured, colloidal solution, which may contain as much as 6 per cent. Sn, and which, when heated with free exposure to the air, becomes converted into a bluish-white, colloidal liquid containing hydrated stannic oxide. The brown-coloured solution evidently contains an oxide of tin intermediate between stannous and stannic oxides —probably the sesquioxide.

Tin-amalgams of low mercury content ; Vapour pressures of liquid ——. A. Sieverts and H. Oehme. Ber., 1913, **46**, 1238—1246.

The vapour pressures of tin amalgams containing 0·8 to 8 per cent. Hg between 300° and 360° C., range from about 2 to about 70 mm. of mercury, and are nearly proportional at a given temperature to the concentration of the dissolved mercury. A few determinations at 515° and 528° C. gave similar results with 2 and 10 per cent. amalgams, the pressures ranging from 173 to 886 mm. The solubility of mercury in tin thus obeys Henry's law, and as it is known that for the solution of diatomic gases (H_2,O_2,N_2) in metals the concentration of the solution is proportional to the square root of the pressure of the gas, it appears justifiable to assume that when the diatomic gases dissolve in metals their molecules are split up into atoms.—W. H. P.

Alloys ; Elastic limit of ——. A. Portevin. Comptes rend., 1913, **156**, 1237—1240.

The work of previous investigators on the microscopic deformation of metals and alloys as shown by the appearance of slip-bands has been repeated in order to determine whether their formation determines the elastic limit of the metal. The deformation was produced by the compression of pyramidal test-pieces (Frémont). It is shown that :—(1). The slip bands commence to appear in certain layers of grains extending later to all the grains in alloys consisting of a chemically homogeneous solid solution, and it is possible to determine a maximum and minimum limit of elasticity as shown by the appearance of the slip-bands in the first layers and in the last. (2). In alloys formed by a heterogeneous solid solution the slip-bands appear first in the centre of the grain layer extending progressively to their periphery. (3). In alloys consisting of two phases the slip-bands appear in the α phase first. It is concluded that the elastic limit cannot be expressed by a definite number since the slip-bands commence at certain points in the alloy and spread progressively to the other regions, such progression being determined by the mechanical anisotropy of the grains and the chemical heterogeneity of the alloy.—A. H. C.

Decomposition of lead sulphate by ferric oxide. Proske. *See* VII.

Electroanalysis of copper, antimony, bismuth and tin with acidified chloride electrolytes. Schoch and Brown. *See* XXIII.

Patents.

Steel ; Preparatory refining furnace, adapted to be supplied direct from the blast-furnace in the manufacture of ——. F. Bernhardt, Königshütte, Germany. Eng. Pat. 17,543, July 29, 1912.

A preparatory refining mixer arranged in a single rocking structure with one or more collecting vessels for the refined metal. The mixing container communicates with the collecting vessel by means of an opening in the intervening wall, and transference of the refined metal from the former to the latter is effected by tilting the structure. —W. E. F. P.

[*Steel.*] *Furnace, Open-hearth* ——, *adapted for use with blast-furnace gas.* Poetter, Ges.m.b.H., Düsseldorf, Germany. Eng. Pat. 18,148, Aug. 7, 1912. Under Int. Conv., Aug. 14, 1911.

A regenerative, open-hearth furnace in which the waste gases are caused to pass in series through a recuperator and a regenerator while the fuel gas and the combustion air pass through the same in parallel; the recuperator is preferably employed for heating the air and the regenerator for heating the fuel gas.—W. E. F. P.

Malleable iron ; Process for the production of —— *direct from ore.* A. R. Lindblad, Ludvika, Sweden. U.S. Pat. 1,058,991, April 15, 1913.

Ore and reducing material are charged into a shaft furnace, in which the ore is fully or partially reduced, and the mass, without cooling, then passes into an electric melting furnace situated immediately below the shaft furnace. The gases issuing from the throat of the furnace are heated outside the furnace, and are re-introduced into the space above the charge in the melting furnace.—T. St.

Furnace [*for heating steel billets*]. Georgs-Marien-Bergwerks- und Hütten-Verein, A.-G. Ger. Pat. 258,147, Dec. 15, 1910.

The furnace is arranged for regenerative gas firing and the billets are moved through the furnace by means of a percussive device. The heating flames flow in both directions parallel or approximately parallel to the track on which the billets move through the furnace. The gas-burners, at least at the feed end of the furnace, are below the track, and at this end also the air required for complete combustion is introduced at some distance from the gas-inlet and the combustion chamber is separated from the track by an arch.—A. S.

Aluminium ; Process for coating iron sheets, plates and the like with ——. C. Woud, Krommenie, North Holland. Eng. Pat. 6971, Mar. 21, 1912. Addition to Eng. Pat. 20,669, Sept. 5, 1910 (this J., 1911, 695).

The aluminium varnish instead of being fed direct to the pressing rolls, as described in the original patent, is conveyed thereto by a number of distributing rolls.—T. St.

[*Aluminium*] *Alloys ; Manufacture of* ——. W. N. Naylor, Forest Hill, and S. P. Hutton, Beckenham. Eng. Pat. 15,690, July 4, 1912.

A device for facilitating the introduction of magnesium, phosphorus and similar elements or deoxidants into, and beneath the surface of, molten aluminium alloys, consists of a tube or casing, open at its lower end and fitted with a plunger or piston or a sliding indicating rod.—W. E. F. P.

Tungsten wires or the like ; Manufacture of drawn ——. C. H. Fischer, Charlottenburg, Germany. Eng. Pat. 9981, April 26, 1912.

Pure anhydrous tungstic acid is reduced (at a temperature of about 1000° C.) in a current of hydrogen and in the presence of phosphoric anhydride (dehydrating agent), by which means crystalline, ductile, metallic tungsten is obtained; after being separated from unreduced oxide by mechanical means, the crystalline, metallic powder is subjected to pressure and the resulting flakes of metal are agglomerated into rods or bars by the application of pressure and electrical heat simultaneously: the bars are considerably reduced in thickness by means of rolls before being finally drawn into wires or filaments.—W. E. F. P.

Annealing furnace for metals ; Continuously operating ——. C. Kugel, Werdohl, Germany. Eng. Pat. 18,082, Aug. 6, 1912.

In a furnace for annealing metals in an inert atmosphere, the annealing and cooling chambers are connected, by an extension at each end, with vertical hoisting chambers through which the material is charged into or discharged from the annealing chambers.—W. E. F. P.

Annealing furnace. H. Hillebrand, jun. Ger. Pat. 257,716, June 24, 1911.

Above the vertical annealing retort is a cooling chamber, the axis of which is parallel to that of the retort. The cooling chamber and the annealing retort can be sealed as a whole against the outer air and an atmosphere of reducing gases is maintained therein. Four cooling cylinders are mounted on arms projecting from the axis of the cooling chamber and these can be sealed both against the outer air and against the atmosphere of the cooling chamber. The articles to be annealed are introduced into one of these cylinders by a crane, and the cylinder is then moved round until it is above the annealing retort, into which the articles are lowered by means of another crane. After the annealing the articles are raised into the cylinder, and a second cylinder, which has been filled in the meantime, is brought round over the annealing pot. The cylinder filled with the annealed articles finally again arrives below the crane and is emptied.—A. S.

Silver and silvered articles ; Cleaning composition for ——. E. S. Balchin, Enfield. Eng. Pat. 27,119, Nov. 25, 1912.

A mixture of "hyposulphite" (thiosulphate), chloride and carbonate of sodium in the approximate proportions of 40, 20 and 2 parts by weight, respectively.—W. E. F. P.

Ore dressing apparatus. H. Velten, Milan, Italy. Eng. Pat. 502, Jan. 7, 1913. Under Int. Conv., Jan. 15, 1912.

Descending particles of ore are met by an upward stream of a liquid or a gas, so that while the heavier and larger particles descend, the lighter and smaller particles are carried forward by the stream. Classification is brought about at an abrupt and short contraction in the vertical passage down which the ore is descending, the medium, and the particles carried with it, passing along a lateral discharge situated immediately above the contraction. —T. St.

Ores and the like ; Method of treating ——. N. C. Christensen, jun., Salt Lake City, Utah. U.S. Pat. 1,058,034, April 8, 1913.

The ground ore passes down a vertical shoot divided into compartments by horizontal grids which can be given a reciprocating movement, so as to retard or accelerate the movement of the ore as desired. In the several compartments the ore is subjected to the action of different atmospheres at markedly different temperatures, the atmosphere used in one compartment being transferred to another compartment after the introduction of a gaseous metallurgical reagent extraneous to the metalliferous material under treatment.—T. St.

Lead and zinc ; Process for the industrial separation of ——, *contained in the state of sulphides in ores.* G. de Bechi, Forest Gate, Essex. Eng. Pat. 4246, Feb. 19, 1913. Under Int. Conv., Apr. 11, 1912.

The ore, in the form of an impalpable powder, is treated with a hot solution of ferric sulphate containing free sulphuric and nitric acids, whereby the metallic sulphides are converted into sulphates and free sulphur liberated. After filtration, the zinc is recovered from the solution by crystallisation, the mother liquor being employed for the treatment of a further quantity of ore; the zinc sulphate is calcined for the regeneration of sulphuric acid and the production of zinc oxide. From the insoluble portion containing lead sulphate and sulphur the latter is recovered by distillation or by means of solvents, after which the residue is smelted for the production of metallic lead. —W. E. F. P.

Zinc; Apparatus for the manufacture of metallic ——. R. D. Lance, La Garenne-Colombes, Assignor to P. Ferrere, Paris, France. U.S. Pat. 1,059,307, April 15, 1913.

A horizontal retort open at both ends is held by the walls of a central heating chamber, the ends projecting into two side chambers. Means are provided for admitting cold air into the side chambers, and for establishing communication between the side and central chambers. The ends of the retort are connected by conduits with inverted bottle-shaped receivers, the open ends of which are in turn received by collectors. Doors are provided in the outer walls of the side chambers in line with the retort.—T. St.

Slag; Treatment of ——. G. L. Danforth, jun., Chicago, Ill. U.S. Pat. 1,058,158, April 8, 1913.

Molten slag, or other material which is friable when solid, is poured on to a bed on which are placed tension-members. When the slag has cooled, it is disintegrated by withdrawing the tension-members.—T. St.

Copper; Process for treating ——. D. W. Blair, Assignor to Metallurgical Research Co., New York. U.S. Pat. 1,058,941, April 15, 1913.

Copper cathodes are melted in a furnace by means of the highly heated products of combustion of a hydrocarbon burner, so regulated as to produce an oxidising atmosphere, whereby a sufficient amount of oxide is formed to react with the carbon used in the poling operation. The copper is then run off and poled.—T. St.

Bearing-metal; Light ——. Allgemeine Elektricitäts-Ges. Ger. Pat. 257,868, March 24, 1911.

The ground mass of the alloy consists of: Al 40—90, Sn 5—50, and Pb (or other metal soluble in Sn) 0—20 per cent. The alloy also contains 5—30 per cent. Sb or Ni or other metal which does not form a solid solution with the ground mass but combines with aluminium to yield a crystalline compound harder than the ground mass. —A. S.

Metal scrap; Process for the continuous treatment of —— with acids or acid solutions. K. Albert and C. von der Linde. Ger. Pat. 258,262, March 10, 1912.

The scrap is placed in troughs or gutters of acid-proof material, *e.g.*, earthenware, which are immersed in the acid liquid, and to which a shaking or vibratory motion is imparted by means of gearing outside the vessel. Rotating magnets are mounted between the gutters for the purpose of transferring magnetic articles from one gutter to another. —A. S.

Cobalt steel; Process for making high-speed ——. Stahlwerk Becker Akt.-Ges. Fr. Pat. 450,793, Nov. 20, 1912. Under Int. Conv., Aug. 9, 1912.

See Eng. Pat. 27,838 of 1912; this J., 1913, 430.—T. F. B.

Steel and other metals; Process of electric smelting for the manufacture of ——. G. H. Benjamin. Fr. Pat. 451,520. Dec. 6, 1912.

See U.S. Pat. 1,051,065 of 1913; this J., 1913, 198.—T. F. B.

Copper; Extraction of —— from sulphide ores and other materials. N. V. Hybinette. Kristianssand, Norway. Eng. Pat. 5806, March 7, 1912.

See Fr. Pat. 440,712 of 1912; this J., 1912, 822.—T. F. B.

Metals: Extraction of ——. A. H. Perret, Paris. Eng. Pat. 5867, March 8, 1911. Under Int. Conv., Aug. 12, 1910. Addition to Eng. Pat. 26,777 of 1910, dated Nov. 24, 1909.

See Addition of Aug. 4, 1911, to Fr. Pat. 412,641 of 1910; this J., 1912, 237.—T. F. B.

Briquettes of fine granular material for metallurgical purposes; Method of forming ——. W. Boehm, Charlottenburg, Germany. Eng. Pat. 8246, April 4, 1912.

See Fr. Pat. 444,271 of 1912; this J., 1912, 1134.—T. F. B.

Briquettes from ore or blast-furnace dust; Process of manufacturing ——. W. Haage, Assignor to Gewerkschaft Pionier, Walsum on Rhine, Germany. U.S. Pat. 1,059,150, April 15, 1913.

See Fr. Pat. 448,276 of 1912; this J., 1913, 431.—T. F. B.

Sulphurous ores; Treatment of ——. G. Fusina, Genoa, Italy. Eng. Pat. 8426, April 9, 1912.

See Fr. Pat. 442,280 of 1912; this J., 1912, 931.—T. F. B.

Metals and alloys; Treatment of —— to render them ductile and malleable. Westinghouse Metallfaden Glühlampenfabrik G. m. b. H., Vienna. Eng. Pat. 19,288, Aug. 22, 1912. Under Int. Conv., Sept. 14, 1911. Addition to Eng. Pat. 12,869 of 1912, dated June 7, 1911.

See Addition of Sept. 4, 1912, to Fr. Pat. 445,208 of 1912; this J., 1913, 240.—T. F. B.

Zinc; Electrodeposition and refining of ——. U. C. Tainton, Manchester, and J. N. Pring, Sandbach. U.S. Pat. 1,059,233, April 15, 1913.

See Eng. Pat. 7235 of 1911; this J., 1912, 780.—T. F. B.

Zinc-lead ores containing manganese; Process for treating complex ——. A. G. French. Fr. Pat. 449,569, Oct. 18, 1912.

See U.S. Pats. 1,041,060, 1,055,157, and 1,055,158; this J., 1912, 1082; 1913, 431.—T. F. B.

Colloidal metals; Production of ——. H. Crookes, London. U.S. Pat. 1,059,841, April 22, 1913.

See Eng. Pats. 21,521 and 21,528 of 1911; this J., 1912, 1093.—T. F. B.

Aluminium alloys. W. N. Naylor and S. P. Hutton. Fr. Pat. 450,805, Nov. 20, 1912. Under Int. Conv., Dec. 6, 1911, and July 4, 1912.

See Eng. Pats. 27,382 of 1911 and 15,680 of 1912; this J , 1912, 094.—T. F. B.

Pyrites and other iron sulphides; Treatment of ——. L. T. Wright. Fr. Pat. 451,423, Nov. 21, 1912. Under Int. Conv., Nov. 22, 1911.

See Eng. Pat. 26,128 of 1911; this J., 1913, 29.—T. F. B.

Metallurgical furnace; Electric ——. V. Stobie. Fr. Pat. 451,498, Dec. 5, 1912.

See Eng. Pat. 26,184 of 1911; this J., 1913, 30.—T. F. B.

Machines for washing or separating coal, ore, and other granular and like materials. Eng. Pat. 10,929. *See* I.

XI.—ELECTRO-CHEMISTRY.

Electro-analysis of copper, antimony, bismuth and tin with acidified chloride electrolytes. Schoch and Brown. *See* XXIII.

Patents.

Cells; Galvanic ——. J. T. and A. Szék, Brussels. Eng. Pat. 18,404, Aug. 10, 1912. Under Int. Conv., Aug. 12, 1911.

The cell is provided with a carbon electrode having inner and outer ventilating conduits, connected together by transverse conduits at the top and bottom. The electrode is surrounded by a depolarising mass, and then wrapped in a fabric such as blotting-paper. The whole is rolled up in a metallic electrode formed from expanded metal, for instance pure zinc, or metal of at least 99·5 to 99·9 per cent. purity. The elements of the expanded metal are not less than 3·5 mm. and not more than 4·5 mm. wide, whilst the slots are between 15 and 20 mm. in length. The openings of the metal are filled with electrolytic paste, consisting of flour or flakes of rice mixed with silicious earth, plaster, ammonium chloride, and chloride of zinc, aluminium, magnesium or the like. The whole is surrounded by parchment or paraffined paper, and tied with string. To obtain a wet battery, it is sufficient to immerse the mass from time to time in liquid electrolyte. —B. N.

Storage battery. Separator for storage-battery plates. W. Morrison, Des Moines, Iowa. U.S. Pats. 1,058,778 and 1,058,779, April 15, 1913.

(1) The positive pole electrode contains lead oxide, and, as a binder, a compound containing titanium and oxygen. (2) The separators for the battery plates are composed of wood, which has been heated in a bath of melted wax, such as paraffin, at a temperature and for a time sufficient to drive off the volatile ingredients of the wood. The latter is removed from the bath, and the residual bath material dissolved from the wood.—B. N.

Anti-cathode for Röntgen tubes; Tungsten ——. Siemens Bros. and Co., Ltd., London. From Siemens und Halske, A.-G., Berlin. Eng. Pat. 25,052, Nov. 1, 1912.

The anti-cathode consists of a fused tungsten mirror, the latter being fixed to the body of the anti-cathode by soldering or other similar means.—B. N.

Electrode; Electric furnace carbon ——. A. T. Hinckley, Niagara Falls, N.Y., Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,058,057, April 8, 1913.

A hole is formed through the electrode, together with a narrow slit in the wall thereof, both extending longitudinally from end to end.—B. N.

Ozoniser. C. F. Wallace, New Brighton, N.Y. U.S. Pat. 1,059,014, April 15, 1913.

The ozoniser consists of a number of units, each comprising two concentric glass tubes spaced apart, with "headers" at each end of the tubes, and a free passage through the centres of the tubes. The heads are provided with openings in communication with the space between the concentric tubes, and couplings are carried by the heads adjacent to the openings, whereby the units are secured together. An electrode is arranged on the outer surface of each of the outer tubes of the units, and one on each of the inner surfaces of the inner tubes.—B. N.

Ozone; Manufacture of ——. J. Steynis, New York City. Eng. Pat. 19,146, Aug. 21, 1912.

See U.S. Pat. 1,035,489 of 1912; this J., 1912, 884.—T.F.B.

Electric arc furnaces. E. C. R. Marks, London. From Patents Purchasing Co., Appleton, Wis., U.S.A. Eng. Pat. 8791, April 13, 1912.

See Fr. Pat. 442,548 of 1912; this J., 1912, 932.—T. F. B.

Furnace; Electric ——. E. Stassano, Turin, Italy. U.S. Pat. 1,059,499, April 22, 1913.

See Eng. Pat. 21,281 of 1912; this J., 1913, 95.—T. F. B.

Ozone; Apparatus and process for producing ——. J. Steynis. Fr. Pat. 451,602, Feb. 15, 1912.

See U.S. Pat. 1,035,489 of 1912; this J., 1912, 884.—T.F.B.

XII.—FATS; OILS; WAXES.

Fats in oleaginous fruits; Formation of ——. IV. Phillyrea media. F. Scurti. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1913, 6, 29—37.

Experiments with the plant *Phillyrea media* gave results exactly analogous to those obtained previously with the olive and with the Japanese privet (this J., 1911, 1021; 1912, 884). In the Phillyrea the fatty acids present are oleic, palmitic and stearic acids, whilst the waxy alcohol (*fillirol*) from which the fatty acids are produced, melts at 290°—295° C., and has the same composition, $C_{31}H_{50}O_3$, as oleanol and ligustrol. The fatty matter (soluble in petroleum spirit) extracted from the Phillyrea fruits (yield 11·93 per cent. of the dried material) has the acid value, 25·6 and saponification value, 172·2.—A. S.

Cork; Formation of fat in ——. F. Scurti. *V. Cork from the elder (Sambucus nigra).* F. Scurti and G. Tommassi. *VI. Leaves of the elder. VII. Fellonic acid of Kügler.* Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1913, 6, 39—59, 67—75.

Investigation of the cork (cortex) of the elder (*Sambucus nigra*), on the lines previously adopted for oleaginous fruits (see this J., 1911, 1021; 1912, 884; also preceding abstract) showed that the ether extract contains a waxy alcohol, m. pt. 278°—280° C., of the same composition, $C_{31}H_{50}O_3$, as oleanol, ligustrol, and fillirol; it is this compound which has been described as cerin by previous investigators. The portion of the ether extract soluble in petroleum spirit contains stearic acid and other fatty acids which have not been identified. In plants (olive, Japanese privet) of the order, *Oleaceæ*, the waxy alcohol is formed in the leaves of the plant, but its transformation into fatty acids takes place almost entirely in the fruit. In the elder, on the other hand, which belongs to the order, *Caprifoliaceæ*, the formation of the waxy alcohol and its transformation (to a considerable extent) into fatty acids both take place in the leaves. The constituent of cork, named *fellonic acid* by Kügler (Inaug. Diss., Strassburg, 1884; Archiv Pharm., 222, 217) has been isolated by the authors and identified as α-hydroxybehenic acid, $C_{22}H_{44}O_3$ (see Fileti, Gazz. chim. ital., 1897, II., 298).—A. S.

Ox-foot and sheep's foot oils; Distinctive reactions of ——. N. Chercheffsky. Les Matières Grasses, 1913, 6, 3070—3071.

(1) 20 grms. of the oil are dissolved in 5 c.c. of carbon bisulphide, and the solution added little by little to 10 grms. of sulphuric acid (sp. gr. 1·84). Ox-foot oil gives a brownish-red colouration, whilst the liquid remains clear; sheep's foot oil gives a yellowish-brown colouration and a turbidity. (2.) 20 grms. of the oil are dissolved in 5 c.c. of carbon bisulphide, and the solution treated with 10 drops of a solution of potassium bichromate in strong sulphuric acid. Ox-foot oil gives a brown colouration and sheep's foot oil a straw yellow colouration. (3) A mixture of 10 c.c. of the oil, 10 c.c. of hydrochloric acid, and 0·1 c.c. of a 2 per cent. alcoholic solution of furfural is shaken for 2 minutes. Ox-foot oil becomes brown and the colour is intensified on heating, whilst sheep's foot oil remains colourless even when heated.—C. A. M.

China wood oil; Detection of adulteration of ——. L. S. Potsdamer. Eighth Int. Cong. Appl. Chem., 1912. Sect. Vc. Orig. Comm., 25, 791—793.

The author has been unable to obtain satisfactory results with the Bacon test (this J., 1912, 782). He recommends the determination of the temperature of polymerisation. A test-tube containing the sample is placed in an oil-bath heated to 510°—525° F. (226°—274° C.), and the temperature at which polymerisation sets in is observed on a thermometer placed in the sample. For pure oils the average temperature is about 553° F. (289° C.), but it is considerably lower for oils adulterated with soya bean oil (the most likely adulterant) or paraffin.—A. S.

Deglycerinated oils. Lacombe. Bull. Soc. Ind. Nord de la France, 1913, 41, 160—162.

Commercial deglycerinated oil consists of a mixture of various fatty acids with the neutral oil from which they were produced, together with different unsaponified and unsaponifiable substances, alcohols and hydrocarbons. A considerable quantity of this product is imported into France from foreign countries, notably Belgium, and to escape heavy customs duties it must be of a certain composition. It must not contain more than 15 per cent. of neutral unsaponified oil, or more than 6 per cent. of fatty acids solid at 20° C. For the determination of the solid fatty acids the following method is proposed:—10 grms. of the oil are kept for an hour at 20° C. with occasional shaking to prevent supersaturation, and are then filtered at 20° C., and the filtrate weighed. The iodine values of the filtrate and the residue on the filter are then determined, and the proportion of solid fatty acids in the residue calculated from the ratio between the two iodine values. —C A. M.

Triglycerides; Saponification of ——. J. Meyer. Chem.-Zeit., 1913, 37, 541—542.

The author points out that the results obtained by Fortini (this J., 1912, 997), and especially the series of acetyl curves, tend to support the view of Lewkowitsch (this J., 1900, 254) and of Kellner (this J., 1909, 531, 1093) that the three different stages of the saponification proceed simultaneously rather than consecutively.—C. A. M.

Lubricating oils for the cylinders of steam engines; Examination of ——. A. Cormorant. Bull. Soc. Ind. Nord de la France, 1913, 41, 153—156.

For cylinders of engines using superheated steam it is advisable only to use lubricating oils answering to the following requirements: Sp. gr. 0·90; fluidity at 35° C., 12° to 15° (Barbey); at 100° C., 100° to 150° (Barbey); viscosity at 50° C., 50° to 60° (Engler); at 100° C., 6° (Engler); and ignition point in closed vessel 300° to 330° C. For the cylinders of engines using saturated steam the oils may have a sp. gr. of 0·88; fluidity at 35° C., 40° to 50°; at 100° C., 150° to 250°; viscosity at 50° C., 30°; at 100° C., 35°; and ignition point 220° to 250° C. The fluidity is measured by Barbey's ixometer, in which the degrees indicate the number of c.c. of the oil that pass during one hour, at a definite temperature, through a capillary space between a tube 5 mm. in diameter and 200 mm. in length, and a rod 4 mm. in diameter centred in exactly the same axis as the tube. The apparatus is standardised on fresh cold-drawn colza oil, which should give a reading of 100° (Barbey) at 35° C. under a constant pressure of 100 mm.—C. A. M.

Patents.

Tallow and other fats, Means of and apparatus for melting and treating ——, and for degreasing bones and the like. W. T. Powling, jun., and B. B. Powling, Prittlewell, Essex. Eng. Pat. 8397, Apr. 9, 1912.

Relatively small quantities of the material to be extracted are heated, without water or solvent, in a horizontal jacketed cylinder, and are meanwhile constantly thrown against the heating surface, by means of revolving blades or the like, until the fat has been separated and the water evaporated. Various modifications of the machinery for carrying out this process are claimed.—C. A. M.

Fat product; Hydrogenated edible ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,058,738, Apr. 15, 1913.

A mixture of fatty oils is hydrogenised with excess of hydrogen, so as to obtain a product more consistent than lard. This is pressed to remove part of the hard stearin-like bodies, and to leave a residue (resembling lard), which may then be bleached. Claim is made for an edible fat, thus prepared, which melts at about 28° C., is non-toxic, and when melted and slowly cooled does not materially alter in its consistence.—C. A. M.

[*Candelilla*] *Wax-extracting apparatus.* W. S. Watson, Memphis, Tenn. U.S. Pat. 1,058,648, April 8, 1913.

The apparatus, for the extraction of wax from the candelilla plant, comprises an elongated tank arranged to hold water, with a shallow extension on one side, the bottom of the extension being below the normal level of the liquid. Conduits, disposed outside the main tank, connect the bottom of the extension with the bottom portion of the main tank, one end of the latter serving as a receiving end for the candelilla plant and the other as a discharging end. A steam pipe, with an inlet near the bottom of the tank on the side opposite the extension, is bent backward and forward along a portion of the bottom of the tank, and a second steam pipe is arranged with an inlet at the opposite end of the tank. The second pipe is formed into a coil along the end, and along a portion of the two sides. Each of the steam pipes is provided with a perforated end portion, extending inwardly from the ends of the tank from the bottom, with a valve for controlling the perforated end portions. A flow of water is produced toward the extension, and a flow of the top layer of water backwards towards the receiving end.—B. N.

Train oil; Process for deodourising ——. Sudfeldt und Co. Fr. Pat. 451,127, Nov. 21, 1912.

See Eng. Pat. 17,430 of 1912; this J., 1913, 243.—T.F.B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

White pigments; Manufacture of ——. S. Pope, Manchester. Eng. Pat. 8546, Apr. 11, 1912.

A continuous process for the manufacture of normal and basic sulphates of lead in the wet way. Litharge, preferably prepared according to the method of Eng. Pats. 17,178 of 1898 and 11,526 of 1909 (this J., 1899, 1033; 1910, 1306)—acetic acid or lead acetate, and water are mixed in suitable proportions in the first of a series of vessels, and sulphuric acid is added, whilst the mixture is kept in agitation by means of stirrers. A mixture of litharge, acetic acid or lead acetate, and water, is then fed into the first vessel till the materials overflow into the second vessel of the series. Instead of adding the whole of the sulphuric acid to the first vessel of the series part of it may be added to the second or to succeeding vessels. From the last vessel of the series the materials pass into a suitable receptacle, whence they are removed for subsequent treatment, the pigment being separated and the solution being returned to the circuit with fresh litharge. Coarse particles and metallic lead fall to the bottom of the vessels and are run off through tubes, each provided with two valves. To produce basic sulphate of the composition $2PbSO_4Pb(OH)_2$ the proportions required are those represented by: $3PbO+2H_2SO_4=2PbSO_4,Pb(OH)_2+H_2O$. The process is preferably carried out in the apparatus described in Eng. Pat. 16,974 of 1911 (this J., 1912, 1042). —E. W. L.

Colour lakes; Process for preparing ——. E. Ulrichs. Ger. Pat. 258,392, May 21, 1912.

The alkali or ammonium bisulphite compounds of the alkali or ammonium salts of the dyestuff, naphthylaminesulphonic acid-2.1-azo-β-naphthol, are treated with alkaline earth salts, with or without the addition of a substratum, and then with an alkali or alkaline-earth hydroxide. The first operation furnishes, *e.g.* Lithol Red-barium-sodium bisulphite, which on treatment with barium hydroxide is converted into the barium lake of Lithol Red; it is somewhat bluer in shade than the normal lake.—T. F. B.

Enamel paint; Quick drying, hard ——. G. Koizumi, London. Eng. Pat. 18,257, Aug. 8, 1912.

A rapid-drying, hard, non-absorbent paint is prepared by mixing together lac (say 2½ lb.), methylated spirit (say 1 gall.), and camphor (say ¼ lb.) with *e.g.*, 1—10 lb. of pigment. For a white paint bleached white lac (5 lb.) is used instead of ordinary lac.—C. A. M.

Rosin; Process of extracting —— and other by-products from wood. W. M. Bashlin, Grove City, Pa. U.S. Pat. 1,059,261, Apr. 15, 1913.

The wood, in small pieces, is heated in a closed vessel with a mixture of refined turpentine (one-fifth) and deodourised benzine (four-fifths). The extract is drawn off and separated into its constituents, whilst the solvent still retained by the wood may be recovered by injecting a current of steam and condensing the vapours evolved. The extraction of the rosin may be promoted by the production of a vacuum in the closed vessel.—C. A. M.

Minium; Process of producing ——. J. Muhlbauer, Prague, Austria-Hungary. U.S. Pat. 1,059,195, April 15, 1913.

SEE Eng. Pat. 25,757 of 1911; this J., 1912, 347.—T. F. B.

Lacquers and varnishes; Process for the manufacture of ——. A. Cohn, Neukölln, Germany. Eng. Pat. 8194, April 4, 1912. Under Int. Conv., Feb. 6, 1912.

SEE Fr. Pat. 441,703 of 1912; this J., 1912, 886.—T. F. B.

Resinous compositions of high adhesive power. Gebr. Schübert. Fr. Pat. 450,949, Nov. 22, 1912. Under Int. Conv., Jan. 24, 1912.

SEE Eng. Pat. 26,182 of 1912; this J., 1913, 253.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Depolymerisation and transformation of ——. G. S. Whitby. Z. Chem. Ind. Kolloide, 1913, 12, 190—193.

THE author describes several cases of deterioration of samples of rubber (*Hevea brasiliensis*), in which the resin content increased and the rubber, at first tacky, became hard and brittle. In one case the resin content increased to 78 per cent. The deteriorated rubber had a very low viscosity. The effect is considered to be the result of depolymerisation, followed by oxidation, and is probably due to the action of an enzyme or enzymes. The author also discusses the question of the transformation of caoutchouc in the plant.—A. S.

Caoutchouc; Addition compounds of —— *with hydrogen halides and halogens.* F. W. Hinrichsen, H. Quensell and E. Kindscher. Ber., 1913, 46, 1283—1287.

A CURRENT of dried gaseous hydrogen halide was led into a 1 per cent. solution of purified Para rubber in benzene or chloroform, cooled with ice. On subsequent addition of petroleum spirit or alcohol, the addition compound was precipitated as a white amorphous substance. In this way a dihydrochloride, $C_{10}H_{16},2HCl$, a dihydrobromide, and a monohydriodide, $C_{10}H_{16},HI$, were obtained (see also Harries, this J., 1913, 372). In a similar way by the action of chlorine and bromine respectively on cooled solutions of Para rubber in chloroform, the compounds, $C_{10}H_{14}Cl_6$, and $C_{10}H_{16}Br_4$, were obtained. It is stated that by brominating rubber in a chloroform solution cooled with ice, the tetrabromide is always obtained independent of the excess of bromine used and the duration of bromination. The halogen cannot be completely removed from the addition compounds by the action of boiling alcoholic sodium hydroxide. Ultramicroscopic examination of chloroform solutions of the hydrobromide and bromide showed that these are of colloidal nature. —A. S.

Caoutchouc; Action of iodine on ——. F. W. Hinrichsen and R. Kempf. Ber., 1913, 46, 1287—1291.

A REPETITION of Weber's experiments (this J., 1900, 215) failed to yield the compound, $C_{20}H_{32}I_6$, described by him, only a green substance containing from 6 to 14 per cent. I being obtained. The action of iodine on caoutchouc is notably influenced by light. On adding a 1 per cent. solution of iodine in chloroform, in small portions, to a 1 per cent. solution of Para rubber in chloroform, exposed to direct sunlight, the iodine is rapidly absorbed until finally 4 atoms have been consumed for each $2C_{10}H_{16}$ molecules, when no further absorption of iodine occurs. If the colourless solution be concentrated *in vacuo*, filtered through paper, and stirred into a large quantity of petroleum spirit, a white powder is obtained of composition corresponding approximately to the formula $C_{20}H_{27}O_7I$. The compound is soluble in chloroform, and, especially on warming, in alcohol. It decomposes, with liberation of iodine, even at the ordinary temperature, and very rapidly on exposure to light. If it be placed together with iodine in an exsiccator and the latter exhausted, the compound becomes dark brown and absorbs iodine to the extent of about 170 per cent. of its weight, so long as it is protected from the light, but the absorbed iodine is again liberated on exposure to light. —A. S.

Caoutchouc; Reaction of —— *with sulphur chloride and sulphur.* F. W. Hinrichsen and E. Kindscher. Ber., 1913, 46, 1291—1297.

EXPERIMENTS on the cold vulcanisation of rubber with sulphur chloride have shown that the final product is a compound $(C_{10}H_{16})_2S_2Cl_2$ (see this J., 1910, 891; also Bernstein, this J., 1912, 1087). For the experiments on hot vulcanisation, solutions of Ceylon plantation rubber (Hevea) in cumene (2 grms. in 100 c.c.) were treated with varying quantities of sulphur (from 2 to 10 grms.) and heated for a definite period (4 hours in one series of experiments and 8 hours in another) in a thermostat at 170° C. After removing the greater part of the excess of sulphur by crystallisation, the reaction product was extracted repeatedly with acetone, finally in a Soxhlet apparatus, to remove the remaining uncombined sulphur, and then analysed. In both series of experiments the amount of sulphur combined increased with the excess used and the duration of vulcanisation, but the values found approached asymptotically 32 per cent., corresponding with the formula, $C_{10}H_{16}S_2$ (see Spence and Young, this J., 1912, 785). The product was a brown hard powder which, unlike the raw rubber, was not capable of decolourising bromine water. When attempts were made to remove the uncombined sulphur by means of alcoholic sodium hydroxide solution instead of acetone, products of lower content of combined sulphur were always obtained.—A. S.

PATENTS.

Rubber gums; Process for drying low-grade ——. P. Schidrowitz, London. Eng. Pat. 5328, Mar. 2, 1912.

LOW-GRADE rubber gums, such as the coagulum obtainable from the latex of *Euphorbia tirucalli*, are dried in a vacuum at a temperature preferably below that of boiling water. The removal of the moisture is much facilitated by mechanical working of the gum during the application of the vacuum. The temperature is kept low until the bulk of the water has been expelled and is then raised until, at the conclusion of the drying operation, the product is sufficiently liquid to be poured out of the containing vessel with ease. The product thus obtained from *Euphorbia tirucalli* is a tough elastic and plastic solid, which is rendered workable by the warmth of the hand and on heating above 50° C. becomes semi-liquid, viscid and extremely adhesive.—E. W. L.

Rubber from plants yielding the same; Extracting ——. S. Goldreich, London. Eng. Pat. 8676, April 12, 1912.

THE stems or branches of the plants are divided into sections of convenient size, and treated with hot smoke, with or without the addition of steam. The bark is removed from the wood, converted into pulp, and the rubber extracted therefrom by any suitable method. —B. N.

Rubber; Art of refining ——. W. A. Lawrence, New York, Assignor to Intercontinental Rubber Co., Jersey City, N.J. U.S. Pat. 1,058,186, April 8, 1913.

"RUBBER" is "improved" by subjecting it to the action of a caustic alkali in solution in the presence of the distillate obtained by the destructive distillation of woody matter.—E. W. L.

Latex from rubber-yielding plants; Process for preserving and improving ——. G. Eichelbaum. Ger. Pat. 256,904, Nov. 28, 1911. Addition to Ger. Pat. 254,196.

INSTEAD of the oxygen-compounds of sulphur mentioned in the chief patent (see Fr. Pat. 438,778; this J., 1912, 651), their organic derivatives, especially hydrosulphite- or sulphoxylate-aldehyde compounds, are used as reducing agents.—A. S.

India rubber substitutes. O. Röhm, Darmstadt, Germany. Eng. Pat. 613, Jan. 8 1913. Under Int. Conv. Jan. 30, 1912.

Solid acrylic acid esters of formula $(CH_2:CH{\cdot}CO_2R)_x$, where R is any fatty or aromatic alcohol radical—obtained by polymerisation, may be converted into a commercially utilisable rubber substitute by one of the known methods of vulcanisation.—E. W. L.

Rubber or similar substances from polymerised vinyl bromide or polymerised vinyl chloride or their methyl homologues ; Process for obtaining ——. I. Ostromislensky, and Obstchestvo proizvodstva & torgovli resinovymi izdeliami "Bogatyr," Moscow. Eng. Pat. 6299, March 13, 1912.

See Fr. Pat. 442,981 of 1912 ; this J., 1912, 1043.—T.F.B.

Rubber or its isomers and similar substances ; Process for the manufacture of —— *from divinyl, and homologues and other hydrocarbon substitution derivatives thereof.* I. Ostromislensky, and Obstchestvo proizvodstva & torgovli resinovymi izdeliami "Bogatyr," Moscow. Eng. Pat. 6300, March 13, 1912.

See Fr. Pat. 442,982 of 1912 ; this J., 1912, 1043.—T. F. B.

Milky juice or latex of rubber-bearing plants ; Process for coagulating the ——. W. Pahl. First Addition, dated Oct. 28, 1912, to Fr. Pat. 421,650, Oct. 20, 1910. Under Int. Conv., Feb. 2, 1912.

See Eng. Pat. 24,795 of 1912 ; this J., 1913, 98.—T. F. B.

Rubber ; Coagulation and treatment of ——. F. A. Byrne. Fr. Pat. 450,452, Nov. 12, 1912. Under Int. Conv., Dec. 9, 1911.

See Eng. Pat. 27,664 of 1911 ; this J., 1913, 98.—T. F. B.

Rubber ; Process and apparatus for coagulating and treating ——. F. A. Byrne. Fr. Pat. 450,561, Nov. 12, 1912. Under Int. Conv., Dec. 9, 1911.

See Eng. Pats. 27,665 of 1911 and 292 of 1912 ; this J., 1913, 35.—T. F. B.

Elastic product similar to rubber from animal matter ; Process for making an ——. Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappy. First Addition, dated Oct. 14, 1912, to Fr. Pat. 416,644, April 22, 1910. Under Int. Conv., Dec. 20, 1911.

See Eng. Pat. 8523 of 1912 ; this J., 1912, 1088.—T. F. B.

Plastic or very elastic and non-hygroscopic masses ; Process for making ——. W. Plinatus. Fr. Pat. 450,967, Nov. 23, 1912.

See Eng. Pat. 25,805 of 1911 ; this J., 1912, 1139.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Tannic acid fermentation. L. Knudson. J. Biol. Chem., 1913, **14**, 159—202.

Tannic acid is toxic to a large number of fungi at relatively low concentrations and of many moulds examined only *Aspergillus flavus*, *A. niger*, *A. oryzae* and *Penicillium sp.* were able to grow in a 10 per cent. solution. *A. niger* is a more vigorous fermentative organism than *Penicillium sp.* and fermentation was found in all cases to be more rapid in a gall nut infusion than in a solution containing gallic acid as the only source of carbon. The presence of other organic compounds in the gall nut infusion protected the gallic acid to a certain extent. The addition of 10 per cent. of sugar protected the gallic acid entirely while 5 per cent. had no such action but simply increased the growth of the organism. When gallic acid and sucrose to the extent of 5·5 per cent. and 10 per cent. respectively, were present together, the sucrose alone was fermented. Fermentation can take place under anaerobic conditions and 1 mgrm. of mycelium is sufficient to effect the transformation of 2·706 grms. of tannic acid in ten days. In an approximately 15 per cent. solution of tannic acid, fermentation was most rapid when the tannic acid alone served as the source of carbon and when aerobic conditions were maintained, yet this method of fermentation is wasteful from the standpoint of an economical yield of gallic acid. The economical methods are (a) those in which growth occurs under aerobic conditions and the tannic acid is supplemented by sucrose, or (b) those in which, with tannic acid alone, the supply of oxygen is limited to a small amount. The presence of 10 per cent. of sucrose does not inhibit the secretion of the enzyme tannase by *A. niger* but it seems to inhibit, to some extent, the secretion of the enzyme by *Penicillium sp.* The enzyme is secreted into the culture solution by submerged mycelium as well as by surface growth. There is no evidence that tannic acid is consumed directly ; probably it is first transformed into gallic acid and the latter then utilised. There is a progressive increase of tannase in *A. niger* and *Penicillium sp.* with increased concentration of tannic acid in Czapek's solution containing 10 per cent. of sugar (Czapek's solution consists of $MgSO_4$ 0·5 grm., K_2HPO_4 1·0 grm., KCl 0·5 grm., $NaNO_3$ 2·0 grm., and H_2O 1000 c.c.). In a full nutrient solution containing, as a source of carbon, 2 per cent. of tannic acid, the addition of sucrose decreases the quantity of tannase produced by the organism, the higher the concentration of sugar the lower being the quantity of tannase produced. *A. niger* produces more tannase or a more active tannase per unit weight than *Penicillium sp.* The production of tannase in *A. niger*, *Penicillium sp.* and *P. rugulosum* is stimulated by tannic acid and gallic acid, and the former is more effective than the latter. There is a progressive increase of tannase in *A. niger* with increased concentration of gallic acid in a nutrient solution containing 10 per cent. of sugar.—D. J. L.

Gelatin films ; Iridescent —— *and their use in the manufacture of imitation pearls.* R. E. Liesegang. Z. Chem. Ind. Kolloide, 1913, **12**, 181—188.

The author discusses in detail the nature and causes of the diffusion rings produced when certain saline solutions are allowed to diffuse into a gelatin film, and describes briefly the best conditions for obtaining effects capable of application in the manufacture of imitation pearls. Solutions of pure trialkali phosphate of not more than 10 per cent. concentration and of pure gelatin should be employed, and should always be subjected to a preliminary test to ascertain their suitability for the purpose. A 10 per cent. solution of the gelatin is prepared, the water used for soaking being renewed several times to remove acid. The beads which are to form the basis of the imitation pearls are dipped in the warm gelatin solution, then placed on a glass plate which has been coated with a 10 per cent. solution of gelatin, and a ring marked around each bead with the phosphate solution. Or, 5 c.c. of a 10 per cent. solution of trisodium phosphate may be added to each 20 c.c. of the gelatin solution used for coating the glass plate. Two other methods consist in : (1) fixing a small piece of wood or a thread to the bead and allowing the end of this to dip in the phosphate solution ; (2) closing the end of a glass tube by means of the coated bead and a little gelatin solution and then filling the tube with the phosphate solution. In all cases the phosphate gradually diffuses into the film on the bead and produces the desired effect. The atmosphere should be moist in order to prevent the gelatin drying too quickly. The imitation pearls thus produced may be treated with formaldehyde vapour in order to harden the gelatin film.—A. S.

Patents.

Leather ; Product resembling ——, *and process for making same.* Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 449,213, Oct. 10, 1912. Under Int. Conv., Oct. 11, 1911, Feb. 1 and March 21, 1912.

See Ger. Pats. 256,407 and 256,408 ; this J., 1913, 438. The film of bacteria may be mounted on tanned or untanned split hide.—T. F. B.

Leather board ; Method of producing stock for making ——. W. P. Thompson, Liverpool. From Hide-Ite Leather Co., Brockton, Mass., U.S.A. Eng. Pat. 26,918, Nov. 22, 1912.

See U.S. Pat. 1,046,555 of 1912 ; this J., 1913, 99.—T. F. B.

Leather-board ; Process for producing stock for the manufacture of ——. Hide-Ite Leather Co. Fr. Pat. 450,939, Nov. 22, 1912.

See U.S. Pat. 1,046,555 of 1912 ; this J., 1913, 99.—T. F. B.

Leather ; Treatment of ——. D. B. MacDonald. Fr. Pat. 450,817, Nov. 21, 1912. Under Int. Conv., Nov. 22, 1911.

See Eng. Pat. 26,105 of 1911 ; this J., 1912, 1044.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soils ; Organic constituents of ——. O. Schreiner. U.S. Dept. Agric., Bureau of Soils, Circular 74, Jan. 17, 1913. 18 pages.

A summary of the soil studies of the Bureau of Soils (compare this J., 1911, 40, 143, 227, 438 ; 1912, 350 ; 1913, 374). A number of organic compounds were discovered having an obvious relationship with the tissue material of plant and animal debris, indicating that the process of humification is similar to laboratory processes in which complex organic substances are decomposed by hydrolysis, oxidation, reduction or de-amidisation into simpler derivatives. Some of the organic soil constituents have a harmful effect on plant growth, and infertility has been shown in many cases to be associated with the presence of dihydroxystearic acid. Other organic soil constituents, *e.g.*, creatinine, are decidedly beneficial to plant growth and less nitrate is used by the plant when grown in their presence than in their absence. The degradation products of protein are absorbed by the plant directly from the soil and used for building up the complex proteins. All nitrogenous soil constituents are not beneficial to plant growth, some, *e.g.*, tyrosine and guanidine, being distinctly harmful. The various fertiliser salts act differently in overcoming the respective harmful effects of toxic organic compounds ; consequently the soil requires different treatment according to the plant growing in it, that is according to the rotation of crop followed. In addition to any plant-food value which they possess, fertilisers affect the soil and produce changes and influences of a far-reaching character, consequently they may be used as well for fertile as for infertile soils to bring them to the highest capacity for crop production.—E. F. A.

Patents.

Fertiliser ; Manufacturing solid ——. F. W. Braun, Los Angeles, Cal. U.S. Pat. 1,058,145, April 8, 1913.

Ground phosphate rock containing phosphate and carbonate of calcium is mixed with a sufficient quantity of nitric acid to convert a portion of the phosphate into monocalcium phosphate and calcium nitrate, the mass being agitated and then allowed to stand.—B. N.

Phosphate fertiliser ; Making ——. C. N. Meriwether, Trenton, Ky. U.S. Pat. 1,058,249, April 8, 1913.

The fertiliser is prepared from mineral phosphates by adding an alkali, calcining the resulting product and again adding alkali. The mass is re-ground, again calcined and finally pulverised.—B. N.

Fertiliser ; Composition of matter for use as a ——. E. C. Lindemann, Boulder, Colo. U.S. Pat. 1,058,765, April 15, 1913.

A fertiliser composed of 5—20 per cent. of titaniferous iron ore and 95—80 per cent. of raw calcium carbonate. —O. R.

Chemical manures ; Production of ——. J. Ciselet, Forest-lez-Bruxelles, and P. Noblet, Ixelles, Belgium. Eng. Pat. 8609, April 11, 1912. Under Int. Conv., June 19, 1911.

See Fr. Pat. 436,388 of 1911 ; this J., 1912, 448.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

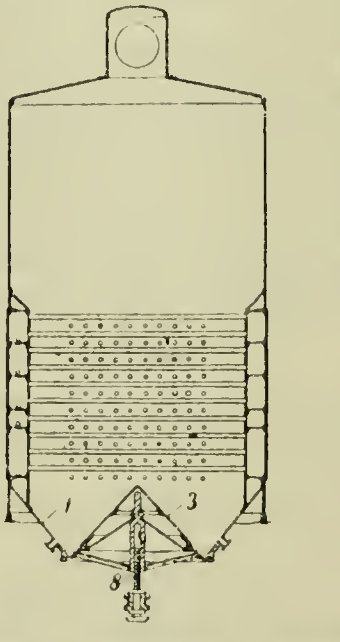
Manna ; A new variety of —— *and a note on the melting point of dulcitol.* J. R. Furlong and L. E. Campbell. Chem. Soc. Proc., 1913, 29, 128.

A specimen of leaves and twigs partly covered with a white incrustation ("manna") was received recently at the Imperial Institute from C. N. B. Venables, North Western Rhodesia. The plant was identified at the Royal Botanic Gardens, Kew, as a *Gymnosporia*, sp., probably *G. deflexa*, Sprague. The incrustation had a slightly sweet taste, and was found to contain 4·9 per cent. of moisture, 54 of dulcitol, 6·4 per cent. of reducing sugar, calculated as dextrose, and 6·6 per cent. of sucrose. The melting point of dulcitol was found to be 183° (uncorr.) and 188° C. (corr.). (See also J. Chem. Soc., 1912, **101**, 1043.)

Date sugar industry in Bengal. H. E. Annett. Mem. Dept. Agric., India. Chem. Series, 1913, **2**, 281—389.

Patents.

Evaporating and boiling apparatus for sugar factories and refineries. J. B. Swaryczewski. Ger. Pat. 256,445, March 11, 1911.



The bottom of the evaporator is formed by two conical parts, 1, 3, leaving an annular opening for the massecuite. This opening is closed by a device of similar shape which can be moved into and out of position by a screw, 8. —A. S.

[*Sugar.*] *Crystallising apparatus.* J. Heine. Ger. Pat. 257,713, April 27, 1912.

The cylindrical crystallising vessel is provided with a stirrer, and also halfway round the inner wall with a helical guide-plate. Air is blown in at the bottom of the guide-plate, rises through the channel formed by the latter and the wall of the vessel, and, escaping at the top, serves to agitate and, if hot air be used, also to warm, the contents of the vessel.—A. S.

XVIII.—FERMENTATION INDUSTRIES.

Yeast ; Chemistry of ——. *I. Nature of the cell membrane. II. Investigations of yeast protein.* G. Dreyer. Z. ges. Brauw., 1913, **36**, 201—206.

The material of the cell wall of yeast was obtained as a light grey powder quite free from nitrogen, by allowing pressed bottom-fermentation yeast to undergo auto-digestion for 8 days at 40° C. in 0·45 per cent. acetic acid, and purifying the residue by digestion for one day in *N*/2 sodium hydroxide and subsequent extraction with alcohol and ether. The yield amounted in some cases to 19 per cent. of the dried substance of the yeast. The product was boiled for half an hour with 3 per cent. alkali (cp. Salkowski, this J., 1894, 411) and a quantity of yeast gum was precipitated from the solution by addition of copper sulphate. After purification, this gum formed a white powder, and when hydrolysed it yielded equal quantities of dextrose and mannose. It contained no galactose and only a trace (0·35 per cent.) of pentosans. The material of the cell wall, thus freed from gum, was heated with water under 2—2·5 atms. pressure for 20 hours (cp. Salkowski, this J., 1895, 376) and thereby resolved into a soluble portion possessing the properties of glycogen, and an insoluble residue which when hydrolysed yielded dextrose and mannose in the proportion 3 : 2. This residue contained neither galactose nor pentosans. The author concludes that yeast membrane is to be regarded as a hemi-cellulose, and indeed as a mannodextran (cp. Meigen and Spreng, this J., 1908, 514). The yeast gum obtained by boiling yeast with water or by treatment with alkalis is probably not present in the free state in the membrane, for it is readily soluble in water, but is a rather loosely combined constituent of the hemicellulose. The substance extracted from yeast membrane by boiling under pressure (Salkowski's "erythro-cellulose") is probably not a chemically combined constituent of the membrane, but is either glycogen or a very similar carbohydrate. During the autofermentation or autodigestion of yeast it undergoes hydrolysis and is therefore present in only small quantities in the cell membrane obtained by autodigestion, whereas in freshly killed, well-nourished bottom-fermentation yeast it occurs in considerable amounts. By treatment of fresh pressed yeast with ammonia, ammonium carbonate or sodium hydroxide, coagulable protein, amounting in some cases to 12 per cent. of the dried substance of the yeast, may be extracted. Such large quantities of protein must come from the protoplasm within the cells; possibly certain parts of the cell wall are permeable by dissolved protein. The extracted portion consists of 60 per cent. albumin and 40 per cent. globulin.—J. H. L.

Yeasts; Resistance of —— cultivated at different temperatures, towards various antiseptics, and the influence of temperature during the action of the latter. P. Lindner and D. Schmidt. Woch. Brau., 1913, **30**, 265—268.

The resistance of yeast cultures grown in wort or gelatin, towards antiseptics (mercuric chloride, formalin, "antiformin") varies according to the temperature of cultivation (10°, 15° or 25° C.); but the optimum temperature is not the same for all yeasts. The destructive power of the disinfectants studied, is practically the same at 10°, 15° and 25° C. The antiseptic power of acid ammonium fluoride diminishes when it is stored in glass vessels not coated internally with paraffin wax.—J. H. L.

Invertase; Action of ammonia on ——. IV. T. Panzer. Z. physiol. Chem., 1913, **84**, 408—416. (See this J., 1913, 41, 441.)

Dried invertase, under conditions similar to those of the earlier experiments, absorbs about 3—6 per cent. of ammonia. In a vacuum desiccator over sulphuric acid it assumes again its original weight, but shows a slight permanent increase of nitrogen-content. The hydrolytic power of the enzyme is not affected by the absorption of ammonia, but is somewhat diminished by the subsequent withdrawal of the latter *in vacuo*, possibly owing to some kind of anhydride-formation. The chemical changes which ammonia produces in invertase are probably not altogether the same as those produced in diastase (this J., 1913, 441.)—J. H. L.

Fermentation vats; Yield [of alcohol] in closed ——. E. Lühder. Z. Spiritusind., 1913, **36**, 213—214.

Data are given respecting the yield of spirit obtained from potatoes (saccharified by oat-malt) by fermentation in upright, closed, iron cylindrical vats, each of 3478 litres (765 galls.) capacity. The vats were cooled externally by trickling water, but this was not often required. The escaping carbon dioxide was washed with water and the yield of alcohol thereby increased by 0·3—0·4 per cent. The total yield corresponded to 68—69 litres of 100 per cent. alcohol per 100 kilos. of starch, or 6·8—6·9 galls. per 100 lb of starch.—J. H. L.

Beer; Contribution to the study of ropy ——. E. Kayser. Comptes rend., 1913, **156**, 1266—1268. (See also Baker and others, this J., 1913, 207.)

The author has studied an organism isolated from a ropy beer of Normandy. The cells, which are round and about $1{\cdot}7\mu$ in diameter, occur singly and as diads and tetrads, and form colonies yellowish white in colour. The organism grows best between 25° and 28° C. It is a facultative anaërobe and develops in malt wort, in beer containing as much as 6 per cent. of alcohol, in yeast water and in sugared peptone broth, producing in all cases ropiness which persists for a considerable time. It attacks sucrose, maltose, dextrose, lævulose, galactose, arabinose, dextrin and mannitol, and readily absorbs nitrogenous nutriment in the form of peptone or asparagin. It secretes maltase and produces inactive lactic acid and smaller quantities of volatile acids (acetic, propionic and valeric). Sugar is transformed almost completely into these acids. The organism grows best in worts which are neutral or faintly alkaline. Its development is checked by the presence of 1 per cent. of lactic acid, but accelerated by addition of calcium sulphate or carbonate or by the presence of aërobic organisms. It is capable of developing in liquids containing 3 per cent. of alcohol, which have been treated with 256—356 grms. of hops per hectolitre. Although resembling in some respects the organisms responsible for the "*graisse*" disease of wines and ciders (this J., 1911, 762), it probably belongs to a different group.—J. H. L.

Wine making; Use of ammonium salts in ——. R. Marcille. Comptes rend., 1913, **156**, 1336—1338.

A specimen of grape must containing total nitrogen 0·114 grm. and ammonia-nitrogen 0·007 grm. per litre required several weeks for conversion into wine when fermented in the usual manner but behaved normally when treated with a small quantity (15—25 grms. per hectolitre) of an ammonium salt (phosphate or sulphate) before fermentation.—A. S.

Methyl alcohol [in re-natured spirit]; Detection of ——. P. N. Raikow. Eighth Int. Cong. Appl. Chem., 1912. Sect. IV. Orig. Comm., **25**, 417—419.

Two hundred c.c. of the spirit are acidified with phosphoric acid and fractionated. The first 10 c.c. of distillate are mixed with 4 grms. of red phosphorus and then gradually, whilst heating under a reflux condenser, with 25 grms. of iodine. After 20 mins. the mixture is fractionated and the first 5 c.c. of distillate are distilled slowly with 2—3 grms. of silver nitrite; separate portions (3—4 drops) of the distillate are now treated with a few drops of concentrated ammonia solution and a drop of a concentrated solution of sodium nitroprusside added. A blue colouration changing to yellow, but re-formed on addition of another drop of nitroprusside solution indicates the presence of nitromethane derived from methyl alcohol in the original spirit. Nitroethane gives a pale red colouration and acetone a tolerably intense violet changing to reddish brown.—A. S.

Tannic acid fermentation. Knudson. *See* XV.

Patents.

Malt, grain, and the like; Apparatus for roasting ——. W. N. Savory, Oulton Broad, Suffolk. Eng. Pat. 9141, April 18, 1912.

The roasting drum rotates on hollow trunnions in a stationary casing; the trunnions communicate with tubular flues which pass through the drum in a circuitous manner and superheated steam or combustion gases are conducted through these flues and thence pass into the casing surrounding the drum. A baffle-plate in the upper part of the casing directs the steam or gases downwards again before they escape. The gases generated within the drum pass through ports into the flues. Means are provided for sampling the contents of the drum during the roasting operation, and conical baffles fitted in the drum prevent the contents of the latter from piling.—W. P. S.

Malt liquors; Production of ——. A. C. Chapman, London. Eng. Pat. 8991, April 16, 1912.

In order to increase the nutritive value of malt liquors they are treated, at some stage of manufacture after the commencement of the mashing operation, with 2 per cent. or other suitable proportion of protein matter (*e.g.*, skimmed milk or products therefrom) which has been predigested by a peptonising or pancreatising ferment. Claim is also made for a preliminary treatment of the protein matter, when necessary, by which it is rendered soluble before being peptonised; casein, for example, may be dissolved by addition of alkalis or alkaline salts.—J. H. L.

Wine, vinegar and similar liquids; Manufacture of a clarifying agent for ——. A. Ornstein, Vienna. Eng. Pat. 4597, Feb. 22, 1913. Under Int. Conv., Feb. 23, 1912.

The agent claimed consists of soy beans from which the fat has been extracted.—J. H. L.

Saccharometer; Fermentation ——. A. Eppens. Fr. Pat. 450,597, Nov. 14, 1912.

See Eng. Pat. 26,696 of 1912; this J., 1913, 310.—T. F. B.

XIXa.—FOODS.

Patents.

Butter fat; Process of treating —— *and converting same into cream.* J. Willmann, Assignor to Diary and Machinery Co., Derby, Conn. U.S. Pat. 1,058,508, April 8, 1913.

Butter is melted and, while in a fine state of division, subjected to the action of a current of hot dry air; the water is thus removed and the curd is separated. The butter fat is then mixed with milk and the mixture "homogenised."—W. P. S.

Milk-testing apparatus. A. Faitelowitz, Halensee, Germany. U.S. Pat. 1,059,289, April 15, 1913.

See Eng. Pat. 26,264 of 1910; this J., 1912, 42. The flask to contain the milk under test has an elongated neck of approximately the same diameter as the side tube.—T. F. B.

Baking-powder. E. Jacoby, Assignor to Diamalt Akt.-Ges., Munich, Germany. U.S. Pat. 1,058,980, April 15, 1913.

The baking powder is mixed with a per-salt, especially a percarbonate, which on treatment with acid yields a gas containing oxygen.—J. H. J.

Condensing and drying milk, meat extract, and the like liquids; Apparatus for ——. J. O. A. Amundsen, Stavanger, Norway. Eng. Pat. 9723, April 24, 1912.

See Fr. Pat. 443,057 of 1912; this J., 1912, 1005.—T. F. B.

Margarine and similar products; Manufacture of —— *and production of a synthetic agent for use therein.* A. R. Wilson. Fr. Pat. 451,136, Nov. 22, 1912.

See Eng. Pat. 24,050 of 1911; this J., 1913, 104.—T. F. B.

Hydrogenated edible fat product. U.S. Pat. 1,058,738. *See* XII.

XIXb.—WATER PURIFICATION; SANITATION.

South African Sheep Dips. [*Scab.*] *See under* V, p. 530.

Patents.

Filter beds; Tiles for ——. R. Ames, Brighton. Eng. Pat. 16,232, July 11, 1912.

The tiles are of two forms; one form is made with feet and a projecting groove along each side, the other form is without feet and with a rib on each side underneath. The tiles are placed on the bottom of the bed in such a way that two tiles with feet support between them one tile without feet, the respective grooves and ribs fitting into one another. The upper surfaces of the tiles form a continuous flat floor, and holes are formed in each tile for drainage purposes.—J. H. J.

Septic tank. G. R. Payne and S. Moore, Assignors to Texarkana Pipe Co., Texarkana, Tex. U.S. Pat. 1,058,458, April 8, 1913.

A horizontal cylindrical casing composed of separate sections, is divided into compartments by baffle-plates secured between the adjacent ends of the sections. The baffle-plates are less in height than is the casing, so that the liquid may flow over their upper edges from one compartment to the next. Each compartment is fitted with a manhole.—W. P. S.

Water for plunge baths or the like; Method of and apparatus for the treatment of —— *to render it fit for re-use.* F. C. Pulsford, Leicester. Eng. Pat. 16,945, July 20, 1912.

A current of air is forced through the water, whilst it is being sprayed into an open tank. From the tank the water passes to a filter, and thence through a heating apparatus. Reagents may be added to the water before it enters the filter, and air or carbon dioxide under pressure may also be injected into the water.—W. P. S.

Sterilising water by means of electric mercury lamps generating ultra-violet and similar rays; Device for industrially ——. P. G. Triquet, Paris. Eng. Pat. 9314, April 19, 1912.

See Addition of May 26, 1912, to Fr. Pat. 434,069 of 1910; this J., 1912, 948.—T. F. B.

Röntgen rays having any desired degree of hardness which can be adjusted at a moment's notice; Process and devices for producing in a continuous manner ——. J. E. Lilienfeld, Leipzig, Germany. Eng. Pat. 23,169, Oct. 10, 1912. Under Int. Conv., Oct. 10, 1911.

See Fr. Pat. 449,305 of 1912; this J., 1913, 505.—T. F. B.

Permutit (a water-softening substance consisting chiefly of sodium-aluminium silicates); Method for revivifying or restoring ——. G. Schweikert and A. Czeczowiczka, Vienna. Eng. Pat. 23,706, Oct. 17, 1912.

See U.S. Pat. 1,054,460 of 1913; this J., 1913, 377.—T.F.B.

Refuse; Process for destroying ——. O. Uhde, Hamburg, Germany. U.S. Pat. 1,059,787, April 22, 1913.

See Eng. Pat. 16,781 of 1911; this J., 1912, 252.—T. F. B.

Sedimentation tanks for treating sewage and other foul waters. W. J. Dibdin. Fr. Pat. 451,167, Nov. 28, 1912. Under Int. Conv., Dec. 1, 1911.

See Eng. Pat. 26,927 of 1911; this J., 1912, 1198.—T.F.B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine and narcotine; Comparative solubility of —— *in acetone, in water, and in mixtures of the two.* G. Guérin. J. Pharm. Chim., 1913, **7**, 438.

Solvent.	Solubility at 15° C.	
	Morphine.*	Narcotine.
	grms. per litre.	grms. per litre.
Acetone	1·28	41·96
Acetone and water (1 : 1 by vol.	1·32	0·70
Water	0·288	0·10

* Crystalline, with 1 mol. H_2O.

—A. S.

Morphine; Homologues of ——, codeine and dionine and some of their derivatives. F. Ferrein. Arbeiten aus dem Pharm. Inst. der Univ. Berlin, **9**, 153—171. Chem. Zentr., 1913, **1**, 1697—1698.

NITROCODEINE when reduced with tin and glacial acetic acid yields acetylaminocodeine, and the latter when heated with acetic anhydride and sodium acetate yields diacetylaminocodeine, m. pt. 118° C. Aminocodeine, melting at 224° C. with decomposition, was obtained by reducing nitrocodeine with tin and 25 per cent. hydrochloric acid. Ethylmorphine when nitrated in glacial acetic acid solution yielded the nitro-compound, m. pt. 166°—167° C. Aminoethylmorphine, m. pt. 115° C., was obtained by reducing the nitro-compound with tin and hydrochloric acid. The mono- and di-acetylamino-derivatives of ethylmorphine were prepared in a similar way to the corresponding codeine derivatives; the diacetylamino-compound melts at 156° C. The reactions of the various compounds with alkaloid reagents are shown in the following table:—

Compound.	Formalin-sulphuric acid (6 drops of 35 per cent. CH_2O + 4 c.c. of conc. H_2SO_4).	Frohde's reagent (0·05 grm. of molybdic acid in 10 c.c. of hot conc. H_2SO_4).	Erdmann's reagent (20 c.c. of H_2SO_4 and 10 drops of a solution of 6 drops of conc. HNO_3 in 100 c.c. of water).
Nitrocodeine ..	orange	orange-red	orange
Aminocodeine	violet	ruby-red	pink
Acetylamino-codeine (hydrochloride)	colourless	green	greenish-yellow, soon disappearing
Diacetylamino-codeine	purple	emerald green	faint greenish-yellow, soon disappearing
Nitroethylmorphine	orange, not characteristic	orange-red	ruby-red
Aminoethylmorphine	purple-red	pale red	very faint red
Acetylamino-ethylmorphine (hydrochloride)	brownish	green	faint brownish
Diacetylamino-ethylmorphine	faint violet, disappearing on stirring	green	faint greenish-yellow, soon disappearing

—A. S.

Apomorphine. I. Alleged formation of apomorphine during heating or storage of solutions of morphine. [Detection of apomorphine.] M. Feinberg. Z. physiol. Chem., 1913, **84**, 363—378.

CONTRARY to statements in the literature, there is no formation of apomorphine when solutions of morphine or its hydrochloride are boiled for a long time, or are left to stand for long periods with or without addition of nutrient liquids. The slight precipitate which sometimes separates in such cases consists of morphine. A new and very sensitive test for the detection of apomorphine in presence of morphine consists in adding 3 drops of a 1 per cent. solution of potassium ferricyanide, and shaking with 1 c.c. of benzene. In presence of apomorphine, the benzene becomes coloured amethyst-violet, and on addition of a few drops of dilute sodium hydroxide and renewed shaking, the colour changes to violet-red and on long standing, to a fine violet. The presence of morphine does not interfere with this test, by which apomorphine may be detected at a concentration of only 0·003 mgrm. per c.c.—J. H. L.

Alcohols of the hydroaromatic and terpene series. (Preliminary note.) R. H. Pickard, W. Lewcock, and J. Yates. Chem. Soc. Proc., 1913, **29**, 127.

THE methods adopted for the isolation and purification of the borneols and *iso*borneols (Chem. Soc. Trans., 1907, **91**. 1973) and of the menthols (this J., 1912, 457) have been applied to fenchyl alcohol and *iso*pulegol. The reduction of *d*-fenchone by means of sodium in moist ethereal solution yields *l*-fenchyl alcohol, very little (if any) of the other possible isomeride being formed. This alcohol, after purification by means of its hydrogen phthalate, has $[\alpha]_D^{20°} = -15{\cdot}5°$. Tiemann (Ber., 1896, **29**, 914) prepared *iso*pulegol with $[\alpha]_D = -2{\cdot}9°$ from the condensation products of citronellaldehyde. His work has been repeated, and from these products one of the theoretically possible *iso*pulegols has been isolated in a pure state. This has a specific rotatory power $[\alpha]_D^{20°} = -22{\cdot}2°$. The application of these methods to the isolation in a pure state of the tertiary alcohols has been hindered by the difficulty of preparing their acid esters. It has, however, now been found that the long-continued action at temperatures below 100° C. of the anhydrides on an excess of the alcohols gives good yields of the desired acid esters. In this manner optically inactive terpineol has been converted into its esters. The *hydrogen phthalate* melts at 117° and the *hydrogen succinate* at 45° C. whilst both esters form crystalline salts with the commoner alkaloids.

Lecithin of eggs; Hydrogenation of the ——. Catalytic actions of colloidal metals of the platinum group. IX. C. Paal and H. Oehme. Ber., 1913, **46**, 1297—1304.

LECITHIN in alcoholic solution was hydrogenised in presence of an aqueous solution of colloidal palladium in the manner described previously (this J., 1908, 864, 875; 1909, 611), and from the reaction product hydrolecithin was isolated in the form of a white micro-crystalline powder insoluble in water and less soluble than lecithin in organic solvents; it is readily soluble in chloroform and in warm carbon bisulphide and benzene. It sinters at 83°—84° C. and decomposes above 150° C. On saponification with barium hydroxide it yielded glycerin, phosphoric acid, choline, and barium soaps chiefly of stearic and palmitic acids but also of an acid of lower molecular weight, probably myristic acid (or lauric or capric acid). The fact that there are at least three different saturated fatty acids among the products of saponification of hydrolecithin, shows that the latter, and hence also the original lecithin, is a mixture of at least two different compounds. The high iodine value (55·3) of the original lecithin indicates that it contains an acid such as linolic acid or linolenic acid in place of or in addition to oleic acid.—A. S.

Arsenic compounds; A new class of lipoid ——. E. Fischer and G. Klemperer. Therap. d. Gegenwart, Jan. 1913. Chem. Zentr., 1913, **1**, 1715—1716.

BEHENOLIC acid, prepared from erucic acid, is heated with arsenic trichloride and the reaction product treated with bases, whereby salts of *chloroarsenobehenolic acid*, containing arsenic and chlorine in equivalent proportions, are obtained. The alkali salts are similar to soaps. The strontium salt ("*Elarson*"), containing about 13 per cent. As and 6 per cent. Cl, is most suited for medicinal use and is of value in cases where a slow and gradual introduction of arsenic into the system is needed. It is insoluble in water, slightly soluble in alcohol, ether, and olive oil, and is decomposed by cold dilute hydrochloric acid, especially in presence of ether, with liberation of the free acid. The latter is a thick oil of a faint brownish-red colour, insoluble in water, easily soluble in alcohol, ether, benzene, and olive oil. When heated with excess of potash, it is decomposed with formation of potassium arsenite.—A. S.

Citric acid in citrates and lime juice; Spica's process for the determination of ——. F. Scurti and G. Tommassi. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1913, **6**, 61—65.

SPICA'S process (this J., 1910, 1331) is quite useless for the determination of citric acid in commercial calcium citrate and lime juice, for besides citric acid many other substances (sugars, starch, inulin, cellulose, wood, gum arabic, lactic acid, egg albumin) yield carbon monoxide when heated with concentrated sulphuric acid.—A. S.

Paraldehyde for acetaldehyde; Testing of ——. G. Heyl. Apoth.-Zeit., 1913, **28**, 306—307. (See this J., 1913, 307).

THE German Pharmacopœia, although allowing as much as 4 per cent. of acetaldehyde to be present, states that paraldehyde, if sufficiently pure, should not give a yellow colouration when mixed with potassium hydroxide solution, a reaction which is capable of detecting as little as 0·3 per cent. of acetaldehyde. A good sample of paraldehyde, such as can be met with in commerce, should pass the following test: 10 c.c. of a solution of 2·5 grms. in

100 c.c. of water are shaken with 20 drops of freshly prepared 1 per cent. sodium nitroprusside solution and 3 drops of piperidine, when no blue colouration should appear. When more than 0·2 per cent. of acetaldehyde is present, the colour develops.—F. Shdn.

Patents.

Trypanosomes and other pathogenous micro-organisms ; Production of preparations for giving immunity against ——. E. Teichmann and H. Braun, Frankfort-on-the-Maine, Germany. Eng. Pat. 7969, April 2, 1912.

A preparation for giving immunity against trypanosomes and the like is made by taking the blood of an infected animal when the infection is at its height and separating the organisms from the blood corpuscles and serum. The organisms are dried at a moderate temperature. Different methods of carrying this out are described.—F. Shdn.

Amyl series ; Manufacture of chlorine derivatives of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 19,764, Aug. 29, 1912.

Chlorine derivatives of the amyl series can be made by allowing chlorine and trimethylethylene to interact under reduced pressure. The products can be used to make isoprene.—F. Shdn.

Amino[hydr]oxyarylarsinic acids ; Manufacture of derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 25,493, Nov. 6, 1912. Under Int. Conv., Dec. 20, 1911. Addition to Eng. Pat. 13,485 of 1910, dated June 9, 1909 (see Ger. Pat. 224,953 of 1909 ; this J., 1910, 1178).

The acidyl derivatives of aminohydroxyarylarsinic acids, in which the acidyl group is attached either to the amino group or to the hydroxyl group, may be converted into the corresponding arseno compounds, *viz.*, the acidylaminohydroxyarsenobenzenes, by treatment with strong reducing agents. The new acidyl compounds possess spirillocidal properties similar to those of the unsubstituted compounds, but have the advantage over the latter of being soluble in dilute sodium carbonate solutions.—T. F. B.

1.3-*Butyleneglycol ; Manufacture of* ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 940, Jan. 13, 1913. Under Int. Conv., March 16, 1912.

The reduction of crude aldol (obtained by condensing an aqueous solution of acetaldehyde) to 1.3-butyleneglycol may be advantageously effected by electrolysis, *e.g.*, in sulphuric acid solution. The unchanged aldehyde or paraldehyde is reduced to alcohol, which can be recovered. The yield of butyleneglycol is said to be more than 50 per cent. of the aldehyde used, whilst more than 30 per cent. of the aldehyde is recovered as alcohol (compare U.S. Pat. 1,008,333 of 1911 ; this J., 1911, 1470).—T. F. B.

Antiberiberic ; Preparation of ——. J. Tsuzuki, Tokio, Japan. U.S. Pat. 1,058,927, April 15, 1913.

A product suitable for the treatment of beriberi can be obtained by extracting rice-bran with an organic alcoholic solvent and purifying the extracted material from albuminous impurities.—F. Shdn.

Urea from cyanamide ; Process for preparing ——. H. Immendorff and H. Kappen. Ger. Pat. 257,642, Dec. 25, 1910.

Acid solutions of cyanamide or of its salts are decomposed by means of solid catalysts, which are preferably kept distributed through the liquid by agitation. It is stated that urea free from dicyanodiamide is produced (compare this J., 1912, 257 ; 1913, 450).—T. F. B.

Glycollic acid ; Process for preparing salts of —— *from trichloroethylene or acetylene tetrachloride.* Konsortium f. Elektrochem. Industrie. Ger. Pat. 257,878, Feb. 22, 1912.

When trichloroethylene or acetylene tetrachloride is heated with an aqueous solution or suspension of an alkali or alkaline-earth hydroxide, with or without addition of a copper compound or other metallic compound with catalytic properties, a good yield of the corresponding alkali or alkaline-earth glycollate is obtained.—T. F. B.

CC-Dialkylbarbituric acids containing unsaturated hydrocarbon radicals attached to nitrogen ; Preparation of ——. E. Merck. Ger. Pat. 258,058, May 26, 1912.

By heating the halogenides of dialkylmalonic acids with alkylene-ureas, derivatives of barbituric acid are obtained. Thus, N-mono- and NN′-diallylbarbituric acids are obtained from dialkylmalonyl chloride and mono- or NN′-diallylurea. The products can be converted into the dialkylbarbituric acids by addition of halogen and its subsequent replacement by hydrogen.—T. F. B.

Beta-gamma-dimethylerythrene ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8871, April 15, 1912. Addition to Eng. Pat. 13,677, June 6, 1910.

See Addition of April 11, 1912, to Fr. Pat. 425,582 of 1911 ; this J., 1912, 1007.—T. F. B.

Lecith-albumin compound and process of making the same. R. Adler, Assignor to Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappij, Amsterdam. U.S. Pat. 1,057,316, March 25, 1913.

See Eng. Pat. 8524 of 1912 ; this J., 1913, 446.—T. F. B.

Calcium salt of acetylsalicylic acid ; Process for the formation of ——. Gedeon Richter, Budapest, Austria-Hungary. U.S. Pat. 1,058,904, April 15, 1913.

See Eng. Pat. 4986 of 1912 ; this J., 1912, 844.—T. F. B.

Amino- and diaminoketones ; Process for preparing aliphatic ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 450,543, Oct. 28, 1912. Under Int. Conv., Nov. 16, 1911.

See Ger. Pat. 254,714 of 1911 ; this J., 1913, 380.—T. F. B.

β-Methyl-γ-hydroxybutyldimethylamine ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,109, Nov. 11, 1912. Under Int. Conv., Nov. 16, 1911.

See Ger. Pat. 254,713 of 1911 ; this J., 1913, 380.—T. F. B.

Chlorinated derivatives of the amyl series ; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 451,315, Dec. 3, 1912. Under Int. Conv., May 3, 1912.

See Eng. Pat. 19,764 of 1912 ; preceding.—T. F. B.

Dialkylaminoformic esters ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,596, Dec. 7, 1912. Under Int. Conv., Dec. 14, 1911.

See Ger. Pat. 255,942 of 1911 ; this J., 1913, 380.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Toning photographic prints ; Process of ——. H. M. Ward, Leicester. Eng. Pat. 8002, April 3, 1912.

A silver print or transparency is treated with a copper toning bath to convert the image wholly or partially into copper ferrocyanide ; a chromate bleaching solution or a chloride, bromide, or iodide may be combined with the toning bath, or the toned print may be bleached by the usual process. The bleached print is "sulphided" by any of the known methods, and then heated with a solution of a ferricyanide containing ammonium thiocyanate or other silver solvent. The resulting image consists of a mixture of copper ferrocyanide and silver sulphide.
—T. F. B.

Light-sensitive layers, emulsions, or plates for photographic purposes. R. Fischer, Steglitz, Germany. Eng. Pat. 15,054, June 27, 1912.

In order to make photographic plates, etc., which will furnish equally good results with subjects of widely differing contrasts, the sensitive surface is composed of a mixture of two emulsions, one of which is suitable for subjects of strong contrasts and the other for "flat" subjects. For example, an emulsion which "works hard" and is sensitive to blue may be combined with a "soft" emulsion sensitive to green; by using a suitable light-filter, the desired result may be produced.—T. F. B.

Photographs in natural colours; Process of making ——. R. Fischer, Steglitz, Germany. U.S. Pat. 1,055,155, March 4, 1913.

See Ger. Pat. 253,335 of 1912; this J., 1913, 45.—T. F. B.

Colour photography. A. Hamburger, London. U.S. Pat. 1,059,867, April 22, 1913.

See Eng. Pat. 20,880 of 1911; this J., 1912, 1054.—T. F.B.

Photography in colours; Process of ——. J. B. Tauleigne, Pontigny, and E. Mazo, Paris. U.S. Pat. 1,059,917, April 22, 1913.

See Fr. Pat. 420,584 of 1909; this J., 1911, 308.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives in Coal Mines Order of March 31, 1913. Coal Mines Act. Statutory Rules and Orders, 1913. No. 359.

The following explosives have passed the new test (Home Office Memorandum of May 1912). In each instance, under the heading "maximum charge" is given the number of ounces which must not be exceeded in any one shot hole, and, under the heading "ballistic pendulum," is given the swing in inches as the result of firing 4 oz. of the explosive, tamped, in a mortar. A similar weight of gelignite containing 60 per cent. of nitroglycerin, fired in the same manner gives a swing of 3·27 in. *Ammonite No.* 2:—Ammonium nitrate (71—75 parts), potassium nitrate (16—18), dinitronaphthalene (2—3), sodium chloride (7—8), and moisture (0—1 part). Not less than a No. 6 detonator to be used. Maximum charge 10 oz. Ballistic pendulum 1·99 in. *Bellite No.* 2:—Ammonium nitrate (59·5—62·5 parts), dinitrobenzene (11—13), sodium chloride (25·5—28·5), and moisture (0—0·75 part). Not less than a No. 7 detonator to be used. Maximum charge 32 oz. Ballistic pendulum 2·42 in. *Bellite No.* 4:—Ammonium nitrate (67—70 parts), dinitrobenzene (12—14), sodium chloride (17—19), and moisture (0—1·5 part). Not less than a No. 7 detonator to be used. Maximum charge 12 oz. Ballistic pendulum 2·72 in. *Cambrite*:—Nitroglycerin (22—24 parts), barium nitrate (3—4·5), potassium nitrate (26—29), woodmeal (32—35), calcium carbonate (0—0·5), ammonium oxalate (7—9), and moisture (3·5—6 parts). Not less than No. 6 detonator to be used. Maximum charge 30 oz. Ballistic pendulum 1·98 in. *Dreadnought*:—Ammonium nitrate (73—77 parts), sodium nitrate (14—17), ammonium chloride (4—6), trinitrotoluene (3—5), "red oil" (0—0·1), and moisture (0—1 part). Not less than a No. 7 detonator to be used. Maximum charge 32 oz. Ballistic pendulum 2·05 in. *Dynobel*:—Nitroglycerin (31·5—33·5 parts), nitrocotton (0·5—1), potassium perchlorate (26—28), woodmeal (8·5—10·5), ammonium oxalate (28·5—30·5), and moisture (0—1·5 parts). Not less than a No. 6 detonator to be used. Maximum charge 22 oz. Ballistic pendulum 2·61 in. *Essex Powder*:—Nitroglycerin (22—24 parts), nitrocotton (0·5—1·5), potassium nitrate (33—35), wheat flour (32—35), ammonium chloride (5—7), and moisture (2—5 parts). Not less than a No. 6 detonator to be used. Maximum charge 38 oz. Ballistic pendulum 2·17 in. *Haylite No.* 1:—Nitroglycerin (25—27 parts), nitrocotton (0·5—1·5), woodmeal (12—14), potassium nitrate (19—21), barium nitrate (19—21), mineral jelly (6—8), ammonium oxalate (10—12), and moisture (0·5—2·5 parts). Not less than a No. 6 detonator to be used. Maximum charge 10 oz. Ballistic pendulum 2·18 in. *Kentite*:—Ammonium nitrate (32·5—35·5 parts), potassium nitrate (32—35), ammonium chloride (16—18), trinitrotoluene (14—16), and moisture (0—2 parts). Not less than a No. 6 detonator to be used. Maximum charge 18 oz. Ballistic pendulum 2·64 in. *Melling Powder*:—Nitroglycerin (4—6 parts), trinitrotoluene (5—7), ammonium nitrate (51—55), sodium nitrate (11—13), woodmeal (3—5), ammonium oxalate (18—20), and moisture (0—2 parts). Not less than a No. 6 detonator to be used. Maximum charge 12 oz. Ballistic pendulum 2·62 in. *Neonal*:—Nitroglycerin (20—22 parts), nitrocotton (0·5—1·5), trinitrotoluene and dinitrotoluene (0—0·4), woodmeal (14—16), potassium perchlorate (36—38), ammonium oxalate (24—26), and moisture (0—2 parts). Not less than a No. 6 detonator to be used. Maximum charge 16 oz. Ballistic pendulum 2·56 in. *Nitro-Densite*:—Nitroglycerin (17—19 parts), barium nitrate (24—26), woodmeal (4—6), starch (24—27), French chalk (22—24), and moisture (2—5 parts). Not less than a No. 6 detonator to be used. Maximum charge 28 oz. Ballistic pendulum 1·47 in. *Pit-ite No.* 2:—Nitroglycerin (23—25 parts), potassium nitrate (28—31), woodmeal (33—36), ammonium oxalate (7—9), and moisture (2·5—5 parts). Not less than a No. 6 detonator to be used. Maximum charge 32 oz. Ballistic pendulum 2·15 in. *Stanford Powder*:—Ammonium nitrate (68—72 parts), sodium nitrate (21—23), trinitronaphthalene (3—4), ammonium chloride (3·5—4·5), and moisture (0—1 part). Not less than a No. 6 detonator to be used. Maximum charge 12 oz. Ballistic pendulum 2·12 in. *Super-Excellite*:—Nitroglycerin (3·5—5 parts), ammonium nitrate (73·5—77), potassium nitrate (6·5—8), woodmeal (2—4), ammonium oxalate (9—11), and moisture (0—1·5 part). Not less than a No. 7 detonator to be used. Maximum charge 10 oz. Ballistic pendulum 2·74 in. *Superite*:—Nitroglycerin (3·5—4·5 parts), ammonium nitrate (80—84), potassium nitrate (9—11), starch (2—5), and moisture (0—2 parts). Not less than a No. 7 detonator to be used. Maximum charge 10 oz. Ballistic pendulum 2·53 in. *Super-Kolax*:—Nitroglycerin (24·5—26·5 parts), potassium nitrate (24·5—26·5), barium nitrate (4—6), ammonium oxalate (6—8), woodmeal (26—28), starch (6—8), and moisture (2—4 parts). Not less than a No. 6 detonator to be used. Maximum charge 30 oz. Ballistic pendulum 2·10 in. *Syndite*:—Nitroglycerin (10—12 parts), collodion cotton (0·1—0·3), glycerin (2—5), starch (2—5), ammonium nitrate (45—49), sodium nitrate (7—9), sodium chloride (26—28), and moisture (0—2 parts). Not less than a No. 7 detonator to be used. Maximum charge 40 oz. Ballistic pendulum 2·22 in. *Uplees Powder*:—Ammonium nitrate (62—65 parts), trinitrotoluene (4—6), ammonium chloride (13—15), sodium nitrate (12·5—14·5), starch (2—4), and moisture (0—1·5 parts). Not less than a No. 7 detonator to be used. Maximum charge 16 oz. Ballistic pendulum 2·64 in. *Westfalite No.* 3:—Ammonium nitrate (58—61 parts), potassium nitrate (13—15), ammonium chloride (20—22), trinitrotoluene (4—6), and moisture (0—1 part). Not less than a No. 6 detonator to be used. Maximum charge 12 oz. Ballistic pendulum 2·55 in.—G. W. McD.

Explosion of nitroglycerin; Circumstances attending an —— which occurred in the Final Washing House of the factory of the Explosives and Chemical Products, Ltd., at Bramble Island, Essex, on the 11*th March*, 1913. Major H. Coningham, H.M. Inspector of Explosives. [Cd. 6760.]

As the result of this explosion one workman was killed. The building contained 120 lb. of nitroglycerin in the final washing tank, and 232 lb. of nitroglycerin in three boxes. At the position where the final washing tank stood a crater was formed 12 ft. by 7 ft. by 3 ft. deep, and another 11 ft. 6 in. in diameter and 7 ft. deep which corresponded with the position of the three boxes. The washing tank was of lead, 4 ft. 2 in. in diameter. The arrangement for running the nitroglycerin from the washing tank to the filter consisted of an outlet pipe of lead, over which was fixed a soft rubber pipe. The other end of this rubber pipe, when not

in use, was kept closed by being slipped over a lead plug provided with a central air hole, through which compressed air was passed while the nitroglycerin was being washed, the object being to keep the nitroglycerin out of the rubber tube whilst this operation was in progress. When the air was not being passed through the air hole in the plug the level of the nitroglycerin in the bend of the rubber pipe would be the same as that of the nitroglycerin in the washing tank. The nitroglycerin in the final washing tank was in the frozen state, and had a layer of from 10 to 12 in. of cold water on top of it. The nitroglycerin in the three boxes was in the liquid state. Major Coningham considers that the explosion occurred at the final washing tank, where the workman was almost certainly engaged in thawing the nitroglycerin. The explosion was probably caused by the breaking of crystals of frozen nitroglycerin in the bend of the nitroglycerin pipe or at the plug, possibly owing to the workmen straightening out the pipe to place its end in the filter, or squeezing the pipe unduly hard at the bend in order to feel if the nitroglycerin was frozen. In order to prevent a further accident of a similar nature it is recommended that in the event of nitroglycerin being frozen in the washing tank, after thawing it, special care should also be taken to thaw any nitroglycerin in the rubber pipe by applying to it thick cloths wrung out of warm water.
—G. W. McD.

Explosives ; Use of the ballistic mortar for determining the strength of ——. A. M. Comey and F. B. Holmes. Eighth Int. Cong. Appl. Chem., 1912. Sect. IIIb. Orig. Comm., **25**, 209—215.

Irregular results obtained with the ballistic mortar were found to be due largely to the effect of the residue left from one test on the recoil produced in succeeding tests. Blasting gelatin when fired leaves practically no residue and cleans the mortar more efficiently than can be done by mechanical means, and the authors have been able to obtain concordant results in successive tests on the same explosive by firing two shots of blasting gelatin before each shot of the explosive being tested or of the standard explosive.—A. S.

Explosives ; Methods for the determination of the effective strength of high ——. A. M. Comey and F. B. Holmes. Eighth Int. Cong. Appl. Chem., 1912. Sect. IIIb. Orig. Comm., **25**, 217—233.

For determining the strength of explosives the ballistic mortar (see preceding abstract) is more convenient than the Trauzl block and gives more concordant results in duplicate determinations. The Trauzl block, moreover, does not show the relative strengths of explosives of different types, as the results are dependent to some extent upon the velocity of detonation as well as upon the strength. The "*Druckmesser*" test, although more expensive and giving less concordant results in duplicate determinations than the ballistic mortar and the Trauzl block, is of value because it is the only test in which the actual pressure developed is determined directly.—A. S.

Inflammability of powders ; Apparatus for determining the ——. N. L. Hansen. Z. ges. Schiess- und Sprengstoffw., 1913, **9**, 165—167.

Use is made of a bifilar pendulum 2·35 m. long with a bob weighing ½ kilo., carrying at its lowest point a fine needle, on which is fixed the flake or grain of powder to be tested. At the lowest point of swing the needle passes through a Bunsen flame (0·93 cm. long). The pendulum is drawn back to a certain distance, and, on releasing it, the grain of powder on the needle passes through the flame. Ten experiments are made at each distance, beginning at 1 cm., and the greatest distance at which all the ten samples ignite and the least distance at which none will ignite are determined. The relative sensitiveness is measured by the total number of grains or flakes ignited from 1 cm. swing up to the point at which none ignite.—G. W. McD.

Tetraphosphorus trisulphide and a new phosphorus oxysulphide, $P_4S_3O_4$. Stock and Friederici. *See* VII.

Patents.

Signal-fusee ; Time-burning railway ——. L. S. Ross, Newtonville, Mass. U.S. Pat. 1,059,214, April 15, 1913.

Sulphur, perchlorate, a metallic nitrate (or a salt producing a coloured flame on ignition) and carbonaceous matter devoid of oxygen (*e.g.*, a hydrocarbon or a mixture of carbon and a hydrocarbon), are mixed in suitable proportions to produce a fusee which will burn brilliantly and without incandescence within a fixed limit of time, and is not liable to spontaneous ignition.—C. A. M.

Signal-fusee ; Time burning railway ——. L. S. Ross, Newtonville, Mass. U.S. Pats., 1,059,767 and 1,059,768, April 22, 1913.

(1). A mixture of a metallic nitrate, carbonaceous material, sulphur, perchlorate and strontium peroxide. (2). Potassium chlorate is added to the above composition, in an amount at least equalling the potassium perchlorate present.—G. W. McD.

Liquefying solid nitro bodies or other chemical substances ; Apparatus for ——. H. G. C. Fairweather, London. From Deutsche Sprengstoff Act.-Ges., Hamburg, Germany. Eng. Pat. 9586, April 23, 1912.

See Ger. Pat. 249,978 of 1912 : this J., 1912, 1009.—T. F. B.

Explosive. S. A. G. Nauckhoff, Vinterviken, Assignor to Nitroglycerin Aktiebolaget, Stockholm, Sweden. U.S. Pat. 1,058,891, April 15, 1913.

See Fr. Pat. 422,727 of 1910 ; this J., 1911, 573.—T. F. B.

Mine powder. R. Ponnay and J. F. Hubbard. Fr. Pat. 451,559, Dec. 6, 1912. Under Int. Conv., Feb. 16, 1912.

See U.S. Pat. 1,033,927 of 1912 ; this J., 1912, 798.—T.F.B.

XXIII.—ANALYTICAL PROCESSES.

Nitrogen [in gaseous mixtures] ; Direct determination of elementary —— *with the help of commercial calcium carbide.* B. Natus. Z. anal. Chem., 1913, **52**, 265—292.

The nitrogen is absorbed by contact with a finely powdered mixture of calcium carbide with one-tenth of its weight of fused calcium chloride, at 900°—1000° C., and the product is then treated by Wilfarth's modification of Kjeldahl's method (in which the substance is heated with a mixture of concentrated and fuming sulphuric acids and a drop of mercury). A known weight of the carbide mixture (previously heated in a current of hydrogen, to remove volatile impurities) is introduced into a porcelain boat within a porcelain tube which is connected at either end with gas burettes ; the apparatus is filled with pure dry hydrogen and then the carbide is heated and the gas to be absorbed introduced, the absorption being completed by slowly passing the gaseous residue twice backwards and forwards through the tube. The absorption product, after cooling, is transferred to the decomposition flask and at once moistened with sulphuric acid (not water) ; decomposition is complete in about an hour with Wilfarth's mixture, and the cool diluted liquid is rendered alkaline, treated quickly with potassium sulphide solution, and distilled in the presence of zinc dust. The average loss of nitrogen in the process (with water in the gas burettes) is 1·9 per cent. (maximum 3·6) or, with dry gas contained over mercury, 0·75 per cent. (maximum 1·4).—F. Sodn.

Copper ; Electrolytic determination of —— *in solutions containing nitric acid.* E. Gilchrist and A. C. Cumming. Faraday Soc., May 7, 1913. [Advance proof.]

The authors confirm Stansbie's statement (this J., 1912, 1132) that the failure to deposit all the copper in the electrolysis of nitric acid solutions is due to the formation of nitrous acid. The deposition can be made complete using stationary electrodes, and an electrolyte containing 10 c.c. of strong nitric acid per 100 c.c. of electrolyte, if about 2 grms. of urea be added towards the end of the electrolysis.—W. H. P.

Electroanalysis of copper, antimony, bismuth and tin with acidified chloride electrolytes. E. P. Schoch and D. J. Brown. Trans. Amer. Electrochem. Soc., 1912, **22**, 265—275.

The metals mentioned can be deposited from hydrochloric acid solutions completely and rapidly in the presence of a suitable reducing agent. For tin the best agents are hydroxylamine hydrochloride and oxalic acid and a conveniently rapid method consists in depositing the main quantity of tin without any reducer at a temperature up to 70° C. with rapid stirring. Then ammonium oxalate and oxalic acid are added and the reduction completed. In this way the deposition can be completed in about 90 mins. Copper can be deposited completely from a solution of cupric chloride in hydrochloric acid in presence of hydroxylamine hydrochloride or formaldehyde. To get the metal in a good form the cathode potential must not be higher than —0·60 volt against a calomel electrode. It is easy to see when this potential is being exceeded as hydrogen is evolved under such conditions. If the difference of potential against the normal electrode is kept down to —0·40 volt the copper can be readily separated from tin and all other metals more positive than tin which are not deposited under these conditions. In the determination of antimony it is necessary to avoid the loss of volatile antimony hydride or pentachloride, and at the same time to work above 50° C., so as to avoid the deposition of impure "explosive" antimony. The cathode potential suitable for the analysis is —0·40 volt against the normal electrode. The reducing agent used is hydroxylamine hydrochloride. In the case of bismuth the earlier portions of the deposit are obtained with a cathode potential of —0·25 volt and the voltage is then raised gradually to —0·60. Otherwise the determination is similar to that of antimony.—W. H. P.

Phosphoric acid; Separation of —— by means of stannic acid in qualitative analysis. W. Mecklenburg. Z. anal. Chem., 1913, **52**, 293—298.

The stannic acid is preferably used in the form of a jelly containing about 10 per cent. SnO_2, which is prepared by dissolving tin in nitric acid at 0° C., pouring the resulting colloidal solution into a large volume of water, and filtering and washing the precipitate obtained. The phosphate solution, which should be as free as possible from hydrochloric acid and contain about 15 c.c. of concentrated nitric acid per 100 c.c., is vigorously boiled for about 15 minutes with 1—2 tablespoonfuls of the jelly, and the mixture is then filtered and the filtrate treated in the ordinary way for the detection of the metals present, iron and titanium being detected in the residue. A second treatment with stannic acid may be necessary to remove all the phosphoric acid.—F. Sodn.

Tungsten and molybdenum; Sensitive reaction of —— in presence of a mixture of potassium iodide and mercurous nitrate. E. Pozzi-Escot. Bull. Soc. Chim., 1913, **13**, 402—403.

The reaction described by E. Kafka (this J., 1912, 664) gives good results in the case of tungsten; it is quite useless for the detection of molybdenum, however, since it is not sensitive and the blue colour obtained is very pale and transient. Further, contrary to Kafka's assumption, the reaction depends on the reducing power of metallic mercury and not on that of hydriodic acid. If a solution of a trace of sodium tungstate in concentrated hydrochloric acid is treated with a globule of mercury, the blue colour is at once developed; the colour disappears in the course of a few minutes owing to further reduction. —L. E.

Mercury from bismuth; New method for the analytical and quantitative separation of ——. A. P. Castanares. Eighth Int. Cong. Appl. Chem., 1912. Sect. I. Orig. Comm., **25**, 39—40.

The solution, containing not much more than 0·1 per cent. Hg, is acidified with nitric acid of sp. gr. 1·42 (5 c.c. per 100 c.c. of solution), heated to 60° C., excess of a 10 per cent. solution of ammonium carbonate containing 1 per cent. of ammonia added, and the whole heated to 80° C. The mercury remains in solution and the precipitate of basic nitrate and carbonate of bismuth is collected in a Gooch crucible, washed with a 1 per cent. solution of ammonia (sp. gr. 0·90), and ignited to the sesquioxide. If chlorides be present in the original solution, the precipitate must be dissolved in dilute nitric acid, evaporated several times with concentrated nitric acid to convert the bismuth oxychloride into nitrate, and the bismuth re-precipitated with ammonium carbonate or phosphate. The mercury is determined as sulphide. —A. S.

Titration of sulphurous acid and of sulphurous acid in presence of thiosulphuric acid. Bosshard and Grob. *See* VII.

Iodometric determination of persulphuric acid. Müller. *See* VII.

Colour reaction for the detection of thiosulphates. Pozzi-Escot. *See* VII.

Determination of oxygen in iron and steel by reduction in an electric vacuum furnace. Walker and Patrick. *See* X.

Determination of phosphorus [*in iron and steel*]. Ridsdale. *See* X.

Determination of manganese in cast iron and steel by Von Knorre's process. Huybrechts and Joassart. *See* X.

Proposed standard method for the determination of zinc. Breyer. *See* X.

Determination of nickel and cobalt. Hallett. *See* X.

Distinctive reactions of ox-foot and sheeps'-foot oils. Chercheffsky. *See* XII.

Detection of adulteration of China wood oil. Potsdamer. *See* XII.

Examination of lubricating oils for the cylinders of steam engines. Cormorant. *See* XII.

Detection of methyl alcohol [*in renatured spirit*]. Raikow. *See* XVIII.

Homologues of morphine, codeine and dionine, and some of their derivatives. Ferrein. *See* XX.

Alleged formation of apomorphine during heating or storage of solutions of morphine. [*Detection of apomorphine.*] Feinberg. *See* XX.

Spica's process for the determination of citric acid in citrates and lime juice. Scurti and Tommassi. *See* XX.

Testing acetaldehyde for paraldehyde. Heyl. *See* XX.

Patents.

Analysis and indication of gases; Apparatus for the continuous and automatic ——. P. R. Boulton, Birmingham. Eng. Pat. 5601, Mar. 6, 1912.

The apparatus is intended more particularly for indicating or recording the percentage of carbon dioxide in flue gases, and comprises an absorption chamber connected between two gas chambers of equal capacity provided with inlet and outlet valves. The valves are worked so that first of all the flue or chimney is placed in communication with the first chamber which is at that time cut off from the absorption chamber, while the other chamber is also cut off from the absorption chamber and is placed in communication with an exhauster, so that a difference in pressure in the two chambers is established. The flue and the exhauster are then cut off, and the two chambers are opened to the absorption chamber. The extent to which the pressure falls below the mean of the pressures in the two chambers is a measure of the percentage of gas absorbed. By means of a specially arranged combination of gas-bells sealed in tanks and free to rise or fall according to the pressures above and below them, the pressure difference referred to above is indicated directly by a pointer. —A. T. L.

[Laboratory] Centrifugal machines. L. Déraud and G. Rivat. Fr. Pat. 449,696, Oct. 21, 1912.

The tubes of centrifugal machines of the laboratory type are heated electrically by means of resistance coils surrounding them, the temperature being regulated automatically by a benzene thermometer operating a mercury contact.—H. H.

Trade Report.

The chemical industries of Canada. By Dr. S. Dushman and Prof. J. W. Bain.

An abstract of a report prepared by a Committee of the Canadian Section of the Society of Chemical Industry and presented to the Eighth International Congress of Applied Chemistry, held at Washington and New York, 1912. With a powerful and prosperous nation to the south, highly skilled in manufacturing processes and seeking eagerly for markets for its surplus production, Canada has developed more slowly from an industrial point of view than if she occupied an isolated position geographically. The products of Europe and of the United States have long been familiar to the Canadian people, and the manufacturers of British North America have had a difficult struggle to establish their wares. But this day is past. All over the Dominion new factories are building, new articles are being manufactured and new plans for the future are being evolved. The situation to-day can only be conveyed with the help of statistics, which have been prepared by the Canadian Section of the Society of Chemical Industry as a survey of present conditions.

Products of wood distillation.

The destructive distillation of wood flourishes in certain parts of Canada where there is an abundant supply of hard wood, maple and beech being preferred. The wood is charred in long horizontal retorts holding six cords each, as is usual in American practice. The crude pyroligneous acid is distilled to remove the tar, the distillate is then treated with lime and redistilled, yielding alcohol, acetone, etc., and a solution of calcium acetate. The alcoholic distillate is fractionated, and is then shipped to the central refinery for a further rectification. Some of the alcohol (methylic) is oxidised to formaldehyde, for which there is a considerable demand. A portion of the calcium acetate is used in the manufacture of acetone, which is sold to England for the smokeless powder industry.

Four companies have a capital of $5,965,000, and employ about 2300 men. The amount and value of each of the total products is given below :—

Charcoal	8,000,000	bushels of 20 lb ..	$560,000
Acetate of lime	14,000	tons	465,000
Wood alcohol	1,019,000	Imperial gals.	489,000
Acetone	400	tons	110,000
Formaldehyde........	1,400	barrels............	50,000
			$1,674,000
Pig iron	18,000	tons	325,000
			$1,999,000

Products of coal tar distillation.

Refined tar, soft pitch, briquetting pitch, black varnish, roofing cement, soluble disinfectant or sheep dip, crude benzol, rectified benzol, creosote oil, liquid creosote, creosote stain, crude carbolic acid, purified carbolic acid, crude naphtha, purified naphtha, emulsion (germicidal), ammoniacal liquor and light oil are produced. At six plants a total of 706,700 tons of coke, 7100 tons of ammonium sulphate and about 5,000,000,000 gallons of tar are produced. The value of these is approximately $4,600,000.

Fertilisers.

The use of commercial fertilisers in Canada has scarcely passed the infantile stage, although in the Maritime Provinces, in the fruit and potato-growing districts, fertilisers have been popular for years. Ontario and Quebec have, during the past five years, given the subject more attention and may be expected to rapidly increase their consumption. British Columbia values fertilisers and ranks as a consumer of large quantities. The provinces of the middle-west will not be heavy consumers for many years to come, although the use of fertilisers there has commenced, chiefly among market gardeners and potato growers ; they are also being used to a small extent by grain growers. The high freight rates add greatly to the cost and aggravates the difficulties of pioneer work. In the younger provinces of Alberta and Saskatchewan, interest in fertilisers seems greater than in Manitoba. The following table shows the principal fertiliser materials imported into Canada during the years ending June 30th, 1904, and February 20th, 1912, respectively.

	12 months ending June 30, 1904.		12 months ending Feb. 29, 1912.	
	lb.	$	lb.	$
Fertilisers—				
(manufactured)	—	134,063	—	413,905
(unmanufactured) .	—	19,155	—	3,151
Muriate and sulphate of potash	1,836,315	33,740	6,840,138	125,849
Kainit and other crude potash salts	726,917	5,868	985,750	9,252
Acid phosphate......	285,707	15,248	1,348,422	61,554
Phosphate rock......	—	8,000	—	43,774
Blast furnace slag	—	6,808	—	119,141
Sulphate of ammonia	186,084	5,485	520,863	16,156
Nitrate of soda......	12,849,769	258,578	58,711,867	873,766
Nitrate of potash ...	1,978,972	86,308	2,273,437	107,313

Pulp and paper.

In response to the growing demand for paper and pulp' Canada's output of these materials is growing rapidly. Stretching unbroken from the Atlantic to the Pacific are immense forests of spruce and balsam, the woods which are to-day most commonly used. Pulp mills are usually situated on rivers near the edge of civilisation, while the paper mills are as a rule near the industrial centres. The products are exported largely to the United States, which is the best customer, and also to the United Kingdom.

1910..	Quebec	Ontario	Nova Scotia	New Brunswick	British Columbia	Total
Pulp production	282,938	156,076	25,955	9,285	350	474,604
Mechanical pulp	235,889	108,351	25,955	—	—	370,195
Sulphite pulp..	40,681	47,271	—	7,685	350	95,987
Soda pulp	6,368	454	—	1,600	—	8,422
Spruce used, cords	239,824	189,196	25,636	15,134	440	470,230
Balsam used, cords	96,474	20,256	3,745	—	—	120,475
Plants	25	15	6	4	1	51

No figures regarding paper are available.

Wood pulp exported—328,977 tons, value..........	$5,694,896
1911.	
Mechanical pulp produced, tons	362,321
Sulphite ,, ,, ,, ...	110,391
Soda ,, ,, ,, ...	24,121

Rubber industry.

The manufacture of rubber goods is carried on by three companies. A recent development which may be mentioned under this heading is the manufacture of Bakelite. As is well known, this is a condensation product of phenol and formaldehyde. A large number of products which have hitherto been made of ebonite or fibre, such as parts for motors, switches, high tension apparatus in general, insulating varnishes, etc., are already manufactured.

Compressed and liquefied gases.

The most important product of this class is liquid carbon dioxide. There are only two firms engaged in the manufacture of this gas. One utilises the calcination of magnesite rock, the other the combustion of coke. In each case the gas is purified and compressed into steel cylinders for shipment to bottlers, brewers, and makers of soda fountains. The combined output of the two plants for 1912 has been estimated at 2,500,000 lb of liquid gas, with a gross value of about $150,000. Liquefied ammonia is produced on a commercial scale but there has been a notable extension in recent years of the compressor system of artificial refrigeration, and a large amount of the liquefied gas is being utilised in the manufacture of ice and in many cold storage plants.

Starch.

The manufacture of starch and starch products is carried on by two companies. One plant at Cardinal, said to be the largest in the British Empire, treats about 2500 bushels of corn, and turns out 75,000 lb. of starch per day. The combined output is about 1,000,000 lb. of starch, glucose, and syrup per day, about 60 per cent. of which is syrup, the remainder starch and starch products. A description of the practice at these plants will be found in a paper by W. P. Kaufmann, presented about two years ago before the Society of Chemical Industry (see this J., 1910, 527). The by-products obtained are cattle foods and an oil which is used in the manufacture of linoleum, etc.

Extraction and refining of metals.

The metallurgical industry of Canada has grown rapidly during the past twenty-five years. In 1886 the total metallurgical production of Canada was valued at approximately $8,000,000; in 1893 at $16,000,000, and in 1910 at $50,000,000. The production of the more important metals during 1910 and 1911 is thus tabulated :—

	1910		1911	
	Quantity	Value	Quantity	Value
		$		$
Copper ....lb.	55,692,369	7,094,094	55,848,665	6,911,831
Gold ......oz.	493,707	10,205,835	—	9,762,096
Pig iron ...tons	800,797	11,245,622	917,535	12,306,860
Lead ......lb.	32,987,508	1,216,249	23,525,050	818,672
Nickel ....lb.	37,271,033	11,181,310	31,098,744	10,229,623
Silver......oz.	32,869,264	17,580,455	32,740,748	17,452,128
Other metallic products	—	510,081	—	409,674
Total	—	59,033,646	—	57,890,884
Less pig iron credited to imported ores....	695,891	9,594,773	875,349	11,693,456
Total metallic	—	49,438,873	—	46,197,428

The subdivision of the mineral production in 1910 and 1911, by provinces, was approximately as follows :—

Provinces.	1910		1911	
	Value of production	Per cent. of total.	Value of production	Per cent. of total
	$	%	$	%
Nova Scotia.....	14,195,730	13·29	15,354,928	15·01
New Brunswick..	581,942	0·54	611,597	0·60
Quebec	8,270,136	7·74	9,087,698	8·88
Ontario	43,538,078	40·76	42,672,904	41·72
Manitoba	1,500,359	1·40	1,684,677	1·65
Saskatchewan ...	498,122	0·47	618,379	0·60
Alberta	8,996,210	8·42	6,404,119	6·26
British Columbia	24,478,572	22·92	21,237,801	20·76
North-West Territories	4,764,474	4·46	4,619,592	4·52
Totals	106,823,623	100·00	102,291,686	100·00

Gold. The history of gold mining in Canada has been somewhat similar to that in California and Australia. Simultaneously with the exploitation of the gold fields of California, placer mining received a great impetus in British Columbia, and at one time a considerable amount of gold was derived from this region. Later on, about 1896, the Klondike was found to contain gold and the gold production rose rapidly, attaining a maximum value in 1900. As the placer deposits of this district became exhausted, the total production of the Dominion fell off from over $27,000,000 in 1900, to $8,000,000 in 1909. Within the past two years, however, the gold production of the Yukon has been increasing, and it is reasonable to suppose that it will continue owing to the extensive scale on which dredging and hydraulic mining are being carried on. While the Yukon territory yields about half the total gold production of Canada, British Columbia supplies almost all of the remainder. Most of the gold produced in the latter province is derived from auriferous copper pyrites ores in the Nelson and Rossland districts, only about ten per cent. being obtained from placer deposits. The following table gives the production for 1909, 1910, and 1911, by provinces :—

Provinces.	1909	1910	1911 (estimated)
Nova Scotia...............	$210,711	$163,891	$142,000
Quebec	3,990	2,565	12,443
Ontario ....(b)	32,425	63,849	37,929
Alberta ....(a)	525	1,850	—
British Columbia .... (c)	1,174,579	5,403,318	4,989,524
Yukon ....(a)	3,960,000	4,570,362	4,580,000
Total	9,382,020	10,205,835	9,761,896

(a) Placer gold.
(b) Gold from vein mining.
(c) Gold from placer and vein mining.

That the gold resources of the Yukon and British Columbia have only been skimmed, as it were, is evident from the fact that the mountain ranges of this territory in which gold deposits have been found so far, form the northern extremity of the western or Cordilleran belt which, extending from South America to Alaska, is recognised as one of the greatest mining regions in the world—noted principally for its wealth in gold, silver, copper, and lead. In both Mexico and the United States this mountain range has yielded about $3,000,000 per mile of its length, and Canada, which possesses over 1300 miles of this range, may yield enormous amounts of the precious metals in the future. The resources of placer gold in the Klondike alone have been estimated at $100,000,000. Up to the present probably not one-twentieth of this vast area has been prospected in detail.

Silver and cobalt. The total silver production of the Dominion for 1911 is estimated at 32,740,748 oz., valued at $17,452,128, of which 30,761,690 oz. were from Ontario, 1,910,323 from British Columbia, 50,300 from the Yukon, and 18,435 oz. from Quebec. Since the discovery of the deposits at Cobalt, Ontario, in 1904, the production has grown rapidly, and Canada now ranks third among the silver-producing countries of the world. Ores from the Cobalt district are at present being treated at three metallurgical works. Silver bullion of fineness varying from 850 to 998·2 is produced at the works, other products being white arsenic, and in the case of the Coniagas plant, nickel and cobalt oxides. During 1910 these three works combined treated 9466 tons of ore and concentrates, the silver recovered amounting to 14,574,837 fine oz. The remainder of the output, consisting of 24,893 tons of ore and concentrates, yielding 16,076,580 oz. of silver, was mainly exported to the United States. The material sent abroad for treatment contained on an average 645 oz. per ton, while that refined at home had an average of 1539 oz. per ton. The ores of the Cobalt district are extremely complex and the problem of treating so as to extract economically the silver, cobalt, nickel, and arsenic, still awaits solution. Some idea of the extent of this over-production of both cobalt and arsenic may be gathered from the fact that the ore contains on the average 6·76 per cent. cobalt, 3·72 per cent. nickel, and 30 per cent. arsenic. The demand for cobalt and arsenic does not keep pace with the amount produced as by-product during the extraction of the silver. One year's production of the Cobalt mines produces ore enough to meet the present consumption of cobaltic oxide for several years. The cobalt oxide, mixed with nickel oxide, is exported to Europe for use in the manufacture of china ware. The quantity of oxide is believed not to exceed 300 or 350 tons per annum, which is much below the equivalent of ore produced by the silver mines of Cobalt. Attempts have been made to find an application of cobalt as a constituent of alloys, and a recent report mentions alloy with chromium as possessing a number of useful properties. (See this J., 1910, 1253; 1913, 28.) According to this report, an alloy containing 25 per cent. chromium and 75 per cent. cobalt is superior to steel for knife blades and is very resistant to corrosion, and takes an edge comparable to that of tempered steel. As regards resistance to corrosion it is equalled only by gold and the metals of the platinum group. Its use in the chemical and physical laboratory in place of platinum has been suggested. It may therefore be that in this or similar directions an outlet will be found for the excess of cobalt.

Arsenic. At one time all the arsenic manufactured in Canada was obtained from auriferous arsenic pyrites in Hastings County, Ontario. But in recent years the reduction works at Copper Cliff have supplied the total demand for this product. During 1910, 1524 tons of white arsenic, valued at $70,709, an average of 2·31 cents per lb. were recovered and sold. The demand for arsenic has not kept pace with the increase in supply, and since the opening of the Cobalt mines the price has fallen from six or seven cents per lb. to less than three.

Copper and nickel. Copper in the refined state is not produced in Canada. The ores are smelted to a matte containing gold and silver and then exported to the United States for refining. The production of the Dominion is derived from the provinces of British Columbia and Ontario. In the former province, "gold-copper" ores occur in the Rossland and Boundary districts. The average content of these ores is rather less than 30 lb. per ton; but with present treatment facilities, it is possible to smelt 9000 tons of ore daily. Two works have a furnace production of 2000 tons of ore daily, and two converters, equal to about 2500 lb. of copper per hour, working on matte of 45 per cent. copper content. The product from the converter is blister copper and is sent to the Nicholls Chemical Company, New York, for refining. Another works is a completely equipped and modern plant, designed to treat all grades of copper and lead ores, and includes a refinery for producing pig lead, as well as refined silver, gold, and antimony, with copper sulphate as a by-product. Another works in British Columbia employs about 300 men at the smelter, besides 500 men at the mine. The plant is capable of treating 4000 tons of copper ore daily. Both matte and blister copper are produced. The former averages between 40 and 44 per cent. copper; 10 to 15 oz. of silver, 1·6 and 2·6 oz. of gold per ton, while the latter carries 99·5 to 99·6 per cent. copper, 25 to 37 oz. of silver, and 4 to 6·5 oz. of gold per ton. During 1910 this company produced 11,407,351 lb. of blister copper, containing 30,945 oz. of gold and 227,445 oz. of silver. The total capital of the company is about $30,000,000, and the total number of men employed by them 1100. The production of blister and matte copper from the province during 1911 was approximately 35,500,000 lb. The copper production of Ontario is mainly derived from the nickel-copper ores of Sudbury. At present there are only two companies, the Canadian Copper Company, and the Mond Nickel Company, engaged in active smelting operations. Both these companies produce a nickel-copper matte from a nickeliferous pyrrhotite ore, with additional values in copper. The matte is shipped to refining works in the United States and England for subsequent treatment. The smelting works of the Canadian Copper Company are at Copper Cliff, near Sudbury, and constitute one of the largest and best-equipped plants of the kind, and costing about $4,000,000. Power for operating the mines and works is developed at High Falls on the Spanish River, about 28 miles from Copper Cliff, where there is a natural drop of about 65 feet, increased by damming to 85 feet. About 12,000 horse-power can be obtained here, and costs delivered at Copper Cliff about $15 per horse-power-year. Ore is taken for the most part from the Creighton mine, which furnished 391,575 tons out of the 508,404 tons raised by the Company in 1910. This ore contains about 1·5 per cent. copper, and 4·5 per cent. nickel. A very efficient method of treating these complex nickel ores has been developed and a matte is produced containing about 35 per cent. copper-nickel, 27 per cent. sulphur, and the balance iron. Through subsequent bessemerising this matte is reduced to about 40 to 49 per cent. nickel, 26 to 49 per cent. copper, 12 to 23 per cent. sulphur, and 0·5 to 2 per cent. iron. The smelter treats about 1000 tons of ore per day. The Mond Nickel Company's smelting plant is at Victoria Mines on the Sault branch of the Canadian Pacific Railway. The Company owns altogether 7000 acres of mining lands, partly leased and partly in fee simple. The average analysis of the run of mine ore is about 2½ per cent. nickel, and 2½ per cent. copper. The capacity of the smelter was about 310 tons of high grade matte per month in 1908. The bessemer matte produced contains about 40 per cent. copper and 40 per cent. nickel, about 15 per cent. iron, and the balance sulphur and impurities. This matte is put up in barrels and shipped to Swansea, England. The discovery of the copper-nickel ores in the Sudbury district has placed Ontario in the position of supplying about 75 per cent. of the world's nickel. The production of nickel-copper matte for 1909 and 1910 is given in the following table:—

	1909	1910
Ore raised ....Tons	451,892	652,392
Ore smelted .... ,,	462,336	628,947
Bessemer matte produced .... ,,	25,845	35,033
Nickel contents .... ,,	13,141	18,636
Copper contents .... ,,	7,873	9,630
Value of nickel	$2,790,798	$4,005,961
Value of copper	1,122,219	1,374,103
Wages paid	1,234,904	1,698,181
Men employed.......................	1,796	2,156

An alloy of nickel and copper known as "Monel metal" is produced directly from the matte, in the proportions almost required for the alloy, which are about 67 per cent. nickel, and 33 per cent. copper, and by careful attention to the furnace charge a Bessemer matte can be produced within one per cent. required for "Monel." It is claimed to possess great strength and to be practically non-corrodible (see this J., 1909, 94, 313; 1910, 1060; 1911, 287, 427; 1912, 541).

Iron.—The Canadian iron industry dates back to the establishment of the St. Maurice forges by the French Government in 1737.

Production of Pig Iron by Provinces, 1910 *and* 1911.

Provinces.	1910			1911		
	Tons	Value $	Value per Ton $	Tons	Value $	Value per Ton $
Nova Scotia	350,287	4,203,444	12·00	390,242	4,682,901	12·00
Quebec ...	3,237	85,255	26·34	658	17,282	26·34
Ontario ..	447,273	6,956,923	15·55	526,635	7,606,674	14·44
Total ..	800,797	11,245,622	14·04	917,535	12,306,860	13·41

Table showing the origin of the raw materials utilized in production in 1911.

Material	Domestic	Imported
Ore	67,434	1,628,368
Coke	543,933	577,388
Limestone.......................	625,216	—

It is thus seen that this industry is to a large extent dependent upon imported raw materials. Nearly all the ore used in Nova Scotia is imported from Newfoundland, while a great deal of that used in Ontario is derived from the south shore of Lake Superior. The classification of the production according to the purpose for which it was intended was as follows:—Bessemer 208,626 tons; basic 461,220 tons; foundry and miscellaneous 244,686 tons. The history of the iron and steel industry in Ontario forms an attractive chapter in the evolution of Canadian industry. The story down to 1904 has been told interestingly by Prof. W. R. Lang. A detailed account of the industry, not only from an historical but from an economical, geological and metallurgical point of view, is to be found in the Report of the Bureau of Mines of Ontario, 1908, pp. 190-342, from which source a great deal of the information has been derived regarding the individual plants.

Lead.—The production of lead in Canada is almost entirely from British Columbia mines. Lead smelting in this province dates practically from 1894, when a smelter was erected. Others followed rapidly. In most of these plants the Huntington-Heberlein process for treatment of lead ores has been adopted, with more or less modification. An electrolytic lead refinery at Trail, uses Betts' process. As a description of the plant and process is available in numerous publications, details are unnecessary.

	1910	1911
Total refinery output	$2,160,911	1,731,874
Gold, ounces	13,298	15,260
Silver, ounces	1,798,960	1,325,294
Lead, tons......................	16,493	11,763

Structural Materials.

With the enormous increase in population there has naturally occurred a rapid growth in the production of structural materials. The most important of the materials which come under this heading is Portland cement. The value of the production has grown from $18,000 in 1890 to over $7,500,000 in 1911, during which year 5,677,539 barrels (of 350 lb. net) were produced at an average price of $1.34 at the works. This was an increase of 29 per cent. over the production in 1910. Furthermore, the amount imported has decreased from 64 per cent. of the total consumption in 1901 to only 7 per cent. in 1910. According to returns to the Department of Mines in 1911 there were 22 plants operating in 1910, with a total daily capacity of 25,835 barrels. These plants are distributed as follows: one in Nova Scotia, using blast furnace slag; one in Manitoba, making a natural Portland cement; one in British Columbia, two in Alberta and three in Quebec, using limestone and clay; and fourteen in Ontario of which eleven use marl and three limestone.

The use of shell marl as the source of lime was the prevailing tendency at the outset of the industry. But more recently the tendency is strongly towards the use of solid rock, as it has been found more economical to raise and grind the rock than to dredge the marl and handle the large proportion of water accompanying it; this tendency is shown by the following table:—

Year.	Cement from marl	Cement from limestone
1908....................	1,573,090	1,922,871
1909....................	810,706	3,336,002
1910....................	1,214,479	3,181,803

The method of manufacture is in most cases the standard American practice, involving the use of rotary kilns in preference to those of the stationary type. The number of men employed in the cement industry is over 2,200, and the wages paid about $1,300,000 per annum.

Lime.—About 80 firms are engaged in the manufacture of lime throughout the Dominion. The average number of men employed in 1910 was reported as 976, and wages paid $466,876. The annual production for 1909, 1910, and 1911 has been about 5 to 6 million bushels at an average value of 19 to 20 cents per bushel. About 50 per cent. of this production is derived from Ontario.

Plaster.—Gypsum is found in considerable quantities in the provinces of Nova Scotia and New Brunswick. The tonnage of gypsum mined or quarried in 1910 was 548,019 tons, and the quantity calcined 69,889 tons. At Windsor, N.S., there are immense deposits; the beds found in the vicinity of Hillsborough, N.B., are, however, very large and of great purity, and form the basis of the most extensive operations. In manufacturing plaster-of-Paris, the stone is first dried in the air and ground—not burned in lumps as is still done to a considerable extent in England and on the Continent; and the pulverised materials subjected to a process of calcination in kettles, of a capacity of sixty barrels of 300 lb. of the calcined plaster, furnished with lids and stirring arms which keep the material in constant motion. When the required temperature has been reached (285° F., 140° C.), the plaster is removed and packed in paper-lined barrels for market. Analysis of the Hillsborough gypsum shows it to be 99·88 per cent. $CaSO_4,2H_2O$.

Petroleum.

Petroleum occurs in commercial quantities in the counties of Kent and Lambton, in the province of Ontario; but the supply has been decreasing during the last few years. While in 1907 there were produced nearly 800.000 barrels of crude petroleum, the production had diminished by about 300,000 barrels in 1910. This decrease is due largely to the gradual diminution in the yield of the wells of the Lambton County field. The wells at Petrolea and Oil Springs have been producing oil for over forty years, and the average production per well is now very small, being not over eight or nine gallons per day. Other fields have fallen off in yield quite rapidly. Petroleum has also been found in Quebec, Nova Scotia, New Brunswick and Alberta. The hopes which were at one time entertained that the North-West would provide a supply that would counteract the diminution of the Ontario supply have so far not materialised. As the output of Canadian crude oil is quite inadequate to meet the requirements of these refineries, the deficiency is made up by imports from the oil fields of the United States. Thus the quantity of Canadian oil distilled in the above refineries in 1910 was nearly 14 million gallons, while over 17 million gallons of imported crude oil were distilled. The following statistics give a comparison of the operations carried on by oil refining works at Sarnia and Petrolea.

Petroleum and Petroleum Products.

	1909	1910
Crude produced ....Imp. gal.	14,723,105	11,004,357
Crude distilled............ ,,	35,530,918	36,171,032
Value crude produced	$559,478	$368,153
Value distilled products	$2,501,384	$2,511,368
Illuminating oil..........Imp. gal.	17,902,254	18,983,357
Lubricating oil .... ,,	3,856,778	4,469,038
Benzene and naphtha ... ,,	3,930,691	4,297,615
Gas and fuel oils and tars.........	4,687,588	5,876,498
Paraffin wax and candles.......lb.	7,092,278	5,179,391
Workmen employed ....No.	436	428
Wages paid	$261,014	$280,485

Refined Chemicals and Drugs.

The greater proportion of what may be classed as fine chemicals used in Canada at the present time is imported. The principal countries of origin are Great Britain, which enjoys preferential duty, Germany, United States, and France. The Canadian market for products coming in, of this class, is, however, increasing rapidly, and it seems reasonable to suppose that the manufacture of the same will be undertaken with greater energy as the market develops. The following are the principal lines manufactured at the present time: Iodides and iodine preparations, silver and gold salts, salts of mercury, hydrogen peroxide, phosphates of soda, sulphites and bisulphites, amyl acetate. On account of the exigencies of the Canadian market, which demands a very wide range of material, a number of smaller lines are made which will not be enumerated here, their manufacture taking place from time to time, and not continuously, as a rule, on a steady scale. The manufacture of pharmaceutical products in Canada is being carried on aggressively at the present time by a number of firms, who confine their activities to three general classes of pharmaceutical products; first the standard preparations of the pharmacopœia; second, standard preparations of a non-secret character; third, of proprietary and other preparations.

Sulphuric, Nitric, and Hydrochloric acids, etc.

Canada manufactures practically all her acids, the amount imported being very small. While the demand for these and similar heavy chemical products has been moderate in the past, it is increasing very rapidly, and there is every reason to suppose that the future will see an enormous expansion in this line of manufacture. But even at the present time the manufacture of the heavy acids may be said to be the most important, as far as the chemical industry is concerned in this country.

Explosives. While this is not a large business in Canada, it is carried on mostly by three companies. There have been a number of factories built by other companies, which were in the nature of experimental plants, but so far the products have not been approved by the consumers.

Electrolytic alkali and chlorine. An electrolytic alkali industry was attempted about twelve years ago by the Lake Superior Power Co., one of the subsidiary organisations initiated by this Company for the electrolytic manufacture of caustic soda and bleaching powder, and an installation of one hundred and twenty cells of the Rhodin mercury type, each cell utilising 1000 ampères at 5·5 volts, was made. The total capacity of the plant was 4·5 tons of caustic and 9 tons of bleaching powder per day. The salt was obtained from wells in the County of Huron. The work was discontinued. There was then, as now, no protection for caustic soda. At the present time the Canadian Salt Co., of Windsor, Ont., has an electrolytic alkali plant at Sandwich. The Gibbs cell is said to be used.

Electric furnace products.

The low cost at which hydro-electric power may be obtained in a large number of localities throughout the country has led to the establishment of a number of electrochemical industries, especially in Ontario and Quebec, where both raw materials and water power facilities are readily available.

Calcium carbide. This constitutes the oldest electrochemical industry in Canada. Very recently the three plants operating at Thorold, Ont., at Ottawa, Ont., and at Shawinigan Falls, Que., have amalgamated as the Canada Carbide Company, Ltd, with a capitalisation of $2,000,000. The plant at Thorold has been in operation since 1897. Six furnaces are in operation, each requiring from 2500 to 3000 amperes at 75 volts. The voltage is regulated automatically by special devices. After fusion of the charge, which consists of lime, coke and coal, the furnace is dumped and the unfused material re-treated. The carbide is obtained in the form of a solid fused mass, which is crushed and bolted and finally packed into steel receptacles, each containing 100 lb. Power is obtained from three power stations on the Welland Canal, near by. The total capacity of the plant is about 1200 tons of carbide per annum. The plant at Ottawa is located on Victoria Island, the power being supplied by the Ottawa Power Company. The capacity of the plant is 3000 to 4000 tons per annum.

Shawinigan Falls, situated about 85 miles east of Montreal on the St. Maurice River, supplies about 25,000 h.p., most of which is transmitted to Montreal at 50,000 volts. Part of this power is, however, utilised locally by the carbide plant and that of the Northern Aluminium Company. The former is situated at a distance of two miles from the power house of the Shawinigan Water and Power Company. "The electric furnaces operate continuously: the manufactured carbide is drawn off in pots, and the fused mass, after cooling, is broken up and granulated in mills. Eight furnaces have been installed, two of which require each 1500 h.p. for their operation. The combined capacity of the furnaces is 25 tons of carbide per day, requiring a total of 7500 h.p." The three plants produced over 8000 tons of carbide during 1911, and it is estimated that the production for 1912 will attain 10,000 tons. The carbide is sold for $65 per ton of 2000 lb. at the works, and the consumption of the product is increasing rapidly, especially for domestic lighting in different rural districts. About 185 men are employed in the different plants.

Cyanamide. The American Cyanamid Company, located near Niagara Falls, Ont., manufactures calcium cyanamide by the process of Frank and Caro, the nitrogen being obtained by passing air over heated copper, which is then regenerated by natural gas. The power is obtained from the Ontario Power Co. The Company commenced operations in January, 1910, with a 10,000 ton plant. This is at present producing to its full capacity, and a large extension is contemplated. The cyanamide is not sold as such, but is previously mixed with Chili saltpetre. The whole output is shipped to the United States.

Silicon carbide and graphite. The Norton Company, of Niagara Falls, N.Y., has a plant at Chippewa for the manufacture of crystolon. The latter is a trade name for carbide of silicon. The raw materials used are two different grades of coke (a metallurgical coke with 92 per cent. or more fixed carbon and 5 per cent. ash, and a petroleum coke, containing about 91 per cent. fixed carbon with less than 1 per cent. ash), a very pure silica sand, and sawdust. Two grades of product are manufactured, green and steel gray. The power is derived from the Ontario Power Co., and amounts at present to 2000 h.p., which is received at 12,000 volts and transformed to 145 volts, after which it passes through induction regulators which "buck" or "boost" the voltage to 70 and 215.

The whole of the production, which amounts to over 5 tons per day, is shipped to the Company's main works at Worcester, Mass., where it is manufactured into different abrasive articles. The International Acheson Graphite Company has also established a small 1000 Kw. plant near Niagara Falls. The number of men employed is about 30, and the output of the plant during 1910 and 1911 has been over 2,000,000 pounds of Acheson graphite in bulk and powder form as well as electrodes.

Ferro-alloys. The work of the Department of Mines, in connection with electric processes for the production of iron and steel, has had the direct effect of stimulating at least two companies to embark upon the manufacture of ferro-alloys by the electric process. After the completion, in 1907, of the Government experiments at Sault Ste. Marie, the Lake Superior Power Co. bought the experimental plant from the Government and used it for the manufacture of ferro-nickel pig from pyrrhotite. At the present time it is utilising the furnace to produce ferrosilicon for its own consumption.

Aluminium, etc. The Northern Aluminium Co., a branch of the Aluminium Co. of America, was the first industry to establish itself at Shawinigan Falls. Owing to the necessity of using direct current at low voltage, it was considered better to generate the power as direct current. The company therefore take their supply of water from one of the penstocks leading from the canal of the Shawinigan Water and Power Co., and are expected to take the capacity of another penstock. The plant covers an area of about 10 acres. The process used is the well-known reduction process of C. M. Hall, the alumina being prepared from bauxite in the East St. Louis (Ill.) plant of the parent company. There are 340 cells in operation, each producing, on an average, 150 lb. of aluminium, 99·4 per cent. fine, per day." The total capacity of the works is 25 tons of aluminium per day, about 500 men being employed when the plant is running at full capacity.

Sugar.

The annual consumption of sugar in Canada amounts to about 400,000,000 lb., most of which is imported. The raw sugar comes from the West Indies and is refined at Halifax and Montreal chiefly; the beet sugar factories also carry on the refining business to a certain extent during their slack season. The beet sugar industry is not a very large one in Canada; the difficulty has been as at other points on this continent, that the labour is scarce and costly, while, as is well known, the cultivation of the beet requires constant care and attention.

Paints and varnishes.

The total amount of capital invested in this industry is over $10,000,000 and the annual output is approximately $6,000,000. About 800 to 1000 men are employed at the different plants. The standard products are white lead, red lead, litharge, etc., and various lines of paints and varnishes.

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MR. E. C. ROSSITER IN THE CHAIR.

BAKELITE AND ITS APPLICATIONS.

BY H. LEBACH, PH.D.

In the year 1872 Adolph von Baeyer made researches in connection with the condensation of phenols and aldehydes[1]; he obtained crystalline and also some amorphous and resinous bodies, which greatly hampered his progress.

Although formaldehyde is now obtainable at a moderate price, it has still proved impossible owing to the high cost of manufacture to put a soluble, fusible, and resinous phenol-formaldehyde condensation product on to the market at a price to compete with natural shellac, to which it is not even superior. At all events, none of the artificial shellacs manufactured according to the patents of Blumer[2], De Laire[3], Bayer und Co.,[4] Sarason[5] and others[6] has ever been put on to the market in appreciable quantities; nor has the resinous compound invented by myself[6] been a commercial success, at any rate, not as an equivalent to shellac.

With Bakelite, however, it is different, because it is not a substitute for any natural or artificial material, but must be judged on its own merits.

Bakelite[7] and its kindred products, "resinite,"[8] "condensite,"[9] etc., are based on the condensation of phenol or cresol and formaldehyde. The formaldehyde is mostly used in the 40 per cent. commercial quality, but the reaction can be brought about equally well with para-formaldehyde, trioxymethylene, methylal, hexamethylenetetramine, and other substances with a reactive methylene group.[10] Besides the above, acetaldehyde, benzaldehyde, and other aldehydes condense with phenols, but owing to their high cost are of no practical interest at present in this connection.

Some of the substances studied by Bayer and his pupils, as well as by Claisen[11], Auwers,[12] Lederer,[13] and others, are well crystallised and belong to either the diphenylmethane or the phenol-alcohol series. The diphenylmethanes are usually formed in the presence of powerful condensing agents, whilst the phenol-alcohols are easily affected by chemical means and by heat, and therefore the reaction in producing them must be very mild.

According to Raschig,[14] there are many transitional stages between the two classes and these are of importance in the interpretation of the formation of Bakelite. It is, therefore, regrettable that Raschig's reports do not definitely state which of his formulæ are based on analytical facts and which on hypothesis.

When phenol-alcohols are heated, either alone or in the presence of acids, anhydrides are formed which polymerise to the so-called "saliretines."[15] These "saliretines" are resinous, brittle substances of variable fusibility and solubility in alcohol and other organic solvents.[16] They are formed immediately by the condensation of phenols and formaldehyde, especially when acid condensing agents are used, with an excess of phenol, provided sufficiently intense and lengthy heating takes place. In appearance and qualities they resemble natural resins such as shellac and copal.

Baekeland has shown that 14 molecules of phenol-alcohol react with one molecule of phenol, or 15 molecules of phenol with 14 molecules of formaldehyde, whereby water is set free. This reaction forms an amorphous substance of the empirical formula, $C_{104}H_{92}O_{16}$, and which has acid properties. This probably is the fundamental substance upon which all these artificial resins are built up, and to which Baekeland has proposed to give the name of "Novolac."[16] Its fusibility and solubility are chiefly due to an excess of phenol tenaciously retained by the resinous materials, and the phenol gives to the resins a characteristic and disagreeable smell. The phenol thus retained has caused some misapprehension as to the actual reaction which takes place. The uncombined phenol can, however, be expelled by heating *in vacuo* or by similar methods. At the same time the fusibility and solubility are reduced to such an extent that in the end an infusible and practicably insoluble product is obtained. This product, however, greatly differs from Bakelite by reason of its physical condition.[17]

By using pure *o*-cresol instead of phenol, Bayer und Co.,[18] Blumer,[19] and myself[20] have succeeded by various methods in producing, without further purification, an odourless Novolac. The reason for this has not yet been determined, but it is not thought that the lower boiling point of the *o*-cresol (188° C.) can have any influence, inasmuch as crystallised phenol with an even lower boiling point (182° to 184° C.) produces a very evil-smelling resin.

The chief representative of the third class of substances formed by the combination of phenols and formaldehyde is Bakelite. In producing Bakelite the first products obtained are liquids or solid, brittle, and resin-like substances, which, however must not be confounded with the Novolac substances, because under the influence of heat the Bakelite products become hard, insoluble and infusible substances of a high chemical and mechanical resistance. These initial stages of Bakelite have received various names such as Bakelite "A," Liquid or Solid (Baekeland), Resinit Mass (Lebach), etc. Four years ago I proposed to call the whole of this class "Resoles."[21] "Res" is derived from the Latin "resina," a resinous body, and the "ol" refers to the solubility in alkalis which points to the probable presence of hydroxyl groups. For the final product whether it be called Bakelite "C," Resinite, Condensite, or by some other name, I suggest the name "Resite."

Besides these products, Baekeland distinguishes an intermediate polymerisation product, which he terms "Bakelite 'B,'" which, although no longer fusible or soluble, is yet affected by solvents and also becomes plastic under the influence of heat. This intermediate condensation product I would suggest to call "Resitol."

We have therefore to deal with four distinct groups: (1) Novolac. (2) Resoles. (3) Resitol. (4) Resites.

Groups 2 and 3 (Resoles and Resitol) can be transformed by purely physical means, that is by heating, into products of group 4, Resites, whereas group 1, Novolac, can only be transformed by further chemical treatment, as I shall explain later on.

The first man to handle Resites was probably Kleeberg.[22] By the action of strong hydrochloric acid upon a mixture of phenol and formaldehyde he obtained a hard, porous mass, which was insoluble in all solvents and not affected by most chemicals.

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[1] Ber., **5**, pages 25, 280, 1094, etc.

[2] Eng. Pat. 12,880/1902.

[3] Eng. Pat. 15,517/1905, Ger. Pat. 189,262, Fr. Pat. 361,539.

[4] Ger. Pat. 237,786.

[5] Ger. Pat. 219,570.

[6] Ger. Pat. 228,639, Eng. Pat. 28,009/1907.

[7] Baekeland.

[8] Lebach.

[9] Aylsworth.

[10] Knoll (Lebach) Eng. Pat. 28,009/1907, Belg. Pat. 204,811.

[11] Liebig's Ann., **237**, 261; Ber., **19**, 3316.

[12] Liebig's Ann., **302**, 105, *et seq.*; Ber., **40**, 2524.

[13] Ber., **27**, 2409; Ger. Pat. 85,588 (Bayer und Co.).

[14] Z. ang. Chem., **25**, 1945.

[15] Piria, Liebig's Ann. **48**, 75, **56**, 37, **81**, 245, **96**, 357. Kraut, Liebig's Ann. **156**, 123. Beilstein and Seelheim, Liebig's Ann. **117**, 83. Gerhardt, Ann. Chim. Phys. (3), **7**, 215.

[16] Baekeland, Chem. Zeit., 1909, No. 96, p. 857; 1912, p. 1245. J. Ind. Eng. Chem., 1912, No. 10.

[17] Baekeland, l.c.

[18] Ger. Pat. 201,261.

[19] Ger. Pat. 206,904.

[20] Ger. Pat. 219,728 (Knoll und Co.).

[21] Z. ang. Chem., 1909, 1598.

[22] Liebig's Ann., **263**, 283.

Arthur Smith[23] endeavoured to make practical use of the reaction, which it was technically impossible to deal with in the manner described by Kleeberg. Smith employed methyl or amyl alcohol for diluting purposes and at the same time replaced the formaldehyde by acetaldehyde. In doing this he suggested that the solvent took a part in the reaction, which is correct in so far as alcohol and aldehyde can combine to acetals under the influence of acid.[24] These acetals, as well as the unaltered alcohol, are not expelled by the low drying temperature applied by Smith's method, and are only mechanically combined with the condensation product. This is proved by the smell which is still noticeable after a considerable time.

Similar lines to those adopted by Smith were followed by Luft,[25] but he endeavoured to produce an elastic product like celluloid by adding glycerin and camphor.

W. H. Story[26] tried to dispense with the use of condensing agents and solvents, and to combine phenol and formaldehyde by merely heating them together, using a large excess of phenol. Now, according to the later researches of Baekeland, Raschig, and others, the use of an excess of phenol means the production of only Novolac products, provided no basic materials are employed as contact substances. Story reports that in using pure crystallised phenol a long period of heating is imperative, and Baekeland has proved that even after the heating has gone on for several days the condensation is still imperfect and uncertain. From my own experience I can confirm this. It is certain that the reaction is more rapid when using commercial crude carbolic acid, which contains mostly cresols, together with a not inconsiderable quantity of basic substances, the presence of which under all circumstances leads to the production of resites, even if the quantity of phenol much exceeds the quantity of aldehyde. The phenol then simply acts as a diluent and filling medium in very much the same way as the substances used by Smith and Luft. This explains why the use of crystallised phenol retards and impedes the reaction. Crystallised phenol as a rule does not contain alkaline substances, or if it does, only traces of such. It is probably only in the laboratory by using glass vessels that the reaction with pure crystallised phenols has been carried out. The condensation is then brought about by the alkali from the glass containers having been attacked through the long heating. In the total absence of alkaline substances, the result will only be Novolac.

For moulded articles the Story method has never been put into commercial practice, because of the long period of heating which is necessary and which makes the process too expensive, owing to the long time in which the moulds are in use. There is, however, a metal lacquer on the market, which it is said is made by the Story process, and I am led to believe this by the fact that this lacquer requires a long period of heating before it has attained the necessary hardness.

In 1907, Dr. L. H. Baekeland[27] and I[28] simultaneously and independently discovered the condensing effect of basic substances. Manasse and Lederer[29] had already shown that it was possible to produce *o*- and *p*-hydroxybenzyl alcohol by the action of molecular quantities of alkali on phenol and formaldehyde followed by the addition of acid. *o*-Hydroxybenzyl alcohol was previously known as saligenine, produced from its glucoside, salicin, which is found in the willow tree.[30]

De Laire[31] made use of this reaction and produced shellac substitutes by heating the raw phenol-alcohol; in other words, he produced Novolac.

Baekeland and I found that by using small quantities of alkaline substances and without the addition of acid we could obtain more quickly and more easily the results of Smith, Luft, and Story, *i.e.*, Resites.

It is from this period onwards that the production of phenol-formaldehyde condensation products has become of commercial value, and especially so since Dr. Baekeland has turned his attention to the physical and mechanical sides of the problem, which had so far been neglected.

Various alkalis, substances with alkaline reactions, and substances which yield alkali are suitable as condensing agents. Amongst the alkali-yielding substances, special mention must be made of various salts,[32] the use which for condensation has some interesting features. I found a special advantage some time ago in using sodium sulphite in the manufacture of resinit and Dr. Baekeland also in his first publication suggested the use of this particular salt. The following reaction then took place: $CH_2O+SO_3Na_2+H_2O=CH_2{\cdot}OH{\cdot}SO_3Na+NaOH$.[33] The sodium hydroxide thereby formed is the actual condensing agent, whilst the formaldehyde-bisulphite separates into fine crystals after some time, provided sufficient sulphite has been used.

The use of sodium carbonate also provides an interesting reaction; the carbon dioxide is expelled violently after a short heating and the alkali set free effects the condensation. It may be assumed that in this case a similar reaction takes place under the influence of phenol, as is the case when sulphite is employed, that is to say, an intermediate formaldehyde-carbonic salt is formed, but this is immediately decomposed.

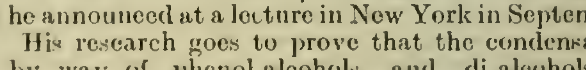
Besides the various alkalis and the salts mentioned there are many other substances which can be used as condensing agents, amongst others, trisodium phosphate, borax, sodium silicate, soap, ammonia, hydroxyleamine, organic amines and amides of weak acids.

Baekeland looks upon the insoluble and infusible final product of the reaction, which he calls Bakelite "C," as a polymerised hydroxybenzylmethylene-glycolanhydride. He bases this theory on the fact, established by myself, that Bakelite "C" or Resites generally can be produced by the action of formaldehyde on saliretines, that is to say anhydrised and resinised phenol-alcohol or "Novolac." Baekeland has discovered that Bakelite "C" is obtained by the action of one molecule of formaldehyde on six molecules of phenol-alcohol, or as an alternative of seven molecules of formaldehyde on six molecules of phenol:

$$6C_6H_4{\cdot}OH{\cdot}CH_2OH+CH_2(OH)_2=C_{43}H_{38}O_7+7H_2O \text{ or}$$
$$6C_6H_5{\cdot}OH+7CH_2(OH)_2=C_{43}H_{38}O_7+13H_2O.$$

In this formula formaldehyde is given as oxymethylenglycol, in which form it reacts in the presence of water.

Baekeland assumes, therefore, that Bakelite "C" is a polymerised hexahydroxybenzylmethylenglycol anhydride:



$$\begin{array}{l} CH_2{\cdot}C_6H_4{\cdot}OCH_2{\cdot}C_6H_4{\cdot}O{\cdot}CH_2{\cdot}C_6H_4{\cdot}O{\cdot}CH_2\diagdown \\ | \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad O \\ O{\cdot}C_6H_4{\cdot}CH_2{\cdot}O{\cdot}C_6H_4{\cdot}CH_2{\cdot}O{\cdot}C_6H_4{\cdot}CH_2\diagup \end{array}$$

This substance can also be called hexasaligenosaligeninmethylenglycolether. Homologues of this compound are obtained by using the homologous phenols.

Lately Raschig[34] has studied the question of Bakelite-formation and arrived at quite different conclusions, which he announced at a lecture in New York in September, 1912. His research goes to prove that the condensation leads by way of phenol-alcohols and di-alcohols to derivates of diphenylmethane, and especially to dihydroxydiphenylmethane-alcohols. The latter are said to condense further amongst themselves. Now Raschig has defined two alternative phenol products which supplied two Resites, which according to their composition are different, yet are similar in their properties. He calls these Bakelite (I.) and (II.), which must, however, not be confounded with Bakelite "A" and "B" of Baekeland. Bakelite (I.) is said to contain 4 molecules of phenol to 4 molecules of formaldehyde, whilst in Bakelite (II.)

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[23] Eng. Pat. 16,247/1899.

[24] Ber. **31**, 545.

[25] Ger. Pat. 140,552; U.S. Pat. 735,278.

[26] Eng. Pat. 8375/1905; Belg. Pat. 210,965.

[27] Eng. Pats. 1921 and 1922/1908; 21,566/1908; Ger. Pat. 233,803 and others.

[28] Eng. Pats. 28,009/1907; Fr. Pat. 395,657; Ger. Pat. 228,639 and others.

[29] l.c.

[30] Liebig's Ann., **48**, 75, **56**, 35.

[31] l.c.

[32] Chem.-Zeit., 1909, No. 35—39 (Baekeland); Z. ang. Chem., 1909, 1598 (Lebach).

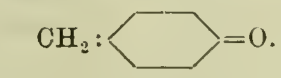
[33] Baekeland, l.c.

[34] l.c.

is one molecule of phenol to every two of formaldehyde. Raschig correctly points out that the whole question is greatly complicated by the fact, that the initial condensation simultaneously produces *o*- and *p*-phenol-alcohol, which can combine with one another in many ways. In the case of the cresols the matter is simplified by the fact, that *p*-cresol does not enter into reaction at all.

J. W. Aylsworth gives a new formula in his English Patent No. 4396/1911 without, however, giving a theoretical or analytical explanation. Aylsworth starts with Novolac, which he turns into Resite by the action of formaldehyde or equivalent substances in practically the same way as Baekeland and I have done. In making the Novolac, however, he works with three molecules of phenol to two of formaldehyde, and claims to obtain a Novolac of a corresponding composition, without, however, giving analytical proof of his assertion. His instructions are to heat this product "for the purpose of expelling the water" for half an hour to two hours at a temperature of 400° F.; in doing so not only the water is expelled, but also up to one-third of the phenol employed returns unaltered, clear proof that Aylsworth's formula is without scientific basis.

Lately a new theory of the chemical structure of Resites has been published by Wohl.[35] He looks upon the Resites as polymerisation products of methylene-derivatives of the tautomeric phenol



He has formed this opinion by the study of acrolein-derivatives of phenols and of so-called resorcinol ethers, which, as he has personally informed me, can only be formulated rationally by the aid of tautomeric phenols.

Whatever may be the actual formula for Bakelite "C" or generally for Resites, it is wrong to assume that the process of the formation is always identically the same. In their research work neither Baekeland nor Raschig have taken into consideration the fact that the course of the reaction, quite apart from other factors, is greatly influenced by the condensing agents which are used. Without a doubt the reaction produced by employing alkalis or alkaline salts commences with the formation of phenol-alcohols. This may be definitely inferred from the work of Lederer and Manasse,[36] but even so it seems that in the use of salts the acid portion has a certain effect, because I obtain a somewhat different product when using sodium sulphite than with sodium carbonate or caustic soda. Greater still, however, is the difference in the reaction and also in the product when using volatile alkalis, especially ammonia. To this fact I called attention some four years ago.[37]

Ammonia and formaldehyde form hexamethylenetetramine. In combining hexamethylenetetramine either in substance or in solution with phenol an addition product is formed (according to Tollens and Moschatos)[38] consisting of three molecules of phenol and one molecule of hexamethylenetetramine. This crystallises in the form of needles and is decomposed by heating at a temperature of 115° C. or by boiling its aqueous solution, ammonia being set free. It is always formed when phenol, formaldehyde, and ammonia are brought together. The succession is quite immaterial. No practical use, however, can be made of this reaction, because the large quantity of ammonia evolved renders the final product porous and brittle. It has, however, been shown that a greatly reduced quantity of ammonia yields a product of technical value. The reaction in this case is brought about by the formation of the addition product in a quantity corresponding to the amount of ammonia present (Lebach, *l.c.*). This addition product is decomposed by heat, whilst the ammonia which is set free combines with a fresh quantity of formaldehyde and phenol, and so on until all the phenol and formaldehyde are condensed. The remaining ammonia will be found partly free or as methyl amine in the water formed by the condensation, or will partly escape as gas during the final polymerisation. A third portion of the ammonia, however, remains combined with the final product, either in chemical combination or simply as a solution of the ammonia in the solid Bakelite "C." The latter seems the more probable, seeing that when ammonia-Bakelite is machined the smell of ammonia is sometimes noticed. Baekeland did not mention the retained ammonia in the first analysis, which he published.[39] This is no doubt due to the fact, that he endeavoured to purify the powdered substance by treating it with caustic alkali, acids, and solvents. We, however, have in every case been able to identify ammonia by analysis.

The method of condensation found by Baekeland and myself would not have sufficed to have placed the manufacture of Resites upon a commercial basis, first of all the hardening process being too slow, although accelerated by the use of alkalis. This fact also made the process too expensive.

We both, however, succeeded in overcoming these difficulties, but Baekeland's method[40] is undoubtedly the more suitable of the two for manufacture on a large scale. Until that time it had been necessary to exercise great care in the hardening of the resoles by heating, so that the product should not foam or become porous by the escaping steam of the water or the vapours of the phenol, formaldehyde, or ammonia (according to the method of manufacture employed). One therefore had to keep the temperature below 100° C. for a considerable time, mostly at 80°, until the hardening had sufficiently progressed to make the development of pores in the product, even under the influence of a higher temperature, impossible.

It was Baekeland who showed that by neutralising the tension of the escaping vapours by outside pressure the formation of pores can be prevented, and by simultaneously increasing the temperature he was able correspondingly to shorten the time necessary for hardening.

These improvements Baekeland carries out in a modified form of autoclave or vulcanizer called a *Bakelizer*. This apparatus is heated by steam and the necessary pressure is produced either by means of compressed air or compressed gas, such as carbon dioxide.

If a liquid or powdered Resole such as Bakelite "A" or Resinite-mass be filled into a glass tube and heated in the Bakelizer for two to three hours at a temperature of 140° to 170° C. at a pressure of about 10 atmospheres, the result will be a transparent, insoluble, infusible, strong rod of resite.

Instead of using the Bakelizer the Resoles can be placed in a steel mould and the moulding and hardening can be effected simultaneously in a hot press. When this is done the material needs the further addition of filling material. Pure Resoles would melt under the influence of the heat and then run out of the mould. This difficulty could be overcome by using Bakelite "B," which only softens in the heat and welds together under pressure, but this would be too expensive, owing to the relatively high price of the pure Bakelite. Besides that, pure Resite is so hard that for many purposes it would be difficult to work up. As far as the final resites are concerned, such an incorporation is impossible in consequence of their infusibility and insolubility. Resoles, on the other hand, in the melted or dissolved condition have great penetrating power with all kinds of materials, especially those of a fibrous nature, such as asbestos or cellulose.[41] These Bakelite mixtures show very high tensile test figures, some having reached the same figures as those of cast iron, viz., 10,000 lb. per square inch. The average tensile strength, according to the Riehlé testing machine, was returned at 4000 lb.

Another advantage in the use of filling material is that it prevents the Resole from running out of the mould under pressure. First the Resole melts and then penetrates the filling material, forming a plastic mixture which completely fills the mould in the press. Then, at a temperature between 100 and 200° C. the Resole is turned into Resite. Whether this is done in the press or in the Bakelizer, a dense and homogeneous mass is produced.

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[35] Ber., **45**, 2046.

[36] l.c.

[37] l.c.

[38] Liebig's Ann., **272**, 280.

[39] l.c. Chem.-Zeit., 1909.

[40] Eng. Pat. 1921/1908.

[41] Eng. Pat. 1922/1908.

Bakelite itself is not much affected by heat, in fact, the quality improves with the increase of the temperature: 170° C. is probably the most favourable temperature for the formation of Resite, and it is not until 300° has been reached that charring takes place. While woodmeal reduces, asbestos and other inorganic filling materials increase the heat and fire resisting qualities of the Resites. The period during which the moulded article should be in the press varies from one to two hours.

Advantage can be taken of this press-moulding in the case of sheets for switchboards, for by the use of several platens two to three or even more sheets up to 3 feet square can be made simultaneously.

The transformation ot the Resoles into the Resites in the mould gradually takes place from the outside of the article. Thus a moulded article may be removed from the mould while the inside is still soft and plastic, and the outside has already been transformed into Resite. This point is reached after a very short while, in the case of small moulded articles in a few minutes. The half finished articles are then laid aside until a sufficient quantity has accumulated, when they are placed either into the Bakelizer or into an ordinary drying oven, where the heating is completed.

The transformation of Resoles into Resites can be brought about quickly by another method. By the action of acid upon the mixture of phenol and formaldehyde, one obtains, as a rule, Novolac products, but Kleeberg[42] and Pollak[43] have shown that, under certain circumstances, it is possible to produce by the aid of acids insoluble products, namely, by using an excess of formaldehyde. Kleeberg employed strong hydrochloric acid, but the reaction is of an explosive nature and the products are porous and technically useless substances. Pollak, on the other hand, made use of small quantities of acid, giving a slow reaction.

I have found that the quickest and most rational way of dealing with this problem is to allow the acid to act upon the Resoles themselves and not upon the initial ingredients,[44] the acid in this case being more a polymerising than a condensing agent. For instance, by adding hydrochloric acid to liquid Resoles condensed by alkali, heat will be developed, and the substance will thicken and then solidify after a short time to a homogeneous block of hard Resite. While the mixture is still liquid it can be cast into moulds and as the material penetrates the most delicate moulds it will after hardening be a true replica of the original. In this way, for instance, blocks for newspaper printing have been made, which combine speed of manufacture with light weight.

During the hardening, the mixture is for a short time plastic and it can be kneaded into shape. In this respect it is useful for dental purposes, because of its rapid hardening and setting. The acid can be easily removed by washing and neutralising.

For articles where it is a question of electrical insulation, the hardening process just described is not applicable, because the insulating properties of the hardened compound are not sufficient.

J. W. Aylsworth[47] describes a process based on the observation made by me, viz., that Novolac can be transformed into Resite by treatment with formaldehyde or substances which yields formaldehyde. Amongst the latter, he chiefly uses trioxymethylene or hexamethylenetetramine, at the same time adding nitro- or chloronaphthalenes or acid anhydrides as "solid solvents" and water or ammonia combining agents.

The transformation of polymerised phenol-alcohol anhydrides (Novolac) into Resites by chemical process, *e.g.*, the introduction of methylene, is done in practice by melting Novolac with polymerised formaldehyde or hexamethylenetetramine and causing condensation by prolonged heating at a temperature of over 95° C.

Factories in which Bakelite and Resinite are made have so far been erected in the United States by the General Bakelite Co., New York, in Germany by the Bakelite G. m. b. H., Berlin, and in the United Kingdom by the Bakelite Co., Ltd., Cowley, Middlesex.

The distinction between Bakelite and Resinit is purely arbitrary and dates from the time when the two products competed against one another.

Bakelite "C" in its purest form is a colourless or light golden-yellow mass of a sp. gr. 1·25. It is a bad conductor of heat and of electricity, and therefore a first-class insulating material. It resists mechanical influences, such as pressure and shock, but in its pure form it has a comparatively low elasticity, although for most purposes sufficient. The heat resisting properties are of special value. It can be heated without decomposing, to a temperature of 300° C. When heated to a higher temperature, charring takes place, but the product will not flame.

Bakelite is non-hygroscopic and resists vapours and nearly all chemicals, such as concentrated hydrochloric acid, cold concentrated and boiling dilute sulphuric acid. It is attacked by hot concentrated sulphuric acid, nitric acid, and bromine. The resistance against alkali varies, there being several qualities of Bakelite which resist warm caustic soda. Generally speaking, Bakelite is more resistant than all other plastics, such as celluloid, vulcanite, casein, and shellac. Its excellent refraction of light, and the ease with which it can be worked, have led to its use for making ornaments and beads for jewellery. It is also suitable for pen and pencil holders, umbrella and stick handles, cigar and cigarette holders, pipe mouthpieces, etc.

By imparting to the Bakelite a cloudy effect, it is hardly distinguishable from amber, except that it is less brittle.

It is only for these articles that final Resite is used, whilst practically for all other purposes, such as moulded pieces, for impregnation and lacquering purposes, etc., only the liquid or solid resoles may be used.

Liquid resoles form the first stage of condensation and according to the reaction they can be produced in all grades of fluidity and viscosity. As such, they receive various definitions, for instance, Bakelite Liquid "A," "A.V," "A.10," "A.15" or Resinite—Mass "1," "1K," "2," etc. The applications of these various qualities are numerous. Certain clays used in brick-making contain salts, such as magnesium and calcium sulphates, which effloresce when the bricks are dried and which give them a spotty and unpleasant appearance. Perkiewicz[47] tried coating with glue to prevent this efflorescence. The coating disappears in the oven and leaves a clean and uniformly coloured surface. But while the bricks are drying the coating becomes mouldy, so that spots again appear. Various disinfectants were tried and Resinit Mass "1K" proved to be the most suitable addition. No hardening takes place, because the Resinit is also completely destroyed during the baking process.

In all other applications, the Resoles are merely the initial stages and in the course of their application they are transformed into Resites.

Woodmeal, cellulose, fibre, paper, and other absorbent materials are impregnated with Bakelite. After impregnation, the materials are dried and pressed into knife and razor handles, reels for electrical purposes, photographic developing trays, and such like.

Another application of liquid Bakelite is the impregnation of arc lamp or magneto coils. The liquid Bakelite penetrates right through the windings and forms a solid block. Coils impregnated with Bakelite show higher resistance figures without any chance of the insulation suffering by melting. The heat is also more readily removed, since the heat conducting properties of Bakelite, although small, are greater than those of ordinary resinous materials. Moreover, the various windings of the coil are held together much more firmly than by the brittle resins in use to-day, which, of course, means that the coils are more able to resist mechanical shocks.

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[42] l.c.

[43] Eng. Pat. 21,401/1910.

[44] Eng. Pat. 27,096/1908; 6430/1911.

[45] l.c.

[46] Eng. Pats. 3496, 3497, 3498 of 1911 and others.

[47] Tonindustrie-Zeit., Berlin.

The above advantages of Bakelite are of great use in motors in railway carriages, motors in connection with pumps in chemical works, and in all such places where the motors are subject to damp or fumes of a corrosive nature.

Liquid Bakelite with asbestos powder or sand[48] makes a paste with which pipe lines, flanges, or even entire vessels may be coated and thereby rendered proof against acids, chlorine, weak alkalis, or other substances which attack metals. In the alkali works at Niagara, cast iron parts of chlorine producing apparatus have been treated in this way and have in consequence resisted the effects of the liquid containing chlorine for a year and a half. Similar experience has been gained in Europe, and in several instances earthenware vessels have been replaced by iron receptacles coated with Bakelite paste. Of course, in all these cases it is necessary to transform the Bakelite coating into the final stage by applying heat.

If the condensation of Resoles is carried far enough products are formed which in ordinary temperature are solid, brittle, and easily powdered, but if these be heated they first melt again before they are finally transformed into Resites. In the powdered form these Resoles can be readily mixed with various filling materials and these mixtures can be moulded into all manner of articles, the mixtures usually consisting of 30/40 per cent. Bakelite and 60/70 per cent. of woodmeal or asbestos fibre. The percentage of the mixture depends upon whether greater mechanical strength or better insulation is required. Asbestos produces heat resisting materials to a greater extent than woodmeal, although the iron contained in the asbestos reduces their electrical insulating properties.

When Bakelite is used in connection with self-lubricating bearings, etc., graphite must be added, and for fire resisting mixtures clay or other inorganic body must be added.

Sheets of pure Bakelite have shown a dielectric strength of 23,000 volts per millimeter thickness. Sheets of Bakelite and asbestos 30/70 per cent. mixture 8,500 volts and woodmeal mixtures with 30 to 50 per cent. of Bakelite 7000 to 11,000 volts per millimetre thickness. Better figures even were obtained by impregnating paper with Bakelite.

It is possible to mould metal parts firmly into Bakelite, despite the fact that the expansion of the Bakelite is very slight.

Three works are turning out Bakelite buttons on the Continent, each of which can produce 100 to 300 gross of buttons per day.

Varnishes and lacquers.—So-called Bakelite varnishes are merely 50 per cent. or more solutions of Solid Bakelite "A" in methylated spirit. Bakelite lacquer is produced by diluting Bakelite varnish with amyl acetate or other diluent. It is being used for the coating of brass bedsteads and other ornaments, but its application is not quite as simple as one might believe. When an article is coated with it and heated in an oven in the usual way the coating is pitted with innumerable small nits, craters, and flakes, the cause of which has not yet been proved. We have, however, succeeded in remedying this defect, so that the coating now produces a very smooth and brilliant surface.

The advantages of Bakelite lacquer are quite apparent from the qualities which the Resites possess, viz., hardness, insolubility and power of resistance against the action of chemicals, especially against the influences of methylated spirit, ammonia, and salt water.

Bakelite lacquers can also be used as acid proof coatings, such as for the insides of fire extinguishers.

Bakelite varnish is used for the impregnation of coils, armatures for magnetos, arc lamps, transformers, etc., in a similar way as with Bakelite "A,"

Paper impregnated with Bakelite varnish is also used in the manufacture of "Micarta" sheets, "Pertinax" tubes, and transformer terminals. In most of these cases ordinary paper is impregnated with Bakelite varnish and then dried, and a sufficient number of the sheets of paper are then pressed together or rolled into tubes by special machinery. In this way cylinders up to 3 ft. in diameter and transformer terminals from 6 ft. to 9 ft. long for over one hundred thousand volts have been made.

The special qualification of Bakelite paper is apparent from comparative figures of the specific inductive capacity of Bakelite with several well-known insulating substances.[49]

Specific inductive capacity.

Substance.	Observer.	Spec. Ind. Cap.
Glass, plate	Arons, Rubens	5·37 to 6·20
Glass, flint	Hopkinson	6·61 to 9·90
Glass, Jena	Lowe	5·05 to 5·52
Glass, crown	Lowe	6·20 to 7·96
Glass, chrome high refract.	Lowe	9·14
Paraffin	Boltzman, Lampa, Hormell	2·32 to 1·92
Shellac	Winkleman, Gordon	3·10 to 2·70
Celluloid...........	Elsas	1·19 to 2·66
Resin	Boltzman	2·55
Porcelain	Curie, Starke	4·38 to 6·84
Paper	Pirani	2·00 to 2·25
Vulcanite	Boltzman and others	2·55 to 3·15
Mica	Klemencic	6·64 to 5·66
Bakelite sample No. 1	Electrical Testing Laboratories, New York	8·85
Bakelite sample No. 2		6·05
Bakelite sample No. 3		6·30
Bakelite sample No. 4		5·95
Bakelite sample No. 5		5·60

The dielectric strength of sheets of impregnated Bakelite paper averages about 53,700 volts per $\frac{1}{16}$in., as against 50,460 volts when using shellac paper of the same thickness.[50]

Other advantages of Bakelite paper are great mechanical strength combined with comparative elasticity, which surpass all other Bakelite impregnated substances. The heat resistance of Bakelite paper is naturally inferior to Bakelite mixed with an inorganic filling material, nevertheless, 350° F. is resisted by Bakelite paper for a considerable period.

Another application of Bakelite varnish is in the brush-making trades for holding the bristles.

Bakelite varnish has been suggested for use as an antiseptic in hospitals, slaughterhouses, and breweries, as well as for the painting of boats and yachts. Hardening, in this case, is not advisable, as the disinfecting power would thereby be destroyed.

Soft wood can be made proof against influences of water and rot by means of impregnation with Bakelite "A" or varnish.

A special quality of Resinit varnish, or "Resinit Enamel," is used to coat gold-plated articles. Ordinary enamel could not be used for this purpose, because the high enamelling temperature would alloy the gold with base metal. Resinit enamel has also found unexpected use in connection with the finishing of silk crape.

Discussion.

Mr. L. **Archbutt** inquired how water pipes were coated with Bakelite, what temperature it would stand effectively, and the cost of the process. Could it be used inside a steam boiler? What were the points of difference in the several Bakelite materials?

Mr. W. B. **Parker** inquired what was the experience in relation to the use of Bakelite or cotton, paper, or fibres used in the preparation of electrical machinery. Was the fibre damaged, or made tender, by the baking at high temperature? He desired to obtain a plastered mass for filling up electrical coils. He tried to temper the original properties of Bakelite bases by adding drying and non-drying oils. Thus by the application of castor oil the mixture produced held together when cold, but when heated to 80° the oil took out the free phenol, of which considerable quantities were contained in the Bakelite. Separation also took place if mineral matters were mixed with the base and with castor oil. He did not think that the claim of a definite compound was proved. The above observation was against the claim. As to the varnishes all the instances given were those of spirit varnishes. Was there any rival to oil varnishes? Was there any preparation which could be used in a similar way in relation to a boiled varnish? How might paper be impregnated with Bakelite C?

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[48] Metallurg. and Chem. Eng., Jan., 1912.

[49] Williams, Electric World, March 9, 1911.

[50] Williams, l.c.

Dr. W. R. Ormandy asked if the new substances were available for replacing ebonite. If the material was effectual for the coating of cast iron pipes, then the long time spent in experimental work had been well spent. As condensation was produced in the presence of small quantities of bases as well as acids and an insoluble material could be produced by using a large excess of formaldehyde in the presence of acids, were the natures of the products in the two cases physically similar? When condensation took place in the presence of a base was it possible to carry the condensation to such a state of completeness that no phenol remained in the condensed mass as it was frequently very difficult to cause condensation to proceed until all material was involved in the reaction? Finally he would like to know whether they had succeeded in making soluble condensates which were practically colourless, since for varnish making it was well known that the price of copals and other gums increased greatly as the material went lighter in colour. It would be interesting to know if the Bakelite products had been produced in this colourless and more valuable form.

Mr. Rex Johnson inquired whether, when using Bakelite for impregnating coils for electrical work, it was possible to use it in any other form than the varnish form. There was always a difficulty in getting a solid impregnation and, with Bakelite varnish, this would be accentuated owing to the large proportion of solvent, which, when expelled, would leave air spaces. In electrical coil impregnation it was essential to have a solid job, and at the present time this was most easily effected by using a high melting point asphaltum compound. The chief drawback to the use of this material was the large coefficient of expansion. Would the lecturer kindly give his opinion as to the best method of applying Bakelite to obtain a solid filling for wire coils.

Mr. F. H. Alcock said having regard to the composition of one of the preparations, which included an appreciable amount of ammonia, he did not think it would be suitable as a brass lacquer. Did the material expand or contract on exposure to air, and to variable climatic conditions; and was it adhesive or elastic, so as to enable the negotiation of corners in work without cracking. What would be the effect of fats and oils (and especially turpentine) upon the material. There would be a limited application, with regard to varnishes, if it did not resist those. Was the material effective in the retention of bristles in brushes: he conceived a difficulty in relation to brushes used for oils and turpentine. Was it suitable for making reservoirs for fountain pens, for its transparency suggested its usefulness for this purpose.

Mr. W. H. H. Norris asked if the shrinkage resultant upon stoving the composition could be overcome. He understood that after coating iron vessels by brushing on a solution of Bakelite they needed to be stoved at a high temperature. He had failed to make a coating which did not crack owing to the shrinkage previously mentioned. It would be most valuable if cotton fibre could be made impervious to the action of acid and chlorine by means of a Bakelite coating. He found that stoving cotton fibre impregnated with a 10 per cent. Bakelite solution in alcohol, at 140° C. in an autoclave for only 10 minutes, made the cotton brittle. With a 5 per cent. solution the stoved cotton could be handled but he was unable to make it sufficiently resistant; he asked if Dr. Lebach had been more successful.

Dr. Lebach, in reply, said that although the cost of coating pipes with Bakelite was rather high, it was not prohibitive in view of the results obtained. The mixture used for coating contained from 20 per cent. upwards of Bakelite; the remainder consisted of sand, asbestos fibre, or some other suitable material. The shrinkage of Bakelite in moulds was very slight if a Bakelite-powder mixture was used. A vessel coated with Bakelite would stand water up to 200° C.; but it would not stand direct heating in a steam boiler, when probably it would crack off.

There was no essential chemical difference in the two qualities of Bakelite, only in the uses. By further heating Resitol (Bakelite B) would result, which had an appearance similar to that of solid Bakelite A; the principal difference was that it no longer melted or dissolved in any solvent. On application of phenol or glycerin it would swell and decompose, and on heating it became soft. The combined action of heat and pressure would weld it together and moulded articles could be manufactured in this way. It was not, however, a process which could be used largely on a commercial scale.

A certain amount of elasticity was invariably lost in impregnation. Cotton impregnated with Bakelite and used as a filtering material for alkali, was not affected by the alkali. But the Bakelite reduced the elasticity of the cellulose and made it brittle.

The ammonia in the Bakelite lacquer did not affect the brass.

If Bakelite was transformed into its final stage there was no considerable contraction or expansion, and he did not think there was any danger in its application in the open air. No oil could attack the final Bakelite. The proposal to mix oils with Resols to alter the properties, probably with a view of getting a more elastic product, was useless. He had never heard any complaint as to inefficiency when used for brushes for oils.

Bakelite had been used for bottles for hydrofluoric acid, and was not attacked. The substance was obtainable without colour; but as transparency increased the price advanced, as colourless Resites could only be made from the purest materials. Resinite enamel, for instance, was quite colourless. The Patent numbers for Bakelite were 1921 and 1922 of 1908; and Resinite 28,009 of 1907 and many others. The liquid material, for coating purposes, cost 15s. 6d. per gallon; the other grades and prices were also obtainable.

Liverpool Section.

Meeting held at the University, on Wednesday, 12th March, 1913.

PROF. F. G. DONNAN IN THE CHAIR.

SOME PROBLEMS OF THE RUBBER INDUSTRY.

BY H. E. POTTS, M.SC.

The ordinary raw rubber of commerce is obtained from the milk or latex of various trees, chief among which is the *Hevea Brasiliensis*. Hevea latex is a thick white liquid which is secreted by the tree and oozes out of incisions made in the bark. In the fresh state it is faintly alkaline. The viscosity diminishes on dilution with water in such a way as to suggest that it is an emulsion rather than a suspension. Seeing, however, that rubber is an emulsoid colloid, and therefore theoretically always a liquid, this does not enable us to draw any conclusion as to the state of polymerisation in the latex. The globules can be readily seen under the microscope; they consist of rubber plus resin. The liquid in which they are suspended contains sugars, salts, etc. The latex also contains protein, which is considered to reside on the surface of the globules as a protective colloid. This view is borne out by the fact that, generally speaking, precipitants of protein exert a coagulating action on the latex. The nature of coagulation is not yet fully elucidated, though it is of absolutely vital importance as regards the quality of the rubber produced.

On the Amazon, the wild Hevea trees are tapped and the latex is coagulated by being poured from a cup on to a rotating paddle held in smoke. Successive layers of rubber are produced by the coagulating action of the heat, acetic acid, and, some say, carbon dioxide. The resulting rubber forms a loaf, shaped like a Rugby football. Clearly this contains the majority of the total solids of the latex, including protein, though not all, since some of the latex is allowed to drain away. When fine hard Para reaches this country it contains 16 per cent. of water and some dirt. It is washed between differential speed grooved rollers, then sheeted between equal speed rollers and dried at a low temperature. The product is termed technically pure Para: it contains about 94 per cent. rubber, 3 of resins, 3 of protein, and about 0·2 of water.

Turning to plantation Para rubber as a contrast, the latex is again obtained by tapping Hevea trees. It is coagulated, usually by the careful addition of acetic acid, washed, sheeted between diamond-studded rollers, thus giving the so-called crêpe, and then dried, perhaps *in vacuo*. On arrival in England it may contain 0·5 per cent. of moisture, but should contain no dirt. No washing process should thus be necessary, unless the amount of adsorbed acetic acid is appreciable, in which case it should be removed, as acid exerts a very deleterious action in rubber mixings.

We now come to the first problem to which I wish to draw attention. On comparing a sample of Plantation rubber with fine hard Para, we prefer the latter. The Para appears harder and "nervier" on the mixing rollers, and in any case it is usually more consistent in quality. Many explanations of this have been advanced, such as the youth of the trees on the Plantations, the acetic acid process of coagulation as compared with the smoking process, and so on. Many patents have been taken out, among the last of which are those of Byrne, for smoking rubber on the plantations. In any case, however, this is a causal explanation. At present no chemical explanation can be given.

Experiments have been made by Schidrowitz and others on the viscosity of solutions of rubber in benzene and these have shown that there is a certain connection between viscosity and "nerve," in the same botanical species. A good rubber gives a highly viscous solution. But even so, we know very little as to the viscosity of colloidal solutions in general, and it appears that the first thing which should be done is to discover how to interpret the viscosity results in terms of the constitution of the colloid, and to see, possibly by ultramicroscopic measurements, whether a high viscosity accompanies a coarse-grained structure or not.

Practically the only reliable way is to make a very careful mixing, to vulcanise it and then to test the vulcanised rubber by mechanical tests (*e.g.*, with a Schopper dynamometer). A convenient method of securing standard conditions of vulcanisation, though it is a little remote from actual practice, is that proposed by Spence, who cures the rubber in very thin sheets between metal, immersed in a glycerin thermostat. Such measurements require time and a fair quantity of material. It seems certain that if they are to be done at all it will have to be by some central organisation. The present method, of buying a substance at £500 per ton on a small sample the size of a handkerchief or less, is absurd. A Conditioning House should be established to which all plantation rubber should be sent immediately on arrival. Vulcanising tests should there be made and the result sent out with the sample. In this way the manufacturer would have some guarantee that he was securing each time a product that would cure at the same speed under the same conditions. This is all important, as the manufacturer cannot afford to be continually changing his times of vulcanisation: he wants them standardised, like everything else. It is only reasonable that he should be given some sort of guarantee such as the above.

Of course, such a test would only ensure constancy of speed; it would not mean that the manufacturer could calculate the cure required under changing conditions. This seems impossible at present owing to the complexity of the problem: the bad thermal conductivity of rubber makes it excessively difficult to say what is actually happening inside the article being cured, except by actual trial.

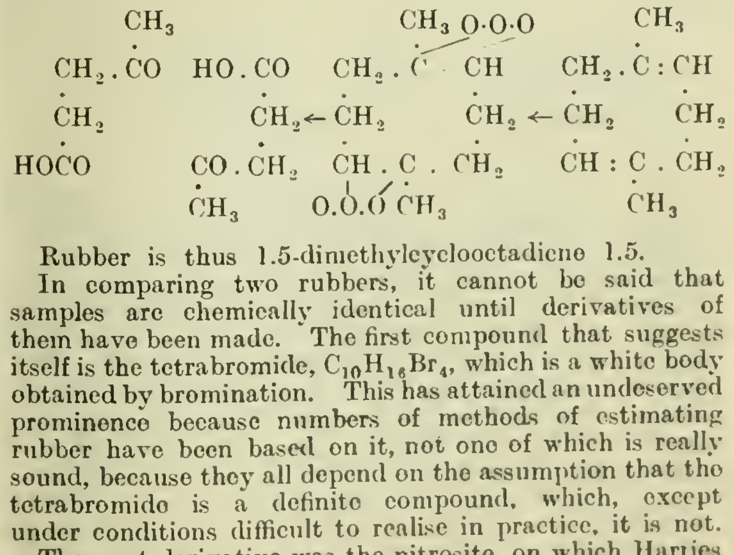
Beyond this, research is required to determine the nature of the factors affecting quality of raw rubber, and its velocity of vulcanisation.

Returning to technically pure raw rubber, from a chemical point of view, the resins may be removed by treatment with acetone, alcohol or other organic hydroxyl compounds. In the laboratory the extraction is best performed in a Soxhlet or in a Zuntz extractor, leaving behind rubber and protein. Numerous processes have been patented for removing the resins from highly resinous raw rubbers in practice. The most ingenious is perhaps that of Wildermann, who employs a resin solvent (such as alcohol) plus a rubber solvent (such as carbon bisulphide). Alcohol alone would only act superficially in a short time. Carbon bisulphide alone would dissolve all but protein. A suitably proportioned mixture will cause the rubber to "swell" just sufficiently to permit the liquid to dissolve out the resin without touching the rubber, except to a small extent.

To separate protein, the rubber is dissolved out by a solvent such as benzene, chloroform, carbon bisulphide, etc. Solution takes a long time, and filtration is exceedingly tedious. Harries has prepared pure rubber by extracting for 24 hours with acetone, dissolving in benzene, filtering, precipitating the solution with alcohol and thus obtaining rubber. The treatment was repeated twice.

The chief investigations into the constitution of rubber are those of C. Harries, and it is very interesting to note the gradual evolution of his methods. At one time he was engaged in researches on oleic acid with the object of determining the position of the double bond. He treated the acid with ozone, two molecules of which added on at the double bond, giving a diozonide. This was decomposed by water and from the products formed it was possible to deduce the point at which rupture of the chain had occurred.

He applied the same method to rubber—a hydrocarbon $C_{10}H_{16}$ with two double bonds. He found that it duly gave an ozonide which on decomposition yielded laevulinic acid and laevulinic aldehyde. We may consider the acid alone; taking two molecules we find



Rubber is thus 1.5-dimethylcyclooctadiene 1.5.

In comparing two rubbers, it cannot be said that samples are chemically identical until derivatives of them have been made. The first compound that suggests itself is the tetrabromide, $C_{10}H_{16}Br_4$, which is a white body obtained by bromination. This has attained an undeserved prominence because numbers of methods of estimating rubber have been based on it, not one of which is really sound, because they all depend on the assumption that the tetrabromide is a definite compound, which, except under conditions difficult to realise in practice, it is not.

The next derivative was the nitrosite, on which Harries did a great deal of work. This does not melt sharply and the only way of comparing two nitrosites was to determine the temperatures at which they frothed on heating.

Harries then tried the ozonides and determined the relative amounts of laevulinic acid and aldehyde formed on decomposition. Differences of this kind at one time led him to believe that gutta percha and rubber were stereoisomers. This ratio depends much on the purity of the ozonide. Harries has now shown that two ozonides are formed, a diozonide and a dioxozonide, O_6 and O_8, and his method of comparing two rubbers is to determine the amounts of acid and aldehyde formed on the decomposition of the ozonides, and to determine the reaction-velocity of the decomposition. If this ratio is the same, and if the reaction-velocity curve is the same, the ozonides, and therefore the parent rubbers, are the same.

It is of great interest to note that he has adopted reaction-velocity as the final criterion for the constitution of an organic body.

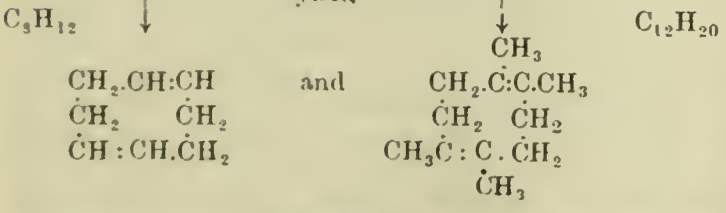
The application of these results is most fruitful in connection with synthetic rubber. The synthetic problem at once divides itself into two parts: (1) The formation of rubber by the polymerisation of isoprene. (2) The production of isoprene.

The polymerisation is perhaps of more general scientific interest and I will therefore discuss it first. The isoprene question is of primary interest from a specialised economic point of view.

This polymerisation has now been done in three ways: (1) By the firm of Bayer, Elberfeld, simply by heating isoprene in a sealed tube for a long time at about 100°. (2) By Harries, who heated the isoprene in a sealed tube with glacial acetic acid. The result is the same as (1), and I will call both these methods "heat polymerisation." (3) By the Perkin, Matthews and Strange group and also by Harries, heating with sodium. The sodium method gives a different product entirely.

All these methods have been exhaustively studied by Harries, who has applied his reaction-velocity method to the ozonides of the rubbers produced. He concludes that the product obtained by heat-polymerisation is actually identical with natural rubber, but that the product of the sodium method is *not*. This only refers to chemical tests, and is not to be construed as saying that the sodium method may not give as good or even better rubber than the other. Whether it does or not, the product is not chemically identical with natural rubber, as is the heat-polymerisation product. Of course, provided the physical properties are the same this does not matter commercially, because the sodium-rubber will vulcanise.

The work has been carried further than this. The homologues of isoprene have also been polymerised to yield homologues of rubber, thus:—



The constitution of those bodies has been confirmed by the ozone method. In particular the C_8H_{12} butadiene rubber has been shown, by the reaction-velocity curve, to be identical with the only other example of an eight-membered ring known in nature, a substance occurring in the bark of the pomegranate tree. Obviously these bodies are not the same as ordinary natural rubber. The fact of their constitutional difference from natural rubber is absolutely an academic point, provided they have similar technical properties. This point has not been sufficiently emphasised, obvious as it is. Of course, *a priori*, there is more chance of $C_{10}H_{16}$ being valuable technically than $C_{12}H_{20}$, but in any case it is a matter for technological investigation, quite as much for synthetic $C_{10}H_{16}$ as for $C_{12}H_{20}$.

Very many patents have dealt with this question of polymerisation, but it has not been elucidated very much except by the researches of Harries. These have been mainly concerned with proving the identity of the final products. There is great scope for research, both from the purely scientific as from the technical side, upon the mechanism of the polymerisation.

Before we know the conditions which lead to a product of the highest quality we must know something more as to the chemical conditions underlying "nerve," the importance of which I have mentioned already.

We will thus take as proved the facts (1) that actual rubber, identical, as far as present chemical criteria go, with wild Para, can be obtained from isoprene; (2) that by treatment with sodium a pseudo-rubber can be obtained; (3) that homologues of rubber can be obtained from homologues of isoprene.

The best known method of obtaining isoprene has been the breaking down of turpentine. The yield was bad at first, only about 10 per cent. Many patents have been granted for processes to increase the yield, such as passing the vapours over heated surfaces of various metals, diluting the vapour with foreign gases, lowering its pressure, etc. (a simple application of Le Chatelier's principle, based on the fact that 1 vol. of turpentine = 2 vols. of isoprene), and so on. However, other methods have now been put forward. Bayer (Elberfeld) propose to obtain it from cresol by a series of reactions. Another process is that of the Perkin group of workers, who obtain iso-amylalcohol from fusel oil, chlorinate it, and treat the product with heated soda lime. Unfortunately fusel oil is too dear at present.

More promising processes appear to be those of preparing homologues of isoprene. The Perkin group have obtained butadiene by the action of soda-lime on chlorinated butyl alcohol. This product has been obtained by Fernbach and Strange from starch by fermentation, together with acetone as a valuable by-product.

Again, Perkin and his colleagues have started with acetaldehyde, which can be readily obtained from acetylene, transformed it into aldol by condensation, chlorinated and treated with soda-lime, giving β-γ-dimethyl butadiene, which in turn can be polymerised by sodium to yield the dimethyl homologue of rubber.

Thus the chief successes of the Perkin group have been so far in the synthesis of rubber homologues, using sodium, which according to Harries does not give normal rubbers. As I have pointed out already, this does not matter technically as long as the product is satisfactory, and there seems to be no reason why it should not be. However, it may be as well to quote the statement made by Dr. Hofmann, of Elberfeld, that it will probably be a very long time before the synthetic problem will be fully solved.

We may now leave synthetic rubber for a moment to follow the technically pure natural raw rubber through the works. After drying, it is mixed with sulphur and various filling materials, appropriately selected in view of the purpose of the article. The dough so obtained is made up into the required shape by calendering and lapping, by calendering and pressing, or by spewing, moulding, etc. It must then be vulcanised or cured, and it is this process of vulcanisation which almost entirely overshadows the horizon in the rubber works.

The difficulties which arise are largely due to the great difficulty experienced in repeating a vulcanisation to give exactly the same result, it may be months later. It is at once clear that the velocity of vulcanisation depends on two very different factors, the nature of the raw rubber and the method of cure. I have already emphasised the importance of having a raw rubber which shall vulcanise at a constant speed, and, if possible, of guaranteeing this by careful tests before buying.

There is no need to describe the physical results following on vulcanisation. It is enough to say that the rubber may be made progressively harder as the coefficient of vulcanisation increases, until at length, with a sulphur content of 33 per cent. the mixing when fully cured will be perfectly black and hard ebonite. All intermediate properties may be obtained by suitably modifying the percentage of sulphur and the time and temperature of cure.

At first sight, the reaction appears a simple one. Rubber has a molecule containing two double bonds and the sulphur adds on with evolution of H_2S. Vulcanisation is thus saturation. Much controversy has arisen as to whether the sulphur is adsorbed by the rubber in vulcanisation or whether a chemical compound is produced as in the analogous cases of dyeing and tanning. The view current at the moment is that the sulphur is at first adsorbed, and then fixed as a disulphide. We must regard all the various stages of vulcanisation as being solid solutions of disulphide in pure rubber, though it is hardly correct to speak of them as solid on account of the fact that rubber is strictly, in one sense, always a liquid.

Vulcanisation is accelerated by raising the temperature or by increasing the sulphur percentage, as would be expected. Beyond this, there is a remarkable acceleration produced by the presence of certain bases, lime, magnesia, and more especially litharge. Litharge has been shown actually to raise the temperature of the article and thus cause a higher reaction-velocity by burning up the resins and proteins contained in the rubber, which thus exert the function of fuels. This simple but ingenious explanation was only put forward quite recently; previously some mysterious catalytic action was supposed to be exerted on the rubber.

In harmony with this view, it has been found that rubber from which the resins or proteins have been removed will not vulcanise as readily as ordinary technically pure rubber. The conclusion has been drawn that synthetic rubber will be bad on the ground of being too pure. The rubber manufacturer will not be in any way embarrassed on that account and will be quite capable of putting in as much resin as is needed, consistent of course with the limits prescribed by specification work. Many of the experiments which have been published on this point are, I think, inconclusive, not only for this reason, but also because in actual practice mixings of 90 per cent. rubber + 10 per cent. sulphur are rarely used. These for some reason appear to be favoured by those making researches. It would be far better to work on a good standard mixing, containing about 50 per cent. of rubber at most.

Finally there is the question of the regeneration of waste vulcanised rubber. The patent literature shows a heterogeneous collection of processes, most of which are very little use. So far, to my knowledge, it has not proved possible to obtain from waste vulcanised rubber a product like raw rubber and containing no sulphur. The combined sulphur is bound with extraordinary strength. Hinrichsen and his co-workers have published experiments showing a decrease in combined sulphur after treating with zinc and a mixture of benzene and alcoholic soda. These results have, however, been criticised severely by Paul Alexander. What can be done is to remove the free sulphur, some or all of the mineral fillers, and the fibrous matter such as cloth, etc. The reclaimed rubber thus obtained by many processes is a valuable adjunct in cheap mixings. It can take up more sulphur on vulcanisation, since if it contains 5 per cent. combined sulphur it is still unsaturated, as the limit is 33 per cent. The usual processes consist of treatment with acids, alkalis, etc., leaving the rubber behind. Many processes have also been proposed in which the rubber is dissolved by all kinds of solvents leaving the mineral matter behind, and the solution is then precipitated with alcohol or distilled in steam and so on. Solvents are too dear usually.

A curious process is that of Bary, in which the solution in naphtha is dialysed, when the dissolved sulphur, resin, etc., pass through the membrane, leaving the colloidal rubber in solution in the dialyser.

Another group of processes are those in which the waste rubber, usually finely pulverised, is reformed under the influence of heat and pressure. Surprisingly good results can be obtained in this way.

There are thus four leading groups of problems:—

(1) Quality of natural raw rubber.
(2) Synthetic rubber.
(3) Vulcanisation.
(4) Regeneration.

In every case advance is hampered because we do not know what to aim at from a chemical point of view. We know a good article from a bad one, *after* it has been in use for six months: what we want now is to be able to foretell accurately, before the rubber has even been mixed, what the article will be like, and to do that we should be able to interpret the differences of quality in terms of chemical differences.

Discussion.

Mr. J. H. C. Brooking said that it had been stated that Para rubber after being washed was dried at a low temperature, presumably about 60° F.; were not temperatures up to 120° F. meant? Possibly the surprisingly good results mentioned as having been got from reformed rubber were more in the nature of special tests than general commercial practice. Otherwise all rubber manufacturers would be using reformed rubber, in self defence.

Dr. A. J. Allmand asked what was the explanation of the differences observed by Harries with washed and unwashed ozone. How was the ozone altered by the washing and with what was it washed?

Dr. Alex. Rule asked Mr. Potts if he could give any information on the chemical differences between the different varieties of rubber. Why was it that Para rubber would not grow in certain parts of Africa, and was the inferiority of Ceara and other rubbers due to the presence of impurities, or was it that the actual rubber was of different composition, seeing that rubber was stated to be really a series of products? Regarding the vulcanisation, the author said that 33 per cent. was the limit of the amount of sulphur taken up by the rubber. Did this percentage correspond to a definite compound or was it possible, by suitable solvents, to dissolve out a part of the sulphur and leave a definite compound behind? Had any attempt been made to prepare from the tetrabromide of rubber a sulphur compound of definite composition, and if such a one had been prepared did it bear any resemblance to vulcanised rubber?

Mr. Willcox asked whether the manufacture of artificial rubber was kept back wholely because of the cost, or because of the inferior quality of the artificial rubber, or for both reasons.

Mr. H. B. Stocks said that of commercial resins some consisted principally of acids, others contained large proportions of neutral substances. Rubber resins were of the latter class. How were rubber resins formed, from the rubber itself, or from the latex?

Dr. Blackler asked whether, in the manufacture of rubber, lead oxide acted on the impurities of the rubber or whether it tended to oxidise the rubber and make it brittle? In regard to synthetic rubber, was it the proteid matter which gave "nerve" to the rubber? Even if synthetic rubber were made on a large scale, would it last seeing that the physical property known as "nerve" could not be given to it? Had anyone ever brought forward any proof of the constitution of the so-called "nerve" of rubber?

Mr. W. C. Smith, in regard to the suggestion that when synthetic rubber was manufactured on a large scale resins would have to be added to it and that this was an easy matter, said that the character of rubber resins varied considerably, and that these additions might be a very difficult matter.

Mr. H. B. Stocks remarked that a quantity of resin was extracted from low grade rubbers and waste products, and, if wanted for adding to artificial rubber, there would be no difficulty in obtaining it.

Mr. W. P. Thompson said that on soaking rubber in carbon bisulphide, the rubber swelled up but never completely dissolved, a skeleton being always left. What was the composition of this skeleton?

Professor F. G. Donnan asked if the products of polymerisation of isoprene by sodium differed from the products when the other subtances were used to induce polymerisation? What was the effect of keeping rubber at low temperatures?

Mr. H. E. Potts, in reply, said that low temperatures were the best, especially for cut sheet rubber. With regard to the different chemical products as a result of polymerisation by different substances, Harries had not succeeded in explaining this. It was apparently not due to the position of the double bond, but the matter awaited further research. The skeleton to which Mr. Thompson had referred was composed of protein according to Spence, who performed some experiments on silver staining to prove this matter. Litharge did not seem to have a deleterious action on rubber because there were only the impurities which could act as a fuel.

Referring to the extraction of resins from low grade rubbers for addition to synthetic rubber, it was possible that these might not work in the same way. Para resins were optically inactive and unsaponifiable, whilst certain resins from other rubbers were optically active and saponifiable. The inactivity of the resins from Para rubber showed that they are not formed by the breaking down of the rubber itself. He had not seen any large samples of synthetic rubber but believed that two motor tyres made of synthetic rubber had run an enormous distance. Two had also been given as a present to the Kaiser. It was the expense of production, not the want of quality, which was keeping back the industry.

In regard to the growth of rubber in various parts of the world, climatic conditions affected the different species of rubber trees so that they were limited to certain parts of the globe. As regards the compounds of rubber and sulphur, this was a point upon which a great deal of research had been made. A sulphide of rubber $C_{10}H_{16}S_2$ seemed to have been isolated but some of the sulphur might be Alexander Smith's insoluble sulphur. There seemed to be no distinctions between the actual rubbers in the different species, grown in different parts of the world. With regard to the "nerve" it was quite a different story. This "nerve" might be due to the protein, but the rubber was so knocked about in the mixing treatment that the mesh must get broken up very much. Personally he did not think that protein gave the "nerve."

In regard to the washing of ozone, strongest unwashed ozone contained 12 to 16 per cent. of ozone. After being washed by caustic soda and dilute sulphuric acid, the ozone concentration was considerably lower.

Rubber was dried at 110° C. or so, which from a chemical point of view was a low temperature.

London Section.

Meeting held at Burlington House, on Monday, May 5th, 1913.

PROF. W. R. E HODGKINSON IN THE CHAIR.

METHODS AND APPARATUS USED IN PETROLEUM TESTING.

PART II.—VISCOMETRY.

BY W. F. HIGGINS, A.R.C.Sc., B.Sc.

(Abstract.)

Introduction. This paper embodies the results of experiments carried out at the National Physical Laboratory, for the International Commission for the Unification of Tests on Petroleum Products, on the methods and apparatus used in petroleum testing. Apparatus used for the determination of the flash-point of illuminating oils has been dealt with in the July, August and September numbers of the "Petroleum World" for 1911.*

The types of viscometer under consideration are those designed by Dr. C. Engler and Sir Boverton Redwood in 1884 and 1885 respectively. The latter is the instrument most commonly employed by the English oil-trade and chemists, while the former is extensively used in Germany and on the Continent generally.†

Definition of "Viscosity." By the term "true viscosity" is here to be understood the usually accepted physical definition of viscosity which states that the "viscosity of a substance is measured by the tangential force on unit area of either of two horizontal planes at unit distance apart, one of the planes moving with unit velocity relatively to the other, the space between these planes being filled with the viscous substance."

In using the Redwood apparatus, the instrument is previously levelled by the aid of a small circular level which fits on the upper edge of the oil-cup, while in the Engler apparatus the adjustment is made by bringing the oil-surface into coincidence with each of three filling-points.

Experiments made on the Redwood apparatus showed that over a range of 5 mm. on either side of the normal level, the change in the time of outflow was proportional to the variation in level, the value was about 1·4 per cent. in the time for 1 mm. change of level.

Errors in levelling the instrument. For the Redwood instrument it is found that one degree of tilt is equivalent to a reduction of 0·3 mm. in the effective head.* This corresponds to a change of 0·4 per cent. approximately in the resulting time of flow. The small circular levels supplied with the Redwood viscometers are *sensitive* to a change of tilt of about 1/5°, though not always accurate to this extent. The corresponding accuracy in the time of flow is accordingly about 1/10 per cent.

In the Engler instrument the accuracy under this heading is limited to about 0·2 per cent.

Errors in the volume of the measuring flask. It was found by experiment that in the neighbourhood of the normal volume the time of flow is directly proportional to the volume outflowing, for a range of 1 or 2 per cent. on either side of the normal value. In actual practice, however, it is quite unlikely that the measuring flask employed should have an error of as much as 1 per cent. Those employed in the present investigation were tested, and it was found that the error was so small as to be negligible.

Description of the oils used. The following table gives a brief summary of the properties of the oils used in the tests described later. The first column gives the reference number by which the oil is indicated throughout this paper. The second and third columns give a short description of the nature of the oil and the country of origin, if known, for the samples employed. The remaining three columns respectively give their colour, density at 20° C., and viscosity at 20° C. in Redwood units.

TABLE I.

No.	Description.	Origin.	Colour.	Density at 20° C.	Redwood Viscosity Number at 20° C.
1	Shale oil ...	—	Dark brown	0·853	8·25
2	Fuel oil.....	Burma	Dark brown	0·889	14·8
3	Refined machine oil	—	Pale yellow	0·863	21·8
4	Olive oil ...	—	Yellow	0·913	69·3
5	Refined spindle oil	Russia	Pale brown	0·895	76·3
6	Fuel oil.....	Texas	Black	0·931	126
7	Engine oil (refined)	Russia	Brown	0·905	255
8	Fuel oil	Roumania	Black	0·949	579

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* See also National Physical Laboratory, Collected Researches, Vol. VIII., pp. 19—39, 1912.

† Further details regarding these apparatus are given in the following publications :—

The Redwood Viscometer is described in :—

(*a*) "Petroleum and its Products," by Sir Boverton Redwood vol. II., pp. 600—602 ; (2nd edition, 1906).

(*b*) "On Viscometry," Sir Boverton Redwood ; this Journal, 1886, **5**, 121—133.

The Engler Viscometer is dealt with in the following :—

(*c*) "Prüfungsbestimmungen für Zähigkeitsmesser nach Engler" ; Die Chemische Industrie, XXX., Nr. 9 1907. This is a short publication from the Physikalisch-Technische Reichsanstalt, Charlottenburg, dealing with the official test on the instrument.

(*d*) "Ein Apparat zur Bestimmung der sogenannten Viscosität der Schmieröle" ; C. Engler ; Chem.-Zeit. (1885) **9**, pp. 180—190. See also this "Journal," 1893, **12**, 201.

(*e*) "Schmiermittel und ihre Untersuchung." A. Kunkler ; pp. 119—124.

* This is a maximum value and occurs when the radius passing through the setting point coincides with the line of maximum tilt.

Experimental determination of absolute viscosity. The method employed in the determination of the viscosities, in C.G.S. units of the samples of oils used in these comparisons, was similar to that employed by Thorpe and Rodger* in their work on the relation between viscosity and chemical constitution. Some modifications were introduced to suit the nature of the substances dealt with in this investigation.

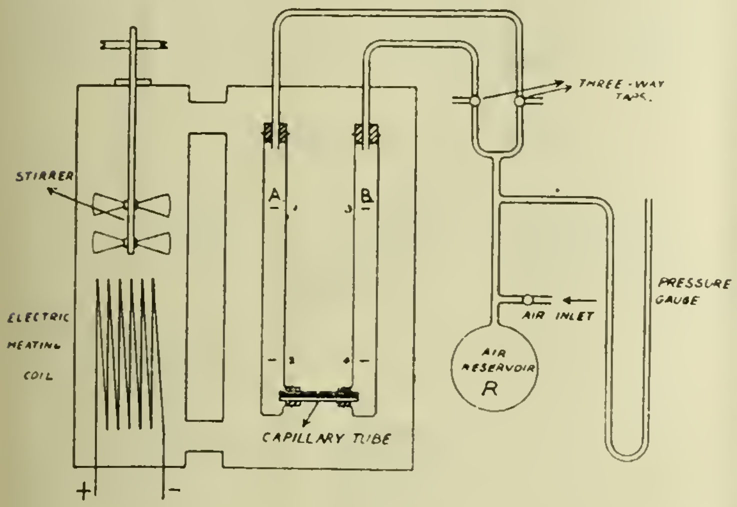

FIG. 1.

The apparatus (Fig. 1) consisted essentially of two vertical tubes, having an internal diameter of about 2 cms. joined at their lower ends by means of a capillary tube of suitable dimensions. The upper ends of these tubes could be connected to a reservoir of air under pressure, or to the atmosphere as desired by means of an arrangement of three-way taps and connecting tubes. This is shown in detail in Fig. 3. Three marks were made on each of the vertical tubes of the viscometer. The relative position of these reference lines is shown in Fig. 2. The marks a_1 and b_1, a_2 and b_2, a_3 and b_3 were on the same levels respectively when the tubes A and B were mounted vertically as used; the marks a_2 and b_2 were respectively midway between a_1 and a_3, and b_1 and b_3. The exact placing of these marks was of comparatively little moment since their position with reference to a vertical scale was determined for each set of experiments by means of a cathetometer.

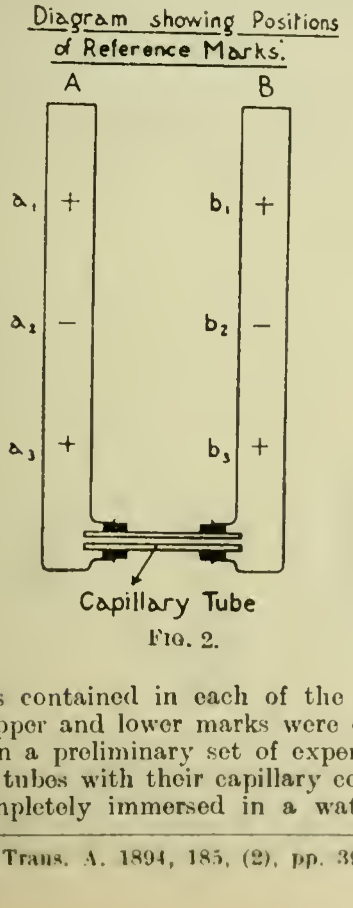

FIG. 2.

The volumes contained in each of the vertical tubes between the upper and lower marks were determined by two methods in a preliminary set of experiments.

The vertical tubes with their capillary connection were supported, completely immersed in a water-bath. The bath consisted of two vertical tubes joined by cross-connections at their upper and lower ends. The right-hand and slightly larger tube was provided with a glass window sufficiently long to allow the reference marks on the viscometer to be clearly seen. The left-hand tube was provided at its lower end with electric heating coils and above these a motor-driven propeller blade produced very rapid and efficient stirring of the water.

When preparing for a set of observations the viscometer was filled with the liquid under test up to the level of the central marks on both limbs. If now the tube A (Fig. 2) be put into communication with the air reservoir while B is left open to the atmosphere, the liquid will pass from A to B through the capillary. If the meniscus in A be allowed to fall from a_1 to a_3 the volume of liquid passing through the capillary is equal to the volume of the tube between these marks; this volume is known. The interval between the transits of the meniscus through the marks a_1 and a_3 was determined by the aid of a stop-watch and a cathetometer.

The pressure driving the liquid through the capillary is not constant. It may be considered as made up of two parts :—(1) that of the air in the reservoir; this is practically constant throughout an experiment as the volume of the air vessel is large compared with that of the viscometer tube; and (2) that due to the difference of level of the liquid in the two limbs of the viscometer. When the level of the liquid in A is between the marks a_1 and a_2, the liquid has a tendency to flow from A to B, while when it is between a_2 and a_3 the pressure due to the difference in level in A and B tends to drive the liquid in the opposite direction, that is from B to A. If however certain conditions hold the *average* value of the pressure during an experiment tending to drive the liquid from one limb to the other is zero.*

These conditions are :—(1) That the distances a_1a_2 and a_2a_3 are equal; (2) that the bore of the tube is constant over the length a_1a_3 (or merely symmetrical above and below a_2), and (3) that the level of the liquid coincides with a_2 when at rest in the viscometer with both limbs open to the atmosphere.

Dimensions of capillary tubes. The capillary tubes used were in most cases about 5 cms. in length. They were chosen of such internal diameter, that a reasonable time of flow was obtained for each of the oils used. The section was examined under a high power microscope, and only those tubes which showed a circular cross-section were employed in the investigation.

The internal diameters were measured by two methods: (1) By the ordinary weighing method employing a thread of mercury. Allowance was made in the case of the larger tubes for the shape of the meniscus at the ends of the mercury thread. (2) By measuring the electrical resistance of the mercury contained in the capillary tube when completely filled. The arrangement employed for this purpose is shown in Fig. 3.

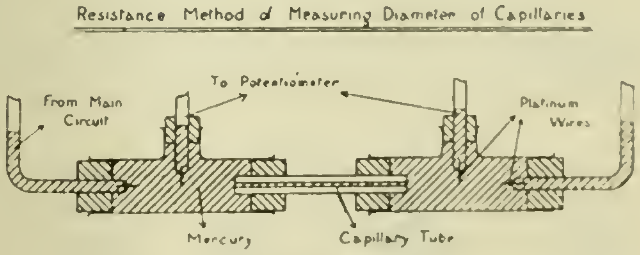

FIG. 3.

Good agreement was obtained between the results of different methods, but it is probable that the greatest accuracy was obtained by the resistance method.

Formulæ used in viscosity determination. The flow of a liquid through a capillary tube may be represented in the simplest case by Poiseuille's formula :—

$$q = \frac{\pi . P . R^4}{8 . \eta . L.}$$

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[*] Phil. Trans. A. 1894, 185, (2), pp. 397—710.

[*] See also Thorpe & Rodger, Phil. Trans. A. 1894, 185 (2), p. 430.

where q = the volume of liquid flowing in unit time, P = the fall in pressure of the liquid over a length L of the capillary, R = the internal radius of cross section of the capillary, and η = the viscosity of the liquid.

Some modifications have to be introduced into this formula to represent actual conditions of working. The most important of these is a correction which is introduced to allow for the kinetic energy of the fluid as it leaves the tube.

The simple formula is deduced on the assumption that all the energy of the liquid due to the pressure at which it enters the tube is used up in overcoming the fluid resistance; this is of course not actually the case since the liquid emerges with a definite velocity, and hence has a certain kinetic energy derived from the pressure which forces the liquid through the tube.

Another correction which is usually taken into consideration is that due to the "end effect" in the capillary tube. The simple formula holds for a tube indefinitely long. In this case the value of the pressure P over a length L is measured for a portion of the tube in which the flow is uniform. In actual practice, however, with tubes of finite length the uniform stream-line motion is not established immediately on entering the tube, but is only assumed after a certain length of the tube has been traversed. This distance depends on the radius of cross-section of the tube, and it has been shown from theoretical considerations that the length of the tube is, in effect, increased by an amount nR, where n = 1·64 and R = the radius of the tube.

The complete formula for the viscosity of a liquid deduced from its flow through a capillary tube then becomes :—

$$\eta_t = \frac{\pi . R^4 . g . \rho . h . T.}{8 . V . (L + n . R)} - \frac{m . \delta . V.}{8 . \pi . (L + n . R) . T} *$$

where the symbols have the following meanings assigned to them :—

ηt = the viscosity of the liquid at the temperature t°.

R = the internal radius of cross-section of the tube.

$g . \rho . h$ = the pressure under which the liquid flows through the tube (due to the head h of liquid of density ρ; g = 981 in C.G.S. units).

V = the volume of the liquid passing through the capillary in time T.

L = the length of the capillary.

δ = the density of the liquid at the temperature t°.

n = the coefficient of the correction for the end effect (n = 1·64); and

m = the coefficient of the correction term for the kinetic energy of the outflowing liquid.

In this paper the value m = 1 has been used, some preliminary experiments with tubes of different sizes showed this to be sufficiently accurate.

Results of viscosity determinations. The method just described has been employed to obtain the viscosities of the oils used in the comparison experiments. Their viscosities were determined at a series of temperatures, at five or six points in most cases. Curves were then drawn to represent these results and from these curves the values given in Table II. were read off.

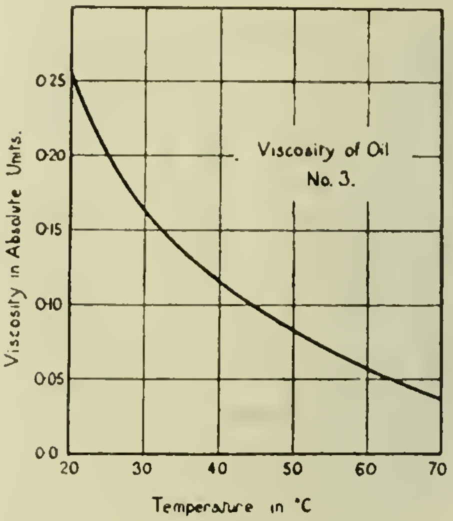

FIG. 4.

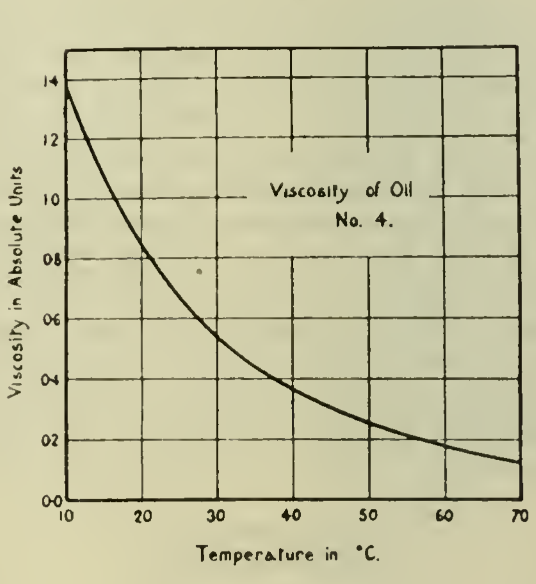

FIG. 5.

TABLE II.

Temperature of oil.	Viscosity in C.G.S. units.							
	Number of oil.							
	1.	2.	3.	4.	5.	6.	7.	8.
10°C.	0·1075	—	—	1·380	—	—	—	—
15°	0·0905	0·216	—	1·075	1·375	—	—	—
20°	0·0770	0·168	0·257	0·840	0·920	—	—	—
25°	0·0660	0·135	0·200	0·670	0·680	1·100	2·05	5·1
30°	0·0570	0·111	0·163	0·540	0·520	0·795	1·515	3·65
35°	0·0498	0·0925	0·1365	0·440	0·400	0·610	1·160	2·68
40°	0·0438	0·0785	0·1160	0·363	0·300	0·478	0·880	1·97
45°	0·0387	0·0675	0·0985	0·304	0·224	0·378	0·640	1·44
50°	0·0343	0·0590	0·0835	0·258	—	0·302	—	1·00
55°	0·0304	0·0515	0·0700	0·221	—	0·244	—	—
60°	0·0270	0·0453	0·0585	0·187	—	0·195	—	—
65°	0·0238	0·0400	0·0476	0·155	—	0·157	—	—
70°	0·0208	0·0350	0·0375	0·124	—	0·126	—	—

Figs. 4 and 5 show some typical curves representing the relation between temperature and viscosity for representative oils. It will at once be apparent how large is the variation of viscosity with temperature:

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* See R. Hosking, "On the Viscosity of Water," Phil. Mag. (6) XVII., 1909, p. 502.

Also G. H. Knibbs, Journ. & Proc. Royal Soc. of New South Wales, vol XXIX., 1895, pp. 77—146.

Table III. has been drawn up to show the percentage change of viscosity per 1° C. at various temperatures.

In view of the very large temperature coefficients of viscosity for oils, as shown by this table, great care must be taken, whatever type of viscometer be employed, to obtain accurate readings of the temperature of the oil under test. The accuracy attainable in commercial viscometry will rarely be greater than 1 per cent. on account of the difficulty experienced in keeping the temperature constant to the corresponding degree of accuracy.

Table III.

Temp. °C.	Percentage rate of change of viscosity per 1° C.*							
	Number of oil.							
	1	2	3	4	5	6	7	8
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
20	3·2	4·7	—	4·7	7·0	—	—	—
25	3·0	4·1	4·5	4·4	5·7	—	—	—
30	2·8	3·8	3·8	4·2	5·3	6·1	5·6	6·5
35	2·6	3·5	3·4	4·0	5·5	5·1	5·4	6·1
40	2·5	3·1	3·2	3·7	5·7	4·8	5·9	6·2
45	2·4	2·9	3·3	3·4	—	4·6	—	6·7
50	2·4	2·7	3·4	3·2	—	4·4	—	—
55	2·4	2·6	3·6	3·2	—	4·4	—	—
60	2·5	2·5	3·9	3·5	—	4·4	—	—
65	2·6	2·6	4·4	4·1	—	4·4	—	—

Reduction formula for Redwood viscometer readings. As pointed out previously the viscosity of a liquid is connected with its flow through a capillary tube by a formula of the type :—$\eta = (AT—B/T)\delta$: where η is the viscosity of the liquid, δ is its density, T the time of outflow, and A and B are constants depending upon dimensions.

In applying this formula to the case of the flow of a liquid through the jet of the Redwood viscometer the calculation is rendered uncertain on account of the values of the coefficients m and n (see page 570) not being known sufficiently exactly. The internal diameter of the jet is large in comparison with its length and hence an accurate knowledge of the value of n is essential. Further in cases where the time of flow is not greater than about 80 secs. the value of the second term is almost equal to the first, and hence to obtain an accurate value of the difference, each term must be known to a high degree of accuracy.

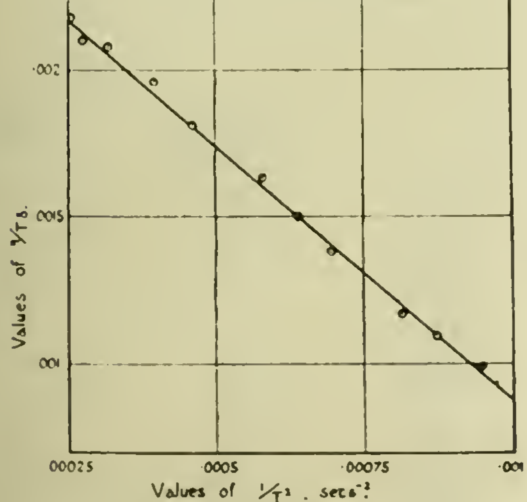

Fig. 6.

Let the above formula be assumed to hold in the present case, this formula may be written :—

$$\frac{\eta}{T\delta} = A - \frac{B}{T^2}$$

Now the experimental results given in Tables IV. to enable the quantities $\eta/T\delta$ and $1/T^2$ to be calculated.

If this is done and the results plotted taking the values of $\eta/T\delta$ for the oils tested as ordinates and the values of $1/T^2$ as abscissae, the resulting points should be on a straight line. This is found to be the case as seen in Fig. 6, and the values of A and B can at once be obtained from the co-ordinates of points defining this line.

The value of A is, however, obtained more accurately from the slope of the curve connecting η/δ and T for values of T greater than 200. For these values B/T is negligibly small compared with AT, and the formula resolves into the simple expression $\eta/\delta = AT$.

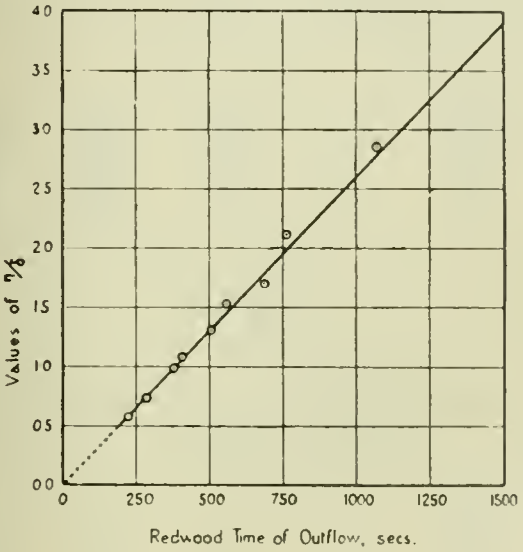

Fig. 7.

The curves above referred to are reproduced in Figs. 6 and 7. The following formula connecting time of flow on the Redwood viscometer and viscosity in absolute units has been deduced from their slopes.

$$\eta = \left(0{\cdot}00260T - \frac{1{\cdot}715}{T}\right)\delta$$

Comparison of Redwood and absolute viscosities. The following tables give the results of some determinations of the viscosities of the oils on the Redwood apparatus and in absolute units at corresponding temperatures.

The values of the density, the viscosity in C.G.S. units, the time of outflow of 50 c.c. of the oil from the Redwood viscometer, the Redwood viscosity number, and the viscosity calculated from the formula

$$\eta = \left(0{\cdot}00260\ T - \frac{1{\cdot}715}{T}\right)\delta$$

are tabulated for a series of temperatures.

The Redwood viscosity number is obtained thus:—"The number of seconds occupied by the outflow of 50 c.c. of the oil is multiplied by 100 and divided by 535, the average number of seconds occupied by the outflow of 50 c.c. of rape oil at 60° F. from the apparatus. The result is multiplied by the specific gravity of the oil at the temperature of testing and divided by 0·915 the specific gravity of refined rape oil at 60° F."*

The resulting number represents the viscosity of the sample in terms of the viscosity of rape oil at 60° F., the standard used with this instrument.

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* See "Petroleum and its Products," by Sir Boverton Redwood, vol. 2, pp. 600 to 602 (1906).

TABLE IV.

Oil No. 1.

Temp. °C.	Density. grms./c.c.	Time of outflow in Redwood viscometer.	Redwood viscosity number.	Calculated viscosity.	Absolute viscosity.
10	0·859	59·0	10·3	0·107	0·1075
15	0·856	52·0	9·10	0·087	0·0905
20	0·853	47·4	8·27	0·074	0·077
25	0·849	44·0	7·64	0·064	0·066
30	0·846	41·6	7·20	0·0565	0·057
35	0·843	39·1	6·80	0·0499	0·0498
40	0·839	37·8	6·49	0·0448	0·0438
45	0·836	36·4	6·22	0·0298	0·0387
50	0·833	35·0	5·96	0·0354	0·0343
55	0·830	33·8	5·73	0·0312	0·0304

TABLE V.

Oil No. 4.

Temp. °C.	Density. grms./c.c.	Time of outflow in Redwood viscometer.	Redwood viscosity number.	Calculated viscosity.	Absolute viscosity.
30	0·906	239	44·3	0·557	0·540
35	0·903	195	36·0	0·450	0·449
40	0·900	162	29·8	0·370	0·363
45	0·896	137	25·1	0·308	0·304
50	0·893	118	21·5	0·263	0·258
55	0·890	103	18·8	0·224	0·221
60	0·886	90	16·3	0·191	0·187

TABLE VI.

Oil No. 5.

Temp. °C.	Density. grms./c.c.	Time of outflow in Redwood viscometer.	Redwood viscosity number.	Calculated viscosity.	Absolute viscosity.
15	0·898	586	108	1·367	1·375
20	0·895	416	76·2	0·965	0·920
25	0·892	301	54·9	0·693	0·680
30	0·889	227	41·2	0·518	0·520
35	0·886	176	31·9	0·397	0·400
40	0·882	140	25·3	0·311	0·300

TABLE VII.

Oil No. 8.

Temp. °C.	Density. grms./c.c.	Time of outflow in Redwood viscometer.	Redwood viscosity number.	Calculated viscosity.	Absolute viscosity.
25	0·946	2080	406	5·12	5·15
30	0·943	1520	293	3·73	3·65
35	0·940	1070	206	2·61	2·68
40	0·936	764	146	1·86	1·97
45	0·933	561	107	1·36	1·44
50	0·930	406	77·5	0·98	1·00

Comparison of Engler and Redwood viscometer results. The work of Ubbelohde[*] on the Engler viscometer has led to the adoption of the formula

$$\eta = Z.\ \delta.\ 0{\cdot}01797$$

to obtain viscosities in absolute units from instrument readings. Z. δ is the "specific viscosity" and is deduced from the formula

$$Z = \frac{4{\cdot}072.T}{T\omega.} - \frac{3{\cdot}513\ T\omega}{T}$$

T is the time of outflow, from the Engler viscometer, of 200 c.c. of the liquid under normal conditions of experiment and Tω is the corresponding time of outflow for water at 20° C. For an apparatus of normal dimensions[†] these formulæ may be combined into the expression

$$\eta = \left(0{\cdot}001435T - \frac{3{\cdot}22}{T}\right).\ \delta\ .$$

If T_R and T_E are corresponding times of outflow determined on the Redwood and Engler viscometers respectively, the two following expressions are obtained:—

$$(1)\ \eta = \left(0{\cdot}001435T_E - \frac{3{\cdot}22}{T_E}\right).\ \delta\ .$$

$$(2)\ \eta = \left(0{\cdot}00260T_R - \frac{1{\cdot}715}{T_R}\right).\ \delta\ .$$

Combining these and solving the resultant quadratic equation the ratio T_E/T_R may be obtained for any value of T_R. The values in the following table have been calculated in this way.

TABLE VIII.

T_R	T_E	T_E/T_R
40	73·2	1·83
50	91·5	$1{\cdot}82_5$
75	136·5	1·82
100	181·5	$1{\cdot}81_5$
150	272	1·81
200	362	1·81
500	908	1·81
1000	1815	1·81
5000	9080	1·81

It will be seen from this table that the ratio of the readings of the Engler and Redwood viscometers is approximately constant for times of flow on the Redwood instrument greater than 100 secs. while below this it increases with decrease in the time of flow. The matter has also been investigated experimentally and the results of some of the tests made are shown in the following table:—

TABLE IX.

No. of oil.	Temperature.	Absolute viscosity.	Results on Engler apparatus. Time of flow, T_E	Results on Engler apparatus. Specific viscosity.*	Results on Engler apparatus. Viscosity.*	Time of flow on Redwood apparatus. T_R.	Ratio T_E/T_R.
1.	10° C.	0·1075	108·8	7·04	0·108	59·0	1·84
	15	0·0905	95·6	5·76	0·089	51·9	1·84
	20	0·0768	87·8	4·96	0·0765	47·3	1·85
	25	0·0660	82·0	4·36	0·0665	44·0	1·86
	30	0·0571	77·4	3·86	0·0585	41·5	1·86
2.	15	0·216	169·2	12·4	0·200	95·8	1·77
	20	0·168	139·2	9·82	0·157	79·0	1·76
	25	0·135	119·0	8·02	0·127	67·6	1·76
	30	0·111	106·4	6·80	0·107	60·0	1·77
3.	25	0·200	173·0	12·8	0·197	99·6	1·74
	30	0·163	146·2	10·45	0·161	83·4	1·76
	35	0·136	126·0	8·65	0·132	71·6	1·76
	40	0·116	110·6	7·20	0·110	62·6	1·77
	45	0·0985	100·2	6·20	0·095	56·0	1·79

* Obtained from values given in Tabellen zum Englerschen Viskosimeter.

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[*] See "Tabellen zum Englerschen Viskosimeter" von Dr. Leo. Ubbelohde, 1907.

[†] For such an apparatus Tω. at 20° C. = 51 secs.

Discussion.

Mr. W. F. **Reid** said that viscometers in the form dealt with in the paper were based on a principle which was very far removed from what took place in practice with most oils. One of the chief objects of testing the viscosity of oil was with regard to its use as a lubricant, and that was precisely the form in which it was not used as a jet. Other principles might be applied. For instance, many years ago he had tried the measurement of the rate of falling of a body in a liquid; this was, in his opinion, preferable to the outflow through a jet. There were many sources of error in a jet, which did not exist in the case of a body falling through the liquid. The movement of a body of a definite shape and size through the oil would approach probably more nearly to the conditions in practice of a lubricant than any other method; but the form of apparatus shown was one which was generally recognised, and as the author had rightly pointed out, it was not so much theoretical accuracy than one most aimed at as uniformity in practice between different individuals possessing the same apparatus in different places. The method for estimating the area of the nozzle which had been described was a great improvement and contributed towards securing accuracy in those apparatus.

Mr. J. H. **Coste** said that he was glad to hear there was a possibility of a standard specification for oils being formulated. He found it difficult to frame specifications which really corresponded to the actual requirements of engineering practice, more especially as in many cases engineers were able to give very little information as to their requirements; they seldom knew the temperatures at which they were working, and were usually only able to say that a certain oil suited their purposes and certain other oils did not. Sir Boverton Redwood's viscometer had been described before that Section nearly 30 years ago, and although it had not been in any way modified it was still used by nearly everyone who tested oils in this country. That was a wonderful testimony to the excellence of the apparatus, though when one looked at it in detail there were the objections that it did not directly measure the real viscosity, the heating arrangements were very defective, and so on. Mr. Higgins had slightly touched on one other defect, viz., that different certified instruments did not all give the same indication; the variation was sometimes considerable. The difficulties with the instrument were perhaps as much in the adjustment as in the actual variation of bore and the jet. On the whole it was convenient to use. No doubt in the past the certification had been carefully done; but Mr. Higgins had shown them it was almost outside the range of the ordinary private person's work to deal with such things.

Mr. **Grant Hooper** said he thought one of the most valuable features of the paper was the suggestion of the advisability of expressing all viscosity results in terms of absolute viscosity by the use of the formula which was given. There was no doubt that different Redwood instruments did yield different results with some oils, though the instruments were adjusted with the standard oil. The paper once again emphasised the necessity for taking trouble about comparatively small details if accurate and comparable results were to be obtained. He thought that with reasonable care no great difference ought to result from variation of temperature. He imagined that the usual practice was to bring the oil to the particular temperature necessary before it was put into the cup, the temperature of the bath being at the standard temperature before starting. Under those conditions no great differences were found in actual practice. Slight differences, however, might still be expected between the results obtained by two men working in different laboratories with different instruments. The question was, were objections to be raised on a few seconds variation on a 400 or 500 seconds run? To his mind it was absurd to enter into conflict over minute differences in viscosity determinations.

Mr. **Coste** said that rape oil had been abandoned as a standard substance, he thought. Recent certificates referred to Redwood's original viscometer as a standard, and the assumption that rape oil had a viscosity of 535 seconds at such a temperature was now abandoned.

Mr. W. P. **Dreaper** said that it was impossible to use the types of viscometers described for cellulose solutions owing to their very high viscosity. Perhaps Mr. Higgins could give them some idea of the relative values of other viscometers when used for very thick solutions of that nature. He had rather successfully used, so far as repeat experiments went, a type of paddle viscometer actuated by a falling weight. There was no doubt also that the falling weight method mentioned by Mr. W. Reid gave useful results. Also the Couette apparatus, especially as modified by Hatschek, was of value in such cases. The matter was of great interest to manufacturers of artificial silk and others and deserved more attention.

Mr. **Higgins** said that the observation of a falling body in a liquid gave very satisfactory results in some cases, but for many oils it was impossible to apply it owing to the oil being opaque. Other methods had been devised, depending on the rotation of a body in the oil whose viscosity was required. In connection with an investigation now being undertaken on the No. 2 type of Redwood viscometer, experiments were being made with an apparatus in which a metal cylinder was rotated in the oil to be tested; the method was especially useful in the case of oils of high viscosity. The No. 2 type of Redwood viscometer had been designed for use with the fuel oils supplied under the Admiralty specifications recently drawn up. The time of outflow of an oil on the No. 2 instrument was about one-tenth of the corresponding time on the No. 1 type.

One of the various simple types of rotation instrument would probably be suitable for nitrocellulose solutions.

The viscometers were generally sent out by the makers with a certificate from Sir Boverton Redwood's assistant. All of them had been adjusted by altering the height of the filling point to make the time of flow agree with that of some particular oil as determined on Sir Boverton Redwood's standard instrument. It had been found in various instruments that the difference from the normal level might be as much as a quarter of an inch, and further for a certain oil two or three instruments might agree exactly, but for an oil of higher or lower viscosity they would give very different results.

Sir Boverton Redwood had abandoned the use of rape oil as a standard owing to the difficulty of obtaining samples of the same viscosity. In the case of the Engler instrument the time of flow of the substance under investigation was referred to that of water, which was 51 seconds in a normal instrument, whereas to obtain the Redwood viscosity number the results were compared with the time of flow of rape oil, for which the constant value 535 seconds had been adopted.

Manchester Section.

Meeting held at Grand Hotel, Manchester, on Friday, May 2nd, 1913.

DR. G. J. FOWLER IN THE CHAIR.

THE OXIDATION OF THIOSULPHATES ON BACTERIAL FILTERS.

BY WILLIAM T. LOCKETT, M.SC.

The oxidation of phenol and thiocyanate on bacterial filters, was made the subject matter of a paper entitled, "The Bacterial Purification of Ammonia Recovery Liquor."* read before the Manchester Section of this Society in December, 1910. In a concluding paragraph of the paper, it was stated that "experiments have been made and are still in progress on the oxidation of thiosulphate on bacterial filters. I have been permitted, through the kindness of Dr. Fowler and Mr. Ardern, to continue independently this investigation on the oxidation of thiosulphate.

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* Fowler, Ardern and Lockett. This Journal, February 28th, 1911, 180, 181.

Reference to the above paper and those of Frankland and Silvester[*] and Skirrow[†] will show that the composition of ammonia recovery liquor varies with the concentration, *i.e.*, with the degree to which the ammonia is removed in the distillation, and that generally the liquors contain 50 to 60 parts per 100,000 of thiosulphate calculated as sulphur; which is accountable for about 10 per cent. of the total oxygen absorption.

In the bacterial purification of ammonia recovery liquor therefore, the oxidation of thiosulphate on bacterial filters is of some little moment, although not nearly so important as the oxidation of phenol and thiocyanate.

The investigation on thiosulphate was originally commenced with the intention of completing the previous work. However, as many points were raised of purely scientific interest it was thought advisable to study the problem in detail.

The methods of investigation were similar to those adopted in the work on phenol and thiocyanate, consisting essentially in passing repeatedly thiosulphate solutions of varying strengths on to matured bacterial sewage filters, until the thiosulphate was completely oxidised, *i.e.*, until such solutions absorbed little or no oxygen from acid permanganate of potash.

Description of filters.—The filters used consisted of stoneware pipes 24 ins. in length by 4 ins. diameter, with one end cemented, filled with "clinkers" either from ¼ in. to 1 in. or ½ in. to 1 in. in size, matured in the first case by treating with septic tank effluent until nitrification was established.

Method of working filters.—To overcome the dilution effect of the interstitial water of the filters, it has been found necessary at the commencement of an experiment to allow a "short" contact of the solution under investigation with the filtering media.

The filters were filled with the solution, allowed to stand 15 minutes, and discharged, the total time taken for filling, contact, and discharge being half an hour. The filtrate obtained was taken as a starting point, and is referred to later in this paper as the "original" solution.

The solutions were allowed two contacts per working day, a quarter of an hour each for filling, andd ischarge with 2 hours contact. In general the procedure was as follows:—

At commencement.—Filling 9 a.m. to 9.5 a.m. "Short" contact 9.5 a.m. to 9.20 a.m. Discharge 9.20 to 9.30 a.m. Filtrate = "Original" solution.

1st Contact.—Filling 9.30 a.m. to 9.45 a.m. Contact 9.45 to 11.45 a.m. Discharge 11.45 a.m. to 12 noon.

2nd Contact.—Filling 3 p.m. to 3.15 p.m. Contact 3.15 to 5.15 p.m. Discharge 5.15 to 5.30 p.m.

3rd Contact.—Filling 9 a.m. to 9.15 a.m. Contact 9.15 to 11.15 a.m., etc.

Filters were allowed to rest from Saturday noon to Monday, 9 a.m.

Oxidation of Thiosulphate.

The following examples may be given of the results obtained by the treatment of solutions of sodium and potassium thiosulphate on bacterial filters, in accordance with the above method.

Oxygen absorption tests (3 minutes and 4 hours) were made of the filtrates as required and the quantities of thiosulphate present determined by means of standard $(\frac{N}{10})$ iodine solution.

Sodium thiosulphate.
Results in parts per 100,000.

	Oxygen absorbed from Acid $KMnO_4$.		Thiosulphate as $Na_2S_2O_3$.
	4 Hours.	3 Minutes.	
Experiment 1.			
"Original" solution	14·26	14·00	42·6
After 2 contacts	—	8·06	22·5
,, 4 ,, ...	—	3·80	5·6
,, 6 ,, ...	0·72	0·52	nil
Experiment 4.			
"Original" solution	31·75	30·50	91·0
After 3 contacts	—	8·53	17·6
,, 5 ,, ...	—	1·29	nil
Experiment 6.			
"Original" solution	47·60	46·40	131·0
After 5 contacts	—	7·92	5·6
,, 7 ,, ...	—	1·86	nil
,, 8 ,, ...	—	0·38	nil
Experiment 12.			
"Original" solution	76·80	75·60	207·9
After 3 contacts	46·00	45·20	82·9
,, 5 ,, ...	32·80	32·40	24·0
,, 8 ,, ...	15·20	14·00	nil
,, 10 ,, ...	6·70	6·80	nil
,, 12 ,, ...	2·35	2·20	nil
,, 14 ,, ...	·38	·16	nil

Sodium thiosulphate.
Results in parts per 100,000.

	Oxygen absorbed from Acid $KMnO_4$.		Thiosulphate as $Na_2S_2O_3$.
	4 Hours.	3 Minutes.	
Experiment 14.			
"Original" solution	96·00	—	243·2
After 1 contact	80·00	—	143·0
,, 2 ,, ...	66·66	—	71·8
,, 3 ,, ...	60·00	—	32·6
,, 4 ,, ...	51·20	—	6·3
,, 5 ,, ...	44·00	—	nil
,, 9 ,, ...	19·60	—	nil
Experiment 16.			
"Original" solution	121·0	—	308·6
After 5 contacts	52·80	—	nil
,, 14 ,, ...	1·80	—	nil
Experiment 19.			
"Original" solution ...	148·00	—	371·2
After 2 contacts	118·00	—	167·3
,, 4 ,, ...	112·00	—	61·4
,, 6 ,, ...	88·00	—	4·5
,, 14 ,, ...	3·30	—	nil
Experiment 20.			
"Original" solution	195·2	—	530·8
After 4 contacts	131·6	—	—
,, 7 ,, ...	92·8	—	nil

Potassium thiosulphate.

Experiment 1.			
"Original" solution	32·00	31·20	98·8[*]
After 3 contacts	20·00	19·65	nil
,, 4 ,, ...	14·93	14·66	nil
,, 5 ,, ...	10·80	10·27	nil
,, 7 ,, ...	—	2·66	nil
Experiment 2.			
"Original" solution	69·60	67·60	223·3
After 3 contacts	48·80	47·60	63·6
,, 5 ,, ...	40·00	37·20	nil
,, 8 ,, ...	18·20	18·40	nil
,, 10 ,, ...	9·50	9·40	nil
,, 12 ,, ...	3·15	3·10	nil
,, 14 ,, ...	·28	·16	nil

[*] Thiosulphate as $K_2S_2O_3$.

The above results show that thiosulphate in dilute solution is readily oxidised on bacterial filters. Solutions containing 91·0 parts of sodium thiosulphate per 100,000 are completely oxidised in 5 contacts. For stronger solutions a greater number of contacts are required, otherwise the results are very much the same. Similar results have been obtained with the potassium salt

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[*] Frankland and Silvester. This Journal, March 30th, 1907.
[†] Skirrow. This Journal, January 31st, 1908.

The final filtrates contain large quantities of sulphate and are generally acid to methyl orange. With very dilute solutions of thiosulphate the basicity of the material composing the filters is sufficient for the neutralisation of the acid which is produced during the filtrations. With stronger solutions, after the first few contacts the filtrates are slightly acid. Estimations have shown, however, that the acidity only increases very slightly as the oxidation proceeds, the excess of acid being neutralised by the material.

Effect of addition of alkali to thiosulphate solutions.—In order to determine how far the production of acid influenced the reactions, the above experiments were repeated together with comparative ones in which alkali (either KOH or Na_2CO_3), was added, sufficient to neutralise the acid formed. The following are comparable results of the filtration of thiosulphate solutions—with and without alkali :—

Results in parts per 100,000.

Experiment 3.	3 Minutes. Oxygen absorption	Thio-sulphate as $Na_2S_2O_3$.	3 Minutes. Oxygen absorption	Thio-sulphate as $Na_2S_2O_3$.	Experiment 4.	3 Minutes. Oxygen absorption	Thio-sulphate as $Na_2S_2O_3$.	3 Minutes. Oxygen absorption	Thio-sulphate as NaS_2O_3.
	Without alkali.		With alkali.			Without alkali.		With alkali.	
"Original" solution	54·80	146·5	56·80	151·3	"Original" solution	79·20	214·7	82·80	225·4
After 3 contacts ..	23·60	30·6	20·80	54·9	After 3 contacts ..	46·60	76·4	32·80	91·4
,, 5 ,, ..	14·90	nil	7·60	2·0	,, 6 ,, ..	26·00	nil	7·00	18·2
,, 6 ,, ..	10·40	nil	1·76	nil	,, 8 ,, ..	18·50	nil	0·51	nil
,, 7 ,, ..	6·34	nil	0·30	nil	,, 11 ,, ..	4·96	nil	—	—
,, 9 ,, ..	1·62	nil	—	—	,, 12 ,, ..	1·66	nil	—	—

Reference to the above table will show that the effect of the addition of alkali is to facilitate the complete oxidation of the thiosulphate to sulphate, although apparently the removal of thiosulphate as such is slightly retarded.

Course of reaction.—In the preceding examples, it will be observed that thiosulphate itself, as determined by the iodine absorption, is removed in the early stages of the filtrations. The production of filtrates, which are readily capable of oxidation by acid permanganate and yet free from thiosulphate, suggests the formation of intermediate products.

Preliminary experiments indicated the presence of thionic acids. The small amounts of ferrous iron present in the filtrates were estimated colorimetrically by means of potassium ferricyanide, and it was found that iron in the ferrous state was only accountable for a very small proportion of the "oxygen absorption" after the removal of the thiosulphate.

The various chemical reactions of the thionates in solutions of ordinary strength are well known. At the outset it seemed doubtful whether some of the tests usually applied would be applicable in very dilute solutions such as are dealt with in this investigation. In order to study, therefore, the course of the oxidation process, information was required in regard to the behaviour of the possible intermediate products in dilute solutions with the ordinary reagents employed in their identification. Pure salts of the various thionic acids were accordingly prepared in the manner described in the following paragraphs :—

(*a*) *Dithionate.*—Barium dithionate was prepared by the usual method of passing sulphur dioxide through water holding finely ground manganese dioxide in suspension and subsequent addition of baryta water, etc. Pure sodium dithionate was prepared from the recrystallised barium salt by the addition of sodium sulphate.

(*b*) *Trithionate.*—Potassium trithionate was prepared by passing sulphur dioxide through a saturated solution of potassium thiosulphate.

(*c*) *Tetrathionate.*—Potassium tetrathionate was prepared by the addition of iodine to a saturated solution of potassium thiosulphate in small quantities until slightly in excess. Alcohol was added and the tetrathionate thrown down, separated, and recrystallised from hot water.

(*d*) *Pentathionate.*—Potassium pentathionate was prepared from Wackenroder solution by addition of potassium acetate to a concentrated solution of the pentathionic and tetrathionic acids, according to Debus,[*] crystallisation several times in acid solution with separation of pentathionate crystals from tetrathionate, and finally recrystallisation of the pentathionate from distilled water.

The purity of all the products was established by analysis.

Action of reagents with thionic acids in dilute solutions. The following is a summary of some of the more important reactions of various reagents with the thionic acids in solutions of ordinary strength. For comparison the reactions of thiosulphate have been added.

Reagent.	Trithionic acid.	Tetrathionic acid.	Pentathionic acid.	Thiosulphuric acid.
Ammonia solution	No change.	No change.	White deposit of sulphur after few minutes.	No change.
Caustic potash	No change	No change.	Immediate white deposit of sulphur.	No change.
Silver nitrate + ammonia ..	No change.	No change.	Brown colouration and black ppt.	No change.
Mercuric cyanide + ammonia	No change at 100° C.	No change at 100° C.	Immediate black ppt. at 100° C.	No change at 100° C.
Mercurous nitrate	Black ppt.	Yellow ppt.	Deep yellow ppt.	Black ppt.
Copper sulphate	Black ppt. at 100° C.	No change at 100° C.	No change at 100° C.	Black ppt. at 100° C.
Ferric chloride	No change	No change.	No change.	Violet colouration.
Iodine	No change.	No change.	No change.	Absorbed.

Dithionic acid does not give any reactions with the above reagents.

The following observations have been made when using solutions of thionates of strengths 0·10 and 0·02 per cent.

(*a*) All the reactions tabulated in the preceding are applicable to solutions of strength 0·10 per cent.

(*b*) With solutions of strength 0·02 per cent. many of the reactions are slower and less pronounced. Nearly all the tests, however, are applicable. The following are the differences that have been noted :—

Trithionate. Copper sulphate test.—Reaction feeble. In the presence of a little acid (H_2SO_4) such as one often finds in thiosulphate filtrates no blackening occurs whatever at 100° C. The presence of acid does not interfere with the reaction in the case of 0·10 per cent. solutions.

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[*] H. Debus, Chem. Soc. Trans., 1888, **53**, 278 seq.

Pentathionate. Potash and ammonia tests.—There is no deposition of sulphur on addition of potash and ammonia to pentathionate in very dilute solutions.

Silver nitrate-ammonia test.—Action slow. Seven or eight minutes elapsing before the production of the black precipitate (with a solution of ·005 per cent. the blackening was hardly appreciable).

Oxygen absorption of thionic acids.

Determinations of the amounts of oxygen absorbed by the thionic acids from acid permanganate of potash have been made with a view to (a) noting any differences between the amounts of oxygen absorbed in different intervals of time—3 minutes and 4 hours; (b) finding a ready means of determining the amount of thionic acid in a solution of a thionate; (c) applying this test as additional evidence to indicate the nature of the intermediate solutions obtained during the oxidation of thiosulphate and thionates on bacterial filters.

The oxygen absorption test has been carried out as follows:—A ·02 per cent. solution of the particular thionate has been prepared from the pure potassium salt, and a suitable volume, 25 to 50 c.c., of this added to 50 c.c. of $N/80$ permanganate solution in presence of dilute sulphuric acid. The reaction was stopped at the end of the desired interval by the addition of a little potassium iodide solution and the liberated iodine titrated back with $N/40$ thiosulphate solution. Blank tests with water were carried out simultaneously. Experiments were made at atmospheric temperature (18° C.) and the times allowed for absorption were 3 minutes and 4 hours.

Two and sometimes three determinations of the oxygen absorption of a particular compound were made, using fresh samples of the salt for each determination.

Appended is a summary of the oxygen absorption results obtained, with corresponding figures calculated for the free acids. In addition figures are given for thiosulphate and thiosulphuric acid. Results for thiosulphates were obtained in a similar manner to the preceding from recrystallised sodium thiosulphate, the thiosulphate being estimated in the solutions by iodine.

Examination of filtrates obtained during the oxidation of thiosulphate on bacterial filters.

1. *Qualitative tests.*—By the application of the tests previously tabulated to the various filtrates, it has been found that:—

(*a*) Trithionate is almost invariably absent; occasionally traces of trithionate have been noted by the mercurous nitrate test, more often in the oxidation of solutions of *potassium* thiosulphate.

(*b*) Tetrathionate appears to be the main intermediate product, sometimes occurring alone, frequently with smal quantities of pentathionate.

(*c*) Pentathionate although present in quantity immediately after the removal of the thiosulphate (*i.e.* after 5 or 6 contacts) is entirely oxidised to sulphate some little time before the complete oxidation of the solution.

Below is given a typical example of the changes of composition of thiosulphate during filtration through bacterial filters as denoted by the qualitative tests. These observations can be supplemented by a consideration of the differences between the 3 minutes and 4 hours oxygen absorptions of the same filtrates, the figures of which are also given.

Summary.

Three minutes oxygen absorption.				Four hours oxygen absorption.			
Grams of oxygen absorbed by :—				Grams of oxygen absorbed by :—			
1 gram of		1 gram of		1 gram of		1 gram of	
$K_2S_3O_6$	0·110—0·134†	$H_2S_3O_6$	0·153—0·187	$K_2S_3O_6$	0·210	$H_2S_3O_6$	0·2925
$K_2S_4O_6$	0·344	$H_2S_4O_6$	0·460	$K_2S_4O_6$	0·344	$H_2S_4O_6$	0·460
*$K_2S_5O_6$	0·413	$H_2S_5O_6$	0·574	$K_2S_5O_6$	0·443	$H_2S_5O_6$	0·574
$Na_2S_2O_2$	0·344	$H_2S_2O_3$	0·477	$Na_2S_2O_3$	0·344	$H_2S_2O_3$	0·477
$K_2S_2O_3$ (calc.)	0·286	—	—	$K_2S_2O_3$	0·286	—	—

* 1 grm. of $2K_2S_5O_6.3H_2O$ absorbs 0·410 grm. of oxygen.

† The 3 minutes oxygen absorption figure for trithionate was found to be "variable," depending upon the strength of acid in solution and the proportion of acid to trithionate. No definite figure can therefore be given, but under ordinary conditions it is considerably less than the one obtained for the 4 hours absorption, the latter being constant no matter what strength of acid is used.

Sodium thiosulphate.

Filtrates.	Results in parts per 100,000.			Action of reagents.				
	Oxygen absorption.		Thiosulphate as $Na_2S_2O_3$.	$AgNO_3$ + ammonia.	$Hg(CN_2)$ + ammonia.	Mercurous nitrate.	Copper sulphate.	Iodine.
	3 Minutes.	4 Hours.						
"Original" solution	74·80	75·60	200·6	nil	nil	Black ppt.	100° C. Black ppt.	Absorbed
After 2 contacts ...	60·80	61·20	94·9	nil	nil	do.	100° C. do.	do.
,, 4 ,, ...	43·60	43·60	10·6	Slight black ppt.	Slight black ppt.	Yellow and black ppt.	100° C. do.	do.
* ,, 5 ,, ...	34·00	36·00	nil	do.	do.	do.	100° C. Slight black ppt.	*Not* absorbe
,, 6 ,, ...	30·00	29·60	nil	do.	do.	Yellow ppt.	100° C. nil	do.
,, 9 ,, ...	11·60	11·60	nil	do.	do.	do.	100° C. nil	do.
,, 10 ,, ...	6·00	6·10	nil	nil	nil	do.	100° C. nil	do.
,, 12 ,, ...	0·96	1·14	nil	nil	nil	Yellow and white ppt.	100° C. nil	do.

* NOTE.—In the filtrate after 5 contacts there is evidence of the presence of a trace of trithionate.

NOTE.—It has been observed that trithionates, tetrathionates and pentathionates are much more stable in dilute solutio (*e.g.*, 0·10 per cent. and 0·02 per cent.) than strong. Consequently, any changes in the composition of the filtrates, free from thiosulphat produced during the filtration of thiosulphate (or thionates), through bacterial filters, are due almost entirely to the effect of oxidati on the filters and no appreciable change due to decomposition would take place during the intervals between each contact.

2. *Quantitative tests.*—To determine definitely which is the main intermediate oxidation product of thiosulphate (tetrathionate or pentathionate) and to determine approximately the proportion of each, where a mixture of these two compounds occurs, the following quantitative tests, in addition to the determinations of the oxygen absorption and ferrous iron, have been made with filtrates obtained after the removal of the thiosulphate (*i.e.* after the 5th or 6th contact). (*a*) Unoxidised sulphur. (*b*) Oxygen due to thionic acids.

Methods of analysis. (*a*) *Unoxidised sulphur.* The determinations of the amounts of unoxidised sulphur present in the filtrates, have been made by precipitation of the sulphate present with barium chloride in the cold, allowing to stand overnight, filtering and subsequently oxidising a known volume of the filtrate by bromine. The amounts of unoxidised sulphur have also been determined by the method contained in the following:—

(*b*) *Unoxidised sulphur and oxygen.*—The determinations of the oxygen and also the sulphur due to thionic acids have been made by the method described in a paper by Maclaurin.* The method consists in almost complete precipitation of the sulphate by barium chloride in the cold. After 24 hours the barium sulphate is collected and the filtrate divided into 3 portions A, B, and C. In A the small amount of SO_3 still remaining is estimated by the addition of excess of barium chloride and keeping for 24 hours. In B the *total* sulphur is determined by oxidising with bromine water and precipitating with barium chloride. C is boiled with mercury cyanide the precipitate collected and the SO_3 in the filtrate determined by boiling with barium chloride (Debus, Trans. 1888, **53**, 278). The reactions taking place with the mercury cyanide are:—

(i.) $Hg(CN)_2+H_2S_4O_6=HgS+S+2SO_3+2HCN.$

(ii.) $Hg(CN)_2+H_2S_5O_6=HgS+2S+2SO_3+2HCN.$

Similarly, the amounts of tetrathionic and pentathionic acids in a mixture can be calculated from the determinations of unoxidised sulphur and oxygen due to thionic acids.

Only approximate values for tetrathionic and pentathionic acids, when present in dilute solution, can be obtained by either of these methods, since very slight errors in the $BaSO_4$ determinations or in the oxygen absorptions will give big differences in the final results calculated. An error of less than a milligram in the weight of $BaSO_4$ representing the unoxidised sulphur would make a difference of 1·0 part per 100,000 in each of the calculated amounts for tetrathionic and pentathionic acids.

Composition of intermediate filtrates.

It has been shown by the quantitative tests that nearly all the filtrates after the removal of the thiosulphate contain, apart from the sulphate, tetrathionate alone or a mixture of pentathionate and tetrathionate. In the following table typical results are given, which have been obtained with filtrates free from thiosulphate and trithionate. The approximate amounts of tetrathionic and pentathionic acids have been calculated by means of the above equations from—

(1) Oxygen absorptions and unoxidised sulphurs.

(2) Unoxidised sulphurs and oxygens due to thionic acids.

The oxygen absorptions have been corrected for ferrous iron, which has been determined colorimetrically. Further, a small correction is necessary for the traces of organic matter contained in the filtrates. It has been found from numerous experiments that this is sufficient in amount to absorb from acid permanganate at least 0·20 parts of oxygen per 100,000, and accordingly this slight correction has been made.

Composition of intermediate filtrates.

Results in parts per 100,000.

$Na_2S_2O_3$ Filtrates.	3 Minutes Oxygen Absorptions corrected for Ferrous Iron and Organic Matter.	Unoxidised Sulphur as $BaSO_4$.	Oxygen due to Thionic Acids as $BaSO_4$.	Approximate amounts of Thionic Acids in Mixtures.			
				(1) Calculated from:— (*a*) Oxygen absorptions. (*b*) Unoxidised sulphurs.		(2) Calculated from:— (1) Unoxidised sulphurs (2) Oxygen due to Thionic Acids.	
				$H_2S_4O_6$.	$H_2S_5O_6$.	$H_2S_4O_6$.	$H_2S_5O_6$.
Experiment E_1 after 7 contacts ..	12·35	98·4	30·0	1·4	20·4	1·3	20·6
,, E_3 ,, 6 ,, ..	33·90	280·6	—	26·9	37·5	—	—
,, F_1 ,, 8 ,, ..	—	(*a*) 92·0				(*a*) 14·0	7·6
	—	(*b*) 89·5	31·9	—	—	(*b*) 16·4	4·8
,, E_4 ,, 5 ,, ..	23·28	200·0	72·0	32·9	14·2	38·5	9·1
,, F_5 ,, 5 ,, ..	26·40	226·0	79·8	35·7	17·4	38·4	14·9

From the above quantitative tests the composition of a solution containing a mixture of pentathionate and tetrathionate can be calculated. For example:—

Given that (a) 1 part of $H_2S_4O_6$ absorbs 0·460 part of oxygen from acid $KMnO_4$ and is equivalent to 4·13 part of sulphur as $BaSO_4$;

and (b) 1 part of $H_2S_5O_6$ absorb 0·574 part of oxygen from acid $KMnO_4$ and is equivalent to 4·52 parts of sulphur as $BaSO_4$,

by determining the oxygen absorption and the total amount of unoxidised sulphur (as $BaSO_4$) the amounts of tetrathionic and pentathionic acids present in the solution can be calculated by use of the following equations:—

Let x=amount of tetrathionic acid in parts per 100,000 and y=amount of pentathionic acid in parts per00010 ,.0

$$\text{Then } 0{\cdot}460\,x+0{\cdot}5747y=A$$

$$\text{and } 4{\cdot}13\,x+\ 4{\cdot}527y=B$$

where A=Oxygen absorption of the solution in parts per 100,000,

and B=Unoxidised sulphur as $BaSO_4$ in parts per 100,000.

From these results it is seen that various mixtures of tetrathionic and pentathionic acids are obtained. By taking the average of a whole series of determinations it has been found, however, that the amount of tetrathionic acid is in excess of pentathionic acid. While it may therefore be concluded that tetrathionate is the main intermediate oxidation product of thiosulphate, considerable quantities of pentathionate are sometimes also found.

Final product of oxidation.—Determinations of the sulphate and total sulphur present in the final filtrates have shown that sulphate alone is the final product. Experiments have also been conducted with a view to ascertaining the amount of sulphur recoverable as sulphate.

In order to eliminate any error due to oxidation changes in the filtering medium itself, a control filter was worked with tap water side by side with the one dealing with thiosulphate. Assuming that the oxidation changes in the medium of the working filter are identical with those of the blank filter receiving water, by deducting the amount of sulphate contained in the final filtrate of tap water from the amount of sulphate determined in the final filtrate from the thiosulphate filter, the amount of sulphate due to the oxidation of thiosulphate is obtained. Results have shown that over 70 per cent. of the sulphur originally contained in the thiosulphate is recovered as sulphate.

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*J. S. Maclaurin, Pro. Chem. Soc., 1911. Vol. 27, No. 380.

Oxidation of thionates on bacterial filters.

Experiments have been carried out on the filtration of dilute solutions of thionates on bacterial filters. The filters and methods of filtration were similar to those used in the work on thiosulphate.

(1) *Dithionate.*—Dithionates cannot be oxidised by ordinary oxidising agents, *e.g.* bromine, permanganate or even nitric acid in the cold. It was thought interesting to see if the oxidation could be effected by bacterial agencies. Accordingly dilute solutions of sodium dithionate have been treated on bacterial filters.

Several attempts to oxidise dithionate by this means have been made without success, although exceptionally active filters have been used and a large number of contac allowed. Active thiosulphate filters, *i.e.*, filters previousl dealing successfully with thiosulphate solutions were als unable to bring about any appreciable oxidation c dithionate.

As the amounts of dithionate present in the filtrate cannot be determined by the oxygen absorption tes estimations of the "unoxidised sulphurs" have bee made by a method similar to the one previously describe After precipitation of the sulphate (due to the oxidatio of sulphur compounds or washing out of sulphate fro the material of the filter) in the cold by excess of bariu chloride the barium dithionate was oxidised with nitri acid. The amounts of dithionate were calculated fro the weights of barium sulphate obtained.

(2) *Trithionate, tetrathionate and pentathionate.*—Th following are typical results obtained during the filtratio of potassium trithionate, potassium tetrathionate an potassium pentathionate :—

Potassium trithionate.

Results in parts per 100,000.

Experiment 3.	Oxygen absorbed from acid $KMnO_4$		Tri-thionate as $K_2S_3O_6$	Sulphate as $K_2S_3O_6$	Total sulphur as $K_2S_3O_6$
	3 Mins.	4 Hours.			
"Original" solution	21·20	27·60	131·5*	—	—
After 3 contacts	17·40	20·40	—	—	—
,, 7 ,,	10·40	15·50	—	—	—
,, 10 ,,	8·64	9·92	—	—	—
,, 14 ,,	—	3·26	—	—	—
,, 18 ,,	0·40	—	—	99·1	99·1

Experiment 5.	Oxygen absorbed from acid $KMnO_4$		Tri-thionate as $K_2S_3O_6$	Sulphate as $K_2S_3O_6$	Total sulphur as $K_2S_3O_6$
	3 Mins.	4 Hours.			
"Original" solution	21·40	29·20	139·0*	—	—
After 3 contacts	15·20	16·80	—	—	—
,, 5 ,,	8·54	8·94	—	—	—
,, 6 ,,	5·36	5·76	—	—	—
,, 7 ,,	3·14	3·66	—	—	—
,, 10 ,,	—	0·54	—	137·0	137·2

* Calculated from 4 hours oxygen absorption.

Potassium tetrathionate.

Results in parts per 100,000.

Experiment 4.	Oxygen absorbed from acid $KMnO_4$		Tetra-thionate as $K_2S_4O_6$	Sulphate as $K_2S_4O_6$	Total Sulphur as $K_2S_4O_6$
	3 Mins.	4 Hours.			
"Original" solution	36·40	36·40	105·8*	—	—
After 5 contacts	12·40	13·00	—	—	—
,, 7 ,,	4·00	4·56	—	—	—
,, 11 ,,	—	0·46	—	95·4	96·5

Experiment 7.	Oxygen absorbed from acid $KMnO_4$		Tetra-thionate as $K_2S_4O_6$	Sulphate as $K_2S_4O_6$	Total Sulphur as $K_2S_1O_6$
	3 Mins.	4 Hours.			
"Original" solution	31·20	31·20	90·7*	—	—
After 2 contacts	22·40	22·60	—	—	—
,, 5 ,,	5·84	6·24	—	—	—
,, 6 ,,	2·40	2·56	—	—	—
,, 7 ,,	—	0·52	—	94·1	95·2

* Calculated from 3 minutes oxygen absorption.

Potassium pentathionate.

Results in parts per 100,000.

Experiment 4.	Oxygen absorbed from acid $KMnO_4$		Penta-thionate as $K_2S_5O_6$	Sulphate as $K_2S_5O_6$	Total sulphur as $K_2S_5O_6$
	3 Mins.	4 Hours.			
"Original" solution	22·40	22·80	50·6*	—	—
After 2 contacts	17·80	18·00	—	—	—
,, 3 ,,	15·60	15·60	—	—	—
,, 5 ,,	11·40	11·40	—	—	—
,, 7 ,,	6·70	6·70	—	—	—
,, 9 ,,	2·64	2·96	—	—	—
,, 11 ,,	0·20	—	—	41·8	41·7

Experiment 5.	Oxygen absorbed from acid $KMnO_4$		Penta-thionate as $K_2S_5O_6$	Sulphate as $K_2S_5O_6$	Total sulphur as $K_2S_5O_6$
	3 Mins.	4 Hours.			
"Original" solution	38·00	38·00	85·8*	—	—
After 3 contacts	27·60	27·60	—	—	—
,, 6 ,,	20·20	20·20	—	—	—
,, 9 ,,	11·50	—	—	—	—
,, 11 ,,	4·15	4·20	—	—	—
,, 15 ,,	0·16	—	—	—	—

* Calculated from 3 minutes oxygen absorption.

Solutions containing upwards of 100 parts of a thionate per 100,000 are readily oxidised on bacterial filters, with the subsequent production of slightly acid filtrates containing sulphate as the final product.

Comparable experiments with ordinary and alkaline solutions have shown that the addition of sufficient alkali to neutralise the acidity produced with each contact has a beneficial effect on the rate of oxidation of the three thionates.

Course of reactions.

(*a*) *Trithionate.*—Tests made with the various reagents showed that in the earlier experiments, trithionate was present in the filtrates until the complete oxidation of the solution. The filtrates from later experiments, when the filter had become more adapted to the oxidation of trithionate solutions, gave no indication of the presence of trithionate after the 5th or 6th contact, whilst tetrathionate was shown to be present in quantity. These observations are supported by a consideration of the 3 minutes and 4 hours oxygen absorptions, marked differences being characteristic of the presence of trithionate. The foregoing conclusions have been endorsed by the quantitative estimations of the unoxdised sulphurs and oxygen absorptions and subsequent calculation of the composition of the mixtures.

During the filtrations occasionally there have been slight depositions of sulphur. There has been no evidence to show the formation of pentathionate or sulphur dioxide.

(*b*) *Tetrathionate.*—From the qualitative tests it was shown that the oxidation proceeds, generally, direct to sulphate. Traces of pentathionate, however, have been noted from time to time. There were no indications of the presence of trithionate or sulphur dioxide in the filtrates and there has been no deposition of sulphur.

The approximate amounts of tetrathionate and pentathionate have been calculated from the estimated unoxidised sulphurs and 3 minutes oxygen absorptions, showing generally that only small quantities of pentathionate are present in the filtrates.

(*c*) *Pentathionate.*—The oxidation of pentathionate appears to be direct to sulphate as no evidence has been obtained either from the qualitative or quantitative tests of the formation of tetrathionate in appreciable quantity or the deposition of sulphur. The filtrates were free from sulphur dioxide and trithionate.

Reviewing the whole of the preceding it may be briefly stated that thiosulphates are oxidised on bacterial filters to sulphate with the intermediate production of tetrathionates in quantity and pentathionates. The pentathionates and tetrathionates so formed are then further oxidised to sulphate—the former directly, the latter with the formation of further small quantities of pentathionate.

Bacteriological investigations.

Experiments have been made to determine whether the oxidation of thiosulphate and tetrathionate on bacterial filters is brought about by living agencies or by purely physical and chemical changes.

The oxidation of thiosulphate is accompanied by the formation of slightly acid filtrates and this, especially after long periods of working, is not conducive to active bacterial action. Again the acidity of the liquid, retained in the pores of the filter from the previous experiment, should assist the first breaking down of thiosulphate in solution.

With the numerous experiments carried out with thiosulphate and tetrathionate it has been observed that:—

(1) Proportionately the amount of sulphur deposited in thiosulphate filtrates is small, often no deposition at all taking place, even with the first contact, although the filtering medium itself has been slightly acid. Further, the filtrates for the first 4 or 5 contacts are generally neutral or alkaline to methyl orange, free acid being found in the solution only after the complete or nearly complete removal of the thiosulphate. Therefore it appears that free acid is not accountable to any great extent for the breaking down of thiosulphate to tetrathionate and pentathionate.

(2) The rate of oxidation of the thionates in dilute solution on bacterial filters increases with the formation of acid filtrates, as the filters become more adapted to the oxidation of such solutions, although tetra- and pentathionates are more stable in acid than alkaline solutions (Debus).

(3) The acid filtrates from thiosulphate and tetrathionate filters are not free from bacteria. Gelatin plates made from 1 c.c. of the filtrates have shown 50 to 100 colonies of bacteria and moulds on incubation. A small portion of material taken from the centre of a filter was found to be fairly active, as was shown by the plating out of 1 c.c. of the 50 c.c. of sterile water with which the material had been washed. The filter had been yielding acid filtrates for some time.

(4) The oxidation of dilute thiosulphate and tetrathionate solutions on filters rendered active by septic tank effluent, commences almost directly and is complete in a few days. By treatment of a similar solution on a filter containing clean, washed and sterile (as far as possible by steaming) material, a much longer period (2 to 3 weeks) is required for oxidation. There is considerable resistance to the oxidation of the first solution on a "sterile" filter, afterwards however the resistance is overcome and in 5 or 6 weeks the filter deals with solutions of thiosulphate and tetrathionate like an active filter. By this time, the filtrates from the "sterile" filter contain a number of moulds and bacteria.

This temporary resistance is also noticed with a "sterile" filter containing humus, *i.e.*, a filter matured in the ordinary way and sterilised by steaming before treating with thiosulphate and tetrathionate solutions.

(5) The removal and "sterilisation" of the material from an active filter, stops the oxidising power of such a medium for some time. Thiosulphate and tetrathionate solutions previously readily oxidised on the active medium, pass through the "sterile" material many times practically unchanged. Very slowly the oxidising power is regained.

(6) Quartz filters containing humus, if not active, offer very considerable resistance to the oxidation of dilute thiosulphate solutions.

From the above it appears that the oxidation of thiosulphate and tetrathionate on filters is brought about by bacterial agencies with the assistance of the physical and chemical properties of the medium.

That living organisms play an important part in the oxidation of thiosulphate and tetrathionate seems very probable from the following experiments:—

Solutions of thiosulphate and tetrathionate were allowed 2 or 3 contacts on bacterial filters, and the filtrates obtained were each divided into two portions. One portion, contained in a suitable bottle, was sterilised for three successive days in a steamer. The second portion was poured into another sterile bottle and aerated continuously by means of a suction pump. The first portion after sterilising was similarly aerated. The conditions for aeration were exactly similar in each case, equal amounts of sterile air (previously passed through mercuric chloride solution) being passed through each. The solutions were tested from time to time with the following results:—

Results in parts per 100,000.

Sodium thiosulphate.

Experiment A.	Active filtrate.		Sterile filtrate.	
	3 minutes oxygen absorption	Thiosulphate as $Na_2S_2O_3$.	3 minutes oxygen absorption	Thiosulphate as $Na_2S_2O_3$.
At commencement ..	23·20	33·0	(*a*) 23·20† (*b*) 20·60	33·0 13·0
After 6 days aeration	—	—	21·20	11·0
,, 8 ,, ,,	17·60	nil	—	—
,, 11 ,, ,,	—	—	20·80	10·0
,, 13 ,, ,,	1·60	nil	—	—
,, 16 ,, ,,	0·69	nil	—	—
,, 4 weeks ,,	—	—	20·80	—
,, 9 ,, ,,	—	—	20·80	4·0

Potassium tetrathionate.

Experiment B.	Active filtrate.		Sterile filtrate.	
	3 minutes oxygen absorption	Tetra-thionate as $K_2S_4O_6$.	3 minutes oxygen absorption	Tetra-thionate as $K_2S_4O_6$.
At commencement	24·60	71·5	(*a*) 24·60* (*b*) 21·60	71·5 62·8
After 2 days aeration	20·20	—	21·17	—
,, 4 ,, ,,	17·80	—	21·20	—
,, 6 ,, ,,	10·20	—	20·00	—
,, 8 ,, ,,	·70	—	21·00	—
,, 10 ,, ,,	·50	—	—	—
,, 12 ,, ,,	—	—	22·00	—
,, 4 weeks ,,	—	—	20·00	—
,, 8 ,, ,,	—	—	21·20	—

* (*a*)=before ; (*b*)=after sterilisation.

The filtrates were examined bacterially before commencing the experiments and the active solutions at the end of the experiments. Numbers of bacteria were found to be present in the filtrates and in the oxidised solutions, although the numbers were slightly less at the end of the experiment than at the commencement. The oxidation of the active solutions was accompanied by slight increases in the acidity.

Pure, dilute and sterile solutions of thiosulphate and tetrathionate, neutral or slightly acid, undergo little or no change after aerating in a similar manner for several weeks.

Summary and conclusions.

The foregoing investigations have established :—

(1) That dilute solutions of thiosulphate, trithionate, tetrathionate and pentathionate can be oxidised on bacterial filters.

(2) That acid filtrates are formed during the oxidation of these compounds and that the rate of oxidation is accelerated by the addition of sufficient alkali to prevent the formation of free acid.

(3) That these compounds are all finally oxidised to sulphate.

(4) That solutions of dithionates cannot be oxidised on bacterial filters.

(5) That solutions of thiosulphate up to a concentration of 500 parts $Na_2S_2O_3$ per 100,000 can be oxidised.

(6) That thiosulphate is not directly oxidised to sulphate but with the intermediate formation of tetrathionate and pentathionates and occasionally small quantities of trithionate.

(7) That 70 per cent. of the sulphur of the thiosulphate is recoverable as sulphate.

(8) That solutions of trithionate, tetrathionate, and pentathionate up to a concentration of 100 parts thionate per 100,000 can be oxidised.

(9) That trithionate is oxidised to sulphate with the intermediate formation of considerable quantities of tetrathionate.

(10) That tetrathionate forms pentathionate in small quantities during its oxidation to sulphate.

(11) That pentathionate is oxidised directly to sulphate.

(12) That the usual tests for thionic acids are applicable with few exceptions to solutions of thionates ·10 and ·02 per cent.

(13) That the amounts of oxygen absorbed from acid permanganate in three minutes and four hours, by thiosulphate, tetrathionate and pentathionate are the same.

(14) That trithionate absorbs less oxygen from acid permanganate in three minutes than four hours.

(15) That 1 gram each of thiosulphuric, tetrathionic, and pentathionic acids absorb respectively 0·477, 0·460 and 0·574 gram of oxygen in three minutes and four hours from acid permanganate.

(16) That 1 gram of trithionic acid absorbs 0·2925 gram of oxygen from acid permanganate in four hours and about two-thirds this amount in three minutes.

(17) That the oxidation of thiosulphate and tetrathionate on bacterial filters is most probably due to bacterial action assisted to some extent by the physical and chemical properties of the filtering material.

In conclusion, I wish to thank Dr. Fowler and Mr. Ar very heartily for their assistance in the writing of paper and for the many valuable suggestions made regard to the arrangement of the subject matter.

Discussion.

The Chairman said the real interest in the paper la the fact that it threw further light on the sulphur c in nature. People were sometimes apt to forget the sulphur cycle was of almost equal importance as nitrogen cycle. He understood that Mr. Lockett was proceeding with the stage before the thiosulphate st with the oxidation of sulphides. Of course, as Mr. Loc said, the work was taken up originally following on work which had been previously described on the oxida of other substances, phenols and thiocyanates, w occur in ammonia recovery liquor. One of the rea for carrying on the investigations was that even w apparently the oxidation had been carried a consider way, and the thiocyanate and the phenol had practically oxidised, there was still something left w absorbed oxygen from permanganate. Mr. Loc had been able to show by a long series of careful inorg preparations and analyses that the oxidisable was mainly tetrathionate together with pentathion He, the speaker, would like to inquire whether Mr. Loc could give them an idea by means of an equation a how the oxidation took place. It was now becon more and more generally recognised that oxidation w process of what one might call hydroxylation. Profe Bone had shown a long time ago that the combustio hydrocarbons consisted in the slow oxidation and addition of hydroxyl groups to the original carbon the splitting off of water, and so on. Recently som them had been able to show that phenol broke d by bacterial oxidation forming hydroxy acids. Furt there was evidence from some recent experiments, wh had not yet been published, to show that there was intermediate oxidation product between ammonia nitrous acid. The investigations were not yet c pleted. It would be interesting to know whether the s general method of addition of oxygen was indica from Mr. Lockett's experiments, because if so it wo point to the conclusion that all these oxidation proce in nature were really processes of hydroxylation, wh was perhaps what one would naturally suppose, that they went on by successive gradual stages. the speaker, could foresee the possibility in certain ca of using bacteria as a gradual and easily controll process for oxidising organic bodies of one sort and anot Of course this had to be done in rather dilute soluti but there was no reason why by careful adjustm the concentration should not be increased, and in event the study of such oxidation changes must to very valuable results.

Mr. W. Thomson inquired what kind of bacteria a upon thiosulphate ? Was it a bacterium of the natur the nitrifying bacteria. Had he tried the effect of any of sewage fungi, such as the "Beggiatoa Alba," which h peculiar way of dealing with sulphur compounds.

Mr. J. H. Hoseason inquired whether Mr. Loc had been able to practically isolate and cultivate bacterium, or the class of bacteria which caused oxidation ?

Mr. T. H. Byrom wrote that he had noticed sev times that a solution of sodium thiosulphate, 3 gram per litre, underwent a peculiar change in about 8 weeks' time. The solution became quite thick gelatinous, resembling a mixture of glycerin and w When poured from one vessel to another, or run of a pipette or burette, it behaved quite like a st liquid.

It was almost impossible to get the liquid in d but a long semi-elastic thread was formed. Shaken beaker the fluid had a gelatinous appearance, and rema quite clear and colourless.

He had never investigated the chemical change, be the noticeable fact that the thiosulphate became siderably weaker with regard to its reaction with io

The physical change was, however, most marked. Probably the change had been noticed by others using dilute thiosulphate solutions.

Mr. **Percy Gaunt** inquired whether in the attempts to oxidise the solutions by sterile aeration, Mr. Lockett had studied the effect of the addition of a small quantity of nitrite. While the oxidation was doubtless mainly or entirely biological, there was the possibility of the traces of nitrites, which might be present, assisting in a chemical oxidation. Had Mr. Lockett studied in detail the oxidation of the compounds in solutions of widely varying concentration. He (the speaker) had found difficulty in obtaining solutions of sulphur compounds of strengths comparable in sulphur content with sewage liquors, to which the accepted analytical methods could be applied, with any expectation of obtaining accurate results. This, he believed, was one of the obstacles to the study of the biological oxidation of the sulphur compounds. The nitrogen compounds had received relatively more than their share of attention, owing, no doubt, to the knowledge of specific nitrifying organisms, and also to the facility with which the accepted methods for their determination could be executed. He suggested that Mr. Lockett should adopt as a minimum concentration the lowest strength of solution to which accurate analytical methods could be applied, and as his maximum a solution of, for instance, one hundred times this strength, determining in the very thorough manner of the present research whether the oxidation of the two solutions proceeded on parallel lines. If this proved to be the case, then one could more confidently interpret from the results the course of oxidation of the still more dilute solutions associated with sewage disposal. With regard to the acceleration of the oxidation of the solutions by the addition of alkalies, it was a common practice to add traces of the alkaline carbonates to laboratory solutions of thiosulphate, to retard decomposition. Would this justify the conclusion that the decompositions involved in the two cases, had little or nothing in common?

Mr. **W. T. Lockett** replied to the discussion. He said he was not prepared to put forward equations representing the actual changes which took place, but he thought that tetrathionate and caustic soda were obtained in the first change. From tetrathionate he thought the change proceeded mainly direct to acid sulphate and sulphuric acid. With respect to the varieties of bacteria, he had made gelatine plates of many filtrates without finding a great many bacteria present. He also had not been able to find any higher organisms such as beggiatoa, etc. The organisms cultivated on gelatine were mainly cocci, and he had been investigating a number of these organisms with regard to the oxidation of thiosulphate. It seemed very likely that the oxidation was not due to any of these, but to other organisms which could not be grown on gelatine. If a bacteriological slide were made of a loopful of a filtrate from an active filter and examined under the microscope a great number of organisms were found. A gelatine plate of the same solution showed only 50 to 100 organisms per c.c. The organisms seen under the microscope were principally of the nature of very small cocci, and these apparently could not be cultivated on gelatine. The cocci actually grown on gelatine were of a much larger type.

With regard to the oxidation of solutions of higher strength, he had oxidised solutions containing as much as 500 parts of thiosulphate per 100,000. He had not attempted to oxidise solutions stronger than these. He had no doubt that physical changes would be greater with stronger solutions, because there would be large quantities of acid sulphate and free acid formed, with the consequence that the material of the filters would become gradually eaten away. With regard to Mr. Byrom's letter the reduction in strength of the thiosulphate solutions found on standing was probably due to oxidation changes, with the formation of tetrathionate. In the absence of further information he had no explanation to offer in regard to the alteration in the physical properties of the solution. He, the speaker, did not introduce any nitrate or nitrite into the solutions owing to the fact that this would complicate matters somewhat. It was probable that nitrate would considerably help the oxidation, but no nitrate could be formed by nitrifying organisms in the filters, because the solutions eventually became acid and nitrifying organisms would not work in acid solution. Concerning the methods of estimation in very dilute solution, he had tried to make the oxygen absorption test of value in this respect. It was possible to learn something of the composition of a solution containing thiosulphate and tetrathionate from the oxygen absorption figure, because one could calculate from the iodine absorption the thiosulphate in terms of oxygen absorbed; and from the oxygen absorption of the mixture, the amount of tetrathionate, in terms of oxygen absorbed, could be determined by difference.

In the particular case under his notice, quantitative determinations showed that the course of the reaction in dilute solutions was similar to that when strong solutions were oxidised, and consequently quantitative determinations were confined to the latter, as offering greater accuracy on account of the increase of amounts of the salts present. It was well known of course that the addition of alkalies to thiosulphate increased its stability, and in the actual filter experiments, where the alkali was added, although the complete oxidation of the thiosulphate was accelerated, the first stage of the oxidation process was actually slightly retarded. The beneficial effect of the presence of alkali was confined to the second stage of the process where the tetrathionate formed was oxidised to sulphate.

Newcastle Section.

Meeting held at Armstrong College, on Wednesday, May 14th, 1913.

MR. T. W. LOVIBOND IN THE CHAIR.

THE ANALYSIS OF COPPER TIN ALLOYS.

BY W. GEMMELL.

In the analysis of copper tin alloys the usual course of procedure is to dissolve the alloy in nitric acid and evaporate to pastiness or dryness on a water bath or hot plate. The mass is then extracted with warm dilute nitric acid, and the oxide filtered off. This is well washed with dilute nitric acid and hot water to remove copper, lead, etc. The tin oxide is ignited and weighed. Using this method for the estimation of tin in commercial alloys, the writer has never been able to obtain a precipitate which was white after ignition. All the ignited precipitates varied from yellow to yellow-red whatever precautions were taken in the evaporation of the solution of the alloy in nitric acid. The method of evaporating to dryness on a hot plate gave worse results in this respect than the water bath evaporation. The colour is due to iron and copper oxides, and continued washing with nitric acid and warm water does not remove these. Hence the copper and iron may be reported too low and the tin too high. inasmuch as a proportion of iron, usually present, is classed as tin.

Methods of electro-analysis using rotating electrodes are rapid with most copper alloys, but in the case of copper-tin alloys much time has to be spent in the separation of the tin. The writer has, however, found that it is unnecessary to remove the tin before proceeding to the estimation of copper, provided the tin is kept in solution. Copper-tin alloys are soluble in *aqua regia*, but the use of this with platinum electrodes is clearly out of the question. However, copper-tin alloys are completely soluble in nitro-sulphuric acid, and from solutions of suitable concentration the copper can be deposited electrolytically in a pure condition.

Method of analysis.—For the purpose of analysis 2 grms. of the alloy is dissolved in a mixture of 10 c.c. of 1·42 sp. gr. nitric acid, 10 c.c. 1·84 sp. gr. sulphuric acid, and 30 c.c. distilled water. This attacks the alloy vigorously, the copper and tin being completely dissolved. The solution is next boiled to expel oxides of nitrogen, and after being allowed to cool it is diluted with about 50 c.c. of cold distilled water.

For the electrolytic separation of the copper from the solution of the alloy, rotating platinum electrodes of almost any description may be used, but the platinum gauze electrodes described by Sand (see this J., 1907, 26, 490) are excellent for the purpose, and are the type used by the author.

In the determination of the copper the anode is rotated and an electrolysing current of 8 ampères suffices to remove all the copper present in thirty minutes.

When the whole of the copper has been removed from solution, washing by water must be carefully avoided and the following method adopted. The beaker containing the electrolysed solution is taken away and immediately replaced by another containing 2 per cent. sulphuric acid. After this washing, which is done with the anode rotating and the electrolysing current running, the electrodes are rinsed down with distilled water. After disconnecting the electrodes they are immersed in absolute alcohol, dried in a water oven at 100° C., and the weight of deposit determined.

The copper thus deposited is pure, and contains no trace of tin. Several determinations of copper in copper tin alloys were made, the coppers being deposited the one on the top of the other until a weight of deposit of over 10 grms. was obtained. On dissolving this off the electrode with nitric acid and evaporating the solution to dryness no trace of tin was found, and on again electrolysing the solution the same weight of copper deposit was obtained.

If the alloy contains lead, part of this is removed as peroxide, which is deposited on the anode, while part will be found in the form of sulphate at the bottom of the beaker containing the solution, which is being electrolysed. This lead sulphate present does not interfere in any way with the purity of the copper deposited on the cathode.

Determination of tin.—After removal of the copper, the colourless solution containing the tin is mixed with the electrode washings, and diluted to a bulk of about 500 c.c. with distilled water. On boiling this solution the tin is precipitated in the form of oxide. The boiling is continued for 15 to 30 minutes, and the tin oxide allowed to settle before being filtered. The precipitate thus obtained is usually in a very fine state of division, and requires to be filtered through a double Swedish filter paper. The precipitate is washed on the filter with 1 per cent. nitric acid or sulphuric acid, and the filtrate is used for the determination of iron and any other metals which may be present.

All the determinations of tin in the alloys or metal mixtures analysed for the purpose of this paper, with the exception of mixtures F and G, were made using the above method. The tin oxide precipitate obtained was ignited and weighed and calculated to percentage of tin in the alloy.

The tin oxide precipitates after ignition were white and showed no trace of colour even when the original alloy or mixture contained as much as 0·8 per cent. of iron.

Using the method just described sometimes a precipitate of oxide was obtained, which was so very fine that it was only with great difficulty that a clear filtrate was secured. It was therefore decided to modify the process somewhat.

Instead of diluting with water after the electrolysis for copper, the solution containing the tin is poured into a cold 2 per cent. solution of sulphuric acid saturated with hydrogen sulphide. The solution is then boiled for a few minutes and the flocculent precipitate thus obtained is filtered through a single Swedish filter without any danger of any of the tin precipitate passing through the filter paper. After washing the precipitate with 1 per cent. sulphuric acid saturated with hydrogen sulphide, the tin may be determined electrolytically. For this purpose the precipitate is digested on the paper with freshly prepared ammonium sulphide in which the tin is readily soluble. The ammonium sulphide solution containing the tin on electrolysis yields the metal in the form of a greyish white coherent deposit on the cathode.

This modification has the advantage over the earlier method employed, in that any lead present does not require to be first separated as sulphate before proceeding to the estimation of the tin. Any lead not removed in the form of peroxide in the electrolysis for copper remains on the filter paper in the form of sulphide after the digestion with ammonium sulphide. This lead sulphide can be converted into lead sulphate, ignited, weighed, and the result calculated to percentage of lead. By adding this figure to the amount of lead determined as peroxide the total amount of lead in the alloy can be obtained. This method of determination is not recommended, and the lead can be much more accurately estimated in the manner about to be described.

The analysis of the metal mixtures F and G were made using the method just described, the tin being determined electrolytically and the lead was estimated in the form of both peroxide and sulphate.

Determination of lead.—For the determination of lead in copper tin alloys it is unnecessary to remove the tin as oxide before proceeding to the separation of the lead as sulphate.

Nitro-sulphuric acid being such an excellent solvent for copper-tin alloys it is only necessary to dissolve say 5—10 grms. of the alloy in nitro-sulphuric acid and then to evaporate until the sulphuric acid begins to fume. Water is next added until the concentration of the sulphuric acid is about 25 per cent. by volume. This can then be boiled, if necessary, to ensure solution of the copper and tin as sulphates, and at this concentration of acid there is no danger of tin being precipitated in the form of oxide. The solution is cooled and cold distilled water added until the sulphuric acid is at a concentration of about 7 per cent. by volume. The lead sulphate is next allowed to settle out preferably over night, filtered off, washed with 6 per cent. sulphuric acid, and the lead calculated from the weight of ignited lead sulphate obtained.

This method gives accurate results and a great saving of time follows in having only one filtration to make.

Determination of iron and nickel.—Most commercial copper alloys contain nickel in amounts varying from about 0·1 to 0·4 per cent. This nickel is not added intentionally, but is introduced with the copper from which the alloy is made. Nickel is a constituent of copper alloys which very often is not suspected, and which fails consequently to be reported as such. The result of this is that some other constituent, usually the zinc, if this is done by difference, is reported at a higher figure than the amount actually present.

The estimation of the nickel and iron present in the alloy can be carried out in the following manner:—

After precipitation of the tin from the solution which has been electrolysed for copper, the filtrate is boiled down. If hydrogen sulphide has been used to facilitate filtration this is expelled on boiling. A little aqua regia is added to convert the iron into the ferric condition, and then the iron and nickel are precipitated together as hydroxides by the addition of excess of pure caustic soda solution. The precipitate is filtered off, dissolved in hydrochloric acid, a fair excess of ammonium chloride is added and the iron is precipitated as hydroxide by the addition of ammonia. The ferric hydroxide precipitate is filtered off, well washed with hot water, and the filtrate used for the determination of any nickel which may be present. The nickel is best estimated by precipitation with dimethylglyoxime.

Determination of zinc.—As a rule zinc is determined by difference, and if the other constituents of the alloy have been accurately determined the figure is fairly near the truth.

In most of the alloys and metal mixtures analysed by the author, according to the scheme described in this paper, the zinc was determined electrolytically, while in the case of the alloys or mixtures analysed by the old methods the zinc figure was obtained by difference.

For the determination of the zinc, the filtrate from the precipitation of the iron and nickel with caustic soda, was used. This filtrate is acidified with sulphuric acid and evaporated until fuming occurs in order to ensure the decomposition of all nitrates. The sulphuric acid is then treated with excess of caustic soda solution, and acidified with acetic acid. The zinc is deposited on a platinum electrode which has been plated previously with copper. A current of 3 ampères in the electrolysing circuit suffices to remove about 0·7 grms. of zinc in less than 40 minutes.

It is necessary to keep the solution, which is being electrolysed, cool and if accurate results are to be obtained it is absolutely essential that no trace of nitrates should be present.

The zinc can also be electrolysed from a solution containing ammonium sulphate, ammonium acetate and acetic acid.

Instead of precipitating the nickel and iron with caustic soda, the iron may first be removed in presence of a large excess of ammonium chloride by precipitation with ammonia. The filtrate is next treated with dimethylglyoxime to remove the nickel, and the filtrate from this is used for the estimation of the zinc. The solution is boiled to remove alcohol introduced with the dimethylglyoxime, excess of nitric acid is added and the solution boiled to low bulk. The boiling with nitric acid destroys the ammonium salts which have been added to, or formed in, the solution.

There is still sulphuric acid present in the solution and this is heated till the nitric acid has been expelled and till the sulphuric acid fumes strongly. After dilution excess of ammonia is added and the solution is then made acid with acetic acid. The zinc is deposited as before on a copper plated electrode.

Both the methods for the estimation of zinc described above were used in the analyses of the alloys and metal mixtures, and concordant results were obtained.

In the testing of the accuracy of the methods already described, several mixtures of pure metals were used in proportions occurring in commercial alloys. The copper used was the finest electrolytic, the tin was Straits tin of a very high order of purity, the zinc employed was electrolytic and the iron was introduced in the form of pure wire. All the constituent metals in the mixture had previously been analysed and there was no doubt as to the degree of their purity.

Several mixtures of varying composition were made up, and these were analysed by the scheme described in this paper, and also by the methods usually employed in analysis of copper tin alloys. The oxide precipitate obtained on treating the alloy or mixture with nitric acid was calculated to tin direct, without having first separated the iron and copper, which were undoubtedly present, in the form of oxides. This is the method which is used by a large number of analysts, so in this respect there has been no departuure from standard practice. The oxide of tin precipitates as obtained by the newer method of precipitation were always white when ignited, and contained no iron or copper.

The tabulated analysis give the results of the analysis of these mixtures using both the old and the newer methods :—

A.—Copper tin mixture.

(*By new methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	86·80	86·79	—0·01
Tin	13·20	13·23	+0·03
	100·00	100·02	

B.—Copper tin zinc mixture.

(*By new methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition. by Analysis.	Error of Determinations.
			per cent.
Copper	86·55	86·52	—0·03
Tin	8·93	8·96	+0·03
Zinc	4·52	4·60	+0·08
	100·00	100·08	

C.—Copper tin zinc mixture.

(*By new methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	79·23	79·23	±0·00
Tin	5·01	5·00	—0·01
Zinc	15·76	15·76	±0·00
	100·00	99·99	

D.—Copper, tin, zinc, iron mixture.

(*By usual methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	82·46	82·43	—0·03
Tin	12·55	12·99	+0·44
Zinc	4·10	(by diff.) 4·23	—
Iron	0·89	0·35	—0·54
	100·00	100·00	

E.—Copper, tin, zinc, iron mixture.

(*By usual methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	75·12	75·08	—0·04
Tin	4·42	4·52	+0·10
Zinc	19·88	(by diff.) 20·02	—
Iron	0·58	0·38	—0·20
	100·00	100·00	

In the case of the metal mixtures D and E the tin oxide precipitate was fused with a mixture of sodium carbonate and sulphur and the iron estimated in the precipitate. In D 0·50 per cent. of iron was found, which, with the 0·35 per cent. estimated in the usual way, brings the actual iron figure up to 0·85 per cent. The mixture E gave on treating the oxide of tin precipitate 0·17 per cent. of iron. This with the iron estimated in the usual way brings the iron figure up to 0·55 per cent.

Another series of mixtures of metals was made up containing copper, tin, zinc, iron, and lead and the two mixtures were analysed in accordance with the scheme already described. The lead was not added with the intention of seeing what accuracy was obtainable in its estimation, but rather to find if it had any effect on the accuracy of the other determinations. The lead was determined by the method of estimating partly as peroxide and partly as sulphate. In the case of the two mixtures F and G the tin was determined electrolytically from ammonium sulphide solution.

The results are as follows :—

F.—Copper, tin, lead, zinc, iron mixture.
(*By new methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	75·16	75·14	—0·02
Tin	18·12	18·17	+0·05
Lead	1·66	1·59	—0·07
Iron	0·84	0·82	—0·02
Zinc	4·22	4·25	+0·03
	100·00	99·97	

G.—Copper, tin, lead, zinc, iron mixture.
(*By new methods.*)

Constituents.	Actual Percentage Composition.	Percentage Composition by Analysis.	Error of Determinations.
			per cent.
Copper	81·61	81·59	—0·02
Tin	4·26	4·22	—0·04
Lead	0·66	0·63	—0·03
Iron	1·14	1·15	+0·01
Zinc	12·33	12·38	+0·05
	100·00	99·97	

Having proved that the newer methods were capable of greater accuracy than the usual methods of determination of copper iron and tin, the next step was to compare the methods by analysis of commercial alloys. Three alloys were specially selected for their iron and lead content, and the analysis by both methods are as under :—

In the case of Alloy No. 3 the zinc has been estimated by difference, owing to the solution for electrolysis becoming spilled accidentally.

	Alloy. No. 1.		Alloy. No. 2.		Alloy. No. 3.	
Constituents.	New Methods	Old Methods	New Methods	Old Methods	New Methods	Old Methods
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Copper	86·87	86·67	81·42	81·27	84·09	83·93
Lead ..	0·61	0·61	1·01	1·00	0·88	0·85
Tin	7·91	8·02	7·52	7·57	8·85	9·13
Iron ...	0·22	0·12	0·77	0·72	0·75	0·52
Nickel..	nil	nil	0·43	0·43	0·10	0·08
Zinc ...	4·41	4·58	8·89	9·01	5·33	5·49
	100·02	100·00	100·04	100·00	100·00	100·00

Although the results obtained by the older methods are perhaps sufficiently near the truth for some purposes, it is desirable to adopt methods of analysis which are accurate. If at the same time the greater accuracy can be secured with an expenditure of less time on the analysis, that is another reason for the adoption of the newer methods.

New York Section.

Meeting held at Chemists' Building, on Friday, April 25th, 1913.

PROF. M. C. WHITAKER IN THE CHAIR.

THE CORROSION OF IRON AND STEEL.

BY WILLIAM H. WALKER.

It is now six years since the electrolytic theory in its developed form was offered as a basis for the explanation of the corrosion of iron and steel, and it seems worth while at this time to inquire into the accuracy of some of the conclusions to which it has led, as viewed in the light of present experience.

In the first place we have found that the factors controlling the rapidity or extent of corrosion are by no means so simple as they were at first thought to be. Many conditions which were considered of little or no importance have been found to exert a profound influence upon the reactions involved. For example, samples of iron and steel which exhibit marked differences in corrosion exposed in the normal condition in which they came from the mill, fail to show any difference upon exposure, when they are first planed to a uniform surface. Apparently the mechanical strain to which the samples are subjected in the planer, masks or neutralises the difference in corrosion inherent in the normal material. It is not surprising, therefore, that many conflicting results have been obtained and published from the investigators now interested in this work. Only those tests which have been carried on under identical conditions of surface finish, temperature, access of oxygen and moisture, general atmospheric conditions, etc., should be given any weight, and even when the greatest care is taken, generalisations must be drawn with caution.

One of the conclusions reached by a consideration of the electrolytic theory of corrosion which has proved misleading, is that homogeneity in the material insures protection, while heterogeneity leads to rapid attack. While this is a corollary which may be logically drawn from the electrolytic theory and is doubtless in itself true, there are evidently other factors which superimpose themselves upon those due to differences in structure, producing a final effect contrary to that predicted. The iron of the old chain bridge at Newburyport, Mass., has withstood corrosion in a truly remarkable manner for the last 98 years; and yet it is conspicuous for its heterogeneous structure. Large areas of perfectly pure iron, free from both carbon and slag, are mixed up with areas showing at least two kinds of slag, and very high carbon; yet all withstand atmospheric corrosion. On the other hand Burgess has shown that iron free from all contaminating elements which could segregate or produce a lack of uniformity, does not withstand rusting so well as the same iron to which has been added a little manganese or copper or nickel. This behaviour is observed also in the case of the so-called pure irons made in an open hearth furnace, and which are relatively free from carbon, manganese, sulphur, and other constituents prone to segregation, which have come to the writer's notice. While theoretically a very pure iron should withstand rust, there are apparently some factors present which more than offset any advantage inherent in purity. Obviously conditions affecting the surface of the material so soon as rusting has started are important causes which have largely been overlooked and which demand more thorough investigation.

The most important advance in this field made in recent years, is a knowledge of the effect of the addition of small amounts of copper to normal open hearth or Bessemer steel. This result is most strikingly brought out in the paper of D. M. Buck published in full in a recent issue of the Journal of Industrial and Engineering Chemistry. The present writer has within a week inspected with much interest the test roofs here described and can testify to the remarkable effect shown. While panels of Bessemer and open hearth steel containing the ordinary amounts of metalloids have entirely failed, the corresponding panels made from these same heats of steel but to which a small amount of copper was added are in a remarkable state of preservation. A panel of the so-called pure iron very low in metalloids, but containing one-half the amount of copper carried by the less pure steels is less attacked than those steels containing no copper, but is much less resistant than are those to which 0·2 per cent. of copper was added. Had copper been omitted entirely from this iron it would doubtless have succumbed even earlier. While these tests do not show that any steel, however poorly made, will, with the addition of copper, withstand atmospheric corrosion, they prove that it is the copper, and not the absence of manganese and the other "impurities" which is the controlling factor. Several hypotheses have suggested themselves as explaining this marked effect of copper in causing steel to resist atmospheric corrosion, but as yet none is sufficiently tangible to afford a working theory.

Rapid progress has been made in acquiring that knowledge of the relation of pigments and finished paints to corrosion which is necessary to a better protection of iron and steel. Predictions founded on theory that a basic paint, or one containing a chromate pigment would inhibit rusting, while one made up from lamp black or graphite would accelerate rusting, have, in the main, been found correct. The effect of the pigment upon the character of the oil film making up the paint, however, has shown itself also to be very important. Many basic pigments, such as basic lead carbonate or zinc oxide, which in themselves inhibit, do not withstand the weather; lamp black and graphite, on the other hand, make a very impervious and highly resistant paint film. The logical conclusion in protecting iron is, therefore, to use a basic priming coat, a second coat of a mixture of a basic pigment and a little lamp black, and when well dried out to apply a lamp black or graphite finishing coat. Experience has shown also the importance of brushing the paint well on to the iron; a good paint may fail on account of poor application.

Careful tests with galvanised work show that an even coating of zinc is the all-important factor. The common practice of clean wiping galvanised ware is fatal to durability, since the protecting layer is not metallic zinc, but a thin deposit of a zinc-iron alloy. While therefore much has been accomplished in the way of making a more resistant base, there is still a necessity for a uniform substantial coating of spelter over the surface.

Discussion.

Mr. R. H. **Gaines** entered a mild protest against Prof. Walker's weakening on the electrolytic theory on the corrosion of iron, which he had done so much in the past to champion. The data presented seemed insufficient to justify his conclusion that heterogeneity was not an influence of the first importance affecting the corrosion of iron and steel. Much of the destructive corrosion that they had to contend with arose from differences of solution pressure, due to heterogeneity of the metal.

Mr. W. A. **Aiken** inquired whether it was to be understood that while attention was called only to the element carbon, to impress the fact that greater or less content thereof had no influence to further corrosion, this statement covered all the ordinary constituents of iron and steel, and that segregation played no part in conducing toward increased corrodability The contention that the purer the iron or steel, the more it suffered from corrosion, would appear to wreck the electrolytic theory of corrosion, which, he understood, was primarily based upon the difference in potential, such as should exist between pure material and impure material, due to segregation.

Mr. S. S. **Voorhees** called attention to the fact that whiting prevented corrosion as long as any portion of the paint was in contact with the steel, possibly due to its basic character, but that as a paint it failed, due to flaking off.

Mr. G. W. **Thompson** stated that half of the steel plates on the Atlantic City Fence were pickled and the other half were painted without pickling, and that all the plates on the Havre de Grace Bridge were pickled.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8d. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane London, W.C.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Liquids; Apparatus for separating deposited matter from ——. B. Kaibel, Darmstadt, Germany. Eng. Pat. 11,137, May 10, 1912. Under Int. Conv., May 11, 1911.

The sludge is allowed to settle at the bottom of a funnel-shaped chamber provided, at the lowest point, with a discharge valve, which is normally closed. As soon as a sufficient quantity of sludge has collected, a central tube, open to the atmosphere at the top and having a flared end with a flanged edge adapted to fit against the sloping sides of the chamber at the bottom, is lowered so as to shut off a body of sludge from the liquid above, whereupon the discharge valve is opened and the sludge drawn off.—H. H.

Water from pasty, pulpy and liquid materials; Process and apparatus for the removal of ——. C. Westphal, Berlin. Eng. Pat. 11,147, May 10, 1912. Under Int. Conv., May 10, 1911.

The material is forced under pressure by a screw conveyor through the space between two sets of heating coils in a tubular drying chamber. One of these sets of coils, near the discharge end of the chamber, is supplied with steam or other suitable heating agent from an external source. The other set of coils extends the whole length of the chamber and is perforated near the discharge end of the dryer; it serves to conduct the hot water or steam driven off from the material back through the tubes and thus to warm up the incoming material. The pressure under which the material is forced into the apparatus ensures that the pressure in the warming up tubes is greater than that of the atmosphere. In the case of liquid materials the chamber rises from front to back and has a high-level steam space at the outlet end. The high-pressure steam from the material collects in this space, and enters a perforated steam-collecting pipe disposed above the level of the liquid, and thence passes through the warming-up tubes in counter-current to the liquid material.—W. H. C.

Drying damp materials. E. R. Besemfelder, Charlottenburg, Germany. U.S. Pat. 1,059,820, April 22, 1913.

The materials are treated in a closed chamber with a current of vapour of a liquid other than water and not miscible therewith. It is afterwards treated with the vapour of another liquid of similar character, but of lower boiling point.—W. H. C.

Dryer. F. Haas, Ges. m. b. H. Fr. Pat. 450,706, Nov. 18, 1912.

A DRYING chamber is divided into two compartments by a vertical partition provided with a valve-controlled opening at the bottom and a ventilating fan at the top. When the valve is closed fresh air is drawn in from outside by the fan and expelled after passing through the chamber, but when the valve is open the air inside the chamber circulates from one compartment to the other.—H. H.

Drying moist materials, more particularly argillaceous materials; Process for ——. J. König. Fr. Pat. 451,590, Dec. 7, 1912. Under Int. Conv., Jan. 29, 1912.

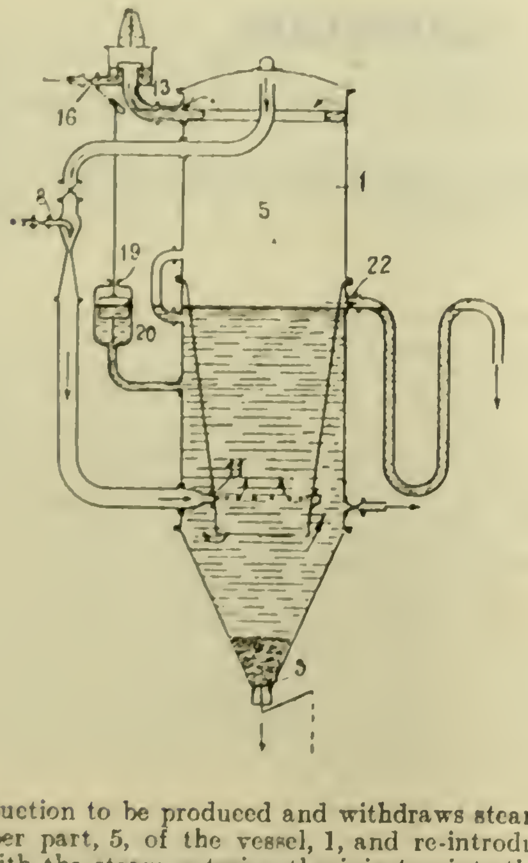
THE materials are submitted to a preliminary drying in air, freed from all smoke, at a pressure above atmospheric, and are then completely dried in the same chamber at a pressure below atmospheric. The second drying may be performed with air containing smoke without any risk of discolouration of the materials.—H. H.

Drying drum. T. Holtz. Fr. Pat. 451,617, Dec. 9, 1912. Under Int. Conv., Dec. 27, 1911.

IN a rotary drying drum of the type having a number of scoops attached to the inner wall so as to raise the material to the top of the drum and allow it to fall, the scoops are arranged in batches, with parallel edges, in such a manner that the material falls simultaneously from the scoops of each batch.—H. H.

Boiling liquids; Process for ——. Soc. d'Exploitation des Procédés Evaporatoires Systême Prache et Bouillon, Paris. Eng. Pat. 11,713, May 16, 1912. Under Int. Conv., May 29, 1911.

THE liquid is admitted through the valve, 16, into the closed vessel, 1, and is heated by steam admitted to the injector, 8. The expansion of the steam in the injector, 8, causes suction to be produced and withdraws steam from the upper part, 5, of the vessel, 1, and re-introduces it, along with the steam entering the injector, into the body of liquid in the boiler, 1, through the perforations, 11. The treated liquid overflows by the pipe, 22, and the supply of fresh liquid is regulated by the float, 19, 20. Any deposited solids are withdrawn through the valve, 3′. As no steam is discharged into the atmosphere, but the whole is circulated again and again through the liquid, no heat is lost and only sufficient steam from external sources is required to raise the liquid to the boiling point. —W. H. C.



Fluids; Separation of particles from —— and apparatus therefor. C. S. Watson, Newcastle-upon-Tyne. Eng. Pat. 17,384, July 26, 1912.

AN apparatus more particularly for separating dust from gases without the use of liquids comprises a cylindrical casing within which rotates a smaller bellows-shaped chamber built up of a number of perforated dish-shaped discs attached to a shaft passing axially through the casing. The discs are mounted back to back in pairs, and flat perforated discs are mounted between the pairs which are spaced sufficiently apart to leave narrow peripheral spaces at the outer angular edges of the chamber through which particles of solid can pass into the outer casing. The perforations in the discs are arranged in such a manner that the gas flows in a zig-zag path through the chamber while rotating therewith, blades being mounted if necessary between the discs to impart a rotary motion to the gas.—H. H.

Refrigeration; Processes of —— and apparatus for use therein. J. H. G. C. Hansen, Hamburg, Germany. Eng. Pat. 20,363, Sept. 6, 1912.

IN cooling apparatus in which the cooling effect is produced by the expansion of a compressed gas, the regulation of the flow of gas through the cooling chamber is effected by dividing the latter into two chambers by a horizontal partition, formed of two or more superposed perforated plates, which may be moved relatively to one another and so act as an expansion valve.—W. H. C.

Cooling apparatus. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 22,869, Oct. 7, 1912.

To prevent the commingling of cooling and cooled liquids, due to leakage, in coolers of the type in which outer tubes for the cooling liquid surround a number of inner tubes for the liquid to be cooled, and at the same time to allow for the expansion of the inner tubes under heat, the inner tubes are fitted with headers which are free to slide in the casing and serve to separate the inlet (or outlet) chambers for the two liquids. Each header is fitted with a triple packing ring, the two outer rings of which form joints against leakage of the cooling liquid and of the liquid to be cooled respectively, while the intermediate ring, which is provided with ducts, enables any liquid which may leak past either of the outer packing rings to escape.—H. H.

Cold; Process and apparatus for the production of ——. E. Josse and W. Gensecke. First Addition, dated Nov. 11, 1912, to Fr. Pat. 436,244, Oct. 26, 1911 (this J., 1912, 479).

THE efficiency of the injectors employed according to the chief patent is increased by making the injection orifices flat or cruciform in shape, so as to increase the surface of contact between the injector fluid and the entrained fluid. A similar effect may be produced by arranging a dividing piece across the injector orifice. The entrained fluid is led into the injector through curved passages terminating in line with the jet.—H. H.

Washing fibrous filtering materials; Apparatus for ——. G. Katzenstein, Berlin. Eng. Pat. 26,385, Nov. 16, 1912.

A VESSEL having an inverted conical base into which dips a vertical open-ended tube extending nearly to the top of the vessel, is provided with double walls through which a heating medium is circulated. An Archimedean screw, working within the tube, causes washing liquid together with suspended fibrous material to flow downwards through the tube and upwards through the vessel, so that a continuous heating and disintegrating action takes place. The double-walled tube may be heated electrically.—H. H.

Leaching-tank or filter. H. E. Kier, Colorado Springs, Colo. U.S. Pat. 1,058,869, April 15, 1913.

The apparatus consists of a fluid receptacle or tank having a concave bottom and concave filtering means arranged in proximity thereto. The material in the tank is agitated by means of curved arms rotating upon a horizontal shaft which can be adjusted vertically.—H. H.

Filtering medium and process for making the same. F. G. Cottrell, Berkeley, Cal., Assignor to International Precipitation Co., Los Angeles, Cal. U.S. Pat. 1,060,065, April 29, 1913.

The filtering medium consists of a woven fabric of vegetable fibre, which has been heated so as to convert its cellulose into pliable, acid-resisting, "pseudo-carbons." —W. H. C.

Filter-plate for filter-presses. J. Rybar. Ger. Pat. 258,431, Oct. 15, 1912.

The plate is provided in the known manner on both sides with ribs on which the filter-cloths rest, but it has in addition strengthening strips or ribs, which project to the height of the rim of the plate. The strengthening ribs on adjacent plates, which come in contact, are at right angles, and the ribs on the front and rear sides of the same plate may be either parallel or at right angles.—A. S.

Grading finely divided material; Method and apparatus for ——. H. K. Hitchcock, Tarentum, Pa., U.S.A. Eng. Pat. 1212, Jan. 15, 1913.

The material is graded in water in a conical vessel, and various grades of material are withdrawn at different levels. All materials, not of the desired grade, are taken to secondary separators where a supplementary grading in water takes place, the finer portions being returned to the primary vessel.—W. H. C.

Separating gases from liquids; Apparatus for automatically ——. A. C. McLaughlin, Palo Alto, Cal., Assignor to H. B. Truett, San Francisco, Cal. U.S. Pat. 1,059,060, April 15, 1913.

A suspended tank balanced by a counter-weight has a flexible inlet pipe for the mixture at the middle, a flexible outlet pipe for the gas at the top, and an outlet opening for the liquid at the bottom. The outlet for the liquid is controlled by a valve provided with a stem projecting below the bottom of the tank and engaging with the delivery trough for the liquid, so that when the tank descends owing to its additional weight at times when the supply of mixture is rapid, the valve opens more widely and allows the liquid to escape freely, and conversely, when the supply of mixture is limited, the valve opening is automatically reduced.—H. H.

Vapourisation and condensation of liquids in vacuo; Process and apparatus for the automatic and continuous ——. D. A. Guelfi dit R. Rochevillars. Fr. Pat. 450,634, Nov. 15, 1912.

An evaporating and a condensing chamber, maintained under vacuum, are immersed respectively in baths of liquid at temperatures slightly above and slightly below zero, so that a continuous evaporation and condensation of liquid takes place without ebullition and an exact interchange of heat between the heating and cooling liquids occurs. To obtain large heating and cooling surfaces the evaporator and condenser chambers are each formed with a series of concentric annular hollow projections immersed in the heating or cooling liquid.—H. H

Mixtures of heated vapours with products of combustion; Process and apparatus for the production of ——. C. D. McCourt and C. Ellis. Fr. Pat. 450,732, Nov. 19, 1912. Under Int. Conv., Jan 4, 1912.

The liquid is contained in a suitable vessel and vapourised by the heat developed by the surface combustion of a gaseous mixture, which is burned either in tubes filled with granular refractory material, and partly immersed in the liquid, or on the surface of a permeable plate, suspended above the surface of the liquid. The products of combustion are mixed with the vapour given off, and the latter becomes thereby superheated. The process may be applied to the distillation of heavy oils, fatty acids, etc.—W. H. C.

Calcining or treating granular materials; Process and apparatus for ——. C. D. McCourt. Fr. Pat. 450,733, Nov. 19, 1912. Under Int. Conv., Jan. 23, 1912.

The granular material is fed continuously into a vertical kiln, and a combustible gaseous mixture is injected into the lower part of the material in the kiln, at a rate greater than the rate of propagation of flame, so that surface combustion takes place among the particles of granular material. The treated material is withdrawn from the bottom of the kiln.—W. H. C.

Mixing and homogenising liquids; Process and apparatus for ——. F. M. Berberich. Fr. Pat. 451,028, Nov. 26, 1912. Under Int. Conv., Dec. 2, 1911.

The liquids are forced under pressure through a series of stepped passages, the horizontal portions of which are prolonged past the vertical portions so as to form a series of *cul-de-sacs* which produce counter-currents of liquid acting in opposition to the main streams, thus giving rise to a maximum of friction between the particles of liquid. The liquids to be mixed enter the stepped passages from two inlets regulated by conical stop-valves and inclined towards one another in such a manner that a preliminary admixture of liquid occurs before the latter enters the stepped passages.—H. H.

Oil; Separation of emulsified —— from water of condensation. E. Hutin. Fr. Pat. 451,202, Nov. 30, 1912.

The water of condensation is made to traverse a bed of iron oxide or iron salts (or salts of another metal such as copper or manganese) and is then treated with a suitable quantity of lime water to precipitate the oil, and decanted from the precipitate.—C. A. M.

Glass carboys, etc., filled with caustic or poisonous liquids or liquids which evolve easily inflammable vapours; Process for emptying —— Aktienges. für Anilinfabrikation. Ger. Pat. 258,341, Oct. 3, 1911.

The emptying is effected by means of a siphon connected with an aspirator. The latter consists of two receptacles mounted one above the other in a frame and connected by means of a tube. The frame can be inverted. The upper receptacle is connected by means of a flexible tube with the siphon, and on opening suitable taps water flows from the upper into the lower receptacle and sets the siphon working. After inverting the frame the operation can be repeated.—A. S.

Separation of gases, vapours, hydrocarbons, and the like. G. A. M. Arnaud, Paris. Eng. Pat. 4808, Feb. 26, 1912.

See Fr. Pat. 438,195 of 1911; this J., 1912, 628.—T. F. B.

Separating gases and vapours including hydrocarbons; Apparatus for ——. G. A. M. Arnaud, Paris. Eng. Pat. 4809, Feb. 26, 1912.

See Fr. Pat. 438,196 of 1911; this J., 1912, 628.—T. F. B.

Films of liquids or semi-liquids; Apparatus adapted to spread and smooth —— upon a cooling surface for solidification. C. Christensen, Copenhagen, and O. Vang-Lauridsen, Vangen, Denmark. Eng. Pat. 20,568, Sept. 9, 1912.

See Fr. Pat. 449,269 of 1912; this J., 1913, 476.—T. F. B.

Kiln. E. R. Sutcliffe, Leigh. U.S. Pat. 1,061,952, May 13, 1913.

See Eng. Pat. 11,309 of 1911; this J., 1912, 16.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Determination of water in ——. P. L. Teed. Inst. Min. and Met., May, 1913. [Advance proof.]

A weighed sample of the 80-mesh coal is placed in a 100 c.c. pressure flask connected with a weighed U-tube containing quicklime, the latter being in the form of lumps in the limb nearer to the flask and in fine powder in the other limb. The U-tube is connected—through a sulphuric acid drying tube and an intervening tap—with a Sprengel water pump. A vacuum of about 700 mm. having been created in the flask, the latter is immersed in boiling water and the lime tube in a boiling aqueous solution of calcium or sodium chloride. At the end of about 30 minutes, the water and calcium chloride baths are removed, the apparatus disconnected from the pump and air slowly allowed to enter through the drying tube; the lime tube is then washed, dried, and re-weighed. The increase, it is stated, is due solely to water from the coal, no other volatile constituent of the latter being retained by the lime at the temperature employed; no carbon dioxide or phenol was evolved from any of the coals used by the author, but the lime tube was found to be attacked by the hot calcium chloride solution, necessitating a correction for the most accurate work. Excellent agreement was obtained as the result of triplicate determinations made upon various kinds of coal.—W. E. F. P.

Water formed by combustion of substances containing sulphur and nitrogen in the calorimetric bomb; Determination of ——. O. Rau. Z. anorg. Chem., 1913, **81**, 116—121.

The determination is combined with that of the calorific value, by employing a bomb provided with two tubulures and introducing sodium carbonate with the charge, so that the nitric acid and oxides of sulphur produced during combustion are fixed as sodium salts. When the determination of calorific value is completed, the bomb is placed in a paraffin bath and connected with weighed absorption apparatus, through which the contained gases are allowed slowly to escape; the bomb is then warmed to 110 C., and the water vapour swept into the absorption apparatus by a current of pure dry air. The acids formed are determined by subsequently rinsing out the contents of the bomb, titrating with $N/5$ hydrochloric acid and methyl orange (b c.c.), warming, adding 10 c.c. of $N/5$ barium chloride, drop by drop with shaking, and, after the barium sulphate has settled, 20 c.c. of $N/5$ sodium carbonate; then cooling the mixture, making up to 250 c.c., filtering through a dry filter, and titrating 200 c.c. of the filtrate with $N/5$ hydrochloric acid and methyl orange (c c.c.). The sulphur content is 0·004 (c—8) grm. and the nitric acid formed, using a grm. of sodium carbonate, corresponds to $14\left(\frac{a}{53}-\frac{b}{5000}-\frac{c-8}{4000}\right)$ grm. of nitrogen. If s grm. of sulphur and n grm. of nitrogen are oxidised and w grm. of water formed, the observed calorific value, using a grm. of sodium carbonate, must be reduced by $2·02s+0·65n+0·16a-0·004\ w$ kilo.-calories. This correction with 1 grm. of coal and 0·5 grm. of sodium carbonate amounts to about 1·5 per cent. of the calorific value.
—F. Sodn.

Water in the volatile products resulting from the distillation of fuels; Determination of ——. G. Lambris. Z. anorg. Chem., 1913, **81**, 24—39.

Phosphorus pentoxide may be used for the determination of water in vapours containing also benzene, toluene, xylene, ammonia, pyridine, phenol, naphthalene, sulphur dioxide, hydrogen sulphide, hydrogen cyanide, cyanogen, and illuminating gas, for by heating the absorbent to 150° C., besides water, only ammonia, pyridine, and phenol are retained, and these may be readily determined in the absorption product. For this purpose, the contents of the absorption tube, after weighing, are allowed to deliquesce in the air, and then water is added, the solution twice filtered through a hardened filter, made strongly alkaline and distilled; ammonia and pyridine are thus expelled and are collected in $N/10$ sulphuric acid. The residual liquor is treated with an excess of sulphuric acid and distilled in a current of steam, so as to remove the phenol, which is determined in the distillate by the bromine method in the usual way. The excess of acid in the solution containing ammonia and pyridine is titrated, using Congo red as indicator (in such manner as to match the purple colour produced by adding the same volume of indicator to a solution of ammonium sulphate which is exactly neutral to methyl orange), so as to determine the total base, and ammonium sulphate solution is then added, the liquid evaporated to dryness, and the residue heated for 15 minutes at 130° C. Pyridine is thus expelled and its amount is ascertained by titrating the liberated sulphuric acid in the residue (using Congo red as before); 94 per cent. of the pyridine is indicated. Where other pyridine bases are present, the residue must be heated for 30 minutes, and the proportion of base found (reckoned as pyridine) must be multiplied by 1·25.—F. Sodn.

Mine gases; Ignition of —— by the filaments of incandescent lamps. H. H. Clark and L. C. Ilsley. U.S. Bureau of Mines, Bull. 52, 1913.

Most of the experiments were made with a mixture of 91·4 per cent. of air and 8·6 per cent. of natural gas containing: CH_4 82, C_2H_6 16·4, N_2 1·5 per cent. and a trace of carbon dioxide. Tests were made with 1219 standard lamps and 234 miniature lamps. The naked filaments of all standard lamps, operated at rated voltage, will ignite the gaseous mixture used. All classes of standard carbon lamps will sometimes ignite the gas when the tips of the bulbs are broken off. The filament temperature of all classes of standard lamps, and of all but one class of miniature lamps, can be increased to such a degree that the lamps when smashed will ignite gas. When the bulbs of lamps burning at rated voltage were smashed the results showed that 55- and 100-volt lamps of all candle powers ignited gas under the conditions of the tests, and that 32- and 50-candle power 55-volt lamps invariably ignited gas. The 8-candle power 220-volt lamps gave no ignitions, and, in general, the percentage of ignitions obtained from lamps of given candle power decreased as the voltage increased. When the tips of the bulbs were broken the percentage of ignitions increased as the candle power rating increased, and decreased as the voltage rating increased. Although no class of lamps gave 100 per cent. ignitions all classes produced some ignitions.—G. W. McD.

Explosions which occurred at the Cadeby Main Colliery on Tuesday, July 9, 1912; Causes and circumstances attending the ——. R. A. S. Redmayne, H.M. Chief Inspector of Mines. [Cd. 6716.]

It is considered that the fire which originated some years previously in the neighbourhood of the fault had never been completely eradicated, but gave occasional evidence of its existence, and that, as the coal was worked off against the fault, a great cavity formed, both fire and cavity keeping pace with the extraction of the coal. An incipient explosion had occurred previously in January 1912. The condition of affairs on the night preceding the explosion provided just the combination of circumstances necessary to cause an explosion on a more extended scale, *i.e.*—the effective sealing off of the exit from the fire area, but the failure to seal off the inlet, allowed an accumulation of explosive mixture, and a vent for the consequent explosion. The manager's instructions for dealing with the situation were well conceived for effectually sealing off the affected area, but the inspector does not believe that these instructions were carried out in their entirety.—G. W. McD.

Methane; Synthesis of —— by catalysis. W. Ipatiew. J. prakt. Chem., 1913, **87**, 479—487.

No formation of methane could be detected when hydrogen at atmospheric pressure was led over sugar charcoal in presence of nickel oxide or reduced nickel or a mixture of reduced nickel and alumina, at temperatures between 460° and 650° C. By using high pressures, however, it was possible to synthesise methane in this way at 510°—

525° C., using as catalyst nickel oxide, copper oxide, tin oxide, or ferric oxide. For example with 3 grms. of nickel oxide at 510° C., 6·5 per cent. of methane was produced in 26 hours, and with 3 grms. of tin oxide at 515° C., 6·2 per cent. in 12 hours. The author regards the synthesis of methane as a combined oxidation and reduction catalysis, the metallic oxide of the catalyst being reduced to metal and oxidising the carbon to carbon dioxide, which is then reduced by hydrogen to methane and water; the water is decomposed by the reduced metal, with re-formation of hydrogen and the metallic oxide. It is suggested that in the experiments of Bone and Jerdan (this J., 1901, 696; see also Bone and Coward, this J., 1908, 1143), the union of carbon and hydrogen was due to the presence of a small quantity of water whereby the carbon was first oxidised. The interaction of carbon dioxide and hydrogen to form methane and water is shown to be reversible.—A. S.

Coking of coal at low temperatures. S. W. Parr and H. L. Olin. Bull. 60, Eng. Expt. Stat., Univ. of Illinois. U.S.A. Scient. Amer. Suppl., April 19, 1913, 252—255.

The authors' experiments were made in a small scale apparatus from which, after charging, all the air was expelled by means of steam, after which the necessary temperature (about 450° C.) was attained by means of superheated steam brought into direct contact with the coal. It has been shown previously (Parr and Francis, Bull. 24, Eng. Expt. Stat., Univ. of Illinois) that at this temperature steam has no chemical action on the coal. The yields of the different products were: coke, 75—80 per cent.; tar, nearly 8 per cent.; ammonia, 0·8 lb. per ton of coal; gas, about 0·5 cb. ft. per lb. of coal. The calorific value of the gas exceeds 1000 B.T.U. per cb. ft. An average sample contained, H_2S 3·2, CO_2 5·7, illuminants 8·3, CO 5·2, H_2 5·0, C_2H_6 14·4, CH_4 51·4, and N_2 5·7 per cent. The tar yielded on distillation: 20°—100° C., 10·5; 100°—200° C., 29·1; 200°—240° C., 29·8; 240°—275° C., 5·5; coke residue 21·3 per cent. The tar oils are unsaturated, the lighter fraction having an iodine absorption value of 165. The coking properties of coal are considered to be due to unsaturated substances which melt before they decompose, and it is stated that coal which has been exposed under oxidising conditions, loses its coking properties, presumably owing to oxidation of the unsaturated substances. It is stated that the exclusion of oxygen is an essential condition for obtaining coke of good texture in low-temperature carbonisation, but in order to obtain firm blocks, pressure must be applied during the process. The bituminous Illinois coals appear to contain a superfluous amount of the substances which act as binding agents in the coking process, and it is possible to obtain a coke of good texture by carbonising a mixture of the raw coal with a large proportion of material which has already been coked and then reduced to breeze. Another binding agent (preferably molasses) may be used instead of or in addition to the raw coal. —A. S.

Mineral oils of high boiling point; Composition of ——. J. Marcusson. Chem.-Zeit., 1913, **37**, 533—535, 550—553.

(1) *Viscous constituents*:—It has already been shown (this J., 1911, 943) that the most viscous constituents of mineral oils of high boiling point are those not reacting with sulphuric acid and formalin (this J., 1904, 1082; 1911, 201). Further experiments have been made to ascertain whether these constituents are paraffins, olefines, naphthenes or polynaphthenes. The conclusion is drawn that condensed naphthenes (polynaphthenes) must be regarded as the main cause of the viscosity of heavy machine (especially Russian) oils. Besides these hydrocarbons, all light-coloured machine oils contain viscous oxygenated compounds, of a resinous nature, which may be extracted from the oil by means of 70 per cent. alcohol. (2) *Composition of "liquid paraffin."* The so-called "liquid paraffin" of the German Pharmacopœia is a colourless oil, obtained from the heavy fractions of petroleum oil by successive treatments with strong and fuming sulphuric acids. This destroys all unsaturated constituents and leaves a mixture of saturated hydrocarbons resembling melted paraffin wax. A commercial sample gave the following values:—Sp. gr. at 20°/4° C., 0·8827; refractive index at 20° C., 1·4797; viscosity at 20° C., 23·0° (Engler); and $[\alpha]_D = +2·13°$. It contained C 86·74 and H 13·43 per cent., but its physical properties indicated the presence of condensed naphthenes. The optically active constituents consisted chiefly of polynaphthenes. (3) *Reactions with aluminium chloride*:—The optically active constituents of "liquid paraffin" were rendered inactive by treatment with aluminium chloride either alone or in the presence of carbon bisulphide. The explanation of the reactions occurring during such treatment, is that the most viscous constituents of the "liquid paraffin" are converted into double compounds with aluminium chloride. These compounds are partially soluble in carbon bisulphide and when exposed to the further action of the aluminium chloride, undergo other changes such as condensation and resinification. In consequence of these secondary reactions the solvent dissolves more of the double compound, which in turn undergoes further decomposition, until the whole of the viscous and optically active constituents has been decomposed. Hydrocarbons of high molecular weight are more readily attacked (in carbon bisulphide) by aluminium chloride than hydrocarbons of lower molecular weight. For example, whilst benzene gives only a slight colouration, even on heating, toluene gives a slight brown colouration, xylene a deep brown, and naphthalene and anthracene blacken the solution in the cold.—C. A. M.

Lamp oil and varnish spirits (turpentine oil substitutes); Tests distinguishing between ——. D. Holde. Chem.-Zeit., 1913, 37, 610—611.

The relationship between the temperatures of the boiling liquid and vapours above it affords a means of distinguishing between petroleum lamp oils and varnish spirits (lac-benzine). In the case of varnish spirits and "safety" petroleum oils the difference between the two temperatures at the beginning of the boiling usually varied from 5° to 14° C. with a maximum of 18° C., whilst with lamp oils it ranged from 30° to 40° C. On continuing the distillation it gradually fell—*e.g.*, after distillation of 20 per cent. to 4° to 15° C. with varnish spirits and "safety" petroleum oil, and to 21° to 44° C. with lamp oils. "Safety" petroleum oils may be distinguished from varnish spirits not only by their very high flash-point, but also by the difference in their solubility in alcohol. All the varnish spirits examined were completely soluble in three times their volume of 96 per cent. alcohol, whilst lamp oils and "safety" oils gave turbid liquids under these conditions. The lower the b. pt. of petroleum hydrocarbons the greater their solubility in alcohol.—C. A. M.

Westphalian coke oven by-products. Engineer, May 23, 1913. [T.R.]

The manufacture of coke at the pits in the Ruhr district, Rhenish-Westphalia, in 1911, equalled the total output of coke at British collieries and gasworks combined in the same year, and when the British figures are available for 1912 it will be found that the Westphalian pits alone have already surpassed them by a considerable tonnage. As a result of the increase in the output of coke from the by-product ovens in the Ruhr, an expansion is noticeable in the production of gas and by-products. The production of sulphate of ammonia, which only reached 53,000 tons in Westphalia, in 1903, had risen to 236,000 tons in 1911. In the same period the output of coal tar increased from 132,000 tons to 569,000 tons, whilst that of benzoline advanced from 40,000 tons to 70,000 tons in 1911 and 84,000 tons in 1912, and is being further developed by the installation of further plant. The production of lighting gas from the coke ovens advanced from 393,000 cubic metres in 1903 to 84,594,000 cubic metres in 1911, the gas being largely supplied to towns. Similarly the output of electrical energy at the Ruhr pits has been developed from 58,000,000 kilowatt-hours in 1906, to 592,000,000 kilowatt-hours in 1911, and further extensions were made in 1912. Most of the electrical energy is utilised for the collieries and the auxiliary plant, although an increasing quantity is disposed of to third parties.

Sampling coal deliveries, and types of Government specifications for the purchase of coal. G. S. Pope. Bureau of Mines. Dept. of the Interior, U.S.A. Bulletin 63. 1913. Washington, Govt. Printing Office.

Methods and apparatus used in Petroleum testing. Viscometry. W. F. Higgins. *See* London Section, p. 568.

Patents.

Peat and the like ; Treatment of [extracting water from] ——. J. E. Jameson and O. H. Valpy, London, and E. A. Buckle, Manchester. Eng. Pat. 10,370, May 1, 1912.

An electric current is passed through a pulp of the disintegrated material, at 100°—120° C., under a pressure of about 10 atmospheres. It is claimed that the hydrocellulose of the peat is decomposed, the pulp being thus rendered amenable to rapid filtration under slight pressure. —W. E. F. P.

Combustible suitable for automobiles, motors, etc. ; Process for the manufacture of a ——. C. E. H. Medberg and A. F. Medberger. Fr. Pat. 451,134, Nov. 23, 1912.

Ten litres of mineral oil are mixed with ten litres of "industrial sulphite alcohol for motors" and 25 grms. of camphor or 200 grms. of naphthalene are added. If necessary 10 grms. of potassium chlorate are also added. The mixture is allowed to settle, filtered, and about 20 per cent. of benzol or petrol added.—W. H. C.

Combustible for explosion motors ; Process for the preparation of a ——. L. Stahn. Fr. Pat. 451,301, Dec. 3, 1912.

The inflammability and volatility of motor spirit is increased by adding to it, from 1·5 to 4 per cent. of a product prepared as follows :—15 parts of resin, 5 parts of lead acetate, and 10 parts of petroleum ether are dissolved in 100 parts of 95 per cent. alcohol and the mixture is distilled at 100° C. A small quantity of acetone is added to the distillate, which is then mixed with the motor spirit. The greater the specific gravity of the motor spirit, the more of the product is added.—W. H. C.

Coke ovens ; Process and arrangement for discharging vertical ——. Stettiner Chamotte-Fabrik Act.-Ges. vorm. Didier. Fr. Pat. 451,249, Dec. 2, 1912. Under Int. Conv., July 22, 1912.

The stopper is first lowered vertically till clear of the oven, by a ram supported on a travelling carriage, which runs on a tramway beneath the ovens. As soon as it is clear, the stopper is tilted sideways on to a small carriage and moved away sideways, allowing the coke to fall out into the coke truck.—W. H. C.

Gas producers ; Rotary grate for ——. H. Rehman, Düsseldorf. Eng. Pat. 5108, Feb. 28, 1913. Under Int. Conv., Sept. 24, 1912. Addition to Eng. Pat. 10,483, May 6, 1907.

Each outer cone of the grate described in the chief patent is connected with the middle cone by a bridge in the form of a saddle-roof, only the hindmost wall of each bridge (with regard to the direction of rotation) being provided with openings. The grate is thus rendered suitable for use with briquetted brown coal or with fuel containing slag-forming mineral matter.—W. E. F. P.

Producing gas ; Apparatus for ——. H. L. Doherty, New York. U.S. Pat. 1,060,171, April 29, 1913.

The apparatus consists of a furnace chamber for heating the retorts, which is fed with preheated gas and air. The preheating is effected in a regenerator superimposed on the furnace chamber, and provided with adjacent, separate flues for the air, the gaseous fuel, and the waste gases. The latter serves to preheat both the incoming air and gas.—W. H. C.

Gas ; Method of producing ——. J. N. Alsop, Assignor to Alsop Electrical Co., Owensboro, Ky. U.S. Pat. 1,060,410, April 29, 1913.

Air is subjected to the action of an electric arc, and whilst in a state of ionisation is brought into contact with the vapour of a vegetable organic substance.—W. H. C.

Gas-producing oven. A. Gohmann, Assignor to Stettiner Chamotte-Fabr. A.-G. vorm. Didier, Stettin, Germany. U.S. Pat. 1,060,837, May 6, 1913.

The oven is provided with chambers, the partitions between which each contain two vertical series of heating flues, superposed longitudinally, provided with air inlets, and with two sets of gas-supply channels in the wall between the heating flues and leading to the latter. Each set of heating flues is provided with a gas-distributing chest, sub-divided by a partition into two compartments, and connected with one of the sets of gas-supply channels. Gas-regulating valves are removable from the chests lengthwise of the gas channels, so that the latter are accessible from the end of the oven after removal of the valves. The outlets from the gas channels to the heating flues are located at different distances from the air inlets of the flues, and are made of different heights, increasing toward the outlets of the heating flues so as to secure an increasingly better mixture of the gas and air, as the amount of air admixed with the combustion products diminishes. Each individual heating flue is also provided with a number of fuel inlets, arranged at different distances from the respective air inlets and from the ends of the oven. The outlets for the products of combustion are farther away from the air inlets than the last fuel inlets, so that the combustion gases produced at the first fuel inlets are compelled to travel past all the other fuel inlets of the same heating flue before reaching the outlets. Upright collecting channels are provided into which the combustion gases pass directly from each of the several heating flues.—B. N.

Ammonia from the products of the destructive distillation of coal or the like ; Direct recovery of ——. C. Still, Recklinghausen, Germany. Eng. Pat. 28,072, Dec. 5, 1912. Under Int. Conv., Dec. 6, 1911.

The hot gases are introduced at about 100° C. into the bottom of a cooling column, up which they flow and meet a downward spray of cooling liquor, maintained at about 25° C. The gases are thereby cooled to about 35° C. and the cooling liquor, containing all the tar and some condensed water, becomes heated to about 90° C. and flows by way of a seal-pot into a hot water reservoir. The gases, cooled to 35° C., enter a tubular surface condenser, and are cooled to about 20° C., producing a certain amount of condensed water of 25° C., which flows by way of a seal-pot into a cold water reservoir. The gases at 20° C. then pass into a re-heating column, similar to the first column, where they meet a counter-current of water at 90° C., which is pumped up from the first mentioned hot water reservoir ; the gases are thereby heated to about 80° C., at which temperature they issue, free from tar and condensable impurities, into a saturator, and the re-heating liquor is cooled to about 25° C. and flows by way of a seal-pot into a cold water reservoir, from which a pump draws the cooling liquor, which is supplied to the first cooling column. A certain proportion of the liquor, collected in the hot water reservoir, is preferably withdrawn and introduced into the hydraulic main of the coke ovens, or the like, where it is evaporated by the heat of the hot crude gases. By thus increasing the amount of aqueous vapour carried by the gases, the development of the necessary amount of heat in the first column is ensured. —O. R.

Dry purification of [blast-furnace] gases ; Process and apparatus for the ——. A. Stolte. Fr. Pat. 450,957, Nov. 23, 1912.

The apparatus consists of three parts, a refrigerator in which the temperature of the gas is reduced to a temperature considerably below its saturation point, and where it is intimately mixed with a finely-divided spray of water,

a heat interchanger in which the hot incoming gas is cooled, and the previously cooled and moistened gas coming from the refrigerator is reheated, and lastly a filter chamber where the reheated gas is passed through filter bags to retain the last particles of impurity. The gases pass from the downcomer of the blast-furnace, first through the heat interchanger, then through the refrigerator, and back through the heat interchanger to the filter.
—W. H. C.

Bituminous oil, oil compounds, and other products from sand, rock and other material; Apparatus for extracting ——. S. R. Murray and G. E. McDermand, Assignors to The Rocky Mountain Asphalt Mining and Oil Refining Co., Denver, Colo. U.S. Pat. 1,060,010, April 29, 1913.

The material is placed upon a grid extending across the lower part of a vertical retort. The space below the grid is heated by steam coils or in any other suitable way, and the vapours given off are passed through a condenser and the condensed liquid received in a store tank from which a regulated portion is run back into the lower compartment of the retort.—W. H. C.

Chamber ovens; Heating of regenerative ——, *especially such as are suitable for the manufacture of coke or gas.* N. Lengersdorff, Bunzlau, Silesia. Eng. Pat. 19,812, Aug. 30, 1912.

See Ger. Pat. 254,121 of 1910; this J., 1913, 412.
—W. E. F. P.

Gas producers; Fuel feeding apparatus for ——. E. Pineau, Nantes, France. Eng. Pat. 13,229, June 5, 1912. Under Int. Conv., June 6, 1911.

See Fr. Pat. 444,620 of 1912; this J., 1912, 1172.—T. F. B.

Gas-producer system. G. Akerlund, Assignor to Standard Gas Power Co., Atlanta, Ga. U.S. Pat. 1,060,807, May 6, 1913.

See Fr. Pat. 441,049 of 1912; this J., 1912, 806.—T. F. B.

Gases or fuels; Process for the recovery of by-products from ——. A. Rottmann, Assignor to Dr. C. Otto und Co. Ges. m. b. H., Bochum, Germany. U.S. Pat. 1,061,949, May 13, 1913.

See Fr. Pat. 445,402 of 1912; this J., 1913, 13.—T. F. B.

Flame; Means for preventing the backward propagation of ——. A. C. Jonides, jun., London. U.S. Pat. 1,061,847, May 13, 1913.

See Eng. Pat. 12,346 of 1912; this J., 1913, 412.—T. F. B.

Paraffins, particularly ozokerite-like hydrocarbons; Process for the separation of solid —— *from mineral oil residues, and viscous or semi-liquid natural products.* J. Tanne, Rozniatow, Austria, and G. Oberländer, Berlin. Eng. Pat. 1664, Jan. 20, 1912. Under Int. Conv., June 2, 1911.

See Fr. Pat. 439,175 of 1912; this J., 1912, 633.—T. F. B.

Hydrocarbon liquids; Methods of purifying ——. T. S. Hamilton, Kansas City, U.S.A. Eng. Pat. 9463, April 22, 1912. Under Int. Conv., April 22, 1911.

See U.S. Pat. 1,018,971 of 1912; this J., 1912, 324.—T. F. B.

Recovery of sulphur from mixtures [*e.g. spent oxide*] *containing tarry matters.* Eng. Pat. 8097. *See* VII.

Preparation of solutions of alkali sulphides or polysulphides. Ger. Pat. 258,249. *See* VII.

Apparatus for testing the consistency of bitumen, tar, and like liquids. Eng. Pat. 9603. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Electric incandescence filaments or bodies; Manufacture of ——. F. Hansen and W. F. Mohr, London. Eng. Pat. 9941, April 26, 1912.

"A compound of boron and tungsten" is used as initial material for the production of filaments the strength and electrical resistance of which are stated to be superior to those of pure tungsten filaments. In the preparation of the compound, tungsten trioxide, saturated with a hot aqueous solution of boric anhydride, is dried, heated to 700° C. and reduced by heating to 1100° C. with zinc dust; the excess of zinc having been removed by means of hydrochloric acid, the washed and dried residue is made into a paste with collodion and extruded from dies in the ordinary manner.—W. E. F. P.

Electrodes for arc lamps. A. Blondel, Paris. Eng. Pat. 14,741, June 24, 1912.

To ensure convexity at the end during use, the carbon-paste electrode is provided with a central core less mineralised than the outer portion, or containing mineral matter less volatile than that of the latter. For the purpose of increasing or modifying the light produced, the inner zone of the electrode may be provided with one or more suitably mineralised "wicks" or cores.—W. E. F. P.

Electrodes; Arc lamp ——. The British Thomson-Houston Co. Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,689, Aug. 14, 1912.

Electrodes (of the "flaming" type) composed of carbon, an earthy titano-fluoride such as that of calcium, cerium or barium, and an alkali titano-fluoride.—W. E. F. P.

Mantles; Manufacture of ——, *for use in incandescence lighting by gas, hydrocarbons and the like.* C. L. Colas, Paris. Eng. Pat. 25,360, Nov. 5, 1912. Under Int. Conv., April 25, 1912.

A small quantity (3—5 per cent.) of finely divided kaolin is suspended in the solution of rare-earth salts with which the supporting fabric of the mantles is impregnated, by which means, it is claimed, the mantles produced have a porcelain-like appearance and greatly increased strength.
—W. E. F. P.

Electrode [*for arc lamps*]. C. R. Krueger, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,061,758, May 13, 1913.

See Eng. Pat. 27,620 of 1911; this J., 1913, 14.—T. F. B.

Treatment [*Destructive distillation*] *of sewage sludge.* Eng. Pat. 24,636. *See* XIXb.

III.—TAR AND TAR PRODUCTS.

Phenol; Effect of temperature, acid concentration, and time on the bromination of —— *for quantitative determinations.* L. V. Redman, A. J. Weith, and F. P. Brock. J. Ind. Eng. Chem., 1913, 5, 389—393.

Rhodes and Redman (J. Ind. Eng. Chem., 1912, 4, 655) have shown that if the concentration of the phenol be about *N*/100, the reaction with bromine (hypobromite solution or a bromide-bromate mixture) is complete in about 1 minute with thorough shaking, and only tribromophenol is formed as a white flocculent precipitate. Experiments on the effects of varying experimental conditions on the reaction have shown that for the complete bromination of phenol in 1 minute at 22° C. in a solution containing free acid in a concentration of 0·8*N*, a 2 per cent. excess of free bromine is sufficient. In making a determination, 15 c.c. of the phenol solution (about 0·1*N*) are added to 50 c.c. of water and 5 c.c. of hydrochloric acid of sp. gr. 1·2 in a 500 c.c. stoppered bottle, and a 0·1*N* bromide-bromate solution (2·76 grms. of potassium bromate and 15 grms. of potassium bromide per litre) added, with agitation, until the solution has a permanent slight yellow colour. The temperature should be about 22° C. The solution is shaken continuously for 1 minute and then again for another minute after addition of 0·5 c.c. of a 20 per cent. solution of potassium iodide, and the liberated iodine titrated with 0·1*N* thiosulphate (24·8 grms. per litre). It is stated that in this way phenol may be determined to within 0·00005 grm.—A. S.

Patents.

Phenols from monochloro substitution products of aromatic hydrocarbons; Manufacture of monohydric ——. K. H. Meyer and F. Bergius. Fr. Pat. 450,305, Nov. 7, 1912. Under Int. Conv., Nov. 8, 1911.

Monochloro derivatives of aromatic hydrocarbons can be converted into the corresponding phenols by heating them with water at high temperatures and pressures. The yields are said to be higher and the reaction more rapid when an alkali hydroxide is added to combine with the hydrochloric acid. For example, if 100 parts of chlorobenzene are heated with 400 parts of water for 10 hours under pressure, at 300° C.; the resulting solution contains about 5 parts of phenol, and the remainder of the chlorobenzene can be submitted to a further treatment. Using a 10 per cent. solution of caustic soda in place of the water, a yield of phenol equivalent to 70 per cent. of the chlorobenzene is obtained, together with about 10 per cent. of an oil of b. pt. 240° C.—T. F. B.

β-Nitramines of anthraquinone; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 450,865, Nov. 4, 1912.

The β-nitramines of anthraquinone are readily obtained by the action of oxidising agents on β-isodiazotates of anthraquinone. They cannot be prepared by treating β-diazo compounds of anthraquinone with oxidising agents. *Example.* Ten parts of β-diazoanthraquinone sulphate are added to 50 parts of caustic soda solution (35° B., sp. gr. 1·32) and the mixture is heated to 100° C. for two hours; the resulting isodiazotate solution is diluted with 1000 parts of water and heated for a short time with the necessary quantity of sodium hypochlorite or potassium ferricyanide, until the diazo compound has disappeared. The sodium salt of β-nitraminoanthraquinone crystallises from the solution on cooling, and can be converted into the free nitramine by treatment with dilute hydrochloric or acetic acid. The β-nitramine is a pale yellow powder, which detonates at 206° C.; it is much less soluble in most organic solvents than the α-nitramine.—T. F. B.

Phenolcarboxylic acids; Process for preparing ——. J. Zeltner and M. Landau. Ger. Pat. 258,887, Jan. 10, 1912.

Phenols or their homologues or substitution products are treated with carbon tetrachloride and alkali hydroxide solutions in presence of copper or a copper compound. It is stated that one or more carboxyl groups may be introduced into the phenol by this method, and that the process may be carried out in open vessels, without the use of high pressures, and in absence of alcohol.—T.F.B.

Phenols; Process for the manufacture of monovalent —— from monochlor-substitution products of aromatic hydrocarbons. K. H. Meyer, Munich, and F. Bergius, Hanover, Germany. Eng. Pat. 25,555, Nov. 7, 1912. Under Int. Conv., Nov. 8, 1911.

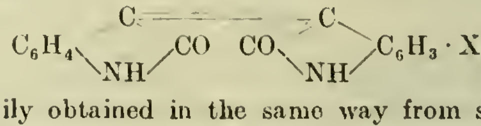
See Fr. Pat. 450,305 of 1912; preceding.—T. F. B.

Apparatus for testing the consistency of bitumen, tar, and like liquids. Eng. Pat. 9603. *See* XXIII.

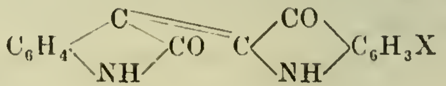
IV.—COLOURING MATTERS AND DYES.

Indigoid group; Syntheses in the ——. A. Wahl and P. Bagard. Comptes rend., 1913, **156**, 1382—1385.

Isoindogenides have been shown to result when oxindole is acted upon by cyclic aldehydes, isatin or isatin chloride (this J., 1909, 420, 831); thus oxindole and isatin in acetic acid solution condense in the presence of hydrochloric acid to give isoindigotin. Substituted isoindigotins:



are readily obtained in the same way from substituted isatins, monobromo, dibromo, methyl and nitro derivatives having been prepared. The reaction gives colourless products when conducted in an alcoholic medium in the presence of sodium methoxide. In sulphuric acid isoindigotindisulphonic acid is obtained, which, however, is more readily obtained by direct sulphonation. The salts of this compound are described; the sodium salt dyes wool in reddish orange shades. In benzene solution oxindole condenses with isatin chloride to give indirubin, identical with that obtained by Baeyer from indoxyl and isatin. Substituted isatins, however, give derivatives of isoindirubin for which is suggested the formula:



Isomeric bromo, dibromo and nitro indirubins have been prepared. The methyl derivative appears to be identical with that obtained from isatin and *p*-methylindoxylic acid or *p*-methylindoxyl (Ger. Pat. 108,128). The isomerides show no appreciable difference in tinctorial properties.—J. B.

Indanthrene; 1·2-Diaminoanthraquinone and the synthesis of —— therefrom. E. Terres. Ber., 1913, **46**, 1634—1647.

The blue vat dyestuff obtained by acting on 1·2-diaminoanthraquinone with 1·2-anthraquinone, oxidising the product thus obtained and then reducing the azine (see Fr. Pat. 355,331; this J., 1905, 1223) is shown to be identical with Indanthrene. The pure 1·2-diamine was prepared from 1-nitro-2-methylanthraquinone by oxidising to the acid, and converting this into the acid amide, from which the 1-nitro-2-amino compound was obtained by the action of bromine and caustic potash and finally the 1·2-diamine by reduction. Substances analogous to anthro-anthraquinoneazine obtained by condensing 1·2-diaminoanthraquinone with oxalic ester, benzil, 1·2-naphthoquinone and phenanthraquinone are described. The azine from oxalic ester gives a soluble vat but is without affinity for the fibre; the others give insoluble products with hydrosulphite. The reduction of 2-methylanthraquinonyl diazonium sulphate to 2-methylanthraquinone by means of potassium-cuprous cyanide is described.—J. B.

Dyestuffs; Double —— from diarylparaffins. J. v. Braun and O. Koscielski. Ber., 1913, **46**, 1526—1529.

In order to throw light on the question of how far the repetition in the same molecule of a given colour-producing complex affects the tone and intensity of a dyestuff, the authors have prepared double dyestuffs from the bases tetra-amino-diphenylhexane,

$$(NH_2)_2 \cdot C_6H_3 \cdot (CH_2)_6 \cdot C_6H_3(NH_2)_2,$$

and tetra-amino-2.7-diphenyloctane,

$$(NH_2)_2 \cdot C_6H_3 \cdot CH(CH_3) \cdot (CH_2)_4 \cdot CH(CH_3) \cdot C_6H_3(NH_2)_2.$$

Both bases give with nitrous acid the same shade and intensity as a solution of 2·4-toluylenediamine of the same concentration. Similarly the double Chrysoidines prepared from these bases by the action of diazobenzene hardly differ from the Chrysoidine given by 2·4-toluylenediamine. Triphenylmethane dyestuffs were prepared by condensing the double bases with Michler's hydrol, acetylating the amino groups, oxidising and then hydrolysing. These have exactly the same green shade as the analogous dyestuff from 2·4-toluylenediamine. Just in the same way the indamines prepared by condensing the two double bases with nitrosodimethylaniline show no difference in shade from ordinary Toluylene Blue, and the azines derived therefrom by boiling are only very slightly more violet in tone than Witt's Toluylene Red.—J. B.

Patents.

Monoazo dyestuffs and their production. H. Levinstein, and Levinstein, Ltd., Blackley. Eng. Pat. 9574, April 23, 1912.

The diazo derivative of a mono- or dinitro-*o*-aminophenol is combined in alkaline solution with a dinitrophenyl-β-aminohydroxynaphthalenesulphonic acid. In general the dyestuffs dye wool from acid baths brown shades which are very fast to alkalis, and also to light and to milling, even without after-treatment with chromium compounds. The dyestuffs similarly prepared from unsubstituted β-aminohydroxynaphthalenesulphonic acids also dye wool brown shades, but the dyeings are not fast to alkali. —T. F. B.

Azo colouring matters, suitable for use in the form of their lakes; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,147, June 28, 1912.

Azo dyestuffs especially suitable for use in the form of lakes, are obtained by combining unsulphonated diazo compounds with monochlorobenzoyl-1.8-aminonaphthol-4.6-disulphonic acid or with *o.p*-dichlorobenzoyl-1.8-aminonaphthol-4.6-disulphonic acid. The lakes, particularly the barium lakes, are generally yellower and more brilliant than those obtained from the non-chlorinated compounds. The preparation of the dyestuff from *m*-chloro-aniline and the dichlorobenzoyl-1.8-aminonaphthol-4.6-disulphonic acid is described in detail; this dyestuff forms brilliant bluish-red lakes with alkaline-earth salts.—T. F. B.

Polyazo dyestuffs; Substantive ——. Badische Anilin und Soda Fabrik. Fr. Pat. 450,713, Nov. 18, 1912. Under Int. Conv., Sept. 19, 1912.

The tetrazo derivative of a *p*-diamine is combined with one mol. of phenol-*m*-sulphonic acid or a derivative thereof containing a free *p*-position as regards the hydroxyl group, and with one mol. of another substance suitable for azo dyestuff formation, *e.g.*, a phenol, aminonaphtholsulphonic acid, or a monoazo dyestuff derived from 1.8-aminonaphtholmono- or disulphonic acid. The products are said to be distinguished by their great purity of shade on cotton and especially on paper which contains no wood pulp. The dyestuff from benzidine, phenol-*m*-sulphonic acid, and 2.8-aminonaphthol-6-sulphonic acid is red, and that from *o*-tolidine, phenol-*m*-sulphonic acid, and *p*-nitrobenzene-azo-1.8-aminonaphthol-3.6-disulphonic acid is green.—T. F. B.

Dyestuffs of the anthracene series. Badische Anilin und Soda Fabrik. Fr. Pat. 451,216, Nov. 30, 1912. Under Int. Conv., Aug. 2, 1912.

The dianthraquinonyl derivatives described in Fr. Pat. 357,239 (this J., 1906, 66) are treated with nitrating agents in presence of a suitable organic diluent, and the nitro groups reduced. The products dye vegetable fibres bright green shades from the vat. Dyestuffs giving faster shades may be obtained by introducing into the amino group acidyl (benzoyl, acetyl) aryl, or alkyl groups. When fibres dyed with the above nitro or amino compounds are treated with oxidising agents, in neutral, acid, or alkaline solution, very fast brown shades are produced. Bleaching powder, bichromates, persulphates, or nitrous acid may be used as oxidising agents; when nitrous acid is used, the shades may be further modified by treatment with a phenol or an amine.—T. F. B.

Dibenzanthrone derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 259,370 April 20, 1912.

Dibenzanthrone is treated with an oxidising agent, and the resulting product is reduced. The substances thus obtained have only feeble affinity for the fibre and are not fast, but may be used as intermediate products for preparing vat dyestuffs.—T. F. B.

Anthracene series; Manufacture of compounds and colouring matters of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 14,498, June 20, 1912.

See Ger. Pat. 259,370 of 1912; preceding. The products yield vat dyestuffs on heating either alone, or with a solvent or suspending agent, with or without a condensing agent.—T. F. B.

1.2.4-Purpurine-3-carboxylic acid; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat 29,506, Dec. 21, 1912. Under Int. Conv., Dec. 27, 1911.

A 1.2.4-purpurin-3-carboxylic acid, identical with the pseudopurpurin, to which the Turkey-red lake obtained from madder is said to owe its greater fastness compared with that from synthetic alizarin, can be obtained by treating 1.2-alizarin-3-carboxylic acid with oxidising agents, such as manganese dioxide and sulphuric acid. The dry product is a red powder, easily soluble in hot water; when crystallised from chloroform it is obtained in the form of red leaflets, which melt at 222°—224° C., with evolution of carbon dioxide, purpurin being formed.—T. F. B.

Sulphide dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 450,420, Nov. 11, 1912. Under Int. Conv., Nov. 17, 1911.

Sulphide dyestuffs which are very soluble in water, and give pure blue shades on cotton very fast to washing, are obtained by heating with alkali polysulphides the indophenols or leuco-indophenols from diarylaminocarboxylic acids having a free *p*-position in the aryl nucleus which does not contain the carboxyl group, and nitrosophenols or their derivatives or analogues. The dyestuff from diphenylamine-*o*-carboxylic acid and nitrosophenol is greenish-blue.—T. F. B.

Azo dyestuffs; Process for preparing ——. Fabriques de Couleurs d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat 450,866, Nov. 4, 1912. Under Int. Conv., Jan. 31, 1912.

Many azo dyestuffs containing phenolic groupings are so sensitive to alkalis as to be inapplicable to dyeing. This has been remedied by alkylating the hydroxyl groups, and it is now found that the same result is obtained by replacing the phenolic hydrogen by an arylsulphonic group. If the original dyestuffs are acid wool dyestuffs, this property is not altered by the process, but direct cotton dyestuffs generally lose to some extent their affinity for cotton; a notable exception, however, is the arylsulpho derivative of nitrosostilbenedisulphonic acid-azo-phenol, which has an affinity for cotton fully equal to that of the alkyl derivative. The introduction of the arylsulphonic group is best effected by dissolving or suspending the dyestuff in dilute caustic potash or soda solution, and gradually adding an aryl sulphochloride, with constant stirring, until a sample of the product shows no sensitiveness to alkali. The resulting dyestuffs are generally similar in shade to the original colours, and are suitable for use in dyeing silk and wool; the shades produced are faster to fulling and washing than those obtained with the corresponding alkyloxy derivatives. —T. F. B.

Disazo dyestuffs and process for making them. Manuf. de Mat. Col. anc. L. Durand, Huguenin et Cie. Fr. Pat. 451,169, Nov. 28, 1912. Under Int. Conv., Aug. 30, 1912.

The tetrazo compound of benzidine-2.2′-disulphonic acid is combined with salicylic acid, *o*-cresotinic acid, or other *o*-hydroxycarboxylic acid. Yellow dyestuffs are obtained, especially suitable for printing on cotton on account of their great solubility and fastness to light, soaping, and alkalis. Very bright shades are obtained by dyeing on chrome-mordanted wool.—T. F. B.

Monoazo dyestuffs especially suitable for making lakes ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 258,654, May 19, 1912. Addition to Ger. Pat. 256,999 (see Eng. Pat. 6379 of 1912 ; this J., 1912, 635).

A DIAZO compound of the benzene series which does not contain a negative substituent, is combined with an arylamide of 2.3-hydroxynaphthoic acid which contains in the aryl nucleus at least one negative group other than a sulpho-group.—T. F. B.

Dyestuff sensitive to alkalis ; Process for preparing a red-violet ——. M. Lange. Ger. Pat. 258,895, Oct. 20, 1912.

NITROSO-R-ACID, obtained by converting 2.3.6-naphthol-disulphonic acid into its nitroso derivative, is treated with a cyanide. In the form of its acid salt the product is reddish violet ; it is extremely sensitive to alkalis, by which it is converted into a deep greenish-blue. It can be converted into other dyestuffs, *e.g.*, with nitrous acid it furnishes a normal diazo compound.—T. F. B.

Dianthraquinonyl sulphides ; Process for preparing amino-substituted ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 259,560, Nov. 11, 1909. Addition to Ger. Pat. 249,225 (see this J., 1912, 766).

THE condensation products obtained by interaction of an aminohalogenanthraquinone and a salt of an anthraquinonylmercaptan, can be used as vat dyestuffs, and can also be converted into other dyestuffs by replacing the amino group, *e.g.*, by treatment with a halogen-anthraquinone, an acid chloride, etc.—T. F. B.

Sulphide colours [dyestuffs] ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9719, April 24, 1912.

SEE Fr. Pat. 450,420 of 1912 ; preceding.—T. F. B.

Sulphur [sulphide] dyes ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,163, May 22, 1912.

SEE Ger. Pat. 253,239 of 1912 ; this J., 1913, 16.—T. F. B.

Sulphur [sulphide] dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,409, July 26, 1912.

SEE Fr. Pat. 446,566 of 1912 ; this J., 1913, 131.—T. F. B.

Dyes containing sulphur and process of making them. H. Wolff, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,061,714, May 13, 1913.

SEE Fr. Pat. 433,323 of 1911 ; this J., 1912, 119.—T. F. B.

Hexabromindigo ; Greenish-blue ——. A. Schmidt and K. Thiess, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,061,781, May 13, 1913.

SEE Eng. Pat. 2609 of 1909 ; this J., 1909, 1245.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE , PAPER.

Wool and other protein matters ; Action of quinones on ——. W. Scharwin. Z. angew. Chem., 1913, **26**, 254.

WHEN wool is steeped in a hot aqueous solution of *p*-benzoquinone, it becomes dyed a reddish-brown. Similar effects, but with different degrees of facility, are obtained in other solvents ; increase of temperature favours the reaction. Quinone vapours in a desiccator will stain wool a fine pink at the ordinary temperature. The reaction is not peculiar to benzoquinone ; all the other para-quinones tested gave stains of various shades more or less readily. Benzoquinone, toluquinone, α-naphthoquinone and chloranil all gave very similar dark reddish-brown colourations ; thymoquinone and its two dihalogen derivatives gave orange shades, *m*-dimethoxy-*p*-benzoquinone gave a khaki shade ; anthraquinone and phenanthraquinone were without action. Reactions were obtained not only with wool but also with silk, horn, leather, casein, egg-albumin, gelatin, etc. The reaction is analogous to the reaction of benzoquinone with aniline, with the formation of arylated mono- or diaminoquinones and the reduction of a portion of the quinone to quinol. In a similar manner the quinones react with aromatic and aliphatic amino-acids. The reaction, which in certain cases takes place without heating, may possibly serve as a test for the presence of active amino groups in the animal fibres, in place of the somewhat indefinite nitrous acid test. On heating, a partial hydrolysis of the protein substance may occur with the formation of fresh reactive amino groups. Chloranil and the two dichloroquinones split off hydrochloric acid in the reaction. The quinone dyeings on wool are generally very fast, but change somewhat on exposure to light.—J. F. B.

Sulphite wood pulp ; The ash of ——. E. Richter. Wochenbl. Papierfab., 1913, **44**, 1776—1779.

THE ash of sulphite cellulose rarely exceeds 1 per cent. and is more frequently about 0·5 per cent., calculated on dry substance. The proportion of silica is usually almost exactly one-third of the total ash, even with relatively large variations of the latter. The quantity of silica in the original wood is very much smaller than in the sulphite pulp and it is probable that the silica is fixed by the fibre in the form of a calcium or magnesium silicate during the digestion process. Taking as a typical instance a Scandinavian pulp containing 0·59 per cent. of total ash and 0·18 per cent. of silica, it is calculated that in the course of 100 digestions, producing 10 tons of cellulose per charge, 1800 kilos of silica must have been taken up by the fibre. Such a quantity could not possibly be all derived from the lining of the digester and most probably it comes mainly from the bisulphite liquor. The quantity of iron in the ashes of sulphite pulps ranged, in the series of samples examined, from 1·4 to 9·2 mgrms. per 100 grms. of cellulose. The quantity of iron, however, shows no regular relationship either to the total ash or to any other character of the pulp. The ash constituents of the wood appear to have little or no influence on the percentage of ash in the pulp ; this depends rather on the composition of the digestion liquor and the manner of digestion. For instance, two varieties of pulp, made from the same wood and using the same limestone, but with liquors containing different proportions of combined sulphurous acid, showed in the one case an average of 0·27 per cent. of ash and in the other 0·65 per cent. Only in a limited degree does the percentage of ash rise and fall with the percentage of lignin remaining in the pulp ; it is probable that these constituents are not directly interrelated but that both of them depend on the method of digestion. —J. F. B.

Cellulose from pea and bean stalks. O. Reinke. Chem.-Zeit., 1913, **37**, 601.

ON digestion with not more than 6—7 per cent. of caustic soda, waste pea and bean stalks readily yield cellulose in higher proportions and of better quality than that obtained from asparagus stalks (this J., 1913, 132). The cellulose is easily bleached by bleaching powder liquor, still better by a 1 per cent. solution of potassium permanganate followed by sulphurous acid. The celluloses are free from knots and consist of small fibres, fine, woolly and brilliant white. The percentage of cellulose in these stalks is higher than in asparagus and the pressed material would more profitably be transported to the cellulose factories. The cellulose is eminently suitable for chemical treatments such as the manufacture of nitrocellulose, viscose, etc.—J. F. B.

Oxycellulose; Studies on ——. R. Oertel. Z. angew. Chem., 1913, **26**, 246—250.

Oxycellulose was prepared by treating cellulose in a neutral 15 per cent. solution of potassium chloride which was subjected to electrolysis. The cellulose was gradually attacked, being ultimately converted entirely into soluble products. When about 60—70 per cent. of the cellulose had been dissolved, the residue of oxycellulose was entirely soluble in cold 10 per cent. sodium hydroxide solution; still further treatment yielded an oxycellulose giving a stable colloidal solution with water. The "copper values" of the oxycellulose products, determined by Schwalbe's method (this J., 1907, 548) were very high, increasing with the degree of treatment, a maximum of 39·5 being recorded. The "copper value" is not always in direct relationship with the solubility in sodium hydroxide. The furfural value of the oxycellulose prepared by electrolysis was 1·7 per cent., whilst that of ordinary cotton is less than 1 per cent.; the furfural value is, however, not sufficiently definite to serve for the characterisation of oxycellulose. Tested according to Ost's viscosity test (this J., 1911, 1247), oxycellulose shows minimum values at an early stage. Its susceptibility to acid hydrolysis (Schwalbe's "hydrolysis-difference" value) is high (12·12 as compared with 2·18 for cellulose). When saccharified with 70 per cent. sulphuric acid according to Ost and Wilkening's method (this J., 1910, 688) oxycellulose yields at the most only about 90 per cent. of the quantity of dextrose obtainable from cellulose. This would indicate that 1 in 10 of the dextrose residues in the oxycellulose molecule exists in the oxidised condition. On acetylation, using zinc chloride as a catalyst and steeping the material for some days in glacial acetic acid before acetylation, oxycellulose is more readily esterified than cellulose; the product contains a greater proportion of ester soluble in acetone and this portion has a lower lævorotatory power. Whereas the acetates prepared from cellulose contain about 62·5 per cent. of combined acetic acid, those from oxycellulose contain only 59—60 per cent. On acetolysis according to Ost's method, oxycellulose yields only 30—31 per cent. of crystallised cellobiose acetate, as compared with 40 per cent. from cellulose. Elementary analysis of oxycellulose showed C 43·8 and H 6·30 per cent. The author concludes that oxycellulose prepared by his process is an oxidised derivative of hydrolysed cellulose, not a homogeneous product, but probably varying in the degree of modification in both directions. Its formula ranges probably between $(C_6H_{10}O_5)_6O$ and $(C_6H_{10}O_5)_{10}O$. The hydrolytic modification of the cellulose in the production of oxycellulose is indicated by the low viscosity of its solutions, the cupric-reducing power, the high proportion of acetate soluble in acetone, and the low rotatory power of the normal acetic ester. The oxidative modification is indicated by the increased cupric-reducing power as compared with hydrocellulose, the low combined acetic acid in the acetic ester, showing suppression of hydroxyl groups, the low yield of dextrose on saccharification and the low yield of cellobiose on acetolysis.—J. F. B.

Cellulose esters of benzoic acid and its derivatives. J. F. Briggs. Z. angew. Chem., 1913, **26**, 255—256.

Replying to a criticism of Cross and Bevan's work on this subject by Hauser and Muschner (this J., 1913, 357), the author attributes their failure to obtain the fibrous dibenzoate and the soluble tetrabenzoate (C_{12} unit) to the fact that the cellulose was steeped first in benzoyl chloride and the mixture then shaken with caustic alkali. Under such conditions, the cellulose being resistant to penetration by the oily chloride, it is quite conceivable that the reagents would mutually exhaust themselves entirely outside the cellulose without the formation of any ester. In a heterogeneous system it is necessary to develop the maximum reactive surface of the colloid hydroxyl groups by steeping first in caustic alkali and then to treat the alkali-cellulose adsorption compound so formed with the benzoyl chloride. Even under the best conditions, the product of such a combination of "immiscible" reagents is necessarily heterogeneous and consists of mixtures of unaltered cellulose, dibenzoate and tetrabenzoate. In order to control the velocity of the reaction and avoid wastage of the benzoyl chloride, it is advisable to introduce the moist alkali-cellulose into a dilute solution of benzoyl chloride in an indifferent solvent, such as benzene. To obtain the fibrous dibenzoate as the main product, cotton is steeped in 20 per cent. caustic soda lye, squeezed out and transferred to a 5 per cent. solution of benzoyl chloride in benzene. To obtain a maximum formation of the soluble tetrabenzoate, it is preferable to employ gelatinous hydrated cellulose, precipitated from viscose; this is brought into a state of semi-solution in caustic soda lye and the pasty mass is shaken with a 10 per cent. solution of benzoyl chloride. In any case, the analysis of the products without previous separation of the constituents is useless. The crude product is boiled with chloroform or acetic acid to extract the tetrabenzoate; the residue is exhausted repeatedly with strong cuprammonium reagent until all the unchanged cellulose is removed and the final residue is the fibrous dibenzoate. Either of these esters or the crude product itself may be further converted into mixed nitro-benzoic or aceto-benzoic esters soluble in organic media.—J. F. B.

Rosin sizing; The reactions of ——. E. Heuser. Papierfabr., 1913, **11**, 554.

The author has studied the reactions which take place between neutral sodium resinate and aluminium sulphate when the latter is added to the former in the molecular proportions $Al_2 : 6Na$. In the absence of cellulose a precipitate is formed which contains 3·14 per cent. Al, as against 2·91 per cent. calculated for the neutral resinate $Al_2(C_{20}H_{29}O_2)_6$. The filtrate contains no aluminium, but the whole of the sulphuric acid introduced as aluminium salt. The aluminium resinate, immediately after drying at 80° C., is soluble in cold ether without decomposition, also in chloroform and benzene, but insoluble in alcohol. When the ethereal solution is heated, it is decomposed; a similar decomposition also takes place when the precipitated resinate is allowed to stand. The resinate, which was originally completely soluble in ether, was found to become only partially soluble after standing for 14 days in a desiccator. These results confirm the observations of Remington (this J., 1911, 949), but the latter records a melting point of 135°—140° C. for the resinate, which the present author finds to have no definite melting point, but to turn brown with decomposition at about 115° C. The aluminium resinate also decomposes when boiled with alcohol. When heated with absolute alcohol under a reflux condenser for 8—18 hours, 58·66 per cent. of the original resin was dissolved; the remainder of the resin and the whole of the aluminium remained insoluble both in alcohol and ether. In the reaction between sodium resinate and aluminium sulphate under the above conditions in the absence of cellulose, no basic sulphates of aluminium are produced, nor, primarily, any mixture of free resin and aluminium hydroxide.—J. F. B.

Sizing in high-grade papers; Detection of faulty ——. C. F. Sammet. U.S. Dept. Agric., Bureau of Chem., Circular No. 107, Jan. 29, 1913.

The method is designed to show differences in sizing of papers which are resistant to ink, and to indicate superiority or otherwise obtained by different processes of treatment in the manufacture. A strip of the paper is drawn over the surface of an iron tannate ink and allowed to drain and dry naturally. On examining the inked surface with a lens, a well sized paper shows no indication of the fibre having absorbed the ink; the entire surface is uniformly and lightly coloured. In papers not so well sized, blotches of fibres are seen to have absorbed the ink, in spite of the fact that according to the ordinary methods of testing, the papers are well-sized for writing purposes. The same test may also be applied after rubbing the surface of the paper with an ink-eraser and brushing off the loose particles. The test is especially useful for control purposes in the manufacture of high-grade papers.—J. F. B.

Bibliography of the pulp and paper industries. H. E. Surface. U.S. Dept. of Agriculture. Forest Service. Bull. 123. Washington, U.S.A. Govt. Printing Office, April 28, 1913.

Patents.

Tussah silk; Process for treating ——. J. G. Rovira. Fr. Pat. 451,336, Dec. 4, 1912.

Tussah silk is composed of aggregates of very fine disunited fibres which produce a sort of hairiness on the filament of silk whereby trouble in working is experienced. To correct this irregularity, the silk is subjected to the action of rollers, spinning devices or other mechanism in conjunction with one or more baths containing adhesive substances, such as glue, in order to cause the fibres to adhere together and give a round, compact, and uniform thread. —J. F. B.

Hop-vines; Process for producing fibre from ——. D. N. Honn, Redding, Cal. U.S. Pat. 1,060,255, Apr. 29, 1913.

The hop-vines are cut into suitable lengths and tied in bundles; these are placed in tanks of still water and allowed to steep for 90—100 days until sufficiently retted. The vines are then removed and dried, hackled and finally bleached for 30—60 days.—J. F. B.

Artificial silk; Bobbin for the manufacture of ——. F. Küttner. Fr. Pat. 450,818, Nov. 21, 1912. Under Int. Conv., Nov. 13, 1912.

The bobbin consists of a metal cylinder, preferably of aluminium, over which is slipped a cylinder of cardboard, preferably varnished.—J. F. B.

Artificial threads; Pumps for use in the spinning of ——. F. Küttner. Fr. Pat. 450,906, Nov. 21, 1912. Under Int. Conv., Apr. 29, 1912.

For the delivery of the liquid to the spinning tubes, a rotary pump, consisting of a pair of toothed wheels in a casing is employed. This type of pump has the advantage of being easily cleaned and accurately adjusted; it also acts as a final mixer, breaking down any irregularities which may have formed in the liquid used for spinning. —J. F. B.

Viscose silk; Manufacture of ——. Chem. Fabr. von Heyden, Akt.-Ges. Fr. Pat. 451,156, Nov. 28, 1912. Under Int. Conv., Dec. 2, 1911.

Threads are manufactured by spinning solutions of viscose to which ammonia has been added or in which a portion of the soda has been replaced by ammonia. Such viscose is suitable for coagulation directly in a bath of dilute sulphuric acid; the threads are at first soft and opaque, but after a time become transparent and sufficiently strong to be wound off. The viscose may also be coagulated in saline baths with or without free acid, in which case the baths may be more dilute than is usually the case. Further, it is not necessary to wash the threads on bobbins or cops.—J. F. B.

Artificial silk from viscose; Manufacture of ——. F. Küttner. Fr. Pat. 451,276, Dec. 2, 1912. Under Int. Conv., Nov. 13, 1912.

For the coagulation of threads of artificial silk from viscose, a bath containing about 27 per cent. of sodium bisulphate and 12 per cent. of sodium sulphate (anhydrous) at a temperature of about 50° C. is specified. The viscose should have only a slight degree of "ripeness" and the threads at first produced should be soluble in water. After the operation, the bobbins containing the threads are rotated in a dilute acid solution, *e.g.*, a 7 per cent. solution of sodium bisulphate, in which the threads are gradually transformed into the insoluble condition. The threads so produced are characterised by a flattened section, showing longitudinal depressions, to which their good covering power and industrial superiority are attributed. —J. F. B.

Cellulose xanthate solution; Process of coagulating ——. A. Boisson. Second Addition, dated Jan. 10, 1912, to Fr. Pat. 436,590, Jan. 19, 1911 (this J., 1911, 428).

In the coagulation of viscose by means of a sulphate and an acid other than sulphuric acid, if the base of the sulphate is displaceable by the soda of the viscose, this bath should be the first one and the acid bath should follow; thus there may be employed first a bath of ammonium sulphate and then a bath of hydrochloric acid. If the base of the sulphate is not displaceable, the salt and the acid should be mixed together, *e.g.*, sodium sulphate and hydrochloric acid.—J. F. B.

Plastic mass; Non-inflammable ——, *for the manufacture of combs, moulded articles, etc.* L. Desvaux. Fr. Pat. 450,746, Jan. 25, 1912.

A non-inflammable plastic composition is prepared by mixing gelatin with a fatty acid ester of cellulose. Cellulose acetate soluble in acetone is preferred; 50 kilos. of this are mixed with 10 kilos. of coal tar creosote, 25 of pentachloroethane and 25 of alcohol until the acetate is dissolved. To the pasty mass in the mixer, 12·5 kilos of gelatin previously softened by glacial acetic acid are added. The whole is mixed and then rolled into thin sheets. A number of these sheets are superposed in a hydraulic press, compressed hot (50°—70° C.), and then allowed to cool under pressure.—J. F. B.

Cellulose acetate; Manufacture of ——. Debauge et Cie. Fr. Pat. 450,886, Nov. 16, 1912.

In the manufacture of cellulose acetate, the product of the reaction, containing acetic acid and the excess of acetic anhydride, is poured into a liquid, such as benzene, which will precipitate the cellulose acetate and dissolve the acetic acid and anhydride without decomposition. The latter reagents are then recovered for future use by distilling off the benzene. Other suitable liquids for the same purpose are petroleum spirit and carbon tetrachloride. —J. F. B.

Cellulose; Manufacture of viscous [cuprammonium] solutions of ——. O. Müller. Fr. Pat. 451,406, Nov. 15, 1912.

Cuprammonium solutions prepared by the action of sodium hydroxide upon copper sulphate with addition of ammonia tend to deposit crystals of sodium sulphate when in use as solvents for cellulose. This may be avoided by mixing the cupric salt with a solution of sodium chloride and glycerin before adding the ammonia and caustic alkali. Example: 120 kilos. of powdered copper sulphate are stirred with 200 litres of a 1—2 per cent. solution of sodium chloride containing 2·25—3 litres of glycerin; to this are added 300 litres of ammonia, sp. gr. 0·91, and the copper salt is dissolved. Then 200 litres of caustic soda lye, sp. gr. 1·125—1·2, are added and 50 kilos. of cellulose are finally introduced.—J. F. B.

Wood pulp and the like for use in the manufacture of paper; Bleaching ——. F. W. Dobson, Tamworth, Staffs. Eng. Pat. 15,720, July 5, 1912.

Wood pulp, esparto grass, or the like, is placed in a dry or semi-dry state in a closed rotary vessel, and water is added in amount sufficient only to moisten the material and render it limp and weak. The vessel is rotated and the material is reduced to a dry or semi-dry macerated condition. A quantity of concentrated bleaching liquor is then added, and a further supply of water if necessary, the vessel being again rotated.—B. N.

Paper pulp; Electrolytic apparatus for the preparation of ——. F. F. Strong, St. Petersburg, Fla. U.S. Pat. 1,059,322, Apr. 15, 1913.

Apparatus is provided for the flow of subdivided plant-material whilst subjected to electrolytic action to loosen the fibres. Such apparatus may consist of a tube having porous walls, situated in a tank containing an electrolyte and an electrode mounted within the tube to convey the current to the material flowing through the tube; alternatively the apparatus may comprise a series of porous jars connected together by tubes and forming a continuous passage for the material. Separate means are provided for immediately washing the material after treatment; also separate means for the immediate bleaching by electrolytic processes of the washed material, the whole being so arranged that the material is substantially in continuous movement through the entire series of processes.—J. F. B.

Wood, shavings, sawdust and wood waste; Process for the decomposition of ——. R. von Walther. Ger. Pat. 258,180, Jan. 7, 1912.

The material is first treated for a short time at a high temperature with a lye having a low content of sulphurous acid and alkaline-earth or alkali, and is then subjected to the usual boiling process with a stronger lye. It is stated that in this way a liquor rich in sugar and other organic substances is obtained as by-product in the first stage of the process.—A. S.

Waste papers; Process for the recovery of pulp from printed ——. J. M. Burby, Astoria, N.Y. U.S. Pat. 1,060,158, Apr. 29, 1913.

The waste papers are subjected to the action of a solution of sodium or potassium bicarbonate at a temperature below its boiling point, and agitated therein. The solution is drained off, the material is washed in fresh water and the clean pulp collected.—J. F. B.

Paper; Process of treating —— [*producing a matt finish*]. S. S. Sadtler, Flourtown, Pa., Assignor to E. W. Bacon, Philadelphia, Pa. U.S. Pat. 1,060,366, Apr. 29, 1913.

The surface of paper coated with a composition containing casein or other albuminous substance is treated with a solution of a compound containing a basic radical, *e.g.*, chemically combined calcium. This solution forms insoluble and soluble substances on the paper, which is then washed to remove the latter and the excess of the reagent.—J. F. B.

Paper pulp; Beating engines for refining ——. L. Thiry. Fr. Pat. 450,261, Oct. 17, 1912.

The beating engine is provided with two beating rolls and their respective bed-plates, one being constructed with grinding elements of basalt lava and the other with ordinary metal bars. The pressure of the rolls is accurately adjustable by means of counterpoise levers with sliding weights. The wear of the bed-plates is compensated by mounting them on a block composed of three wedges, the middle one being movable between the two outer wedges so as to raise or lower the bed-plate as required. The trough of the engine has a special shape to facilitate the circulation and eliminate the possibility of lodgments.—J. F. B.

Art printing paper; Manufacture of ——. A. Allihn. Ger. Pat. 258,181, March 6, 1912.

Claim is made for the use, as vehicle for the pigment, of boiled starch with water-soluble silicates, precipitated partly or completely by acid compounds or other precipitants of silicic acid.—A. S.

Vegetable or animal fibre; Process for separating ——. V., G., V., C., and M. del Prato, Naples, Italy. U.S. Pat. 1,061,902, May 13, 1913.

See Fr. Pat. 445,180 of 1912; this J., 1913, 18.—T. F. B.

Artificial bristles for brushes and the like; Process for the production of ——. B. Borzykowski, Charlottenburg, Germany. Eng. Pat. 30,398, Dec. 31, 1910.

See Fr. Pat. 424,428 of 1910; this J., 1911, 740. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 17,140 of 1893 and 2026B of 1907.—T. F. B.

Artificial filaments; Manufacture of ——. L. Sarason, Westend, Berlin. Eng. Pat. 21,586, Sept. 23, 1912.

See Fr. Pat. 448,429 of 1912; this J., 1913, 420.—T. F. B.

Artificial silk from viscose; Manufacture of ——. Chem. Fabr. von Heyden A.-G., Radebeul, Saxony. Eng. Pat. 27,732, Dec. 2, 1912. Under Int. Conv., Dec. 2, 1911.

See Fr. Pat. 451,156 of 1912; preceding.—T. F. B.

Cellulose esters of organic acids; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 10,706, May 6, 1912.

See Fr. Pat. 449,253 of 1912; this J., 1913, 482.—T. F. B.

Cellulose esters; Process of treating ——. H. S. Mork, Assignor to Chemical Products Co., Boston. U.S. Pat. 1,061,771, May 13, 1913.

See Fr. Pat. 416,752 of 1910; this J., 1910, 1371.—T. F. B.

Caustic liquor resulting from digestion of wood; Process of treating the residual ——. J. M. Neil, New York. Eng. Pat. 9541, April 22, 1912.

See Fr. Pat. 442,850 of 1912; this J., 1912, 1027.—T. F. B.

Agglutinant for the manufacture of agglomerates. Fr. Pats. 451,522 and 451,523. *See* XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Furs; The dyeing of ——. M. C. Lamb. J. Soc. Dyers and Col., 1913, 29, 160—165.

A complete account of the tanning, dyeing and finishing of furs. After thorough soaking in 2 per cent. carbolic acid and removal of superfluous flesh, the skins are tanned, either by oil tannage, or by the application of a paste made up of aluminium sulphate, salt, glycerin, gambier and flour, or by treatment with a solution of salt and sulphuric acid. Sometimes the skins are merely pickled. The author suggests tanning by chrome or formaldehyde. The goods are prepared for dyeing by wetting out and removal of the natural grease of the hair by treatment with dilute alkali in a variety of ways. The mordanting process varies according to the method of dyeing, copper sulphate, potassium bichromate and ferrous sulphate being commonly used. Logwood is still largely used for blacks, also silver nitrate and pyrogallic acid, but the modern method of dyeing is by means of oxidation colours (Ursol, Nako and Furrol colours). These products consist of aromatic diamines and aminophenols and their derivatives. Dyeing is performed by immersing the mordanted furs in the solution of the dyestuff and, after thorough impregnation, adding hydrogen peroxide. Various shades of brown, grey and black are produced according to the dyestuff and mordant used. A number of typical recipes are quoted. Furs are "tipped" by applying the dyestuffs with a brush. After dyeing the goods are rinsed, treated on the flesh side with a solution of salt and glycerin, sodium thiosulphate or alum, dried, and finally softened mechanically.—J. B.

Manganese Bronze as an intensifier and restrainer under vat and sulphide colours. E. Knecht. J. Soc. Dyers and Col., 1913, 29, 150—151.

It is known that Manganese Bronze printed on cotton causes an increase in the amount of Indigo taken up from the vat. Patterns of light and heavy shades may be produced in this way. If, instead of forming the Manganese Bronze on the fibre, it is printed directly in the condition of hydrated manganese peroxide, an opposite effect is obtained. A possible explanation of these facts is that the peroxide gives up its oxygen to the Indigo White in both cases, but in one case the deposition of indigotin which results is merely superficial whereas in the other case it takes place in intimate contact with the fibre. Against this explanation, however, is the fact that other vat dyestuffs do not behave in an analogous manner, for, whereas Thioindigo is intensified, brominated indigo (Ciba Blue) is resisted. With Indanthrene and Algol colours the Manganese Bronze acts indifferently or as a restrainer. Similar discrepancies were observed with sulphur dyestuffs. Hydrone Blue is restrained.—J. B.

Calico printing; Thioindigo colours in ——. N. Evans. J. Soc. Dyers and Col., 1913, 29, 144—150.

Direct printing. The dyestuff is printed together with a reducing agent and a thickening, usually British gum. Several modifications of this method are in use to suit individual dyestuffs: (a) The reduction is performed by hydrosulphite and caustic soda. (b) The colour is printed with a strongly caustic alkaline thickening on cloth prepared with glucose. (c) A modification of (a) in which potassium sulphite is added. This enables the caustic soda to be dispensed with or reduced in amount and also reduces the quantity of hydrosulphite required. (d) Hydrosulphite in conjunction with sodium carbonate. (e) Hydrosulphite and potassium carbonate, the latter being more suitable for some colours than sodium carbonate. (f) The vat is prepared with hydrosulphite and then hydrosulphite NF and sodium bicarbonate added. The objectionable causticity is thus eliminated and the method is applicable to nearly all colours. In all cases the colour is fixed by steaming in the absence of air and oxidised by rinsing with cold water followed by dilute bichromate, perborate, or hypochlorite. The colours are finally soaped at the boil with the exception of Thioindigo Red B and Scarlet R. The Thioindigo colours may be used in conjunction with Para Red, aged blacks, mordant colours and sulphide colours. Certain Thioindigo colours may be printed with mordants and fixed by steaming. *Discharge printing.* The colours may be printed with hydrosulphite on any ground which is discharged by this agent. Basic dyes may be used on cloth mordanted in the usual way and printed with the Thioindigo vat by one roller and the usual caustic white discharge by a second roller. Nearly all the Thioindigo dyes discharge well with hydrosulphite NF or CL, or by the leucotrope process. They are not discharged by oxidation. *Resist printing.* Acid reacting metallic salts are used for this purpose and may be used in conjunction with Para Red. Wax resists are used in "battik" dyeing. Two compounds recommended as resists are Reserve Salt W and O. Tables are given showing various results obtainable with Thioindigo colours in printing, and the fastness to different agents of individual dyestuffs.—J. B.

Malt extracts [*for use in the textile industry*]; *The valuation of* ——. W. P. Dreaper. J. Soc. Dyers and Col., 1913, 29, 157—160.

The suggested method consists in treating a standard starched cloth with the malt extract under specific conditions, and estimating the amount of starch attacked by determining the loss of weight. The standard cloth contains 5—8 per cent. of standard farina, the exact quantity being determined by the gain in weight resulting from the dressing, also by the loss on exhaustive treatment with the malt extract. Two grms. of this cloth are treated for five minutes at 35° C. in 300 c.c. of a solution containing 30 c.c. of a 2·5 per cent. solution of the sample of malt extract. The sample is then rapidly squeezed by hand, dried at 90°—100° C., and, after being exposed to the air to take up moisture, is weighed and the loss determined. A blank experiment with distilled water is made, the loss being allowed for in the tests. The author prefers to work so that the amount of starch removed lies between 1·0 and 2·5 per cent. In reply to discussion it was stated that the Lintner and B.P. Codex tests gave no indication of the value of a malt extract for textile purposes. The method using the iodine test is also unsatisfactory. It is known that enzymes act according to a law similar to that of mass action, so that a small scale test in a beaker should give a result comparable with that obtained under working conditions in a kier. The test would be more stringent if the standard cloth were calendered. Starch dried on the fabric would, owing to condensation, offer more resistance to enzyme action and the test proposed deals with such modifications. E. Feilmann suggested the preparation of a more uniform material by impregnating cotton wool with starch and afterwards disintegrating.
—J. B.

Action of quinones on wool and other protein matters. Scharwin. *See* V.

Patents.

Dyeing machine. C. Lumpp et Cie. Fr. Pat. 451,082, Feb. 2, 1912.

The hanks are carried on horizontal spools mounted excentrically on a shaft capable of rotating alternatively in either direction. The mechanism of each spool is carried on a vertical pillar which constitutes a hydraulic ram, by means of which the spool can be easily raised or lowered, thus putting it into the required gear.—J. B.

Dyeing with insoluble colours or insoluble leuco-compounds of these colours. R. Wedekind und Co. Fr. Pat. 451,533, Dec. 6, 1912.

Vat dyestuffs. The material is padded with an aqueous suspension of the insoluble dyestuff and afterwards passed through an alkaline solution of hydrosulphite containing sodium chloride or sulphate. The padding liquor may be acid, alkaline or neutral according to particular requirements. It is claimed that the suspended dyestuff is all taken up by the fibre and economy thus secured. *Mordant dyestuffs.* Cotton mordanted in the usual way is padded with a suspension of the dyestuff together with a calcium salt and Turkey red oil. The lake is developed by heat, *i.e.*, steaming or boiling, but it takes place slowly in the cold. A vat dyestuff and a mordant dyestuff may be dyed together by padding the mixed colours on the mordanted material (wool or cotton) and developing first the mordant dyestuff by boiling or steaming and then the vat dyestuff as before. The vat dyestuff is said not to be removed by the boiling or the mordant dyestuff deteriorated by the reducing agent. *Insoluble leuco-compounds.* The vat dyestuff is reduced in the presence of magnesium hydroxide and the material padded with the suspension of the magnesium salt thus obtained. The colour is developed by rinsing, souring and soaping, according to the requirements of individual colours. The process is applicable to wool and silk on account of the mild alkalinity of the magnesium hydroxide. The bath exhausts and the oxidation is more rapid than is the case with the sodium salts of the leuco-compounds. Other metallic salts may be used, and in the case of animal fibres, it is advantageous to heat the padding liquor.—J. B.

Steaming tissues; Continuous process of ——. Motte et Delescluse Frères. Fr. Pat. 451,413, Feb. 12, 1912.

The fabric is passed continuously round a revolving perforated drum fitted inside with means for the even distribution of the live steam and for the removal of condensation water. The cylinder is covered with a blanket and an endless blanket presses against the cloth on the outside to ensure even steaming.—J. B.

Bleaching process. W. Mathesius and M. Freiberger, Charlottenburg, Germany. U.S. Pat. 1,061,392, May 13, 1913.

See Eng. Pat. 28,485 of 1911; this J., 1913, 20.—T. F. B.

Dyeing [*with azo dyestuffs*]; *Process of* ——. *Dye-bath.* M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,060,002 and 1,060,097, April 29, 1913.

See Eng. Pat. 12,877 of 1911; this J., 1912, 227.—T. F. B.

Dyeing wool and the like ; Apparatus for ——. A. Murray, Geelong West, Victoria. U.S. Pat. 1,060,277, April 29, 1913.

See Fr. Pat. 445,580 of 1912 ; this J., 1912, 1176.—T. F. B.

Dyeing [*with azo dyestuffs*] ; *Process of* ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,060,342, April 29, 1913.

See Eng. Pat. 2550 of 1912 ; this J., 1912, 918.—T. F. B.

Finishing textile fabrics, yarns, or tissues of vegetable fibres with soapy preparations. R. Weiss, Kingersheim, Alsatia. Eng. Pat. 26,303, Nov. 15, 1912. Under Int. Conv., Nov. 27, 1911.

See Fr. Pat. 448,490 of 1911 ; this J., 1913, 435.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

"*Bungo*" *sulphur.* Oil, Paint, and Drug Rep., May 12, 1913. [T.R.]

In Bungo province, Japan, there are many geyser-like craters which intermittently emit sulphurous fumes and whose action is produced by volcanic activity. During their inactive periods the Japanese have placed pipes in the ground and in the crevices about the craters of these so-called geysers in such position that when activity is resumed these fumes are collected in pipes and thereby conducted into hermetically tight reservoirs, from which the condensed sulphur flows down the mountain side in long light conduits where it hardens and from which it is taken, broken into various shapes, put into sacks, transported by coolies down the side of the mountain, and becomes an article of commerce under the name of Bungo sulphur.

Rock salt in British Columbia. Oil, Paint, and Drug. Rep., May 19, 1913. [T.R.]

The U.S. Consul-General at Vancouver says that an extensive bed of rock salt has been discovered on the Skeena River, about forty-five miles from Prince Rupert. So far five holes have been drilled, in some instances over a mile apart, and in every case salt has been struck at depths varying from 50 to 250 feet. Up to the present about eight tons of salt have been secured from the deposits. The tests show that the product is absolutely pure and of the best quality.

Hydrocyanic acid ; Detection of ——. C. Pertusi and E. Gastaldi. Chem.-Zeit., 1913, **37**, 609—610.

One drop of a 3 per cent. solution of copper acetate is mixed with 1 c.c. of a 10 per cent. solution of disodium phosphate and 4 drops of a saturated solution of benzidine acetate, and the solution under examination added drop by drop to the mixture. In the presence of 0·000027 grm. of hydrocyanic acid per c.c., a turbidity and perceptible bluish-violet colouration are produced, whilst the presence of the phosphate prevents the benzidine and copper salt from reacting with iodides, ferrocyanides, etc. The test may be rendered still more sensitive by boiling the solution under examination for 5 to 10 minutes with sodium hydroxide, filtering it, and passing through the filtrate a current of carbon dioxide. This liberates the hydrocyanic acid, which is then carried forward into the reagent (1 drop of 3 per cent. copper acetate solution, 5 drops of benzidine acetate solution, and 0·5 c.c. of water). If metals forming double salts with cyanides in alkaline solution are present, the cyanides must be separated before applying the test.—C. A. M.

Water-glass ; Manufacture of —— *by the fusion process.* H. Knoblauch. Z. angew. Chem., 1913, **26**, 250—254.

The author describes with diagrams the Siemens regenerative gas furnace as applied to this industry. A new gas and air distributing device for regenerative gas furnaces is described. Gas and air are led separately to the fusion chamber and there unite, the flame traversing the entire length of the chamber and passing over into the regenerator at the other end. Commonly employed mixtures are: 100 kilos. of sand and 56 of sodium carbonate, or 100 kilos. of sand, 70 of Glauber's salt and 4 of wood charcoal; for potash water-glass, 100 kilos. of sand and 66 of potassium carbonate or for mixed water-glass, 33 kilos. of potassium carbonate and 26 of sodium carbonate. The operation with alkalis is much simpler and quicker than when sodium sulphate is used. The material is shovelled in from above through openings in the side of the furnace. Newly-lined furnaces should first be used for a run of bottle-glass of high melting point. This impregnates and coats the lining with a resistant layer, protecting it from the action of the alkali. The finished product is drawn off through tap-holes. The melting-chamber should not be drained empty, but the level should be kept as high as possible in order to obtain the full effect of the flame. With pure alkali the addition of charcoal is disadvantageous, but with impure soda-ash or with Glauber's salt it is necessary for the reduction of the sulphate. Generally this reduction should not be allowed to proceed further than the formation of sulphite which reacts readily with the silica; the production of sulphide impedes the reaction but is sometimes permitted for the manufacture of a caustic glass. The correct proportion of charcoal is an important factor but it varies according to the conditions; the quantity of smoke in the flame also causes a variation. Sawdust may be used instead of charcoal, but whichever reducing agent be employed, it should be intimately mixed with the sulphate, slightly moistened, before mixing the whole with the sand. A furnace with exposed heating surface of 3 × 9 metres will fuse about 9 cub. m. of water-glass in 24 hours, equivalent to about 22 tons, and will require about 5 tons of fuel with a calorific value of 7000 cals. per kilo.—J. F. B.

Gold ; Contribution to the chemistry of ——. V. Lenher. J. Amer. Chem. Soc., 1913, **35**, 546—552.

Of a large number of organic and inorganic substances tried, only sulphurous acid and arsenious oxide proved capable of reducing auric to aurous compounds. Sulphurous acid is the more satisfactory; when a solution of sulphurous acid is added to a solution of auric chloride containing a considerable quantity of such chlorides as those of sodium, potassium, calcium, magnesium, zinc, and cadmium, a colourless solution is obtained with a quantity corresponding to the equation:

$$AuCl_3,xMCl_2+SO_2+2H_2O=AuCl,xMCl_2+H_2SO_4+2HCl,$$

and the end point is so sharp that the reaction can be used as the basis of a method for the volumetric determination of gold. In absence of the chlorides mentioned, auric chloride is reduced to metallic gold by sulphurous acid. Many types of organic compounds reduce auric chloride to metallic gold in alkaline solution, but only a few reduce it in acid solution. Many organic liquids immiscible with water extract auric chloride from its aqueous solution; the compounds most effective in this respect are aldehydes, ketones, aliphatic esters and cyanides.—A. S.

Platinum salts ; Action of aqueous hypophosphite solutions on ——. *A contribution to the knowledge of colloidal platinum.* A. Sieverts. Z. Chem. Ind. Kolloide, 1913, **12**, 263—268.

The action of sodium hypophosphite on very dilute solutions of potassium platinochloride is different according to the relative proportions of the two salts. With a large excess of hypophosphite (*e.g.* $120NaH_2PO_2 : 1K_2PtCl_4$) a light brown to yellow solution is produced on warming which can be evaporated without yielding a precipitate, and does not respond to the ordinary reactions of platinum. The solution is not colloidal. On heating, it evolves hydrogen vigorously. With smaller proportions of hypophosphite, the solutions become darker on heating; and with from 20 to 4 mols. of hypophosphite to 1 of the platinochloride, dark reddish-brown solutions are obtained; which are not sensitive to electrolytes; but gradually deposit a precipitate and become colourless on standing. These solutions also evolve hydrogen on heating. The evolution of hydrogen is due to the oxidation of the hypophosphite to phosphite ($NaH_2PO_2 + H_2O = NaH_2PO_3 + H_2$), the platinous salt acting as catalyst. Similar reddish-brown solutions can be obtained if sodium phosphite be used in place of hypophosphite, but they evolve hydrogen much more slowly. If gelatin or gum arabic be added to these solutions, they remain clear on standing, and then resemble in their general properties, and especially in their absorption spectrum, the colloidal "red platinum" prepared by Wöhler (this J., 1910, 1303) by reduction with ethereal solutions of phosphorus. If equal molecular proportions of hypophosphite and platinochloride be used, deep black solutions are obtained even if the concentration of platinum be only a few thousandths per cent. The solutions are stable, but sensitive to electrolytes. They are colloidal platinum solutions of a very high degree of dispersion; only on addition of an electrolyte is it possible to observe the Tyndall effect. Potassium platinichloride and chloroplatinic acid are not reduced or are reduced much more slowly than potassium platinochloride under the same conditions, and are not suitable for the preparation of these black sols.—A. S.

Beryllium (Glucinum) and its compounds; Study of ——. B. Bleyer. Apoth.-Zeit., 1913, **28**, 353—354.

By means of the alumino-thermic reaction the author succeeded in reducing beryllium oxide to metallic beryllium of about 90 per cent. purity. Beryllium hydroxide exists in three modifications of varying stability, the most active and least stable modification changing in the course of time into a less active and more stable form; all three modifications behave as dibasic acids. Beryllium forms normal arsenates and also double arsenates with alkali metals, but the latter could not be isolated, owing to hydrolysis accompanied by the formation of high-molecular products, probably adsorption compounds. Normal ammonium-beryllium arsenate was, however, isolated although it likewise underwent a similar change, when left in contact with water for several days. With weak acids, such as arsenious acid, no definite beryllium compounds could be obtained, the apparent combination of beryllium hydroxide with arsenious acid being due to adsorption. With hydrogen peroxide addition products were obtained, but these were shown to be solid solutions or adsorption compounds of hydrogen peroxide in beryllium hydroxide, the same holding good as regards boric acid and beryllium hydroxide. Beryllium forms a normal chromate (capable of existing only in solution) and a stable, basic chromate. An aqueous solution of optically inactive mannitol was made lævo-rotatory by the addition of alkaline beryllium solutions, the amount of rotation being proportional to the amount of beryllate present.—O. R.

Colloids; Chemical time-reactions with ——. D. Vorländer and R. Häberle. Ber., 1913, **46**, 1612—1628.

If 200 c.c. of a light blue, dialysed solution of Prussian blue be placed in each of a series of beakers and then to each beaker are added respectively 40 c.c. of water or of solutions of sodium hydroxide of increasing concentration, decolourisation is effected more rapidly the higher the concentration of alkali. The effect is not however proportional to the concentration of hydroxyl ions, for whilst the hydroxides of potassium, sodium and strontium act more rapidly than calcium hydroxide, the most effective of all is barium hydroxide. Similar results are obtained when barium chloride, potassium chloride, etc., are added to mixtures of Prussian blue solution and dilute ammonia. Analogous results are obtained on studying the action of alkalis on colloidal arsenic trisulphide solution. The effect of neutral salts on the reaction is found to vary according to the nature of the salt. Sodium chloride greatly accelerates the action of sodium hydroxide on Prussian blue and arsenic trisulphide. Of other salts examined, some accelerate and some retard the action, whilst others have very little influence. In this connection the relative concentrations of the colloid, the alkali, and the neutral salt are of importance. For example barium chloride may accelerate or retard the action of barium hydroxide on Prussian blue, or it may have no influence thereon, according to the concentration of the Prussian blue.—A. S.

Precipitation of aluminium hydroxide and its separation from chromium. Jakób. *See* XXIII.

Oxidation of thiosulphates on bacterial filters. W. T. Lockett. *See* Manchester Section, p. 573.

PATENTS.

Sulphuric acid; Process and apparatus for the manufacture of —— *by the chamber process.* H. Petersen. Ger. Pat. 258,554, July 14, 1912.

Two Glover towers are used, one above the other. The acid from the Gay-Lussac tower is supplied to the lower Glover tower, but only chamber acid to the upper one, from which the gases pass to the chambers.—A. S.

Nitrous gases; Recovery of waste —— *in the chamber process of sulphuric acid manufacture.* A. Taraud and P. Truchot. Second Addition, dated Jan. 16, 1912, to Fr. Pat. 425,913, April 18, 1910 (this J., 1911, 1012).

The washing with water, specified in the first addition to the chief patent (this J., 1911, 1381), when effectively carried out, gives solutions sufficiently rich in nitrous products to render the subsequent alkaline washing unnecessary.—O. R.

Acids [nitric acid]; Process of concentrating ——. E. Collett. Fr. Pat. 450,448, Nov. 12, 1912. Under Int. Conv., Nov. 18, 1911, and April 3, 1912.

Nitric acid vapours are passed in counter-current through a series of desiccators, through which a dehydrating agent, such as sulphuric acid, is flowing; the dehydrating agent is circulated through the series, and is subjected to refrigeration between each pair of desiccating units.—O. R.

Titanium cyano-nitrides and carbides; Manufacture of ——. S. Peacock, Philadelphia, Pa., U.S.A. Eng. Pat. 11,392, May 113, 912.

A mixture of the titanium carbides, TiC_2 and TiC_4, is obtained by heating a mixture of a titanium compound, such as the dioxide, and carbon to about 1800° C. under a pressure of about 2 atmospheres, whilst maintaining the partial pressure of the evolved carbon monoxide at about 200 mm. of mercury. By carrying out the operation in the presence of a steady flow of nitrogen at constant pressure, the cyano-nitrides, $TiCN_2$ and TiC_2N_4, are obtained. The carbon, in the form of coke or charcoal, is preferably used in excess to the extent of 20 to 30 per cent. over the amount necessary for the reaction, to prevent the formation of titanium nitrides.—O. R.

Boron nitride; Manufacture of ——. The British Thomson-Houston Co. Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 21,865, Sept. 25, 1912.

A mixture of finely ground boric anhydride (2 parts), finely divided magnesium (1 part), and ammonium chloride (3 parts), is heated to about 300° C. Reaction takes place with an evolution of heat sufficient to raise the temperature of the mass to about 800° C., boron nitride, magnesia, magnesium borate, and magnesium chloride being formed. The resulting product is washed with dilute sulphuric acid, filtered, washed with alcohol, and dried *in vacuo* at 60°—70° C.—O. R.

Aluminium nitride from alumina, bauxite, or other aluminous substances, by means of sodium vapour as reducing agent; Process for the manufacture of ——. G. Giulini. Fr Pat. 451,405, Nov. 15, 1912. Under Int. Conv., Jan. 29 1912.

Nitrogen is heated to about 1500° C. in a regenerative furnace and is then passed over a mixture of alumina, carbon, and sodium carbonate, the amount of the latter being such as to furnish about 30 per cent. of the sodium theoretically required by the equation : $Al_2O_3+3Na_2+N_2=2AlN+3Na_2O$.—O. R.

Tungstic acid ; Process for obtaining pure ——. C. H. Fischer, Berlin. Eng. Pat. 17,603, April 3, 1912.

Powdered tungsten ore is added to about twice its weight of fused potassium hydroxide mixed with lime, and after cooling, the mass is extracted with water, and the resulting solution of alkali tungstate treated with a large excess of ammonium sulphide to precipitate iron, zinc, etc. The tungsten remains in solution as polysulphide ; it is precipitated as sulphide by adding hydrochloric acid, the precipitate dried and oxidised by roasting, and the tungstic anhydride, thus formed, purified by dissolving in potassium hydroxide solution and reprecipitating with hydrochloric acid.—F. Sodn.

Tungstous oxides ; Process of producing fine ——. K. Farkas, Assignor to G. V. Williams, New York. U.S. Pat. 1,061,058, May 6, 1913.

Yellow tungstic anhydride is heated to a high temperature in a constantly renewed atmosphere of carbon dioxide, until black tungstous oxides are produced in the form of fine, impalpable powder.—O. R.

Copper liquors ; Treatment of ——. J. H. Thwaites and The Zeno Co., Ltd., Peterborough. Eng. Pat. 22,029, Sept. 27, 1912. Addition to Eng. Pat. 9174, April 13, 1911 (this J., 1912, 431).

Barium sulphide is added to the liquor (which must contain a sulphate, in amount at least equivalent to the copper present), so as to precipitate a portion (preferably four-fifths) of the copper as sulphide mixed with barium sulphate, and the rest of the copper is then precipitated by means of zinc sulphide and barium sulphate, as indicated in the principal patent. The total precipitate is treated as before described.—F. Sodn.

Hydrogen peroxide ; Stable ——. O. Liebknecht, Frankfort-on-the-Maine, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,058,070, April 8, 1913.

Claim is made for a solution of hydrogen peroxide in which is a substance containing a body, *e.g.*, benzenesulphonic acid, formed from sulphuric acid and an aromatic hydrocarbon.—F. Sodn.

Potash-bearing brines ; Process of refining ——. C. E. Dolbear, Berkeley, Cal., Assignor to F. H. Hitchcock, Washington, D.C. U.S. Pat. 1,058,684, April 8, 1913.

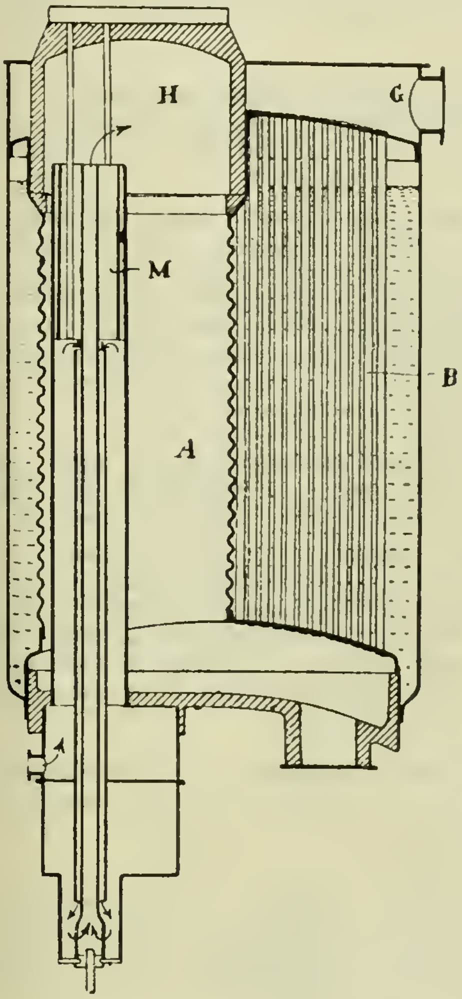
The brine is treated with carbon dioxide and with a substance capable of forming insoluble potassium and (where boron is present) boron compounds. With magnesium bicarbonate, for instance, any sodium carbonate present is precipitated as bicarbonate, boric acid as magnesium borate, and potassium as potassium magnesium carbonate. —F. Sodn.

Nitrogen oxides and the like ; Apparatus for decomposing ——. P. Winand, Cologne, Germany. U.S. Pat. 1,059,584, April 22, 1913.

An apparatus for breaking up oxygen compounds, such as nitrogen peroxide, into a gaseous mixture rich in oxygen, comprises a combustion chamber, a burner discharging into it, having two passages connected with a fuel supply and a supply of the compound to be decomposed respectively, and a catalytic agent, such as a mass of silver, which is disposed in the combustion chamber and is provided with a series of passages for the traverse of the gases.—O. R.

Oxygen compounds of nitrogen ; Arrangement for the utilisation of heat produced in electric reverberatory furnaces serving for the preparation of ——. H. Scheftlein. Fr. Pat. 451,515, Dec. 6, 1912.

The apparatus comprises a boiler for the production of vapour, or for the concentration of solutions, one or more high-tension electric reverberatory furnaces, serving for the production of nitrogen compounds being disposed inside the boiler. The furnaces are of the type in which the flame is produced by an electric arc lengthened by means of a current of air. The furnaces are placed towards the bottom of the tube, A, forming the hearth, the gases passing through the furnace in the direction of the arrows. From the cooler, M, the hot gases pass into a superheater, H, lined with refractory material. The gases descend through A, losing a considerable amount of heat, so that they arrive at the lower ends of the tubes, B, at a temperature which avoids the destruction of the joints of the tubes with the walls of the boiler. The gases, after traversing the tubes, B, leave at G. In an alternative form, several such furnace tubes, A, are disposed in the boiler, the electric furnaces being placed in the upper parts of the tubes, and the gases are led into similar tubes at the base of the boiler. These latter tubes communicate each with a set of tubes, B, which pass through the liquid to be concentrated.—B. N.



Nitrogen compounds, obtained by the action of nitrogen on carbides or carbide mixtures ; Removal of carbides or phosphides from ——. A.-G.-für Stickstoffdünger. Fr. Pat. 450,435, Nov. 11, 1912. Under Int. Conv., May 17, 1912.

The crude product, reduced to fine powder, is treated with a quantity of steam just sufficient to decompose the carbides or phosphides present, so that there is no loss of nitrogen through decomposition of the nitrogen-containing product.—J. T. D.

Conveying warm liquids [ammonium sulphate liquor]; Method of ——. H. Koppers, Essen-on-the-Ruhr, Germany. U.S. Pat. 1,060,102, April 29, 1913.

The claim is for the operation of the "suction jet" used to lift the ammonium sulphate liquor from a saturator, by means of a mixture of steam and air, the point of condensation of which is below or at the temperature of the liquid to be raised. The mixture of steam and air is made by injecting steam into a chamber provided with an air inlet. The air is drawn into the chamber, compressed, and delivered along with the steam to the "suction-jet."
—W. H. C.

Sulphur dioxide from alkali bisulphites; Process for increasing the evolution of —— in water or other liquids. L. Nonnet. Fr. Pat. 450,804, Nov. 20, 1912. Under Int. Conv., July 1, 1912.

Five per cent. of gum arabic is added to a mixture of equal parts of an alkali bisulphite and sodium thiosulphate, which has been fused in its own water of crystallisation. The resulting mass is mixed with the equivalent quantity of anhydrous sodium bisulphate, and the mixture granulated to form a stable powder, which evolves all its contained sulphur dioxide, when brought into contact with water or aqueous solutions.—O. R.

Nitrates; Removal of haloid salts and their oxidised derivatives from crude ——. C. Uebel. Fr. Pat. 451,069, Nov. 27, 1912. Under Int. Conv., Dec. 15, 1911.

The nitrate, without previous pulverisation, is heated with sulphuric acid or a bisulphate, in quantity at least equivalent to the amount of impurities (chloride, chlorate, perchlorate, or corresponding bromine or iodine compounds) present. Any other acid capable of decomposing these impurities may be used, such as hydrochloric, phosphoric, or nitric acid.—J. T. D.

Metallic oxides; Production of ——, in a light and voluminous form, suitable for catalytic reactions. F. Bedford and E. Erdmann. Fr. Pat. 451,155, Nov. 28, 1912. Under Int. Conv., Dec. 18, 1911.

A concentrated solution of a metallic nitrate is mixed with an organic compound, preferably soluble in water and rich in carbon, and then decomposed by heat. The oxides thus obtained are themselves light and bulky, and when reduced in hydrogen yield the metals in similar condition, and having great catalytic activity.—J. T. D.

Toilet pastes and creams, cosmetics and "rice powders"; New product [calcium sulphate] for the manufacture of ——. A. Monin. Fr. Pat. 451,512, Dec. 6, 1912.

The waste calcium sulphate formed in the manufacture of phosphorus from calcined bones, is heated to about 800° C. in a closed vessel and yields a white, impalpable, aseptic powder, which is claimed as a new product for the manufacture of various cosmetics.—O. R.

Alumina; Preparation of hydrated ——. E. S. Fickes. Fr. Pat. 451,593, Dec. 7, 1912.

The solution from which the alumina is about to precipitate is brought into a tall cylinder from the bottom of which a pipe, rises either externally or internally, to just below the level of the liquid, and there ends in one or more horizontally disposed jets which can deliver liquid tangentially to the cylinder. By means of a pump, liquid is circulated through this tube from the bottom to the top, and carries with it a sufficient amount of the alumina precipitate from the bottom to insure that every part of the liquid contains particles of precipitate, which serve as nuclei for the precipitation of further quantities, and are more efficient in this respect than even violent agitation.—J. T. D.

Alkali sulphides or polysulphides; Preparation of solutions of ——. H. Raupp and J. Thilo. Ger. Pat. 258,249, Feb. 15, 1912.

Hydrogen sulphide is led into solutions of alkali carbonates or bicarbonates. When working at the ordinary temperature the solutions used must contain less than 15 per cent. of alkali carbonate, but at higher temperatures solutions containing less than 20 per cent. may be used. The reaction may be applied to gas purification.—A. S.

Alkali-aluminium silicates such as felspar; Process for the decomposition of natural ——. A. Hambloch and S. Gelléri. Ger. Pat. 258,702, May 7, 1912. Addition to Ger. Pat. 247,496 (this J., 1912, 686).

The process described in the chief patent may be modified so that the alkali is recovered in the form of alkali sulphate. For this purpose the silicate mineral is heated with limestone or the carbonate of an earth metal and a sulphate and then treated with ammonium carbonate vapour as in the chief patent or with carbon dioxide under high pressure.
—A. S.

Sulphur from mixtures [such as spent oxide] containing tarry matters; Process relating to the recovery of ——. E. J. Hunt, Oldbury, and W. T. Gidden, Langley. Eng. Pat. 8097, April 3, 1912.

The material is heated to a temperature above the melting point of sulphur, treated with sulphuric acid, and, before or after separation from the acid, the sulphur is recovered by the aid of a solvent. The contaminated acid, when unfit for further use, may be purified by diluting and filtering. Spent oxide from gas purification may be first treated with a sulphur solvent and the crude sulphur obtained submitted to the process described, or the spent oxide may be treated directly, after removing metallic oxides, etc. (by means of a dilute acid) and most of the moisture.—F. Sodn.

Sulphur and sulphates; Production of —— from polythionate solutions. W. Feld, Linz-on-the-Rhine, Germany. Eng. Pat. 10,147, April 29, 1912. Under Int. Conv., March 7, 1912.

Ammonia and hydrogen sulphide are absorbed by polythionates, forming thiosulphate and sulphur (this J., 1911, 1381). The efficiency of the process is diminished by the formation of sulphates, and the object of the present invention is to retard formation of sulphates and, after the liquor has been concentrated to the required strength, to accelerate the formation of sulphates from the polythionates in the reverse process. The supply of sulphurous acid is insufficient for complete oxidation of the thiosulphate present into polythionate, the purpose being to form one molecular proportion of polythionate to two of thiosulphate, while some sulphurous acid remains free in the liquor, which is then heated to a temperature above 60° C.—H. H. S.

Sulphur dioxide; Treatment of gases or vapours containing ——, to recover the sulphur which they contain. The Thiogen Co. Fr. Pat. 450,786, Nov. 20, 1912.

The gases are brought into contact with a heated carbonaceous combustible material, solid, liquid, or gaseous, in presence of a basic substance, preferably granulated or agglomerated lime or limestone, to which may be added accelerating catalysts (metallic oxides or salts). Appropriate means are provided for condensing and collecting the sulphur formed.—J. T. D.

Graphite or other minerals of lamellar or schistose structure; Process and apparatus for separating ——. F. Krupp Akt.-Ges. Grusonwerk. Fr. Pat. 450,540, Oct. 26, 1912.

The crushed material is subjected to hydraulic classification upon a shaking-table the overflow from which is conducted to a sieve, the latter participating in the movement of the table and being of suitable mesh for retaining only the desired flaky portion of the charge.—W. E. F. P.

Oxygen; Process and apparatus for the manufacture of ——. E. F. Aumont and D. G. de Ville d'Avray. Fr. Pat. 451,307, Feb. 10, 1912.

At 600° C. silver behaves towards oxygen like a porous body, and the method and means for separating atmospheric oxygen and nitrogen consist of the following: a compressor forces air through a heater into a cylindrical vessel containing a silver tube, which is sealed at one end and communicates at the other with an aspirator, a cooling appliance being interposed between the end of the cylinder and the air-pump: the oxygen permeates through the tube and is drawn off by the pump, whilst the nitrogen is drawn off from the cylinder in the opposite direction by way of an enclosed tube, which surrounds the conduit from the compressor to the heater, the tube thus serving as a preheater; the tube, instead of being solid silver, may advantageously consist of any suitable porous substance covered with an electrolytic layer of silver. Molten silver rapidly absorbs oxygen, which it immediately gives up again on being subjected to reduced pressure. To make use of this property for the manufacture of oxygen, three containers of fused silver are arranged one above the other, an injector at the bottom of the lowest container, serving to transfer molten silver from it to the next higher container, and at the same time forcing air from a compressor through the fused metal contained in the latter, which communicates by way of an inclined, jacketed pipe with the third, highest container. The fused metal overflows from the third container and passes through the above-mentioned jacket back into the first container. The third vessel communicates with an air-pump, which draws up the molten metal and at the same time liberates its contained oxygen, whilst the tops of the first and second containers communicate by way of a system of pipes with means for the removal of the nitrogen.—O. R.

Aluminium hydrate [hydroxide]; Preparation of ——. E. S. Fickes, Pittsburg, U.S.A. Eng. Pat. 26,903, Nov. 22, 1912.

See Fr. Pat. 451,593 of 1912; preceding.—T. F. B.

Aluminium nitride; Process for the manufacture of ——. O. Serpek, Assignor to Société Générale des Nitrures, Paris. U.S. Pat. 1,060,509, April 29, 1913.

See Eng. Pat. 8347 of 1912: this J., 1912, 816.—T. F. B.

Nitrogen compounds of silicon and aluminium; Manufacture of ——. O. Serpek, Assignor to Société Générale des Nitrures, Paris. U.S. Pat. 1,060,640, May 6, 1913.

See Eng. Pat. 25,141 of 1911; this J., 1912, 127.—T. F. B.

Molybdenum nitride; Process of producing ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,061,725, May 13, 1913.

See Eng. Pat. 12,662 of 1911; this J., 1912, 431.—T. F. B.

Lead oxide; Manufacture of ——. G. V. Barton, Liverpool. U.S. Pat. 1,060,153, April 29, 1913.

See Eng. Pats. 13,600 and 27,867 of 1910; this J., 1911, 956.—T. F. B.

Tartaric salts from waste tartrous materials; Process for the extraction of ——. G. Vigneaux, Paris. U.S. Pat. 1,060,869, May 6, 1913.

See Fr. Pat. 430,883 of 1911; this J., 1911, 1382.—T. F. B.

Nitrous gases; Process of absorbing dilute ——. H. Pauling, Assignor to Salpetersäure-Ind. Ges. m. b. H., Gelsenkirchen, Germany. U.S. Pat. 1,061,630, May 13, 1913.

See Eng. Pat. 14,122 of 1911; this J., 1911, 1252.—T. F. B.

Sulphur; Recovery of —— from mixtures containing tarry matters. E. J. Hunt, Oldbury, and W. T. Gidden, Langley, Assignors to Chance and Hunt, Ltd., Oldbury. U.S. Pat. 1,059,996, April 29, 1913.

See Eng. Pat. 8097 of 1912; preceding.—T. F. B.

Process of treating ores and other materials for the extraction of metals. Fr. Pat. 451,291. See X.

VIII.—GLASS; CERAMICS.

Quartz-glass; Devitrification of ——. A. C. Michie. Chem.-Zeit., 1913, 37, 589—590.

The transformation of quartz glass into cristobalite at high temperatures was noted by Day and Shepherd (this J., 1906, 697) and recently by Rieke and Endell (this J., 1913, 426). Thomas (this J., 1912, 129) stated that small additions of titania or zirconia counteracted this tendency (see this J., 1912, 130 and 1913, 365). The author contradicts this statement and affirms that vitreosil, the English fused silica, is less liable to devitrification than siloxide and other glasses which contain zirconia or titania. (See also Seger and Cramer, this J., 1913, 234.) The method of testing consists of heating the ware at high temperatures in oxidising and reducing atmospheres.—H. H. S.

Clay; Liquefaction of —— by alkali. J. K. Neubert. Kolloidchem. Beihefte, 1913, 4, 261—342.

After a critical review of previous work the author describes in detail his own experiments made to ascertain the cause of the so-called liquefaction of clay by alkalis. The results do not support the view of Böttcher (this J., 1909, 523) that the amount of alkali which produces the maximum effect on a given quantity of clay is independent of the quantity of water present. It is concluded that the effects produced by alkali are closely connected with the presence in the clay of humic substances in the form of a dried gel in a very fine state of division. When the clay is brought in contact with an alkaline solution the clay particles adsorb hydroxyl ions and in consequence of the electrical charge thus acquired repel one another, thus causing the mixture to appear more liquid. This effect is opposed by the stiffening action induced by the swelling of the clay particles. With increase of the concentration of alkali the liquefying action preponderates over the stiffening effect due to swelling of the particles, and rises to a maximum. With still higher concentrations of alkali the clay particles are coagulated and this results in stiffening, but gradually the alkali dissolves the humic substance and thus induces a further subdivision of the clay particles, and the alkali humate acts as a protective colloid and hinders re-aggregation of the particles; this is the cause of the so-called re-liquefaction, *i.e.*, of the fact that when a greater concentration of alkali is added than that necessary to produce maximum liquefaction, the mixture at first becomes stiffer, but on standing its viscosity begins to decrease again.—A. S.

Leadless glazes; Studies on ——. V. Tafner. Sprechsaal, 1913, 46, 301—304.

Following on a preliminary report (this J., 1912, 434), the present article deals with commercial leadless glazes. The two recipes most recommended are: (a) potassium carbonate 32·8, sodium bicarbonate 30, calcined borax 16·28, calcium carbonate 10, alumina 16·5, silica 64, zinc oxide 1·5 parts by weight; and (b) 30 parts each of barium carbonate and silica added during milling to 100 parts of the frit made from: potassium carbonate 32, sodium bicarbonate 30, calcined borax 16·28, calcium carbonate 10, zinc oxide 2·5, alumina 16·5, boric acid 30, silica 64 parts by weight. The latter of these glazes is said to be acid-resisting. Both are fired at cone 012.—H. H. S.

Patents.

Quartz articles; Manufacture of ——. British Thomson-Houston Co., Ltd, London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 415, Jan. 6, 1913.

Crushed quartz crystal, or other form of pure silica, is raised to melting point by means of an electrical heater, consisting of a refractory metal such as tungsten, embedded therein. The operation should be carried out in a vacuum or in an atmosphere of inert gas in order to prevent oxidation of the refractory metal.—H. H. S.

Oven for drying chambers for pottery, surmounted by a heat-collecting chamber. A. Schumann. Fr. Pat. 450,856, Oct. 30, 1912. Under Int. Conv., Aug. 28, 1912.

Drying rooms fed by waste heat from firing kilns are invaded by draughts which cause great loss by cracking of the unfired ware. A special circular oven is provided with flues leading the dry air in the direction opposite to moving waggons of ware, the speed of the currents being controllable.—H. H. S.

Ceramic bodies; Hardening material for refractory ——. L. Parthonnaud. Fr. Pat. 451,224, Feb. 7, 1912.

Broken porcelain pitcher is ground and used as filling material in saggers and other ware, thereby achieving resistance to changes of temperature and whatever porosity may be desired.—H. H. S.

Enamel, glass or glazes; Manufacture of a white body for ——. R. Rickmann. Fr. Pat. 451,238, Dec. 2, 1912. Under Int. Conv., Dec. 4, 1911.

Antimony as metal, oxide, or sulphide, is heated to redness with saltpetre and an alkali hydroxide, such as caustic soda, in order to form antimony tetroxide and antimonate of sodium or other base.—H. H. S.

Drying pottery and the like; Apparatus for ——. J. Bührer, Constance, Germany. U.S. Pat. 1,060,425, April 29, 1913.

See Eng. Pat. 15,249 of 1912; this J., 1913, 535.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement; Control of initial setting time of ——. E. E. Ware. J. Ind. Eng. Chem., 1913, **5**, 369—371.

An account of experiments on a parcel of quick-setting cement clinker which failed to respond to the usual corrective methods. No free lime (compare Reibling and Reyes, this J., 1911, 1117) could be detected in the cement by the microscopic test of White (this J., 1909, 23). It was not found possible to retard the set by addition of plaster, gypsum, hydrated lime, calcium chloride, or acids, but satisfactory results were obtained by hydrating the cement as recommended by Bamber (Concrete and Const., Eng., 1909, (4), 196), by any one of the following methods. (1) The cement, after grinding with the usual amount of gypsum, was heated in a closed tube, hydration being effected by the water expelled from the gypsum. (2) The clinker was heated to about 100° C. and ground while hot. (3) The ground cement was allowed to drop through a vertical tube (30 ins. long) through which a small cloud of steam was rising. All cements which have come under the author's observation become quick-setting when heated to 350°—400° C.—A. S.

Patents.

Fibrous compositions; Manufacture of ——. G. A. Henderson, Charleston, W. Va., U.S.A. Eng. Pat. 8341, April 6, 1912.

Chipped or shredded woody particles or fibres are boiled with water to extract the juices and enlarge the hard sinewy portions; the juices and pulpy matters are drawn off, the sinewy portions loosened by the boiling are washed, the porous residue is thoroughly dried, the dried particles are graded and then impregnated under the influence of heat with a pitch preservative. The impregnated particles, after drying, may be mixed with just sufficient of an asphaltic binder to stick them together. A mixture of 20—30 per cent. of bark chips or shreds to 70—80 per cent. of wood chips or shreds may be used. Suitable proportions of impregnating materials are 20 per cent. by volume of pitch preservative binder, or 18 per cent. by volume of pitch preservative and 5 per cent. of binder. The composition is moulded to form building blocks, paving stones, etc.—J. F. B.

Wood; Injection of [preservatives into] ——. R. H. de la Colombe. Fr. Pat. 450,276, Oct. 25, 1912.

The application of heat in order to volatilise organic compounds and to harden the cellulose tissue at the maximum capacity of the cells, is followed by penetration of the preservative at the temperature necessary to maintain fluidity.—H. H. S.

Impregnation of tree-trunks by means of chemical products and of colouring agents. K. Nesztor. Fr. Pat. 451,571, Dec. 7, 1912.

A watertight cap is fitted to one end of the felled trunk, and the liquid is introduced either by pressure or by suction.—H. H. S.

Plaster allied to cement; Manufacture of ——. C. Keen and J. T. South, London. Eng. Pat. 10,424, May 2, 1912.

(a). Gypsum is calcined and mixed with a small proportion of molasses and potash alum or sodium silicate. (b). Chalk, mixed with a little sulphur and zinc sulphate, is calcined at a temperature high enough to fuse the sulphur and cause it to penetrate the mass. (c). River mud or clay is heated to a sufficient temperature to burn or volatilise vegetable and resinous matter, and is mixed with a little acetic acid and gum arabic, after which it is mixed with sufficient of (b) to give a dry product. (d) Sand or flint is ground to the desired fineness. (a), (b), (c), and (d) are then thoroughly incorporated and ground together, with or without the addition of liquid paraffin or ground naphthalene, to form a plaster suitable for both interior and exterior work.—O. R.

Plaster of Paris; Manufacture of ——. W. M. Brothers, East Leake, Notts. Eng. Pat. 639, Jan. 9, 1913.

Gypsum or other form of calcium sulphate is heated to 200°—300° F. (93°—149° C.) in a steam-jacketed vessel under reduced pressure.—O. R.

Flooring and like purposes; Compositions or cements for ——. J. G. Robertson, Whiteinch, Lanark. Eng. Pat. 12,185, May 23, 1912.

To protect metallic flooring from the corrosive action of the chlorine contained in Sorel cements, an emulsion of equal parts of a hydrated magnesium silicate, sodium silicate (140° Tw., sp. gr. 1·7), and water, with or without the addition of 8—10 per cent. of calcium or aluminium hydroxide, is applied to the flooring and allowed to dry, before applying the oxychloride cement. The chlorine of the magnesium chloride present in the cement acts upon the protective coating, rendering it impervious to moisture. —O. R.

Cement; Manufacture of ——. K. v. Ritter-Záhony, Wildon, Styria. Eng. Pat. 13,803, June 12, 1912.

The crude material, having been ground in a wet state in the known manner, is freed from most of the water by presses, centrifugals or other mechanical means, and is introduced into the rotary kiln as a loose product of the consistence usual in the dry process for the manufacture of cement. A more intimate mixture of the crude materials is attained by wet grinding.—H. H. S.

Portland cement; Manufacture of ——. T. A. Edison, Llewellyn Park, Orange, N.J. U.S. Pat. 1,059,661, April 22, 1913.

Silicious and aluminous materials are heated with limestone in such proportions as to fuse below 2500° F. (1371° C.) and form an extremely liquid, non-viscous slag, containing about 50 per cent. CaO; the molten slag is finely subdivided by a powerful blast, mixed with limestone so as to yield the lime-content required by the finished cement, and the mixture calcined.—O. R.

Concrete; Impermeable ——. E. L. M. Martin. Fr. Pat. 451,532, Dec. 6, 1912.

The mortar used in the mixing contains sand of two degrees of coarseness, so that the finer quality fills up the interstices of the coarser grained material without increasing the volume. The use of a smaller proportion of cement is thereby rendered feasible, with results conducive to impermeability. The mortar consists of 1 cb. m. of coarse sand of mesh 2—6 mm., 0·5 cb. m. of sand of mesh less than 0·5 mm., and 500 kilos. of cement. To 55 cb. m. of this mortar are added 80 of gravel of mesh 0·06—0·02 mm.—H. H. S.

Artificial stone; Process of making ——. W. F. C. M. McCarty, Pleasantville, N.Y. U.S. Pat. 1,060,614, May 6, 1913.

Silica is treated with nitric and hydrofluoric acids, and the softened mass is mixed with silica and an alkaline-earth salt of an organic acid.—O. R.

Lime and the like; Apparatus for hydrating ——. S. Wiebe, Brooklyn, N.Y., Assignor to M. C. Hathaway, Richmond, Va. U.S. Pat. 1,060,805, May 6, 1913.

The material passes from a dry mixer into a wet mixer, where it is partially hydrated, and thence into a silo, where it is allowed to age. The partially hydrated and aged material is then fed into a vessel, in which it is agitated and conveyed through the apparatus against a counter-current of aqueous vapour.—O. R.

Lime; Apparatus for slaking fat and hydraulic ——. C. E. Candlot. Fr. Pat. 451,199, Nov. 29, 1912.

The quicklime is delivered into the top of a tall vessel or "silo," in which are disposed a number of sprays for delivering water. The jets of these sprays are protected from stoppage by the falling lime, by V-shaped deflectors just above them. The steam generated by the heat of the reaction rises through the mass, and begins the slaking of the upper layers of lime. The slaked lime is removed by a conveyor from the lower opening of the silo, and the same motor which drives the conveyor also drives the pump which supplies the water, so that the rates of water-supply and of lime-removal are automatically proportioned to one another.—J. T. D.

Building materials with special properties; Manufacture of ——. C. A. C. de Caudemberg. Fr. Pat. 451,648, Dec. 9, 1912. Under Int. Conv., Dec. 6, 1912.

A material with elastic and waterproof properties, as also capable of readily accommodating itself to vibrations without injury, is produced by adding Portland cement to a mixture of gas-tar and a solution of rubber in benzol and carbon bisulphide. The proportions given are: 0·5 kilo. of rubber dissolved in 5 kilos. each of benzol and carbon bisulphide; 12 kilos. of this solution added to 37 kilos. of gas-tar of sp. gr. 1·22 at 55° C.: 10 kilos. of this mastic to 38 of calcareous sand and 24 of porphyritic gravel, to which mixture is further added 25 kilos. of Portland cement. The product may be used as a building material or as a bed for laying-in rails.—H. H. S.

Acid-proof and fireproof material; Process for the manufacture of an —— consisting of pure silicic anhydride. I. Schlossberg. Ger. Pat. 258,683, Oct. 15, 1911.

Quartzite is worked up with colloidal silicic acid and lime to a plastic mass, from which blocks are moulded, and these are hardened with steam, and freed from lime by treatment with an acid, such as hydrofluosilicic acid or hydrochloric acid, and then with water.—A. S.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; The desulphurising of ——, its laws and their application. W. Heike. Stahl u. Eisen, 1913, **33**, 765—769, 811—817.

The desulphurising of iron is determined by (1) the separation of solid solutions of iron and manganese sulphides, and (2) the solvent action of the slag, between which and the molten iron, the mutually soluble sulphides are divided. The nature of the separated solid solutions depends on the manganese content of the iron and the temperature. As a result of the higher melting points of the sulphides rich in manganese, separation of the sulphur is more complete the greater the manganese content, and the lower the melting point of the metal. The effect of the slag is dependent on its nature, its quantity, and the extent to which oxidation of the sulphides contained in it takes place. The slag is more effective when these agencies restrain the concentration of the soluble sulphides in the slag.—T. St.

Iron; Tenacity of —— at various temperatures. P. Goerens and G. Hartel. Z. anorg. Chem., 1913, **81**, 130—144.

The authors have studied the tenacity of commercial mild steel, between —75° and 1000° C., by the method of shock, and the dependence on temperature of "the specific impact-work" (the work necessary to produce fracture or bending) is shown by means of curves. These curves exhibit maxima at about 35° C. and 600° C. and a minimum at about 450° C.; great brittleness is observed at and below —75° C. A valuable indication of the degree of brittleness is afforded by the angle of bending at which fracture occurs; this varies with the temperature in the same sense as the specific impact-work, but in a more pronounced fashion.—F. Sodn.

Steel; Influence of crushing on the properties of ——. P. Goerens. Rev. Mét., 1913, **10**, 608—664.

Using a series of steels containing from 0·07 to 0·98 per cent. C, and each of which had previously received the same mechanical and thermal treatment, the author determined the alterations in the mechanical properties produced by crushing. The deformation was produced by either drawing or rolling, and the degree of deformation was expressed as the percentage of the reduction in size on the original dimensions. The amount of deformation possible depends on the original dimensions and on the chemical composition. A piece of steel having a sectional area of 160 sq. mm. could be reduced by 60 per cent. whilst one of 21·2 sq. mm. could be reduced 96·5 per cent. The lower the carbon content the greater also the reduction: steels containing 0·10 and 0·75 C per cent. could be reduced by 96·5 and 67·5 per cent. respectively. The process of deformation is shown to exert a great influence, and it is stated that in order to define the mechanical treatment, it is not sufficient to know only the dimensions before and after treatment, but also the intermediate dimensions. The elastic and tensile properties, hardness, specific gravity, electric and magnetic properties, rate of solution in dilute sulphuric acid, and the microscopical structure were determined and discussed in detail; these results are tabulated and graphically illustrated. The paper is accompanied by twenty three micro-photographs.
—A. H. C.

Mild steel and steel; The so-called fibrous structure in ——. P. Oberhoffer. Z. anorg. Chem., 1913, **81**, 156—169.

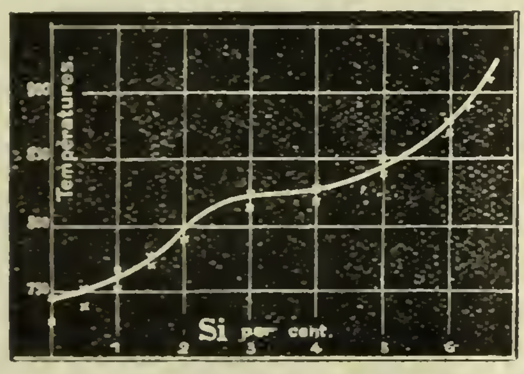
Experiments with commercial material have shown that in all cases in which the metal has been shaped (by rolling, forging, or pressing) at a high temperature, fibrous structure may be developed by slow heating and cooling at not too high a temperature (preferably about 850° C.). The intensity and mode of development of the fibrous structure is dependent on the nature of the stress and the temperature at which it is applied, and also on heating and cooling conditions and subsequent annealing. Determinations of the strength of materials annealed at various temperatures indicate that fibrous structure is preferable to crystalline structure [" *Gussstruktur* "]. Reasons are given for supposing, with Brearley, that the appearance of fibrous structure is due to crystallisation (of ferrite, for example) taking place around elongated inclusions of slag which serve as nuclei.—F. Sodn.

Manganese; Influence of —— on the mechanical and structural properties of low-carbon mild steel of ordinary commercial quality. A. Stadeler. Z. anorg. Chem., 1913, **81**, 61—69.

Seven series of tests were made with steel containing C 0·08—0·14 and Mn 0·30—0·70 per cent., besides low percentages of phosphorus and sulphur and traces of Si. The metal was heated for 3 hours at about 750° C. and slowly cooled before testing, and the results, as well as the composition of each sample, are given in tables. Manganese, even in very small quantities, exerts a distinct influence on the tenacity of low-carbon mild steel, an average increase of 1·34 kilo. per sq. mm. being observed for each additional 0·10 per cent. Mn (which agrees well with Lang's figure for steel containing Si and 1—3 per cent. Mn; this J., 1911, 214), but elongation, reduction of area, and microstructure are not affected.—F. SODN.

Iron and silicon; The transformations of alloys of——. E. Vigouroux. Comptes rend., 1913, **156**, 1374—1376.

As the result of experiments with pure siliconised iron it was found that no phenomena corresponding to the A_1 and A_3 transformations of steels occurred. The influence of silicon upon the temperature of the A_2 transformation of pure iron was determined, the results obtained being shown in the accompanying diagram: the temperatures recorded are the final temperatures of the transformations obtained by reheating.—W. E. F. P.



Phosphorus in steels containing vanadium; The determination of——. J. R. Cain and F. H. Tuttle. J. Washington Acad. Sci., 1913, **3**, 249.

BEFORE precipitating the phosphorus in vanadium steels as phosphomolybdate, it is necessary first to reduce the vanadium to the quadrivalent state. This is accomplished by the addition of a slight excess of ferrous sulphate after the solution has been adjusted to the proper acidity prior to the precipitation of the phosphorus. The precipitation is made at 15° to 20° C., at which temperature the ferrous iron is not oxidised by the nitric acid, and the solution is well agitated.—T. ST.

Hardened products [steel and nickel]; Annealing of ——. L. Guillet. Rev. Mét., 1913, **10**, 665—676.

THE tensile strength, elastic limit, and elongation of hardened nickel and steel, were determined in the original condition, and after annealing, in a salt-bath at temperatures from 100° to 900° C., and the results are tabulated and graphically illustrated. It is shown that the first deflection from the original as the result of annealing occurs at about 400° C. with a marked alteration between 700° and 750° C., which latter was greatest in the case of the elongation. The influence of time on the effect of annealing was also investigated and it is concluded that:—The time of annealing has no influence on the elongation, whilst the breaking strain is slightly lowered in the case of nickel and more so in a hard steel, especially if the time be prolonged, although this result may be influenced by the surface decarburisation produced. In all cases the influence of time is very restricted in contradiction to generally accepted views.—A. H. C.

Hardening by mechanical treatment. Hanriot. Rev. Mét., 1913, **10**, 595—607.

ATTENTION is called to the somewhat vague conceptions as to the hardness of a metal, and the following definition is proposed:—All metals are hard, which by suitable annealing undergo a modification of their physical properties without chemical alteration. It is also suggested that a "figure of hardness" is best stated as the ratio of the hardness when in the hard condition to that when fully annealed. Examples of this are given in some tabulated results of the determinations of hardness of a number of metals. Cubes of several metals were also subjected to a pressure of 10 tons per sq in. in a suitable apparatus devised so as to prevent deformation and it is shown that the hardness produced was uniform throughout the whole metal and that the figure of hardness varied from 1·1 in the case of iron to 1·8 in that of silver. It is concluded that hardness may be produced without deformation, and that the metallographic changes are concurrent with a deformation of the metal. The effect of tension in producing hardness was also investigated and the hardness due to crushing was found to be independent of deformation.
—A. H. C.

Silver; Rapid determination of —— in mill solutions. G. H. Clevenger. Eng. and Min. J., 1913, **95**, 892—893.

A MEASURED volume of the solution is run through a layer of 5 grms. of zinc dust, ⅛ in. thick, placed in a Gooch crucible, care being taken to keep the zinc always covered with the solution. The zinc is then washed into a beaker and 15 c.c. of strong nitric acid slowly added. After all action has ceased, the solution is boiled to expel nitrous fumes, made up to 100 c.c., and the silver titrated with potassium thiocyanate (10 grms. per litre). The thiocyanate solution is standardised against assay silver dissolved, together with 5 grms. of zinc, in 15 c.c. of nitric acid, and treated as described. Mercury and metals forming coloured salts such as Ni, Co, etc., must be absent. Copper may be present up to an amount equal in weight to that of the silver.—T. ST.

[Gold.] Telluride ores; Concentration of——. H. E. Wood. Eng. and Min. J., 1913, **95**, 885—886.

THE ores consist of a hard silicious gangue with sylvanite which is present in very soft blade-like monoclinic crystals. Gravity separations have been unsuccessful because of the loss due to the floating away of the fine telluride particles. The proposed method is to crush the ore dry to 60-mesh or finer, when 50 per cent. of the sylvanite can be recovered by flotation. If the tailings are then treated on a Wilfley table, a further 20 to 25 per cent. is obtained. By regrinding the tailings from the table to 150-mesh, 66 per cent. of the remaining gold is recoverable by the ordinary cyanide treatment. Tables are given showing that about 80 per cent. of the gold, and an average of about 70 per cent. of the silver were recovered by this method, on an experimental scale.—T. ST.

Blende; Presence of strontium compounds in ——. E. Beyne. Bull. Soc. Chim. Belg., 1913, **27**, 159—164.

ATTENTION is drawn to the presence of strontium compounds (from 0·05 to 0·8 per cent. SrO) in certain blendes, and it is pointed out that this, if not taken into consideration, may lead to injustice in cases where contracts for roasted blendes are based on the difference between the total sulphur and the so-called fixed sulphur (*i.e.*, sulphur combined with lead, calcium, magnesium, and barium).
—A. S.

Uranium and radium. C. L. Parsons, Mining and Eng. World (Chicago), May 10, 1913. [T.R.]

WHILE all the radium placed upon the market in the last few years has been produced in Europe, a large portion of this output has come from American ores. At least 20 to 25 tons of high-grade pitchblende have been exported. During the last year, carnotite carrying 28·8 tons of U_3O_8, from which 11·43 grms. of radium bromide could be obtained, were produced. All this ore was shipped abroad for the extraction of radium. The value of the radium salts extracted would be about £106,000. The total supply of radium salts from all other sources was 3·65 grms. of radium chloride, basing the production of the Austrian mines for 1912 upon that of 1911, which is known. Pitchblende has been found in small quantities in Connecticut and in the felspar quarries of North Carolina. Practically the total American output has come from the mines in Quartz Hill, Gilpin County, Colorado. Carnotite consists mainly of potassium uranyl vanadate, but contains also small amounts of barium and calcium compounds. It of necessity carries radium, although it has not yet been definitely established that the uranium and radium are in equilibrium as they are in pitchblende. In carnotite the amount of radium is not far from the equilibrium ratio and in calculations given above an allowance of 10 per cent. has been made to cover this possible deficiency. The more important deposits are scattered over Colorado and Utah. Carnotite always carries vanadium as well as uranium and radium, but is purchased almost wholly on its radium content, comparatively little being allowed for the vanadium present. Ore of 2 per cent. uranium oxide is now worth approximately $75 per ton f. o. b. New York. In the mining of these carnotite ores it is probable that 5 tons of material capable of concentration are wasted for every ton that finds its way to market. To develop methods for concentrating these ores is one of the problems before the Bureau of Mines.

Barium ; Preparation of ——. C. Matignon. Comptes rend., 1913, **156**, 1378—1380.

The process, which is stated to be commercially applicable, is based upon the reduction of barium oxide by silicon in accordance with the equation :—$3BaO+Si=SiO_2.BaO+2Ba$. The mixture of anhydrous barium oxide and silicon (the latter as such or in the form of a ferro-alloy containing 90—95 per cent. Si) is heated in one end of a steel tube the whole of which is enclosed in a porcelain tube ; a vacuum is maintained in the latter. The metallic barium produced is volatilised and condensed in the cooler part of the steel tube. Barium of 98·5 per cent. purity is said to be easily obtainable in this way. —W. E. F. P.

Blast-furnace slags ; Oxidation of the sulphur contained in ——. L. Blum. Ferrum, 1913, **10**, 225—226.

A yellow-white amorphous powder which was found on a slag heap in dry weather proved to consist mainly of calcium thiosulphate, with small amounts of calcium sulphate and free sulphur, and traces of manganese, the latter probably as sulphate.—T. St.

Contribution to the chemistry of gold. Lenher. *See* VII.

Rapid methods for the determination of antimony. Nissenson. *See* XXIII.

Analysis of copper-tin alloys. W. Gemmell. *See* Newcastle Section, p. 581.

Corrosion of iron and steel. W. H. Walker. *See* New York Section, p. 584.

Patents.

Armour plates and other steel articles ; Manufacture of ——. Vickers Ltd., Sheffield, and J. L. Benthall, Chesterfield. Eng. Pat. 885, Jan. 11, 1912.

Steel preferably containing C 0·15 to 0·60, Mn 0·20 to 0·40, Ni 3·6 to 6·0, Cr 0·25 to 2·5 per cent., and which may also contain molybdenum, vanadium, tantalum and tungsten, is rolled to the desired thickness, and freed from internal stresses by heating at 1050° to 1250° F. (566°—677° C.) and allowing to cool in air on supports. If it is to be machine-surfaced before cementing, it is softened by a second heating at 1050° to 1250° F. (566°—677° C.), again being allowed to cool on supports. The face is then cemented at 1700° to 1850° F. (927°—1010° C.) for 8 to 14 days, the metal bent as required at 1400° to 1550° F. (760°—843° C.), heated to 1400° to 1600° F. (760°—871° C.) and oil- or water-hardened. It is then heated to 1150° to 1350° F. (621°—732° C.), and after sprinkling or being allowed to cool in air, is reheated to 1150° to 1350° F. (621°—732° C.), sprinkled, and machined. The final treatments are as follows :—(1) heating to 1300° to 1550° F. (704°—843° C.), and hardening in oil or water ; (2) heating to 1200° to 1350° F. (649°—732° C.), and rebending to counteract distortion ; (3) while still hot reheating to 1200° to 1350° F. (649°—732° C.) and sprinkling ; (4) embedding with the back in sand, and the face exposed, and subjecting to a final hardening temperature varying from 1200° to 1750° F. (649°—954° C.) for a length of time sufficient for the face of the plate to reach the desired temperature to give the correct depth of hardening, and then sprinkling with water.—T. St.

[*Iron, copper, etc.*] *Metallic ore or the like ; Reduction or oxidation of* ——. A. E. Bourcoud, London. Eng. Pats. 10,381, May 1, and 21,934, Sept. 26, 1912.

In a closed-cycle process for treating metallic ores, out of contact with solid carbon, by means of a gas rich in carbon monoxide, and regenerating the latter, the ore treatment and the regenerative portions of the process are performed separately or together in any desired proportion, so that oxidation or reduction of contained metal may be effected to a predetermined extent according to requirements ; for example, in the treatment of ore containing iron and copper, the conditions may be so controlled as to effect the reduction of copper alone or of the two metals simultaneously.—W. E. F. P.

Blast furnaces for the smelting of iron and other ores. T. B. Rogerson, Glasgow. Eng. Pat. 10,399, May 2, 1912.

Below the usual charging bell is placed a feed hopper, and the level of the charge is maintained above the bottom of the hopper, which thus serves as a gas seal. Below the hopper is a series of gas outlets extending upwards to a gas main encircling the upper end of the furnace. The bottom of the hopper projects inwards from the lining so as to give a clear space for the passage of the gas to the outlets. It is claimed that the hopper arrangement renders the ore and fuel less liable to be broken during charging, causes better distribution, and, by protecting the brickwork lining from the impact of the charge, prolongs the life of the furnace, whilst the seal formed by the charge in the hopper prevents the free escape of dust and gas each time the charging device is opened.—T. St.

Steel sheets for use in making tin-plates ; Manufacture of ——. R. P. Bevan, Briton Ferry, Glamorgan. Eng. Pat. 23,679, Apr. 18, 1912.

As an improvement on the process described in Eng. Pat. 23,002 of 1911 (this J., 1912, 1133) the washed steel sheets—before being cold rolled—are dried singly by being passed over or between Bunsen or atmospheric gas flames. —W. E. F. P.

Iron and steel ; Method of and apparatus for recovering —— *from waste enamelled articles.* A. de Back, Essen-Ruhr, Germany. Eng. Pat. 77, Jan. 1, 1913. Addition to Eng. Pat. 3375, Feb. 11, 1910 (this J., 1910, 1390).

The enamelled articles are passed successively through pairs of rollers so arranged that the perimeter of any pair is greater than that of the preceding pair. The articles are thus not only bent and distorted, but also stretched, and the enamel thereby becomes broken and loosened.—T. St.

Steel ; Process of making manganese ——. A. E. Greene, Chicago, Ill., Assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. U.S. Pat. 1,060,078, Apr. 29, 1913.

In making manganese- or other alloy-steel, the ferro-manganese or other alloying material is placed in an electric furnace into which the requisite amounts of steel and basic flux, both in a molten condition, are subsequently charged ; the melting is completed by electrical means and in a reducing atmosphere.—W. E. F. P.

Pig-iron; Method of making —— from steel-scrap. H. W. Lash, Cleveland, Ohio. Assignor to The West Coast Iron Co., San Francisco, Cal. U.S. Pat. 1,061,189, May 6, 1913.

Cast iron is made by melting a mixture of steel scrap, carbon, and silicious material in a reverberatory furnace, the carbon being placed within the charge mixture at or near the hearth of the furnace in order to protect the iron from the oxidising flame of the furnace.—T. St.

Steel; Method of converting iron into ——. F. F. Palli. Fr. Pat. 450,638, Nov. 15, 1912.

Tools made of iron are embedded in a powder composed of ox horn 5, ox bones 60, pine bark 35 per cent., and heated to 900° to 1000° C. for 1½ to 3 hours, the whole being contained in a hermetically sealed cast iron box. The tools are then removed and quenched in running water at 30° C.—T. St.

Compound metal [iron or steel coated with another metal or alloy]; Manufacture of ——. J. Tartiere y Lenegre. Fr. Pat. 450,787, Nov. 20, 1912. Under Int. Conv., Oct. 12, 1912.

The iron or steel having a thickness at least twenty times that of the finished product, is carefully cleaned from oxide, and a light coating of aluminium applied mechanically by means of an aluminium disc rotating at high speed. It is then covered with the metal or alloy in question (carefully deoxidised), heated in a reducing atmosphere to about 700° C., and rolled or drawn. The rolling or drawing is continued with reheating as necessary, between 500° and 700° C., until the thickness is reduced to one-fifth that of the original, further rolling being done cold, in the same manner as for tin plates.—T. St.

Steel; Process for the manufacture of refined ——. Dellwik-Fleischer Wassergas-Ges. m. b. H. Ger. Pat. 258,981, Oct. 12, 1912. Addition to Ger. Pat. 250,999.

In carrying out the process described in the chief patent (this J., 1913, 29), the surface of the vessel containing molten steel and the inner surface of the vacuum chamber are heated to a high temperature, preferably to the melting point of the steel, before the vacuum is produced. The vessel containing the molten steel is mounted in the vacuum chamber on projections or ribs, and the spaces between the ribs are utilised as heating flues.—A. S.

Filter for slimes pulp and the like. G. Ridgway, Kalgoorlie, W. Australia. Eng. Pat. 10,731, May 6, 1912.

An apparatus in which "all the actions of the filtering frames, their timing and reversal," and the admission of compressed air or production of a vacuum are effected automatically by means of appropriate mechanical devices.—W. E. F. P.

Slimes; Process and apparatus for separating —— from sand. P. Argall, Denver, Colo., U.S.A. Eng. Pat. 24,009, Oct. 21, 1912.

A U-shaped trough inclined at about 15° to the horizontal, dips at its lower end into a cylindrical settling tank. Mounted within the trough, and extending its full length, is a pair of oppositely disposed ribbon spiral conveyors, the lower ends of which project into the settling tanks. Sand and slime are fed on to the lower portion of the trough and run down into the settling tank. The mixture is well agitated by the conveyors, which carry the heavier sand forward up the trough, while the slimes overflow from the tank into a circumscribing launder, and are led away. By damming up a portion of the edge of the tank, the length of the overflow portion may be reduced to any extent, according to the desired degree of fineness of the separated slimes. Means are provided for running off the slime-bearing water which separates from the sand as this is carried up the trough.—T. St.

Sodium alloys; Manufacture of ——. The British Cyanides Co., Ltd., and E. C. Rossiter, London. Eng. Pat. 14,254, June 18, 1912.

A sodium-lead alloy is made by heating a mixture of sodium hydroxide and carbon and agitating the charge with molten lead while the reduction is taking place. —W. E. F. P.

Alkali metals; Preparation of —— from alkali chlorides. A. Barth. Ger. Pat. 258,353, Feb. 27, 1912.

A mixture of an alkali chloride, carbon, and oxides or hydroxides of alkaline-earth or heavy metals (to fix the liberated chlorine) is heated so as to distil off the alkali metal produced. A flux may be added to the reaction mixture, or the latter may be added to a melt (from a previous operation) from which the alkali metal has been partly or completely distilled.—A. S.

Zinc; Apparatus for use in connection with the extraction of ——. W. D Jones, Swansea. Eng. Pat. 15,888, July 8, 1912.

An apparatus for extracting zinc (as sulphite) from roasted ores (by subjecting a mixture of the latter and water to the action of sulphurous gases from roasting furnaces) comprising three longitudinal boxes provided with concave bottoms and each divided into five compartments. Each box is provided with a central, horizontal shaft to which a number of "wings" are attached, the latter being made in halves and having eight rows of spoons upon each. The direction of rotation of the shaft of the middle box is opposite to that of the shafts in the end boxes; the single shaft in this box may be replaced by a series of small shafts geared to rotate in opposite directions in adjoining compartments.—W. E. F. P.

Zinc oxides; Process for reducing ——. C. F. Burgess, Madison, Wis. U.S. Pat. 1,059,342, April 22, 1913.

Zinc oxide is volatilised by heating it electrically, and the vapours are led into contact with carbon which has been simultaneously heated electrically to a reducing temperature in a separate chamber.—T. St.

Copper matte; Method and apparatus for bessemerising ——. H. B. Jernee, Perth Amboy, N.J. U.S. Pat. 1,059,367, April 22, 1913.

The converter consists of a rotatable horizontal cylindrical shell with a non-corrodible lining. On the part which is uppermost when the converter is in its normal position are two air-inlets at the ends and a gas-outlet midway between. The air-inlets extend downwards below the normal level of the charge, and from the bottoms of these inlets the lining extends upwards in stepped formation to the gas-outlet. A baffle effect is thus produced, the air being directed downwards through the body of the metal. —T. St.

Nickel alloys; Process of producing low-carbon ——. E. A. Byrnes, Washington, D.C., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 1,059,709, April 22, 1913.

Low-carbon ferrochromium containing nickel is produced by melting high-carbon ferrochromium beneath a calcium aluminate slag, and feeding nickel oxide into the slag, the temperature of the ferrochromium being maintained below the reduction temperature of chromium oxide. —T. St.

Soft solder. J. T. Dwyer, St. Louis, Mo. U.S. Pat. 1,059,982, April 29, 1913.

An alloy composed of approximately: Pb 56½, Sn 41½, Sb 2, and P 0·02 per cent.—W. E. F. P.

Furnace; Metallurgical ——. U. Wedge, Ardmore, Pa., Assignor to The Furnace Patent Co., Philadelphia, Pa. U.S. Pat. 1,060,389, April 29, 1913.

In a furnace of the kind in which the charge is propelled from the highest to the lowest of a series of superposed hearths, the side walls are provided with inserted flue-casings, accessible from the exterior and containing draught channels so located as to divert the draught from the openings through which the charge passes from one hearth to the next.—W. E. F. P.

Furnace; Electric —— [*for the production of alloys*]. D. J. Hauss, Aurora, Ind. U.S. Pat. 1,060,839, May 6, 1913.

The furnace comprises a container for the material to be treated, and an accumulator compartment within the container and beneath the surface of the material. The accumulator communicates through a substantially horizontal opening with the interior of the container. One or more metallic electrodes, outside the container, serve as anode, and are connected with a source of direct current. The cathode is within the accumulator, and is connected with the source of direct current and also with a source of alternating current. A third electrode in the container is also connected with the source of alternating current. Means are provided for controlling the relative amounts of direct and alternating currents passing through the material. The action of both currents is to fuse the material, whilst the direct current serves to electrolyse the substance, and deposits one of the components at the cathode. The product separated at the anode passes through the opening into the accumulator-compartment and becomes alloyed with the cathode deposit.—B. N.

Cupola-furnace. W. N. Best, New York. U.S. Pat. 1,061,158, May 6, 1913.

The bottom of the cupola opens into a substantially closed chamber, into which the molten metal flows. At the end of the chamber on the side away from the cupola, and extending its full width, is a combustion chamber which slopes down to the normal metal level. Liquid fuel is sprayed into the combustion chamber, the air necessary for combustion being delivered just below the spraying gear by means of a separate conduit.—T. St.

Furnace; Gas-fired [*crucible*] *—— for melting metals.* L. Rousseau. First Addition, dated Nov. 28, 1912, to Fr. Pat. 404,287, June 22, 1909 (this J., 1910, 1255).

In the furnace originally described the following improvements have been made —(1). The top of the crucible is made level with or slightly above the crown of the furnace, holes being provided in the upper part of the crucible on the side opposite to the spout, for the escape of products of combustion. The luting which holds the crucible to the crown of the furnace can thus easily be inspected before pouring the molten metal. (2). A hole is provided in the wall of the furnace just below the spout by which the metal is normally poured, so that any metal which has found its way into the furnace, can be recovered. (3). Two openings are provided in the crown of the furnace at opposite ends of the diameter normal to the direction of pouring, for the supplementary addition of fuel.—T. St.

Ores; Process and apparatus for the perfect roasting of —— in furnaces of all systems. E. Bracq. First Addition, dated Nov. 19, 1912, to Fr. Pat. 434,494, Sept. 22, 1911 (this J., 1912, 343).

Relates to improvements in the mechanism by which the material under treatment is divided into thin sections and propelled along the hearth of the furnace.—W. E. F. P.

Furnace for roasting ores. Comp. des Hauts Fourneaux de Chasse. Fr. Pat. 451,163, Nov. 28, 1912.

An adjustably-inclined, rotary cylindrical furnace, fired by gas from the lower end and provided internally with projecting plates or ledges. The air necessary for the roasting is preheated by passing it through an annular chamber surrounding the discharge end of the furnace, which latter is terminated by a device for classifying the roasted product according to size.—W. E. F. P.

Iron ores; Process for roasting carbonate ——. Comp. des Hauts-Fourneaux de Chasse. Fr. Pat. 451,164, Nov. 28, 1912.

The roasting is conducted in a rotary, tubular furnace, preferably of the kind described in the preceding abstract, the ore being slowly and uniformly heated to a temperature just sufficient to effect the decomposition of the ferrous carbonate and the complete oxidation of the resulting oxide without fritting any portion of the charge. —W. E. F. P.

Furnace; Horizontal roasting ——. P. Sarrasin. Fr. Pat. 451,182, Nov. 29, 1912.

The furnace, which has a rectangular bed, is built of fire-brick, with water-cooled walls. The ore is stirred, and worked forward from one end to the other, by vanes on a hollow, water-cooled shaft which extends across the furnace and through slits in the longer walls of the furnace, the ends of the shaft being coupled with the driving gear outside the furnace. The shaft moves backwards and forwards over the length of the furnace, and is made to rotate in the feeding direction only. The cooling water for the shaft is drawn by siphon action from a trough running the length of the furnace. The ore is fed into a vertical shoot which extends down into the furnace and in which are two self-closing valves connected with spindles which project into the furnace. As the shaft returns to the feeding end of the furnace it first engages the spindle connected with the upper valve. The valve opens and a charge of ore drops down the shoot and rests on the lower valve. The shaft then actuates this lower valve, thus admitting the charge into the furnace. At the exit end the roasted ore drops down a shoot opening into the bed of the furnace. The driving gear extends some distance beyond the furnace at the exit end, so that the shaft may be withdrawn and replaced without stopping the working of the furnace.—T. St.

Charging device for mechanical ore-roasting furnaces. R. Scherfenberg-Röstofen-Ges. m. b. H. Ger. Pat. 258,766, March 3, 1912.

The charging hopper has a lateral opening at the bottom, the width of which can be regulated by an adjustable plate. Immediately below this opening is a horizontal plate which can be moved to and fro. On its outward movement the plate receives a definite quantity of the charge from the hopper, and on its backward movement this is swept off by the wall of the hopper acting as a fixed scraper.—A. S.

Furnace for the treatment of a mixture of reducing agents with substances containing reducible compounds of volatile metals. H. Heimann. Ger. Pat. 259,002, Nov. 3, 1911.

The charge is fed into the furnace continuously at the top and is subjected to the action of an upward blast of air, the fused residue, free or practically free from volatile metal, being discharged from the bottom. Below the furnace chamber proper is a closed chamber subject to the full pressure of the air blast. The air passes upwards through slot-like openings in the bottom of the furnace-chamber, through which openings also the fused residue is discharged.—A. S.

Furnace; Vertical —— for obtaining easily oxidisable metals. A. Zavelberg. Ger. Pat. 259,003, June 5, 1912. Addition to Ger. Pat. 226,257.

In the furnace described in the chief patent (this J., 1910, 1460) a space is partitioned off at the front side, parallel to the long axis of the furnace, to serve as a collecting chamber for the vapours of the volatile metals. This space communicates with the reaction chamber proper and with the receivers for the volatile metals. The partition does not reach to the bottom of the reaction chamber; the space left may be utilised for running off slag and for cleaning purposes.—A. S.

Metallic compounds occurring naturally or obtained as by-products; Method of decomposing and utilising ——. P. Fast. Fr. Pat. 450,303, Nov. 7, 1912.

The method has special reference to the treatment of arsenical ores of lead, cobalt, and silver. The ore or by-product is mixed with finely-divided fuel and with suitable fluxes (residues from zinc muffles, metallic carbides), and smelted in a converter.—T. St.

[*Iron and nickel.*] *Metallic catalysers; Process for the manufacture of* ——. C. und G. Müller Akt.-Ges. Fr. Pat. 450,703, Nov. 18, 1912. Under Int. Conv., April 23 and May 24, 1912.

Catalysers such as the iron and nickel employed for the hydrogenation of unsaturated fats are prepared by heating a suitable compound of the metal, or the metal itself in the form of shavings, etc., in a current of hydrogen and then in current of carbon dioxide, the latter operation, it is claimed, increasing the activity of the product. —W. E. F. P.

[*Tungsten and molybdenum.*] *Metals; Process for obtaining malleable* ——. Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 450,762, Nov. 19, 1912. Under Int. Conv., Nov. 20, 1911.

A paste composed of the finely divided metal and a solution of one or more salts of alkaline-earth or rare-earth metals (*e.g.*, calcium chloride, barium nitrate, thorium nitrate or chloride, zirconium oxychloride) is moulded into bars, etc., which are dried, heated to redness in a non-oxidising atmosphere and subsequently hammered, rolled or drawn into wires or filaments.—W. E. F. P.

Tungsten; Production of coherent masses of ——. Bergmann-Elektrizitäts-Werke Akt.-Ges. Ger. Pat. 259,225, Aug. 30, 1911.

An alloy of tungsten with a volatile metal is melted in an atmosphere containing the vapour of the volatile metal, then formed into the desired shape, and the volatile metal expelled by heating *in vacuo* or in a gas which has no action on tungsten. The residual tungsten mass is then heated until it sinters.—A. S.

Metals; Process of treating ores and other materials for the extraction of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 451,291, Dec. 3, 1912. Under Int. Conv., Dec. 3 and 8, 1911.

The process is employed in conjunction with the manufacture of nitrates (*e.g.*, calcium nitrate) from air, the dilute nitric acid obtained in the earlier stages of the latter manufacture being used for the treatment of metallic ores, etc.; the resulting solutions are subsequently treated with lime or chalk for the recovery of the metal values and the simultaneous formation of calcium nitrate.—W. E. F. P.

Ores; Separation of —— *by flotation.* Soc. Française des Métaux Rares. Fr. Pat. 451,487, Feb. 13, 1912.

Ores containing molybdenite are crushed, dried, and distributed on the surface of water in a vat. The water overflows at a suitable rate through a sieve which retains any floating material. Whilst the gangue and other metallic constituents of the ore at once sink in the water, the leafy spangles of molybdenite float on the surface and are caught by the sieve. By using liquids of suitable specific gravity, such as saline solutions, the same method may be extended to the treatment of other materials. —T. St.

Basic phosphate slags; Process for the complete utilisation of ——. H. Naegell. Ger. Pat. 258,709, Sept. 24, 1912. Addition to Ger. Pat. 256,303.

Before the treatment with a volatile acid as described in the chief patent (this J., 1913, 369), the slag is roasted in an oxidising atmosphere, whereby the solubility of certain iron and manganese compounds in sulphurous acid is diminished.—A. S.

Cast iron and steel; Composition of matter for treating ——. J. R. C. Marsh, Cincinnati, U.S.A. Eng. Pat. 12,542, May 28, 1912.

See Fr. Pat. 444,340 of 1912; this J., 1912, 1133.—T. F. B.

Iron and steel; Method of hardening ——. J. W. Boyd, Denver, Colo., U.S.A. Eng. Pat. 15,966, July 8, 1912.

See Fr. Pat. 445,988 of 1912; this J., 1913, 146.—T. F. B.

Iron and steel; Metallurgy of ——. W. S. Simpson and H. Oviatt, London. U.S. Pat. 1,061,950, May 13, 1913.

See Eng. Pat. 9163 of 1909; this J., 1910, 1313.—T. F. B.

Ferro-alloys; Process of melting —— *and keeping them in liquid state.* W. Schemmann and J. Bronn, Assignors to Rombacher Hüttenwerke, Rombach, Germany. U.S. Pat. 1,061,016, May 6, 1913.

See Fr. Pat. 434,120 of 1911; this J., 1912, 236.—T. F. B.

Zinc lead ores; Process for the treatment of refractory complex ——. A. G. French, Nelson, British Columbia. Eng. Pat. 22,077, Sept. 28, 1912. Under Int. Conv., Sept. 30, 1911.

See U.S. Pat. 1,041,060 of 1912; this J., 1912, 1082.—T.F.B.

Ore slimes and ores; Process for treating sulphide or carbonate-sulphide —— *by flotation.* K. Schick, Siegen, Germany. Eng. Pat. 25,689, Nov. 8, 1912.

See U.S. Pat. 1,055,495 of 1913; this J., 1913, 431.—T. F. B.

Electric electrode furnaces. Tilting arrangement for metallurgical furnaces. Jøssingfjord Manufacturing Co. A/S., Jøssingfjord, Norway. Eng. Pats. 26,165 and 26,166, April 4, 1912. Under Int. Conv., April 4, 1911.

See Fr. Pat. 444,151 of 1912; this J., 1912, 1134.—T. F. B.

Tin from base bullion; Process of extracting ——. B. C. Besley, Howell, New South Wales. U.S. Pat. 1,060,527, April 29, 1913.

See Fr. Pat. 445,540 of 1912; this J., 1912, 1187.—T. F. B.

Tinning and leading metals; Method for ——. F. Plathner and V. Dorn, Berlin. U.S. Pat. 1,060,938, May 6, 1913.

See Eng. Pat. 17,613 of 1907; this J., 1908, 128.—T. F. B.

Metal articles; Process for coating —— *with other minerals.* W. G. Clark, London. U.S. Pat. 1,061,164, May 6, 1913.

See Fr. Pat. 435,605 of 1911; this J., 1912, 394.—T. F. B.

Metal; Rolled ——. E. R. Hoyt, Assignor to Hoyt Metal Co., St. Louis. U.S. Pat. 1,061,674, May 13, 1913.

See Eng. Pat. 19,732 of 1911; this J., 1912, 237.—T. F. B.

Metallic salts; Deposition of —— *from solutions containing them.* The Metals Extraction Corporation, Ltd. First Addition, dated Oct. 11, 1912, to Fr. Pat. 433,477, Aug. 7, 1911. Under Int. Conv., Nov. 20, 1911.

See Eng. Pat. 25,919 of 1911; this J., 1913, 30.—T. F. B.

Process and apparatus for the dry purification of [*blast-furnace*] *gases.* Fr. Pat. 450,957. *See* IIa.

XI.—ELECTRO-CHEMISTRY.

Electrolytic separation of tin and tungsten. Treadwell. *See* XXIII.

Patents.

Electrodes for primary or secondary batteries. A. Heil, Frankfort-on-the-Maine, Germany. Eng. Pat. 10,541, May 3, 1912. Under Int. Conv., May 9, 1911.

A porous carbon electrode is impregnated with manganese nitrate dissolved in alcohol, and the whole is heated to a temperature, *e.g.* 128° to 132° C., sufficient to decompose the salt, thus expelling the acid and forming manganese dioxide in the pores and on the surface of the electrode. The impregnated electrode may be dried prior to being heated.—B. N.

Cells; Primary galvanic ——. J. A. E. Achenbach, Hamburg, Germany. Eng. Pat. 29,847, Dec. 27, 1912.

Mercuric oxide is added to a mixture of manganese dioxide and graphite to increase the depolarisation, the mixture being used as an electrode together with a zinc electrode in an alkaline electrolyte.—B. N.

Storage-battery compound. N. Fallek, Assignor to The Cook Railway Signal Co., Denver, Colo. U.S. Pat. 1,060,832, May 6, 1913.

The compound is composed of asbestos (3 parts), a solution of sulphuric acid of sp. gr. about 1·23 (12), and a solution of sodium silicate of sp. gr. about 1·18 (1 part).—B. N.

Electric discharges in gases; Process and arrangement for extracting the reaction products produced by ——. C. F. R. von Koch. Fr. Pat. 451,361, Oct. 9, 1912. Under Int. Conv., Oct. 10, and Dec. 5, 1911.

The electric discharge is produced in a large chamber in the lower part of the furnace, and passes through a narrow passage in the upper part to a cooling space above, the gases also passing through this passage with a great velocity. The passage presents a cross-section considerably smaller than that of the arc flame, though the opening may be advantageously enlarged by the arc itself to a suitable cross-sectional area. One or more gases are introduced into the cooling space to react with the hot gases passing through the narrow opening. These cooler gases may be given a turning or whirling movement, and, in order to increase the yield, may contain solid or liquid particles.—B. N.

Ozone; [Electric] Process and apparatus for the production of ——. J. Steynis. Fr. Pat. 451,484, Feb. 13, 1912.

The apparatus comprises a dryer, an ozone generator, and a refrigerating apparatus, the latter consisting of a compressor and a condenser. Tubes direct the cooling fluid from the compressor and condenser, first through the dryer and afterwards through the generator. A return passage is also provided for the cooling fluid for conveying it directly from the dryer to the compressor. The air to be ozonised is first submitted to the cooling fluid circulating in a closed circuit, and is afterwards subjected simultaneously to the combined action of the electric discharge and the same cooling fluid.—B. N.

Silicon and silicon alloys; Method of and apparatus for moulding ——, *and the application of the products as electric resistances and heaters.* G. Gualtierolli, Milan, Italy. Eng. Pat. 10,657, May 4, 1912.

See Fr. Pat. 441,591 of 1912; this J., 1912, 934.—T. F. B.

Furnace; Electric-resistance ——. L. Ubbelohde, Karlsruhe, Germany. U.S. Pat. 1,060,868, May 6, 1913.

See Fr. Pat. 438,642 of 1912; this J., 1912, 649.—T. F. B.

Electrolytic apparatus for the preparation of paper pulp. U.S. Pat. 1,059,322. *See* V.

Arrangement for the utilisation of the heat produced in electric reverberatory furnaces for the production of oxygen compounds of nitrogen. Fr. Pat. 451,515. *See* VII.

Utilisation of electrolysed saline solutions in the manufacture of soap and glycerin. Fr. Pat. 451,627. *See* XII.

XII.—FATS; OILS; WAXES.

Fats and fatty acids; Nickel oxides as reduction-catalysers in the transference of molecular hydrogen to unsaturated ——. F. Bedford and E. Erdmann. J. prakt. Chem., 1913, **87**, 425—455.

The hydrogenation of oils by means of finely divided nickel, although now worked on a commercial scale, has the disadvantage that the catalyst is extremely sensitive to small quantities of air and to traces of chlorine and sulphur compounds, which latter may be developed from the protein always present in vegetable and animal oils. The authors have now found that oxides of nickel are capable of acting as hydrogen carriers for the hydrogenation of oils at atmospheric pressure, and possess the advantage over metallic nickel of being relatively insensitive to gases containing oxygen and sulphur-compounds; moreover hydrogenation proceeds with much greater velocity than with metallic nickel. Any one of the oxides of nickel may be used, viz., nickel sesquioxide, nickel monoxide, or nickel suboxide (compare Moore, Chem. News, 1895, **71**, 82); with the sesquioxide and monoxide a temperature of about 250° C. is required, but with nickel suboxide 180°—200° C. is sufficient. When the higher oxides of nickel are used they become partially reduced to the suboxide which forms a colloidal suspension in the oil. Hence a nickel oxide catalyst becomes more active after it has been used, owing to the formation of the suboxide. No reduction to metallic nickel occurs during the hydrogenation process, although in absence of oil, reduction of nickel oxides to metallic nickel by hydrogen takes place at 190° C. Nickel suboxide may be distinguished from metallic nickel by its lack of electric conductivity and by its inability to form nickel carbonyl when treated with carbon monoxide under pressure at a moderate temperature. Other metallic oxides (*e.g.*, copper oxide, ferrous oxide) are also capable of acting as catalysers in the hydrogenation of oils, but do not act so well as nickel oxide. The activity of nickel oxide is increased by small quantities of the oxides of aluminium, silver, zirconium, titanium, cerium, lanthanum, and magnesium. Nickel salts of organic acids do not act as catalysts, but in presence of the heated oil are decomposed by hydrogen, yielding nickel oxides and, under certain conditions, also metallic nickel; the nickel oxides then act as catalysts. Nickel formate in the presence of the heated oil is reduced by the hydrogen to nickel suboxide at 210° C., whilst at 250° C. metallic nickel is also produced. In carrying out the hydrogenation, the oil is placed in a quartz glass cylinder, or in a cylindrical copper boiler fitted with an agitator, then heated in an oil-bath to 180° C. whilst a slow current of hydrogen is passed through. A small quantity of the nickel oxide is then added, the temperature is raised to 255°—260° C., a further quantity of the catalyst added, and the supply of hydrogen increased. The hydrogenation is controlled by examining test-samples of the oil as to melting point and iodine value. The oil becomes black owing to the formation of colloidal nickel suboxide, which passes through a filter-paper, but can be removed by centrifuging. Nickel soaps are formed only to a slight extent, probably in consequence of a secondary reaction during the cooling. The hydrogenised fat is free from hydroxy-acids. The catalyst after use contains a certain proportion of organic matter which cannot be removed by extraction with benzene; this appears to consist partly of nickel palmitate or stearate, but also contains other substances, one of which is probably nickel carbide. The process is easy to control, if pure hydrogen is available, and in an experimental plant of 1 ton capacity installed at Sleaford, more than 100 tons of different oils have been hardened by hydrogenation in the manner described.
—A. S.

Oil of manketti seeds. H. Thoms. Arbb. aus d. Pharm. Inst. d. Univ. Berlin, **9**, 225—227. Chem. Zentr., 1913, **1**, 1823.

The manketti seeds (*Ricinodendron Rautanenii* Schinz., *Euphorbiaceae*) weigh on the average 1·47 grms. each. On extraction with ether they yielded 40 per cent. of an oil having acid value, 0·03; saponif. value, 191·95; iodine value, 129·9. A sample of the crude oil examined consisted of a light yellow oil, an aqueous liquid, and an intermediate layer of solid material. The oil became turbid at —2° C. and acquired the consistence of butter at —8° C. It had the following characters: acid value, 0·62; saponif. value, 195·2; Reichert-Meissl value, 1·085; Polenske value, 0·603; iodine value, 130·4; Hehner value, 98·5; m.pt. of fatty acids, 40° C.; iodine value of fatty acids, 140·7; acetyl value, 18·4; acetyl acid value, 163·2. The solid layer mentioned above yielded to petroleum ether a semi-solid fat of m.pt. 33° C.; acid value, 1·5; saponif. value, 195·2; iodine value, 90·27.—A. S.

Oil of Euphorbia gregaria Marloth from German South-West Africa. W. Lenz. Arbb. aus d. Pharm. Inst. d. Univ. Berlin, **9**, 227—228. Chem. Zentr., 1913, **1**, 1885.

The oil was obtained from the seeds by (1) extraction with cold ether (yield 40·84 per cent.) and (2) cold pressing (yield 20·85 per cent.). The oil extracted with ether had the following characters: refractometer reading at 25° C., 71·5; saponif. value, 179·49; acid value, 0·79; ester value, 179·21; iodine value, 98·8 after 2 hours, 103·6 after 18 hours. The cold-pressed oil solidified to a soft white mass at —7° to —8° C., and became liquid again at 6°—7° C. It had the sp. gr. 0·9378 at 15° C.; Hehner value, 95·90; m.pt. of insoluble fatty acids, 35°—37° C.; solidif. pt. of fatty acids, 32°—28° C.; refractometer reading, 71·5 at 25° C., 62·5 at 40° C.; saponif. value, 186·0; acid value, 0·76; Reichert-Meissl value, 2·69; Polenske value, 0·26; iodine value, 104·9 after 2 hours, 107·9 after 18 hours.—A. S.

American holly; Oil from the berries of ——. F. F. Carhart and G. H. Miller. Chem. News, 1913, **107**, 243—244.

The dried berries of the American holly, *Ilex opaca*, contain 46·34 per cent. of sugars, consisting of about equal proportions of lævulose and dextrose, 8·31 per cent. of ash, and 0·61 per cent. of nitrogen. Extracted with ether they yielded 1·5 per cent. of an amber-coloured oil with a nauseating taste and an odour recalling castor oil. This oil did not solidify when chilled with salt and ice. Its sp. gr. was 0·9358 and its saponification equivalent 303. The physical characteristics and colour reactions showed that the oil is closely related to castor oil.—C. A. M.

Whale oil refining process. Bd. of Tr. J., May 29, 1913. [T.R.]

A Norwegian-German company near Fredrikstad, with a capital of £166,700, has been formed to work a new German method of whale oil refining. The Hafslund Falls are being utilised to generate the electric power required by the works, and also to manufacture by electrolysis the hydrogen required for the conversion of the purified whale oil into a solid neutral fat. It is estimated that the daily consumption of oil by the factory will be about 300 barrels.

Development of the use of emulsified oils and emulsions in connection with tanning. Thuau. *See* XV.

Patents.

Hardened fat and the like: Process of making ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,059,720, April 22, 1913.

Oily material containing unsaturated substances is mixed with a catalytic agent in a confined space and brought into communication with a gaseous medium containing hydrogen, which may be under pressure. Portions of the material are passed through part of the gas whereby some of the latter is mechanically withdrawn and is conveyed together with this oil beneath the surface of the main body of the material, so that saturation of unsaturated constituents is effected.—C. A. M.

Catalyser for hydrogenating oils and the like. C. Ellis, Montclair, N.J. U.S. Pat. 1,060,673, May 6, 1913.

A porous body, *e.g.*, "active charcoal," is coated but not materially impregnated with a metallic catalytic agent, such as reduced nickel or "nickel material."—C. A. M.

Vegetable oils; Process and apparatus for extracting ——. I. T. Hawkins. Fr. Pat. 450,861, Oct. 31, 1912.

The fruit, etc. (especially that of the palm tree) is mechanically pulped, and the pulp steam-heated or boiled, after which the containing vessels are conveyed to an apparatus for extracting the oil, preferably of the type claimed in Fr. Pat. 448,041 of 1912 (this J., 1912, 997; 1913, 371). The extracted oil is filtered and separated from water, etc. —C. A. M.

Oil from vegetable seeds and olives; Apparatus for extracting ——. A. Sismondi. Fr. Pat. 451,159, Nov. 28, 1912.

The pulp, etc., is delivered on to an endless filtering cloth or wire gauze, which revolves over chambers within which suction is applied.—C. A. M.

Soap; Apparatus for cooling ——. A. Jacobi, Darmstadt, Germany. Eng. Pat. 29,048, Dec. 17, 1912. Under Int. Conv., Sept. 17, 1912.

Metal sheets, *e.g.*, of nickel, are fixed to the cooling plates by means of cement, and in particular by a tough cement that is liquid while hot and solidifies on cooling.—C. A. M.

Soap and glycerin; Utilisation of electrolysed saline solutions in the manufacture of ——. L. G. A. Andrault and M. Isnard. Fr. Pat. 451,627, Dec. 9, 1912.

Partial saponification of the fat is effected by means of an alkaline lye obtained by the electrolysis of a dilute solution of salt. The liberated glycerin is separated, and the saponification completed by boiling the fat and fatty acids with the product of the electrolysis of a concentrated solution of salt. Both electrolytic alkaline solutions may be made in the same electrolyser. The alkali in the solutions may be neutralised with fatty acids as a principal or secondary operation.—C. A. M.

Soaps and borates containing active oxygen; Process for preparing stable mixtures of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 258,393, March 2, 1909.

Stable mixtures of soaps with perborates, etc., are obtained by mixing or melting together the constituents, with addition of a small quantity of a salt of magnesium, an alkaline earth, or zinc. The alkalinity of the products is not diminished by this process.—T. F. B.

Washing substances. F. Hobein, Aussig, Bohemia. Eng. Pat. 9191, April 18, 1912.

A mixture of turpentine or the like, an oxidising agent such as chloride of lime, and calcined soda, with or without substances such as water-glass, fatty acid soap, alkali carbonates or sulphates and the like. (Reference is directed to Eng. Pats. 1875 of 1862, 1046 of 1867, 5572 of 1882, 2210, 3855 and 3894 of 1885, 11,981 of 1886, 6209 of 1887, 1453, 4561, and 15,671 of 1889, 1589 of 1890, 12,072 of 1894, 16,009 of 1895, 8706 of 1896, 1305 of 1897, 14,480 of 1900, 10,272 of 1904, and 20,387 of 1907; this J., 1883, 359; 1886, 102; 1887, 672, 727; 1889, 625; 1890, 939; 1891, 156; 1895, 665, 983; 1905, 671; 1908, 1037.)—F. Shdn.

Presses and more particularly oil presses. G. van Geenhuizen, Emmerich, Germany. Eng. Pat. 22,008, Sept. 27, 1912.

See Fr. Pat. 449,830 of 1912; this J., 1913, 497.—T. F. B.

Soap blocks, bars, tablets and the like, and apparatus for the production thereof. Z. Mayerfi, Kecskemet, Hungary. Eng. Pat. 9967, April 26, 1912. Under Int. Conv., Oct. 4, 1911.

See Fr. Pat. 442,000 of 1912; this J., 1912, 936.—T. F. B.

Manufacture of metallic [iron and nickel] catalysers. Fr. Pat. 450,703. *See* X.

Manufacture of elastic substances [rubber substitutes]. Eng. Pat. 25,912. *See* XIV.

Producing an edible compound. U.S. Pat. 1,061,254. *See* XIXa.

Congealed emulsions of cod liver oil or the like, with a palatable preservative coating. Eng. Pat. 15,403. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Method for the preparation of ——. H. Hof. Z. anorg. Chem., 1913, **81**, 40—45.

One hundred and fifty kilos. of moist magnesium oxychloride (prepared by treating boiling magnesium chloride mother liquors, from potassium chloride manufacture, with milk of lime, until saturated with magnesium hydroxide, and allowing to stand) are decomposed by about 5 cb. m. of water, in a vessel provided with steam coils, and then, at a temperature of 75°—80° C., magnesium lead chloride (obtained by the action of boiling magnesium chloride mother liquors on crude products containing lead sulphate, such as chamber sludge from sulphuric acid manufacture) is gradually added, with constant stirring, until the liquid no longer reddens phenolphthalein. The lead is thus completely precipitated as oxychloride and after allowing to settle, the liquor is drawn off and an equal volume of water added in its place. A suspension of magnesium carbonate, prepared by decomposing a further 150 kilos. of moist magnesium oxychloride with boiling water and saturating with carbon dioxide until no longer alkaline, is then added with stirring, and the mixture is stirred for an hour, at about 80° C. The oxychloride is thus converted into white lead and, after washing, a product of normal composition and good quality is obtained. The process is said to be readily carried out on the commercial scale. —F. Sodn.

Shellac; The American alcohol-insoluble test for ——. C. T. Bragg, G. E. Ashby, A. C. Langmuir, P. C. McIlhiney, and J. W. Paisley (Committee of the U.S. Shellac Importers' Assoc.). J. Ind. Eng. Chem., 1913, **5**, 435—436.

Shellac is sold in the United States with a guarantee in regard to matter insoluble in alcohol, the U.S. Government specification for "orange gum shellac," requiring that the insoluble residue after treatment with hot 95 per cent. alcohol shall not exceed 1·75—3 per cent. according to the grade of shellac. The following method for the determination of the alcohol-insoluble matter has been approved by the U.S. Shellac Importers' Association. The apparatus consists of a wide-necked (4·5 cm. diam.) flask, 20 cm. high and 8·75 cm. diam. at the largest part, in which is suspended a metal return condenser, 8 mm. diam. and 12 cm. high, the coiled portion within the flask being 6·5 cm. high. A Knoefler extractor, 30 mm. diam. and 10 cm. total height is suspended from the return condenser. In the lower part of the extractor are three indentations upon which the extraction thimble rests, and the siphon tube extends upwards 5·3 cm. above the indentations. Five grms. of the pulverised shellac are weighed into a Schleicher and Schüll No. 603 extraction cartridge (previously extracted with 99·5 per cent. methyl alcohol and dried at 100° C.), the latter is placed in the apparatus and filled with cold 99·5 methyl alcohol to just below the level of the upper bend of the siphon; some methyl alcohol is also placed in the extraction flask. After 1 hour, the alcohol in the flask is heated to boiling and kept boiling briskly until 1 hour after the liquid in the siphon tube has become colourless, whereupon the cartridge is transferred to a weighing bottle (3·75 cm. diam., 8·5 cm. high), dried at 100° C. and weighed.—A. S.

Tests distinguishing between lamp oil and varnish spirits (turpentine oil substitutes). Holde. *See* IIa.

Bakelite and its applications. H. Lebach. *See* Birmingham Section, p. 559.

Patents.

White lead; Manufacture of ——. S. Pope, Manchester. Eng. Pat. 8547, Apr. 11, 1912.

Acetic acid or lead acetate and water (or nitric acid or lead nitrate) are mixed with lead oxide in suitable proportions (say 5 : 1) and introduced into the first of a series of open vessels, where the mass is agitated and treated with carbon dioxide (mixed with any proportion of air). The contents of the first vessel overflow into the second vessel which is at a lower level, and so on throughout the series, a current of carbon dioxide being meanwhile passed into each vessel. Finally the precipitated basic carbonate is removed and the solution used for a further charge. Lead carbonate precipitated from the mother-liquor or ordinary lead carbonate may be added to the materials charged into the apparatus. The lead oxide used may be prepared in accordance with Eng. Pats. 17,178 of 1898 (this J., 1899, 1033) and 11,526 of 1909 (this J., 1910, 1306), or a non-fused lead oxide may be employed. Claim is also made for the use of the apparatus described in Eng. Pat. 16,974 of 1911 (this J., 1912, 1042) for carrying out these processes. —C. A. M.

Stoves or ovens for use in lacquering, enamelling, drying, baking and for other like uses. F. G. Faulkner. Eng. Pat. 10,307, May 1, 1912.

An outer fixed casing of "more or less cylindrical form" is provided with means for heating. Within the casing is mounted a turntable, furnished with vertical radial partitions carrying shelves and fixed at their inner ends to a rotating central vertical shaft. The outer casing has an aperture for the introduction and withdrawal of the goods in each compartment as it comes round in turn, whilst the remaining compartments are still subject to heat. (Reference is directed to Eng. Pats. 716 of 1896 and 14,701 of 1900.)—H. H. S.

Varnishes [for printing inks and paints]. A. Wass, Manor Park. Eng. Pat. 914, Jan. 11, 1912.

A varnish suitable for printing ink or cheap paints is made from a mineral oil which has been fired, with or without previous heating. To this may be added a drier such as ferric sulphate, litharge, manganese borate, or sugar of lead (lead acetate) with or without an agglutinating agent (*e.g.*, "niger paste" from the juice of a Nigerian plant). A part or whole of the pigment incorporated with this varnish may consist of the carbon black deposited during the firing of the mineral oil.—C. A. M.

Viscous, stringy, sticky mass; Process of manufacture of a ——. J. Goepper and O. Geiger. Fr. Pat. 450,758, Nov. 19, 1912.

(1) Rosin (100 parts by weight) is heated at 200° C. with a dehydrating agent such as phosphoric anhydride, calcium chloride, zinc chloride, iron sulphate, magnesium chloride, sulphur trioxide, etc. (0·1 to 10 parts) for 3—4 hours until a sample taken has the desired consistence. The mass is allowed to cool to 100° C. when the clear liquid may be decanted. (2) Rosin (100 parts) is heated at 300° C., with a metallic reducing agent such as zinc or tin (0·2—5 parts). Pitch or other tarry product may be used, in each instance, instead of rosin.—E. W. L.

Chlorinated products [artificial resins] from fats, oils and waxes, balsams and resins, petroleum and its distillates, paraffin, mineral wax, and montan wax. C. F. Boehringer und Söhne. Ger. Pat. 258,156, Dec. 28, 1911. Addition to Ger. Pat. 256,856 (this J., 1913, 499).

The process described in the chief patent is carried out in presence of chemically active artificial or natural light, whereby the time is reduced, the chlorine content of the product frequently increased, and purer products are obtained.—A. S.

Linseed oil ; Process for rendering soluble the oxidation products of ——. K. L. F. Friedemann. Ger. Pat. 258,853, Sept. 20, 1912.

The oxidation products (chiefly linoxyn and linoxynic acid) are treated with a fatty acid, *e.g.*, acetic acid, boiling at a moderately low temperature, and the acid is then removed partly or completely by evaporation. The products are soluble in most solvents and may be used for waterproofing textiles and leather and for similar purposes. —A. S.

Seleniferous and telluriferous substances ; Process for the preparation of coloured ——. A. von Wassermann, Berlin, and E. Wassermann, Frankfort. U.S. Pat. 1,061,889, May 13. 1913.

See Fr. Pat. 443,554 of 1912 ; this J., 1912, 1025.—T. F. B.

Manufacture of azo colouring matters suitable for use in the form of lakes. Eng. Pat. 15,157. *See* IV.

Preparing monoazo dyestuffs especially suitable for making lakes. Ger. Pat. 258,654. *See* IV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Hevea Brasiliensis Mull. Arg. ; Existence of two stable forms of —— *in West Africa.* C. M. Brot. Caoutchouc et Guttapercha, 1913, 10, 7291—7292.

Two stable cultivated forms of *Hevea Brasiliensis* appear to exist in West Africa ; they can be readily distinguished by an anatomical study of the base of the petiolules. They differ in vigour of growth and richness in latex ; the more vigorous is the poorer in latex. These qualities appear to persist in the next generation.—H. E. P.

Hevea Brasiliensis ; Causes of natural changes in latex of ——. G. S. Whitby. Indiarubber J., 1913, **45**, 941—946.

Experiments made with fresh latex led to the conclusion that four activities come into play when latex is allowed to stand in the air. Probably a coagulating enzyme (such as a protease) tends to produce coagulation, which is rendered difficult by dilution. Anærobic decomposition of protein occurs especially in the parts not exposed to air. Hevease (an oxydase) tends to produce discolouration, depending on the acidity. Aerobic decomposition sets in later, especially at the surface, giving an alkaline slime which renders the liquid milky. These activities do not run parallel. The presence of an "oxygenase" could not be detected even in the freshest latex. The sensitiveness of hevease to various agencies was examined, especially with respect to acid concentration. A gap occurs over which no coagulation or only incomplete coagulation can be obtained ; this is reached sooner with a stronger acid and does not appear to be bridged in the case of acetic acid.—H. E. P.

Caoutchouc ; Direct volumetric determination of —— *by means of bromine.* W. Schmitz. Gummi-Zeit., 1913, **27**, 1342—1348.

The author examined the method of brominating rubber by treatment with potassium bromide and bromate in an aqueous solution of hydrochloric acid (Vaubel, this J., 1912, 887). He finds that instead of the 6 atoms Br per $C_{10}H_{16}$ found by Vaubel, the absorption appears to be complete at 5 atoms Br. Two classes of solvents for rubber are discussed : those of low boiling point, and those of high boiling point having a more penetrating action. Of these latter pentachloro-ethane was employed (see this J., 1913, 499). About 2 grms. of acetone-extracted rubber were heated for 6 hrs. with 50 c.c. of pentachoro-ethane (b. p. 130°—159° C.) in an oven at 85°—90° C. Light was excluded. The solution was then transferred to a 100 c.c. flask and the rubber on the sides of the first flask dissolved by more of the solvent, the whole being then made up to 100 c.c. Chloroform was not employed as diluent since chemical action appears to occur on bromination. On the other hand, pure pentachloro-ethane is also affected by bromine ; this can be avoided by five-fold dilution with carbon tetrachloride just before bromination. It is considered that the solution need not be filtered except through glass wool. The bromination is effected by taking 5 c.c. of the filtered rubber solution, diluting with 25 c.c. of carbon tetrachloride and brominating with an excess of potassium bromide and bromate in presence of hydrochloric acid. The excess of bromine is determined by titration with an arsenious acid solution, and final back titration with a dilute bromate solution taking the decolourisation of methyl orange as the end point. To avoid loss of bromine, the bromination should be done in a flask closed by a ground-in stopper containing a funnel with a tap, and a bulbed U-tube containing a little arsenious acid.—H. E. P.

Caoutchouc ; Direct determination of —— *as tetrabromide.* F. W. Hinrichsen and E. Kindscher. Z. anorg. Chem., 1913, **81**, 70—82.

By brominating in ice-cold (chloroform) solution, over-bromination is avoided and a product of constant composition obtained. The experiments were carried out by allowing 0·1 grm. of rubber, after extraction with acetone, to soak in 15 c.c. of chloroform, then adding bromine, and, after bromination, mixing the solution with 3—4 times its bulk of benzine (petroleum spirit) ; the precipitated bromide was filtered off, washed with alcohol until colourless, then with hot water, and then again with alcohol, and ether, after which the bromine was determined in a weighed portion of the dry product by fusing (at a dull red heat) with 3—4 times its weight of fusion mixture and proceeding in the usual manner. The conditions necessary for securing a product entirely free from nitrogen have not been worked out, but the procedure outlined, besides giving a constant product, is said to ensure complete bromination (owing to the bromide formed being immediately soluble) and to allow of the ready separation of mineral impurities, excess of bromine, and bromine compounds.—F. Sodn.

Rubber ; Preliminary note on a new method for the direct determination of ——. L. G. Wesson. J. Ind. Eng. Chem., 1913, 5, 398.

The method suggested consists in precipitating the caoutchouc as nitrosite from carbon tetrachloride solution, separation of the nitrosite by extraction with acetone, and then after recovering the nitrosite by precipitation or evaporation, determining its carbon content by combustion. Combustion is effected in a boat of lead peroxide and minium heated by an external coil of "nichrome" wire and disposed within a tube of Jena glass, 60 cm. long and 2½ cm. bore, containing also a coil of electrically heated platinum wire. The current is supplied through two heavy copper wires coated with iridium, which are inserted through a hole in a rubber stopper in the forward end of the tube ; the leads for the coils rest on the hooked ends of these wires.—A. S.

Rubber ; Solubility of sulphur in ——. H. Loewen. Gummi-Zeit., 1913, 27, 1301—1302.

The author brings forward the following experimental evidence in support of the view (see Weber, Gummi-Zeit., 1903, 18, 83) that one of the phenomena of vulcanisation consists in the solution of the sulphur in the rubber. A small quantity of a mixture of Para rubber with 10 per cent. of sulphur was pressed between a warm (about 80° C.) microscope slide and a cover glass, and heated in a hot-air oven at 130°—140° C. The slide was examined at intervals under the microscope. After a very short heating the sulphur was found to be distributed through the mass in the form of globules of various sizes ; when the heating was continued for 20—30 minutes the mass appeared perfectly clear and transparent immediately after removal from the oven, but on cooling it became cloudy to the naked eye. The turbidity is the result of the separation of small globules of supercooled liquid sulphur, which crystallise on standing. That this is a case of ordinary (molecular) and not of colloidal solution is shown by a number of experimental results, of which two are quoted. (1) If the slide be heated for increasing lengths of time until a point is reached when the preparation just remains clear on first cooling down, the free sulphur separates from the cooled mass in the crystalline form, and not in liquid drops which afterwards crystallise. The solubility of sulphur is higher in vulcanised than in unvulcanised rubber, and this is in agreement with the fact that highly vulcanised rubber (ebonite) does not "sulphur up" although containing high percentages of free sulphur. (2) If a fragment of rubber without sulphur, be pressed between slide and cover glass, and molten sulphur applied round the edges of the latter, so as to be drawn into contact with the rubber by capillary action, and the preparation then heated in the oven for about 45 minutes, the sulphur diffuses into the rubber for a considerable distance in a manner characteristic of true solution. In the light of these results the author considers that adsorption plays no part in the process of vulcanisation, in which the three stages are fusion of the sulphur, solution of the sulphur in the rubber, chemical combination of sulphur with rubber.—E. W. L.

Rubber; Vulcanisation of ——, and radiant energy. E. Stern. Gummi-Zeit., 1913, **27**, 1340.

The author refers to a suggestion by G. Bernstein (which has formed the subject matter of a patent application; see also following abstract) to vulcanise rubber by ultraviolet light; it is contended that the action would be purely superficial owing to the absorption of the light in the surface layers, but it is suggested that a more powerful action might be exerted by Röntgen rays or by radioactive radiation.—H. E. P.

Rubber; Vulcanisation of ——. II. G. Bernstein. Z. Chem. Ind. Kolloide, 1913, **12**, 193—196, 273—277. (See also this J., 1912, 1087.)

Experiments with different kinds of rubber showed that the viscosity is diminished by heating, by mechanical working, and by exposure to ultraviolet rays, and that if the depolymerisation indicated by this reduced viscosity, be carried to completion, the final result is the same whatever the agency employed, *i.e.*, solutions of the depolymerised rubber of the same concentration show the same constant viscosity. With Frank and Marckwald's viscometer, and using a 3 per cent. solution of rubber in xylene, this final constant viscosity value is 15″. Depolymerisation on heating takes place most rapidly between 60° and 85° C., according to the kind of rubber, and these temperature limits are close to the temperature above which, according to Spence, vulcanisation occurs most actively. Vulcanisation of rubber can be effected by exposing a xylene solution of rubber and sulphur to ultraviolet rays. A xylene solution of a mixture of Hevea plantation rubber with 6 per cent. of sulphur, was allowed to evaporate so as to leave a thin film on a transparent quartz plate. This was covered with another quartz plate and exposed on both sides for 40 mins. at a distance of 15 cm. to the rays from a Heræus lamp of 3 ampères and 110 volts. The film then possessed the properties of vulcanised rubber and contained 2·56 per cent. of combined sulphur. Other experiments showed that the percentage of combined sulphur increased with the duration of exposure to the rays. The deterioration of vulcanised rubber on exposure to ultraviolet rays, observed by Henri (this J., 1910, 1169), is considered to have been due chiefly to "after-vulcanisation." The effect of heat or exposure to ultraviolet rays on sulphur alone or in solution is to polymerise it, *i.e.*, to convert it into a colloidal, insoluble form. The author concludes in agreement with Axelrod (this J., 1910, 34) that the vulcanisation of rubber comprises a depolymerisation of the rubber, followed by a polymerisation of the mixture. If this polymerisation of the mixture be of a physical character, it must be accepted that it is due to the adsorption by the depolymerised rubber of the polymerised insoluble sulphur, and this would explain the difficulty of extracting the so-called combined sulphur. It is however not yet possible to decide finally between the chemical and physical (adsorption) theories of vulcanisation.—A. S.

Rubber substitutes (factice). W. Vaubel. Gummi-Zeit., 1913, **27**, 1254—1255.

The author has examined a number of samples of vulcanised oil substitutes, and the results obtained for content of sulphur, chlorine and ash, for saponification value, acid value, bromine value, iodine value calculated from the bromine value, iodine value corrected for the bromine used up in oxidising free sulphur, and iodine value obtained with Wijs' solution are tabulated. For purposes of comparison the author assumes that the "white" substitutes have been made from castor oil and the "brown" from rape oil. The introduction of sulphur and chlorine appears to increase the saponification value to a greater extent than does the simple combination of sulphur. In the case of two samples of "sulphide" substitute there is a decrease in the saponification value. The iodine values of the white substitutes are lower than those of the original oil. This is still the case when a correction is made for the amount of chlorine present in the substitute, indicating that the sulphur also has attacked the double bonds in the molecule. The action of bromine upon the substitute is far more deep-seated than that of iodine chloride, and the direct determination of the iodine value appears to be of little interest.—E. W. L.

Some problems of the rubber industry. H. E. Potts. *See* Liverpool Section, p. 561.

Patents.

Rubber compound. E. von Vargyas, Pittsburgh, Pa. U.S. Pat. 1,061,207, May 6, 1913.

The compound consists of a vulcanised mixture of (say about 1 lb.) rubber, with dry granulated cork ($1\frac{7}{10}$ to $3\frac{3}{10}$ oz.) and granulated coal ash (about $1\frac{1}{10}$ oz.), in which the proportion of rubber should exceed that of the other ingredients together, and the amount of cork be greater than that of the coal ash.—C. A. M.

Rubber; Process for transforming old —— into a regenerated substance of industrial value. H. Carroll. First Addition, dated Jan. 30, 1912, to Fr. Pat. 435,809, Jan. 7, 1911 (this J., 1912, 400).

In place of the crude vaseline of the original patent, crude or distilled wool grease, wool grease tar and pitch, etc., may be used for regenerating vulcanised rubber waste.—E. W. L.

India-rubber; Process of colouring ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 450,567, Nov. 13, 1912. Under Int. Conv., Nov. 18 and Dec. 8, 1911.

Rubber and products resembling rubber, are coloured by mixing them with certain organic dyes before vulcanisation. For example, 100 parts by weight of an ebonite mixing are mixed with 6—8 parts by weight of Thioindigo Scarlet R and vulcanised at 170° C., yielding an ebonite of a violet-pink shade. Other colours mentioned as suitable are Pyranthrene, Indanthrene Blue, Thioindigo Red B, Indanthrene Yellow and other anthracene colours, the colours described in Fr. Pat. 309,612 of 1901 (this J., 1902, 40) azo colours such as Helio Yellow solid 8GL extra, Helio Red solid, Helio Bordeaux solid BL, Orange Ceres, etc.—E. W. L.

Elastic substances [rubber substitutes]; Manufacture of ——. W. E. Reeser, Amsterdam. Eng. Pat. 25,912, Nov. 11, 1912. Under Int. Conv., Jan. 19, 1912.

An animal or vegetable oil or fat is treated with a halogen at the ordinary or a moderately high temperature, and the product (from which the halogen hydrogen acid may be removed if desired) is heated with sulphur. The resulting elastic substance may then be washed with water, Prior to the treatment with the halogen the oil may be dissolved in an inert solvent, which is subsequently eliminated before the vulcanisation. Rubber or solutions thereof and the usual filling materials may be incorporated with the elastic products thus obtained.—C. A. M.

Elastic products possessing toughness and good adhesive qualities; Process for preparing solid —— from drying or semi-drying fatty oils. W. Meusel. Ger. Pat. 258,900, May 9, 1912.

A drying or semi-drying oil, especially linseed oil, hemp seed oil or castor oil, is heated with a very small quantity of finely divided zinc. The zinc may be partly or completely replaced by calcium and or aluminium, and in the case of castor oil also by magnesium and/or *Ferrum hydrogenio redactum.*—A. S.

Elastic materials; Manufacture of ——. Z. Olsson, Hampton Hill, Assignor to Gummi (U.S.A.) Ltd., London. U.S. Pat. 1,061,111, May 6, 1913.

See Eng. Pat. 26,935 of 1911; this J., 1913, 438.—T. F. B.

Plastic or elastic substance; Process for the production of a ——. J. Stockhausen, Crefeld, Germany. U.S. Pat. 1,061,881, May 13, 1913.

See Fr. Pat. 428,468 of 1911; this J., 1911, 1271.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Hides; Salt stains on ——. L. L. Lloyd. Collegium, 1913, 5, 188—193.

Pieces of hide were sprayed (1) with a 1 per cent. solution of mercuric chloride and (2) with the same solution containing 10 per cent. of salt. After several weeks the first piece showed little change while the second had developed a yellow-brown colour owing to the decomposition of the amphoteric hide substance by the neutral salt (see Procter, this J., 1912, 1193; 1913, 231), with the formation of hide-acid substance and hide-alkali substance. The piece treated with mercuric chloride gave practically no extract while the other gave an appreciable extract of hide substance. The material after thorough washing with cold water always contained more chlorine than unwashed hide, showing that hide alkali-substance is more soluble than hide acid-substance, and the same is the case with wool. Experiments made with salt containing small quantities of calcium and magnesium salts in presence of mercuric chloride gave practically the same results as pure salt and it appeared most probable that the chief cause of damage was bacterial decomposition, the action being aided by the neutral salt reaction. Hide treated with salts and bacteria developed colours far more rapidly than those similarly treated with salts and mercuric chloride, the colours varying from yellow-brown, dull red, rusty brown, blue to grey, and only fading slightly on washing. The hide substance is decomposed more rapidly by bacteria with salt containing calcium and magnesium salts than with pure salt and bacteria. The hide-alkali substance being more soluble in water than hide-acid substance, bacteria growing better in alkaline than in acid media will have every opportunity for development with decomposition of hide substance. Becker's results (this J., 1912, 829) on the prevention of salt stains by the use of mustard oil or zinc chloride were not confirmed, some bacteria being found capable of liquefying hide if the material was thoroughly plumped before treatment with zinc chloride. It appears advantageous to spray hides with a solution of mercuric chloride, with or without the addition of salt, immediately on arrival at the skin auction; if, however, the hide is already partially decomposed, the decomposition due to the salt reaction is increased and the mercuric chloride is also decomposed so that bacterial decomposition is not prevented. Probably an organic antiseptic or an organo-arsenic compound would be the most efficient agent for protecting skins from decomposition and experiments with emulsions of organic compounds with soaps are leading to fair results.—D. J. L.

Salt stains in hides and skins; The rôle played by bacteria in the production of ——. G. Abt. Collegium, 1913, 5, 204—206. (See also this J., 1913, 735.)

The author has succeeded in isolating, from a salt stain, an organism which plays a part in the formation of melanins. It has the form of large rods, staining by Gram's method, non-motile, easily forming large spores, liquefying gelatin and producing acid in milk and afterwards digesting the coagulated casein. Cultivated on peptone jelly the organism imparts a brown colouration to the medium and forms colonies with centres of a brown colour. If a precipitate of gelatinous calcium phosphate is formed at a point on the gelatin plate by dropping upon it a drop of secondary ammonium phosphate followed by calcium chloride, the region of the precipitate becomes of a much darker brown colour than the rest of the plate. If a drop of ferric chloride solution is placed in the plate, previously coloured by the organism, the colour becomes much darker than in the neighbouring parts. The colour is produced at the expense of the peptone in the medium, for if an acid amine, such as asparagine is substituted, no colouration is produced. Tyrosine, added to the amount of 1 mgrm. per c.c. of medium, results in the formation of a dirty red colour due to the action of a tyrosinase secreted by the organism. The colour is analogous to that of the melanins produced by the oxidation of tyrosine and is insoluble in alcohol but soluble in water. The mechanism of the formation of salt stains is thus explained. The colouring matter is produced at the expense of the protoplasm of the epidermal cells (as it is not formed on pure gelatin) and diffusing through the skin is fixed, developing its maximum colouration in the precipitates of calcium phosphate or on traces of iron salts. The organism is entirely different from those studied by Becker (this J., 1912, 829) which were micro-cocci, coloured by a substance analogous to the lipochromes and insoluble in water.—D. J. L.

Oak bark suspenders; Determination of acid in ——. F. Tanzer. Collegium, 1913, 5, 194—197.

The brown colour of a pine-bark liquor is changed to green in alkaline solution and it is proposed to use this liquor as indicator for the titration of other liquors, the amount of alkali required for the neutralisation of the pine bark liquor being subtracted from the total amount required for the mixed liquors. About 25 c.c. of the pine bark liquor are diluted with 750 c.c. of water at 40° C. and titrated with $N/5$ caustic soda until the brown colour changes to green. Known amounts of acids added to the bark liquor gave good results on titration. When the colour of the liquor to be titrated is such as to mask the colour change of the indicator the following method is adopted, mangrove being taken as an example. 30 c.c. of the mangrove liquor are mixed with 50 c.c. of a saturated solution of "alcutin" and with the same amount of pine bark liquor. The liquor is separated from the tannin precipitate and 25 c.c. titrated with $N/5$ caustic soda after dilution with 750 c.c. of water, allowance being made for the acid required for the neutralisation both of the "alcutin" and of the pine bark liquor.—D. J. L.

Sulphite cellulose liquors in tanning extracts. C. Monnet. Collegium, 1913, 5, 224—225.

At the last Conference in London of the International Association of Leather Trades Chemists it was decided that the presence of a "pseudo-tannin" (*e.g.*, sulphite-cellulose liquor) when detected in an extract, should be mentioned in the report of the analysis. The author points out that Procter and Hirst's aniline hydrochloride test has lately been found to give rise to erroneous deductions and to give varying results in the hands of different observers, and its indications should therefore be confirmed by other reactions.—D. J. L.

Bating process ; A bacterial study of the ——. W. Cruess and F. H. Wilson. J. Amer. Leather Chem. Assoc., 1913, **5**, 180—195.

By means of plating on agar bouillon, pure cultures of ten different species of bacteria were obtained from pigeon manure bate, from liquor in use in the bating tank, and also from old bating liquor. Among them was a form very closely allied to *Bacillus subtilis* (No. 7) and also a variety of *B. coli* (No. 2). The predominating types had not the power of removing hide substance, their principal action being the removal of lime. Tests to ascertain which of the bacteria was the most promising were made in a medium prepared from an infusion of pigeon-dung boiled and filtered and diluted till it contained about 1 per cent. of total solids. This was distributed amongst several flasks, sterilised and inoculated with the cultures. After 24 hours' growth at 37° C. a small piece of limed hide was put in each flask. The pieces bated quickly but on continued standing were rapidly rotted, presumably by the bacteria in the hide, as the latter was not sterilised before the experiment. Another test was made using a series of four different media, namely, beer wort diluted to 1 per cent. Balling (sp. gr. 1·004), molasses in dilute solution, milk diluted to 1 per cent. Balling (sp. gr. 1·004) and the boiled and filtered pigeon manure infusion containing 1 per cent. of solids. The bacteria grew with the greatest rapidity in the milk medium and the decomposing action noticed in the natural bate was entirely lacking, also the softening effect of the bate was all that could be desired. The growth in the wort was less vigorous than in the milk or pigeon dung but the absence of any over-bating effect on long standing, was noticeable. Growth in the molasses was very slight. A comparison of the depleting action of natural pigeon dung bate with that of pure cultures of bating liquor bacteria in 1 per cent. beer wort, is shown by the following table :—

Culture.	Per cent. loss of hide substance after 12 hours bating.	Per cent. loss after 18 hours bating.
Mixed culture of ordinary pigeon manure bacteria	12·57	25·66
Culture of bacteria No. 2 in 1 per cent. wort	—	1·33
Culture of bacteria No. 4 in 1 per cent. wort	5·6	10·8
Bacteria No. 7 in 1 per cent. beer wort ..	—	3·3
Bacteria No. 8 in 1 per cent. beer wort	4·4	8·4

Since the chief difference in the two solutions was in their sugar content, experiments were made to determine the influence of sugar on the over-bating action characteristic of the material. To the ordinary dung bate as used in the tannery in 4 flasks, were added respectively (1) no sugar, (2) 0·5 per cent. of cane sugar, (3) 1 per cent. of cane sugar, and (4) 0·5 per cent. of dextrose. The hide in the bate without sugar bated rapidly and was in proper condition in 24 hours at 37° C., but from that time rapidly decomposed. The hides in the solutions 2 and 4 bated more slowly but reached a soft and silky condition in 4 days, and the grain was in no way attacked after 3 weeks at 37° C. The hide in solution 3, after a few days, became plump and hard owing to the formation of acid and the grain was not attacked after 3 weeks. From this it appears that a pack of skins placed in a bating liquor to which 0·5 per cent. of glucose had been added, could be left without further attention or fear of over-bating. A series of tests made with many of the bacteria in the milk medium showed that some of them have a softening action whilst others have a plumping effect. The hide in the ordinary bate was badly decomposed after this time, and had an alkaline reaction owing to the formation of amines and ammonia. Tannery tests made on calf skin with bacteria Nos. 3, 7 and 8 grown in dilute skimmed milk showed that the skin bated with the No. 7 culture exhibited the soft and silky condition of a well-bated hide and when tanned into leather the product was as good as that which had undergone the usual bating process. The addition of glucose or molasses to the ordinary bate for the purpose of diminishing the over-bating effect would add very little to its cost.—D. J. L.

Emulsified oils and emulsions in connection with tanning ; The development of the use of ——. U. J. Thuau. Collegium, 1913, **5**, 219—224.

Emulsions as used in the tannery may be divided into four classes. (1) Those with a basis of a sulphonated fatty acid particularly sodium sulphoricinate ; (2) with a basis of soap alone, or with other oils ; (3) with a basis of solvents for oils and fatty acids, and (4) those composed of sodium sulphoricinate and solvents and also of fatty acids and soaps. Sulphonated neats-foot oil forms an emulsion of the first type but not very stable. Emulsions formed only of a sulphoricinate and an animal or vegetable oil are never stable but if a sufficient percentage of mineral oil is mixed with them, perfect stability is obtained. An oil suitable for fat-liquoring chrome leather and giving a very stable emulsion with water consists of :—neutral saponifiable oil 42·2, mineral oil 22·8, sulphonated fatty acids 3·9, water 28·0 and ash 3·1 per cent., and is made by mixing 40 parts of sodium sulphoricinate with 50 per cent. of water, 23 parts of mineral oil and 37 parts of neats-foot oil. Emulsions suitable for dongola or chrome leather are made by mixing sodium sulphoricinate and mineral oil with colza oil, cod oil and other fish oils. Emulsions of the second type are less stable than the previous but are made more stable by the addition of egg-yolk. Good emulsions of this type may be made by the admixture of any oil or fat, with the exception of olein, with the amide of stearic acid. Of the third type, good emulsions are made with ammoniacal soaps in the presence of solvents. Oleic acid may be dissolved in alcohol and a little ammonia added with stirring, water may then be added when a thick and consistent mass is obtained which becomes clear on the addition of water or oil. A good fat-liquor for box-calf is as follows :—Oleic acid 26·6, neats-foot oil 9·8, ammonia 5·2, alcohol 10·0, and water 48·4 per cent. Other solvents such as carbon bisulphide and tetrachloride, benzine or acetylene tetrachloride may be used. Insoluble material up to 30 per cent. can be held in suspension by such an emulsion. The fourth class of emulsions is the best and most stable. An intimate mixture of carbon tetrachloride and sodium sulphoricinate is soluble in water and in aqueous solution will remove grease from leather. Emulsions of many materials insoluble in water such as sulphur may be made by dissolving in carbon bisulphide and adding slowly sodium sulphoricinate and finally mixing with water. A perfect emulsion is made by adding water to a mixture of oleic acid, alcohol, ammonia, sodium sulphoricinate, mineral oil and animal oil. If an emulsion containing much water is required, gum, lichen, glucose or white of egg may be added to the water.—D. J. L.

Chrome leather ; The analysis of ——. U. J. Thuau. Collegium, 1913, **5**, 206—209.

The matter extracted from chrome leather by petroleum ether consists of the free fats and sulphur ; the latter is separated by dissolving away the fatty matter by ether to which a little alcohol is added to assist solution when the fat is solid. The alcoholic extract contains the soaps. Chromium and aluminium when present together in the leather are best estimated as follows. The leather ash is heated for 5 hours in a muffle furnace with sodium carbonate, the melt is dissolved in boiling water, filtered, and ammonium nitrate added in excess to the hot solution until the evolution of carbon dioxide ceases ; the carbonate is thus transformed into nitrate, the chromate remains in solution and the aluminium is precipitated. The excess of ammonia is boiled off and the aluminium hydroxide filtered off. Chromium is estimated by acidifying the filtrate with nitric acid, reducing the chromate with alcohol and precipitating with ammonia.—D. J. L.

Artificial leathers ; Notes on ——. R. Madrn. Collegium, 1913, 5. 209–213.

Leather pieces were soaked in cold water several days and then washed in warm water until nothing further was removed. The pieces were then agitated with a warm solution of sodium carbonate which was renewed several times and gradually strengthened to 5 per cent. They were then washed again in warm water, treated with a solution of pancreatin and finally with a 7 per cent. sodium carbonate solution. The pieces had then become slightly viscous and could be resolved into isolated fibres which were thin, flexible, and resistant, and when pressed together formed a supple sheet very resistant to tension. By uniting them by an albuminoid matter which could be rendered insoluble by tannin, formaldehyde, or quinone a reconstituted leather could be produced. Tissues or paper when used as bases for artificial leather are usually impregnated with boiled oils, rubber, gutta-percha, celluloid or viscose which can be removed by alcohol-ether for the examination of the fabric.—D. J. L.

Patents.

Leather ; Process for treating iron tanned ——. J. Bystron, Teschen, Bohemia, and Karl Baron von Vietinghoff, Berlin. Eng. Pat. 21,175, Sept. 17, 1912.

See Ger. Pat. 256,350 of 1911 ; this J., 1913, 438. A solution of a basic alkali salt or of an alkali base may replace the neutral salt.—T. F. B.

Hides and skins ; Process of hardening and waterproofing ——. K. Hartmann, Berlin. Eng. Pat. 29,997, Dec. 30, 1912.

See Ger. Pat. 256,406 of 1911 ; this J., 1913, 438. The hide or skin may be immersed in a dilute solution of formaldehyde before the treatment with rubber.—T. F. B.

Gelatin ; Method of manufacture of ——. G. Deuerling. Fr. Pat. 451,397, Nov. 13, 1912.

The liquid gelatin is cooled slowly, in a thin layer, on a rotating drum on which it commences to harden. The drying is completed either on a belt travelling through a drying channel or on a drum of large diameter rotating very slowly and heated just sufficiently to dry the gelatin without melting it.—D. J. L.

Agglutinant for the manufacture of agglomerates. L. Penkala. Fr. Pats. 451,522 and 451,523, Feb. 14, 1912.

(1). Vegetables such as marine algæ, Iceland moss and the like, containing gelose (vegetable gelatin) are boiled in an alkaline solution and the agglutinant thus prepared is rendered insoluble by treatment with metallic sulphates or sulphides immediately before pressing. (2). The waste liquors from cellulose manufacture may be mixed with the agglutinant thus prepared and the cakes rendered insoluble by treatment with a mixture of an alkali silicate and lime water.—D. J. L.

Leather ; Process for treating iron-tanned ——. J. Bystron, Teschen, and Karl Baron von Vietinghoff, Berlin. U.S. Pat. 1,061,597, May 13, 1913.

See Ger. Pat. 256,350 of 1911 ; this J., 1913, 438.—T. F. B.

Gelatin ; Apparatus for the mechanical manufacture of edible ——. G. Deuerling, Unterschwappach, Germany. Eng. Pat. 27,281, Nov. 27, 1911.

See Fr. Pat. 451,397 of 1912 ; preceding.—T. F. B.

Treating waste liquors [from tanneries]. Eng. Pat. 2190. *See* XIXb.

XVI.—SOILS ; FERTILISERS.

Potash fertilisers ; Alunite and kelp as ——. J. J. Skinner and A. M. Jackson. U.S. Dept. Agric., Bureau of Soils, Circ. No. 76, April 10, 1913.

Raw and ignited alunite, containing 10 and 14·7 per cent. K_2O respectively, and dry kelp containing 19·8 per cent. K_2O, were added to the soil so as to give 25—500 lb. of potash per acre, and were compared with potassium chloride and sulphate. The raw alunite was not so effective as the potassium salts, but the ignited sample was more effective, the average increase in the crop being about 31 per cent. as compared with about 25 per cent. for potassium sulphate. The kelp gave an increased crop of about 23 per cent. as compared with about 22 per cent. with potassium chloride.—J. H. J.

Fertilisers ; Agricultural —— and fish life. W. J. A. Butterfield. "The Field," May 17, 1913. (See also this J., 1912, 251.)

The fertilisers were used dissolved in or mixed with water in the proportion of 1 part per 500 parts, corresponding to a fairly heavy dressing of 3 cwt. per acre, on the supposition that the whole of the dressing is dissolved out by a fall of a quarter-inch of rain and carried into a stream or pond of five times the volume of the rainfall. Fertilisers usually applied in larger or smaller dressings were used proportionately. The effect of these solutions of the fertilisers was tried on gudgeon, as they had been found less susceptible than most fish to pollution in water.

Substance.	Strength : parts per 1000 parts of water.	Effect on gudgeon.
Sulphate of ammonia	1	Died in 60 minutes
,, ,,	0·1	Unaffected in 18 hours
Calcium cyanamide .	1	Died in 90 minutes
,, ,,	0·25	,, 12 hours
Lime	1	,, 20 minutes
,, ...	0·1	Unaffected in 18 hours
Nitrate of lime	1	,, ,, ,,
,, ,, ...	2	,, ,, ,,
Superphosphate of lime	1	,, ,, ,,
Superphosphate of lime	2·5	,, ,, ,,
Basic slag	1	,, ,, ,,
,, ,, ...	5	,, ,, ,,
Muriate of potash .	1	,, ,, ,,
,, ,,	2	,, ,, ,,
Sulphate of potash	1	,, ,, ,,
,, ,,	2	,, ,, ,,
Kainit	1	,, ,, ,,
,, ...	4	,, ,, ,,
Nitrate of soda	1	,, ,, ,,
,, ,, ...	2	,, ,, ,,
Peruvian guano ...	1	,, ,, ,,
Stable manure, drainage from	=0·2 ammonia	Died in 24 hours

The results showed that there is no reason to fear injury to fish life from normal dressings of calcium nitrate, calcium superphosphate, basic slag, potassium chloride, potassium sulphate, kainit, sodium nitrate and guano to land in the vicinity of streams as the gudgeon were unaffected by 18 hours' exposure to the solutions. With lime, except in small quantity, and cyanamide the gudgeon were killed rapidly, so that these fertilisers should not be applied to land draining immediately into small fish ponds and streams. Ammonium sulphate and stable manure also caused the death of the fish, and although they are rapidly changed in the soil, it would not be advisable to dress the borders of streams with them.—J. H. J.

Patents.

[Fertiliser.] Seaweed ; Method of treating ——. L. Penkala, Paris. Eng. Pat. 27,257, Nov. 27, 1912. Under Int. Conv., Dec. 8, 1911.

A manure is prepared from seaweed by drying and powdering it and consolidating the powder into briquettes, with or without addition of other fertilising substances. The gelatinous matter in the seaweed serves as binding agent, and the consolidation of the powder can be insured either by leaving a small proportion of water in the seaweed, or preferably, by dissolving part of the seaweed in an alkaline solution and then mixing it with the powder. —L. E.

[*Fertilisers.*] *Sodium bisulphate ; Industrial utilisation of* ——. L. A. Angibaud. First Addition, dated Oct. 10, 1912, to Fr. Pat. 339,820, Jan. 25, 1904.

In addition to the substances named in the chief patent (this J., 1904, 720) sodium bisulphate will dissolve also horn, leather, furs, wools, skin, bones, glue-residues, etc. —J. T. D.

Process for the complete utilisation of basic phosphate slags. Ger. Pat. 258,709. *See* X.

XVII.—SUGARS ; STARCHES ; GUMS.

Molasses of the 1912—1913 [*French beetroot*] *campaign compared with those of previous years.* E. Saillard, A. Wehrung, and M. Ruby. Circ. hebd. syndic. fabr. sucre, France, Suppl. No. 1258, May, 1913.

A comparison of the molasses from French beetroot factories obtained during the (a) 1912—1913, (b) 1911—1912, and (c) 1910—1911 campaigns (this J., 1912, 740) gave the following results, expressed as percentages of the dry substance : total nitrogen, (a) 1·69—2·26 ; (b) 2·31—3·06, (c) 1·74—2·37 ; albuminoid nitrogen, (a) 0·07—0·48, (b) 0·02—0·60, (c) 0·11—0·28 ; amide and ammoniacal nitrogen, (a) 0·02—0·05, (b) 0·06—0·14, (c) 0·02—0·07 ; objectionable nitrogen, (a) 1·40—2·03, (b) 1·80—2·57, (c) 1·60—2·13 ; organic matter, *i.e.*, the difference between the total dry substance and the sum of the sucrose and ash, (a) 7·62—9·78, (b) 10·00—11·11, (c) 8·35—11·40. Other values for molasses of the 1912—1913 campaign are : dry substance (by desiccation), 69·18—83·83 ; true purity, 59·9—71·1 ; apparent purity, 58·5—67·9 ; ash, 7·62—11·52 ; saline coefficient, 4·34—6·14 ; ratio of ash to organic matter, 1·39—2·17 ; sulphur dioxide, 0·06—0·92 ; and sulphuric acid, 0·14—0·47 per cent. Determinations of the sucrose content by the double polarisation method, using the different direct readings, showed that the ordinary commercial method, employing the alkaline (basic lead acetate) polarisation, gives too low results ; the Andrlik acid direct reading yields higher results, and the authors' procedure of neutral polarisation indicates the highest values. These figures for the 1912—1913 campaign compared with those of previous years, confirm the statement already made (*loc. cit.*) that the purity value alone is insufficient as a means of judging the degree of exhaustion of a molasses, and that the saline coefficient must also always be taken into consideration.—J. P. O.

Pentoses in presence of other sugars ; Determination of ——, *by the spectroscope.* E. Pinoff and K. Gude. Chem.-Zeit., 1913, **37**, 621.

A mixture of 25 c.c. of the aqueous solution containing the pentoses, which should not exceed 3 per cent., 25 c.c. of hydrochloric acid of sp. gr. 1·19, 50 c.c. of 96 per cent. alcohol, and 0·6 grm. of phloroglucinol, is heated on the water-bath under a reflux condenser for half an hour from the time the alcohol starts boiling, then cooled and 25 c.c. introduced into a Hehner's colourimeter cylinder (3 cm. internal diam.) and diluted until one or two absorption bands are only just visible in a spectroscope. The degree of dilution (*i.e.*, the number of times the solution must be diluted with its own volume of alcohol) +1 is then multiplied by 0·0237×4=0·0948 which gives the percentage of pentoses in the solution.—L. J. de W.

Honey ; Polarimetric determination of sucrose in —— *by the method of Lehmann and Stadlinger.* E. J. Sarin. Z. anal. Chem., 1913, **52**, 367—371.

Determinations of the sucrose-content of 60 samples of honey from different parts of Russia, by the polarimetric method of Lehmann and Stadlinger (this J., 1907, 555), gave values ranging from 0·17 to 9·39 per cent. These results were on the average only 0·28 per cent. higher than those obtained by Meissl's gravimetric method, and in no case did the difference amount to 1 per cent. The polarimetric method appears therefore to be sufficiently accurate for technical purposes.—J. H. L.

Starch pseudo-crystals and dextrose crystals. G. Malfitano and A. Moschkoff. Comptes rend., 1913, **156**, 1412—1415.

The authors discuss the question as to whether the particles which separate out from a solution of starch on cooling are actually crystals. These particles do not exhibit any definite crystalline structure, unlike dextrose crystals, do not polarise light, and their properties agree with the assumption that they are composed of a flocculent deposit of starch.—W. P. S.

Diastatic degradation of starch. Biltz. *See* XVIII.

Patents.

Sugar, syrup, or the like ; Process for filtering ——, *applicable also to other substances in liquid or viscous state.* F. E. Finzel, New Malden, Surrey. Eng. Pat. 8106, Oct. 3, 1912.

The apparatus consists of a number of receptacles having a perforated false bottom or two perforated plates with a layer of filtering material between them. The filtering material consists of grain-husks (*e.g.*, oat-husks), broken reeds or reed-shavings, vegetable or other fibres, etc. The receptacles are first charged with boiling water up to the lower surface of the false bottom ; a certain amount of the filtering material is boiled with water and mixed with the liquor to be filtered ; the mixture is heated to a suitable temperature and run into the receptacles. The perforated bottoms of the latter, in conjunction with the boiling water, then form a barrier to the immediate escape of the dirty liquor, so that time is afforded for the husks or other material to form a filtering layer upon the perforated bottom.—J. F. B.

Molasses ; Process for purifying ——, *and the application of the product to the preparation of chocolate paste.* M. F. Hahn. Fr. Pat. 451,352, Sept. 23, 1912. Under Int. Conv., Sept. 4, 1912.

The molasses, diluted with water, is heated for several hours at 70° C. with porous material, such as diatomaceous earth, in the proportion 2 : 1. The offensive odour and flavour of the molasses are thereby removed, and the product after filtration and concentration is suitable for human consumption. The purified molasses, intimately mixed with cocoa, may be used in the preparation of chocolate paste.—J. H. L.

Sugar ; Process for purifying and decolorising ——. M. Barrios y Carballeda, Mexico City. Eng. Pat. 18,481, Aug. 12, 1912.

See Fr. Pat. 447,206 of 1912 ; this J., 1913, 248.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Starch : Diastatic degradation of ——. W. Biltz. Ber., 1913, **46**, 1532—1536.

A quantity of potato starch paste was treated with malt extract at a temperature of 56° C., the course of saccharification being observed by means of the iodine reaction. Portions of the conversion product were withdrawn at intervals, the dextrins were separated from each portion by repeated precipitation with alcohol, and the average molecular weight of each dextrin preparation was determined by viscosity measurements. The experiments show that the formation of erythrodextrins and of achroodextrins represent intermediate stages in the diastatic hydrolysis of starch. The rate of saccharification of the amylodextrins is greater than that of the erythrodextrins which in its turn is greater than that of the achroodextrins. The average molecular weights of these three groups of substances were found to be over 10,000, 6200—7000, and 3700, respectively, from which it may be concluded that achroodextrins of much higher molecular weight than achroodextrins I. and II. (molecular weights 1800 and 1200 respectively) were present in the reaction-product. The experiments explain Philoche's observation that the rate of saccharification of starch by amylase decreases at first and then remains constant until more than 90 per cent. of the starch has been transformed (this J., 1908, 761); the rate decreases whilst amylo- and erythrodextrins are still present and becomes constant when only achroodextrins remain to be saccharified.—L. E.

Yeast fermentation without sugar. XI. Further study of carboxylase. C. Neuberg and P. Rosenthal. Biochem. Zeits., 1913, **51**, 128—142. (See also this J., 1911, 1179; 1913, 102.)

Carboxylase, the enzyme of yeast which ferments pyruvic acid (this J., 1911, 1179), appears to be more stable than zymase. Living or dried yeast decomposes potassium pyruvate, or mixtures of pyruvic acid with arsenites or borates ("buffer salts"), even in presence of chloroform, whereas this antiseptic arrests the fermentation of sugar, *i.e.*, zymase action. The fermentation of pyruvic acid by yeast maceration juice proceeds much more readily than that of sugar. Moreover, the power of fermenting sugar is lost if maceration juice is stored for several days, or heated for a short time at 40°—50° C., or dialysed for several days against water, whereas in all these cases the juice retains its power of fermenting pyruvic acid. If, as the authors suggest, the carbon dioxide formed during alcoholic fermentation is produced by the action of carboxylase on pyruvic acid (this J., 1913, 102), the facts mentioned above show that this phase of the fermentation process can proceed under conditions which exclude one or all of the earlier phases.—J. H. L.

Diastase; Action of hydrochloric acid and ammonia gases on ——. F. T. Panzer. Z. physiol. Chem., 1913, **85**, 97—111.

Dried diastase, saturated with hydrochloric acid, loses its hydrolytic power (this J., 1913, 41). When subsequently exposed to a current of dry ammonia, it absorbs from 1 to 4 per cent. of the latter (reckoned on the weight of diastase) in excess of the amount required to neutralise the hydrochloric acid present (cp. this J., 1913, 441). At the same time the enzyme recovers its hydrolytic power partially and in some cases practically completely.—J. H. L.

Hops; Antiseptic properties of ——. A. J. Brown and D. Clubb. J. Inst. Brew., 1913, 19, 261—284.

From experiments described the authors conclude that the antiseptic properties of different samples of hops may be determined comparatively by the method previously described (this J., 1911, 102) with a fair approach to accuracy, so long as the determinations are made under precisely similar conditions, *e.g.*, at or about the same time, using the same culture medium and, as far as possible, cultures of *Bacterium X.* (the test organism) of the same age and vigour. The duration of the tests should be 24 or 48 hours, preferably the latter. The antiseptic power of hops thus determined is not directly proportional to their content of soft resins. The aqueous extracts obtained, contain about ⅚ of the total water-soluble antiseptic material of the hops, apparently in a state of true solution, whereas they contain only a small proportion (about ¼) of the soft resins. The antiseptic power of hops is not diminished by removal of the hop-oils by steam distillation. One of the most common disease-producing organisms of beer, *Saccharobacillus pastorianus* (van Laer), is influenced by hop extract in a very similar manner to the test organism *Bacterium X.* The inhibitive action of the antiseptic matter in hops is much stronger, weight for weight, than that of carbolic acid, salicylic acid, or potassium metabisulphite. Both the α- and β-bitter acids of soft resin inhibit the growth of *Bacterium X.*, the α-acid about four times as strongly as the β-acid. The bacterium can be rendered more resistant towards hops by continued culture in hopped media.—J. H. L.

Wines; The organism causing bitterness ("amertume") in ——, and its behaviour with potassium hydrogen tartrate. E. Voisenet. Comptes rend., 1913, 156, 1410—1412.

The *Bacillus amaracrylus*, the organism which causes wine to become bitter (see this J., 1910, 1126), does not cause a diminution in the quantity of tartaric acid or its salts which may be present in a wine containing the bacillus, although the sugars and glycerol are decreased considerably. —W. P. S.

Valuation of malt extracts [for use in the textile industry]. Draper. *See* VI.

Patents.

Brewing; Impts. in ——. M. Hessberg, London. Eng. Pat. 29,143, Dec. 18, 1912. Addition to Eng. Pat. 13,721, June 12, 1912 (this J., 1912, 1091).

The re-mashing of the cooler residue with the succeeding brew is effected either in the mash tun, the underback, or the copper. Or again, the cooler residue is boiled with water or with the wort, either in an open vessel or under pressure, and added to a succeeding brew.—L. E.

Milk [beer, wine, cider, etc.]: Process for the sterilisation of ——. V. Henri, A. Helbronner, and M. von Recklinghausen. First Addition, dated Feb. 2, 1912, to Fr. Pat. 442,807, June 28, 1911 (this J., 1912, 1004).

The process described originally (*loc. cit.*) may be applied to liquids other than milk, for instance, to beer, wine, cider, etc. The temperature during the preliminary heating should be between 55° and 60° C., as this is sufficient to destroy any yeasts which may be present.—W. P. S.

Yeast; Process for improving ——. Diamalt-Akt.-Ges. Fr. Pat. 450,988, Nov. 25, 1912. Under Int. Conv., Dec. 13, 1911.

The moist yeast is mixed with per-salts, preferably with those possessing an alkaline reaction, as sodium percarbonate.—J. H. L.

Ethyl alcohol [from cellulosic materials]; Manufacture of ——. L. Spassky. Fr. Pat. 451,268, Feb. 9, 1912.

Peat, sawdust, straw, moss or other cellular tissue is heated for 3 hours under 5—6 atm. pressure with a 5 per cent. solution of calcium bisulphite. The solution is drawn off from the residue of cellulose, mixed with a 10 per cent. solution of sulphuric or hydrochloric acid, separated from the precipitated lignin, and returned to the cellulose in the autoclave. The mixture is then treated with a 0·25 per cent. solution of hydrofluoric acid and heated at 140° C. until saccharified. The mineral acids are subsequently removed by a current of air under 2—3 atm. pressure, and absorbed in milk of lime or an aqueous suspension of chalk. The glucose, after neutralisation with soda if necessary, is fermented and the alcohol separated by distillation.—J. H. L.

Yeasts and an accelerating mixture; Apparatus for the mixture in predetermined proportions of ——. J. A. Stevenson, Acton. U.S. Pat. 1,060,143, April 29, 1913.

See Eng. Pat. 989 of 1912; this J., 1913, 208.—T. F. B.

XIXa.—FOODS.

Cocoa; Remarks on the preparation of ——. E. Perrot. Comptes rend., 1913, 156, 1394—1396.

The usual method of preparing cocoa can be modified advantageously by treating the beans with a 1 per cent. solution of sodium carbonate and then removing the pulp mechanically after the beans have been subjected to heat in the presence of moisture. It is also recommended that plantation cocoa should be sterilised by means of steam and then dried in order to obtain a more uniform product from one and the same plantation.—W. P. S.

Patents.

Grain and other granular and pulverulent substances; Apparatus for drying or conditioning ——. J. W. Gibbs, Liverpool. Eng. Pat. 9301, April 19, 1912.

The grain is passed through inclined rotating cylinders, inside each of which is a concentric perforated tube. A current of air is admitted to the tubes and, after passing through the cylinder, escapes through openings at the higher end of the latter. Means are provided for stirring the contents of the cylinders and for delivering the grain circumferentially after it has been dried.—W. P. S.

Cereal middlings for baking purposes; Method of conserving ——. T. Schlüter, Berlin. Eng. Pat. 19,532, Aug. 26, 1912.

A portion of the middlings, amounting to about one-third of the whole, is made into a paste which is then heated to a high temperature, dried, ground, and mixed with the remaining portion of the middlings. The moisture content is thus reduced to such an extent that fermentation does not take place.—W. P. S.

Tea; Process for the adjustment of the relative quantities of caffeine and tannin in the manufacture of ——. W. T. Bell, Lincoln, S. A. Vasey, London, and W. M. Steadman, Lincoln. Eng. Pat. 10,471, May 2, 1912.

The tea is treated with a quantity of caffeine or tannin, respectively, so that it shall contain caffeine and tannin in the proportions 1 : 3. The addition is made by atomising solutions of the substances into the air currents during the drying process or by bringing the solutions into intimate contact with the tea during the fermentation or rolling processes.—W. P. S.

Soup or broth-like substances or liquids; Production of ——. G. Braun, Munich, and Andernacher Dörrgemuse und Conservenfabrik Luithlen und Neumann, Andernach a/R., Germany. Eng. Pat. 22,052, Sept. 27, 1912.

Albumin or casein is hydrolysed completely by heating it with a mixture of sulphuric and hydrochloric acids, the sulphuric acid is then eliminated by the addition of a salt such as barium chloride, and the hydrochloric acid is neutralised by the addition of sodium carbonate. The liquid is then filtered.—W. P. S.

Albumins; Method of restoring coagulated —— to the original state. A. H. Rasche, Charlottenburg, Germany. Eng. Pat. 28,613, Dec. 12, 1912.

Coagulated albumin is emulsified with a liquid such as oil or water, or a mixture of the same, the emulsion is heated, charged with a gas such as carbon dioxide or air under a pressure of about 6 atmospheres, and then atomised while still hot and under pressure. In the case of heated milk, and other liquids, the addition of water or oil is unnecessary.—W. P. S.

Coffee substitute or cereal coffee and the process of preparing the same. J. L. Kellogg, Assignor to Kellogg Toasted Corn Flake Co., Battle Creek, Mich. U.S. Pat. 1,059,471, April 22, 1913.

Starch or starchy material is mixed with about 60 per cent. of its weight of a thick syrup of 40° B. (sp. gr. 1·383), and the mixture is heated in a closed retort to 250°—300° for from 1 to 5 hours. The retort is then opened to permit the rapid evaporation of the moisture, and the remaining mass is broken into fragments, which are roasted, and ground to a powder.—W. P. S.

Peptonised vegetable and animal extract. N. Sulzberger, New York. U.S. Pat. 1,060,296, April 29, 1913.

A bouillon is prepared by mixing peptonised animal and vegetable albumin, freed from maltose formed during the peptonisation, with fat, salt, and spices.—W. P. S.

Citrus fruit; Artificially colouring ——. L. B. Williams, Lemon Grove, Cal. U.S. Pat. 1,061,253, May 6, 1913.

The citrus fruit is subjected to the action of acrolein under pressure and in absence of moisture; or the mature fruit is subjected to the fumes from an explosion engine. —J. H. J.

Edible compound; Producing an ——. J. Boyce, Chicago, Ill., Assignor to American Cotton Oil Co., New York. U.S. Pat. 1,061,254, May 6, 1913.

An unsaturated oil or fat is refined and subjected to the action of hydrogen in the presence of a catalyst; the action is arrested when the desired amount of the hydrogenised fat has been produced. The product is a mixture of the original fat with the synthesised stearin and has the consistence of lard.—J. H. J.

Alimentary product resembling milk; Process for the manufacture of an —— from soya beans and other similar vegetable substances. F. Gössel. Fr. Pat. 451,447, Dec. 2, 1912. Under Int. Conv., Dec. 4, 1911.

Ten kilos. of ground soya beans, sesame seeds, or the like, are mixed with 100 litres of water, 5 grms. of sodium or potassium phosphate are added, and the mixture is heated nearly to boiling for a short time. After being cooled slightly, the liquid is filtered under pressure, emulsified with 2·4 kilos. of lactose, a small quantity of sodium chloride, 60 grms. of sodium carbonate, and 2 kilos. of sesame oil or the like, and the emulsion diluted with water to 100 litres. The resulting liquid may be sterilised, concentrated, or dried to a powder.—W. P. S.

Drying milk and other substances; Processes and apparatus for ——. J. McIntyre, Jersey City, and W. de Shetley, New York. Eng. Pat. 12,599, May 28, 1912.

See U.S. Pats. 1,026,756 and 1,026,757 of 1912; this J., 1912, 600.—T. F. B.

Alimentary [milk] products; Manufacture of ——. P. Müller, Frankfort, Assignor to H. Finkelstein and L. F. Meyer, Berlin. U.S. Pat. 1,061,488, May 13, 1913.

See Fr. Pat. 412,256 of 1910; this J., 1910, 1031.—T. F. B.

Baking-powder. W. Klapproth, Ober-Ingelheim, Germany. U.S. Pat. 1,061,183, May 6, 1913.

See Eng. Pat. 10,122 of 1912; this J., 1912, 657.—T. F. B.

Purifying molasses and application of the product to the preparation of chocolate paste. Fr. Pat. 451,352. *See* XVII.

XIXb.—WATER PURIFICATION; SANITATION.

Nitrous acid [in waters] in presence of ferric salts; Detection of ——. P. Artmann. Chem.-Zeit., 1913, 37, 501.

The disturbing influence of ferric salts on the iodide test for nitrites is overcome by adding sodium phosphate before acidifying. 8 grms. of pure crystallised sodium phosphate are dissolved in 100 c.c. of the water to be examined, 0·2 grm. of potassium iodide is added, and the mixture shaken until only a slight turbidity (due to ferric phosphate) remains; it is then acidified with 5 c.c. of 4*N* sulphuric acid, and 2 c.c. of starch solution (zinc iodide-starch is quite suitable) are added. With 0·3 mgrm. of nitrous anhydride, a blue colour appears at once, and, in the presence of ferric salts in sufficient quantity, even smaller amounts may be detected.—F. Sodn.

Disinfectants; Bacterial testing of ——. C. T. Kingzett and R. C. Woodcock. Analyst, 1913, 38, 190—200.

The results of the testing of a large number of substances used as disinfectants or antiseptics by the Rideal-Walker method are tabulated. They confirm the previous conclusion of the authors (this J., 1910, 1032) that this test while serviceable for comparing the germicidal values of coal-tar disinfectants under the specified conditions is useless for determining the real disinfectant values of these and other preparations for practical application. In discussion S. Rideal stated that at the recent International Congress of Applied Chemistry, Washington and New York, 1912, an international committee was appointed to define a simple bacteria test for the control of disinfectants, but he agreed with the authors that it would be necessary to take into consideration also the oxidising power of the disinfectant, *i.e.*, not only the bactericidal effect but also the effect on the environment of the organism.—A. S.

Oxidation of thiosulphates on bacterial filters. W. T. Lockett. *See* Manchester Section, p. 573.

Patents.

Waste-liquors [*from tanneries*]; *Method of and apparatus for treating* ——. J. Forster, Warrington. Eng. Pat. 2190, May 1, 1912.

The lime liquor is led into a tank placed over a boiler flue, where it passes through a coarse and a fine screen and over and down a vertical baffle into a second similar tank, also over the flue, provided with finer screens. The tan-pit liquors are treated separately in the same manner, and then mixed with the clarified lime liquor and evaporated in a tubular boiler, or in tanks along the side walls of the boiler setting. These tanks are connected by transverse pipes passing under the boiler, and by upright pipes leading from the transverse pipes to the top of the tanks. In this manner a good circulation is ensured while the liquids are evaporated to dryness.—J. H. J.

Sewage; Treatment of —— *for utilisation as combustible material and as manure.* L. Penkala. Fr. Pat. 451,524, Feb. 14, 1912.

The materials, which are first ground, dried and sterilised, are separated by sifting into ligneous material and powder, which are agglomerated separately for use respectively as combustible material and as manure. The former is agglomerated into combustible briquettes by means of one of the insoluble agglutinants described in Fr. Pats. 451,522 and 451,523, Feb. 14, 1912 (see page 618). The powder is agglomerated by means of a vegetable preparation, containing vegetable gelatin, which is not rendered insoluble, with the object of making compressed manure. —B. N.

Sewage sludge; Treatment of ——. M. F. Purcell, Preston, J. H. Ryan, Dublin, and C. J. Polglase, Falmouth. Eng. Pat. 24,636, Oct. 28, 1912.

Pressed sludge is subjected to destructive distillation in a producer to which air and steam are introduced. The air is heated to a higher temperature than the steam before being admitted to the producer by passing it through chambers surrounding the condensers for the gases generated in the producer. These gases are conducted through a condenser and scrubbers and then collected in a gas-holder.—W. P. S.

Sterilising liquids in bottles or like receptacles; Method of —— *and apparatus therefor.* L. Giommi, Milan, Italy. Eng. Pat. 9912, April 26, 1912.

The bottles are heated to a suitable temperature in a closed chamber, means being provided for increasing the pressure in the chamber so that it corresponds with that in the bottles as these become heated.—W. P. S.

Feed water for steam boilers; Method and apparatus for treating ——. H. N. Hillman, London. Eng. Pat. 28,166, Dec. 6, 1912.

The water is allowed to flow over a weir of aluminium and then passes in the form of a thin layer over a sloping sheet of aluminium having a flat surface.—W. P. S.

Water; Apparatus for purifying ——. C. R. Darnall, Washington, D.C. U.S. Pat. 1,060,669, May 6, 1913.

The water is pumped through the apparatus in a given direction and a minute quantity of a purifying reagent is introduced by means of a pressure regulator and valves worked by the main flow of water and in proportion to it. A gas reservoir with a pipe connection, containing a pressure regulator, is also provided, and by means of an auxiliary pump, worked by the main pump, and an air chamber between the pressure regulator and the discharge from the auxiliary pump, a quantity of gas may be introduced into the water in proportion to its flow.—J. H. J.

Water purification; Process for thermal ——. H. F. Hodges, Philadelphia, Pa. U.S. Pat. 1,060,901, May 6, 1913.

The water passes down a central cylinder of small diameter where it is heated by steam and the gas given off is removed automatically. It then passes up through a wide surrounding tank where the precipitate settles out into a conical bottom from which it is removed. The water may be heated at a low temperature and pressure in the first part of the process to precipitate the carbonates and at a higher temperature and pressure afterwards to precipitate the sulphates, and then the temperature and pressure reduced automatically by evaporation in a closed chamber from which the purified water is drawn off and the surplus steam returned for use in the first part of the process. —J. H. J.

Water; Apparatus for the sterilisation of —— *by means of mercury lamps emitting ultra-violet and other rays.* P. G. Triquet. First Addition, dated Jan. 26, 1912, to Fr. Pat. 449,713, Dec. 30, 1911 (this J., 1913, 504).

The mercury-vapour lamps are arranged in horizontal tiers in a vertical cylinder through which the water passes upwards. One end of the lamp carrier is, in each case, attached to a central rod in the cylinder whilst the other end is fixed to a handle which passes through a stuffing-box in the wall of the cylinder.—W. P. S.

Water; Process for the purification of ——. T. Goldschmidt, Akt.-Ges. Fr. Pat. 450,520, Oct. 19, 1912. Under Int. Conv., Jan. 15, 1912.

The water is treated with calcium hypochlorite or other hypochlorites or substances of which chlorine is the active constituent, and is then brought into contact with finely-divided tin or aluminium mixed with large quantities of sand. —W. P. S.

Water; Process for the purification of ——. G. Lambert. Fr. Pat. 450,581, Sept. 14, 1912.

The water is treated with permanganate (about 3 grms. per cb. m.), and after 1 hour, the excess of permanganate is destroyed by passing the water through a filter consisting of pieces of iron, and then filtering it through sand. —W. P. S.

Liquids [*water*]; *Process and apparatus for the purification of* ——. G. H. Fraser. Fr. Pat. 451,215, Nov. 30, 1912.

See U.S. Pat. 1,045,830 of 1912; this J., 1913, 105. An apparatus for carrying out the process consists of a U-shaped vessel, having one limb taller than the other. The filtering material (sand) is fed continuously to, and the filtered water discharged from, the taller limb, and the raw water led into, and the filtering material discharged from, the shorter limb. From the latter the filtering material passes to a conveyor and thence through cleaning and sterilising devices, back to the longer limb of the U-tube. The device for removing the filtering material from the shorter limb of the U-tube may be operated by gearing controlled by a float in the receptacle for the filtered water.—A. S.

Halogens in gelatin; Process for preparing solid solutions of ——. J. Herold, jun. Ger. Pat. 258,612, April 2, 1911.

Gelatin is treated either in the dry or in a swollen condition with a free halogen, alone or in solution, and in absence of a substance which combines with acid, and the product is freed from the liquid used to swell the gelatin. The resulting gelatin contains the halogen as an adsorption compound or in solid solution, and not chemically combined; it may be used for antiseptic purposes.—T. F. B.

Distilling and sterilising liquids, especially water; Apparatus for ——. W. Boehm, Charlottenburg, Germany. Eng. Pat. 4897, Feb. 27, 1912.

See Fr. Pat. 440,600 of 1912; this J., 1912, 837.—T. F. B.

Fluids such as water and sewage; Process of treating ——. J. M. Neil, New York. Eng. Pat. 24,356, Oct. 24, 1912.

See U.S. Pat. 1,045,096 of 1912; this J., 1913, 105.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloid silicotungstates. H. R. Jensen. Pharm. J., 1913, **36**, 658—660.

Most, if not all, alkaloids form insoluble compounds with silicotungstic acid, which may be represented by the formula $4H_2O,SiO_2,12WO_3,xH_2O$, x varying between 20 and 22. This substance can be prepared by boiling a solution of sodium tungstate with gelatinous silicic acid till the addition of hydrochloric acid gives no precipitate, when the liquid is filtered and evaporated. Excess of dilute sulphuric acid is added, the liquid extracted with ether and the aqueous portion evaporated, when yellowish white crystals having the above composition separate. The substance is readily soluble in water and the solutions are stable. The precipitation is carried out by adding the solution to a dilute hydrochloric acid solution of the alkaloid. In many cases the precipitates, after being dried at 120° C., have a constant composition, and on ignition yield the non-volatile and stable oxides WO_3,SiO_2. No precipitate is formed when the acid is added to solutions of salts of ammonium, sodium, or potassium, sucrose, dextrin, gum acacia, tannic acid, salicin, strophanthin, adrenaline, or allantoin. Factors are given for converting the weight of ash into the corresponding weight of alkaloid for nicotine, coniine, sparteine, aconitine, atropine, antipyrine, and the cinchona alkaloids. The same reagent can be used to determine colchicine, and the alkaloids of ipecacuanha and jaborandi. The method can be applied to the estimation of the relative proportions of two alkaloids present as a mixture which could only be separated with difficulty.—F. Shdn.

Strophanthic acid, a saponin from the seeds of Strophanthus gratus. E. Sieburg. Ber. deuts. Pharm. Ges., 1913, **23**, 278—290.

The haemolytic saponin, strophanthic acid, which Kobert had previously observed as an accidental impurity of commercial strophanthin, is contained in varying proportions up to 0·2 per cent. in all varieties of the drug, from the alcoholic extract of which it may be obtained by precipitation with an acid after the removal of the alcohol. The pure saponin, $(C_{21}H_{34}O_{10})_4$, is characterised by well marked acid properties, and is precipitated from its solutions in water or alkali by picric or phosphomolybdic acid, and also by concentrated ammonium sulphate or sodium chloride solutions. It is readily soluble in aqueous alcohol, but only sparingly in water and ether. With salts of heavy metals it forms precipitates of indefinite composition. On hydrolysis with acids it is resolved finally into dextrose and strophanthigenin $(C_{12}H_{18}O_2)_2,3\frac{1}{2}H_2O$, a sapogenol which likewise possesses haemolytic properties. —G. F. M.

Aloes; Detection of —— in admixture with extracts of drugs containing hydroxymethylanthraquinones, and identification of the latter by the crystalline form of the isolated hydroxymethylanthraquinones. G. Mossler. Pharm. Post, 1913, **46**, 313—315, 325—327. Chem. Zentr., 1913, **1**, 1842—1843.

The alcoholic solution, or alcohol extract of a solid material, is evaporated, the residue dissolved in water, and the filtered aqueous solution (100 c.c.) heated for ½ hour on the water-bath with 5 c.c. of 10 per cent. sulphuric acid. The sulphuric acid is then precipitated hot with the exact quantity of baryta water, and the filtered solution concentrated to 100 c.c., clarified with the least possible quantity of lead acetate, and filtered. From 10 c.c. of the filtrate the excess of lead is removed as sulphate, and the solution divided into two portions, of which one is extracted with 4—5 c.c. of benzene, and the benzene solution extracted with dilute ammonia. If the separation of the foreign hydroxymethylanthraquinones by the lead acetate has been complete, the aqueous layer, after settling, should have at the most only a light pink colour. A yellow colouration of the benzene indicates the presence of aloes. The other portion of the liquid is treated with excess of bromine water: in presence of aloin a flocculent precipitate forms immediately. The main portion of the solution is now freed from lead and tested for aloin by Hirschsohn's reaction and Schouteten's fluorescence reaction:—(1) 10 c.c. of the solution are warmed with 1 drop of copper sulphate solution and 1 drop of hydrogen peroxide: aloin is indicated by a red colour which becomes more intense on standing. (2) 10 c.c. of the solution are warmed gently and shaken with 2—3 grms. of borax and then allowed to stand for ½ hour: the presence of aloes is indicated by a green fluorescence of the solution. It is stated that 0·2 grm. of extract of aloes may be detected by the above method in 5 grms. of a mixture of rhubarb, Frangula and Sagrada extracts. Drugs containing hydroxymethylanthraquinones may be identified by isolating the hydroxymethylanthraquinone and examining its crystalline form under the microscope.—A. S.

Gentiopicrin in the leaf stalks of Yellow Gentian, Gentiana cruciata and G. asclepiadia; The presence of ——. M. Bridel. J. Pharm. Chim., 1913, **7**, 486—492.

The leaf stalks of the Yellow Gentian and *Gentiana asclepiadia* L. contain about 0·3 to 0·4 per cent. of gentiopicrin. *G. cruciata* L. contains the same substance in a smaller amount. The material was extracted with hot alcohol and the extract concentrated. The residue was taken up with water, cleared with basic acetate of lead, filtered after removing the lead and evaporated under reduced pressure. The final residue was extracted with hot ethyl acetate, which deposited crystals of gentiopicrin. —F. Shdn.

Lemongrass oil; Solubility of —— in 70 per cent. alcohol. J. C. Umney. Perfum. and Essent. Oil Rec., 1913, **4**, 119.

It has been stated that *Cymbopogon flexuosus* yields a soluble and *C. citratus* an insoluble oil, but the author after examining oils imported from the West Indies, Uganda, Cochin, Burma, and Ceylon, considers that differences of solubility are due rather to different methods of distillation, oils distilled from modern steam stills being much less soluble than those distilled by direct fire.—A. S.

Oil of the fruits of Alpinia alba, Rosc. S. S. Pickles and J. C. Earl. Chem. Soc. Proc., 1913, **29**, 164.

A small quantity of the fruits of *Alpinia alba*, Rosc. (*Amomum medium*, Lour.) was received at the Imperial Institute from Hong Kong in 1911. The fruits, on examination, were found to contain a volatile oil, which occurred almost entirely in the seeds. By distilling the fruits with steam, about 1 per cent. of a pale yellow oil, having an odour recalling those of lemon and eucalyptus, was obtained. The following constants were found for the oil: D_{15}^{15} 0·9366, α_D (in a 1-dcm. tube at 20°) —2°15′. The oil was shaken, first with dilute sodium carbonate, next with sodium hydrogen sulphite solution, then with dilute sodium hydroxide, and finally with 50 per cent. resorcinol solution to absorb cineol (eucalyptol). From the results of this treatment and the subsequent examination of the various products, the composition of the oil was found to be approximately as follows: *Eucalyptol*, 69 per cent. *Aldehydes and ketones*, 27·5 per cent., consisting mainly of citral. *Phenols*, 1·5 per cent. *Acids*, 1 per cent. A small quantity of a crystalline acid, m. p. 46°—48° C., was isolated. The residue (about 1 per cent.) appeared to consist of terpenes.

Cherry-stone oil. Schimmel's Semi-Ann. Rep., April, 1913, 111.

The oil, obtained in a yield of 0·016 per cent., by grinding the cherry stones, mashing up, letting the paste stand for several hours, and distilling with steam, has the following characters: Soluble in 2·5 volumes of 60 per cent.

alcohol; specific gravity, 1·0532; optical rotation, +0°; refractive index, 1·53888. The hydrocyanic acid content was 0·27 per cent. It is a colourless to pale yellow oil, having an odour similar to that of bitter almond oil, yet clearly differentiated from the latter.

Essential oils; Constituents of ——. Synthesis of the diterpene, a-camphorene, $C_{20}H_{32}$, and of the sesquiterpene, cycloisoprenemyrcene, $C_{15}H_{24}$. F. W. Semmler and K. G. Jonas. Ber., 1913, **46**, 1566—1571.

The synthesis of a-camphorene, $C_{20}H_{32}$ (this J., 1913, 379), can be accomplished by heating myrcene in a sealed tube at 250°—260° C., and fractionating the product. When a mixture of isoprene and myrcene is similarly treated, a sesquiterpene, cycloisoprenemyrcene, $C_{15}H_{24}$, is formed. This boils at 125°—135° C. at 8 mm., has the sp. gr. 0·8685 at 18° C., and n=1·49166. When the ethereal solution is treated with dry hydrogen chloride, a solid trihydrochloride is formed which can be crystallised from absolute alcohol and melts at 83° C.—F. Shdn.

Camphor; Compounds of —— with quinol, resorcinol, and pyrocatechol. N. Efremow. J. Russ. Phys.-Chem. Soc., 1913, **45**, 348—362. Chem. Zentr., 1913, **1**, 1817—1818.

The author examined micrographically and by thermal analysis mixtures of camphor with the three dihydroxybenzenes. *Camphor-resorcinol.* A compound containing 1 mol. of each of the two components is formed, which melts at 29° C., and also two eutectics melting at 1° and 24° C. and containing respectively 26·6 and 44·5 per cent. of resorcinol. *Camphor-pyrocatechol.* A compound analogous to the resorcinol compound is formed, which melts at 11·5° C. The two eutectics melt at 19° and 7·5° C., and contain respectively 26·6 and 46 per cent. of pyrocatechol *Camphor-quinol.* Here also a compound containing 1 mol. of each of the two components is formed, but it decomposes on melting. The eutectic contains 33 mols. per cent. of quinol and melts at 49° C. The equilibrium diagram also shows a transformation point at 62° C. and 37 mols. per cent. of quinol. All three dihydroxybenzenes are capable of holding camphor in solid solution, viz., quinol, 37·5; resorcinol, 20, and pyrocatechol, 15 per cent. of camphor.
—A. S.

Carbon tetraiodide; The preparation of ——. M. Lantenois. Comptes rend., 1913, **156**, 1385—1387.

The author has studied the various reactions for the formation of carbon tetraiodide by the action of iodides on organic chlorine compounds, first observed by Spindler (Annalen, 1885, **231**, 264). The highest temperature available, in order to avoid decomposition of the tetraiodide, is 90°—92° C., a metallic iodide acting the better on carbon tetrachloride when its temperature of fusion is slightly higher than this temperature. A yield of 53·6 per cent. was obtained with calcium iodide containing 2 mols. H_2O by keeping at 75° C. for 5 days. The author, however, prefers to use lithium chloride with 5 mols. H_2O; this gave a yield of 33 per cent. after heating at 90°—92° C. for five days. The operation is carried out in a sealed tube with an excess of carbon tetrachloride. A study was also made of the method of Robineau and Rollin by acting on iodoform with hypochlorite (Monit. Scient., 1894, **8**, 341), a pure product being obtained by this means. Carbon tetraiodide forms ruby-red octahedra. The sp. gr. is 4·50 at 0° C. Its solubility in boiling benzene is 15·99 per cent. against 9·32 per cent. at 16° C.—J. B.

Patents.

Radioactive elements; Process for the better utilisation in therapeutics of the products of decomposition of ——. Radium-Heil-Ges. m. b. H., Berlin. Eng. Pat. 8908, April 15, 1912. Under Int. Conv., April 22, 1911.

The walls of the emanation generator or storage vessel are brought to a positive electrical or magnetic potential, thereby preventing the deposition thereon of the positively charged decomposition products.—F. Shdn.

Radio-active substance; Vessels for rendering a liquid, gas, colloid, or solid active by the aid of a ——. Radium-Heil-Ges. m. b. H., Berlin. Eng. Pat. 24,887, Oct. 30, 1912. Under Int. Conv., Nov. 15, 1911.

A transparent vessel has within it a container for the radio-active substance, the container being partly or wholly coated with a fluorescent substance, or the latter may be situated within or outside the container.—O. R.

Phenylcinchoninic acid and homologues or derivatives thereof; Manufacture of derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 10,352, May 1, 1912. Under Int. Conv., Jan. 16, 1912.

Derivatives of phenylcinchoninic acid "of great therapeutic value" are obtained by treating a-phenylcinchoninic acid or one of its homologues or derivatives with ammonia or a primary or secondary aliphatic amine. The cinchoninic acid derivatives may be obtained by treating aniline or its homologues with pyroracemic acid and benzaldehyde or its derivatives, or by treating isatin with an aromatic ketone. The product obtained by treating a-phenylcinchoninic acid with ammonia melts at 196° C., or with diethylamine, at 95° C.—T. F. B.

Codliver oil or the like; Congealed emulsions of —— with a palatable preservative coating, and method of producing the same. K. Kawai and Z. Miwa, Tokyo, Japan. Eng. Pat. 15,403, July 2, 1912.

A mixture of codliver or other oil (say, 240 parts) with gelatin (15 parts), agar-agar (2 parts), water (85 parts), sugar (*e.g.*, maltose) or dextrins (270 parts) is cooled, and if desired moulded into balls, etc., and the solidified emulsion subsequently covered with a coating consisting of, *e.g.*, a mixture of gelatin, agar-agar, water, sugar and glycerin.
—C. A. M.

Acidyl-ortho-[hydr]oxybenzoic acids; Manufacture of the calcium salts of ——. Chem. Fabr. von Heyden, Akt.-Ges., Radebeul, Germany. Eng. Pat. 22,237, Sept. 30, 1912. Under Int. Conv., April 20, 1912.

The calcium salts of acidyl-ortho-hydroxybenzoic acids, such as acetylsalicylic acid, can be prepared by treating the cold aqueous solutions of the alkali or ammonium salts of these acids with easily soluble calcium salts.—F. Shdn.

Pharmaceutical preparations [salts of acidylhydroxyphenylcarboxylic acids]; Manufacture and production of improved ——. W. P. Thompson and Co., London. From J. A. Wülfing, Berlin. Eng. Pat. 25,486, Nov. 6. 1912.

Preparations of acidylhydroxyphenylcarboxylic acids can be made so as to dissolve readily in water by mixing the acids in the form of very fine powder with alkali carbonates. For instance, a mixture of acetylsalicylic acid with 1½ molecular proportions of sodium bicarbonate can be compressed into tablets which are stable and break up easily in water.—F. Shdn.

Isopentenes and their derivatives; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 450,461, Nov. 12, 1912. Under Int. Conv., May 31, 1912.

The normal pentenes, and also compounds from which they are formed, such as the normal halogen-pentanes and the pentyl alcohols, are converted into isopentenes by heating to high temperatures, particularly in presence of a catalytic agent. For example, 1065 kilos. of normal monochloropentane (obtained by chlorinating the fraction of gasolene of b. pt. about 36°—38° C.) is passed over 2000 kilos. of quicklime heated to about 385°—400° C., and the vapours generated are passed, without condensation, over calcined alumina heated to about 450° C. The cooled product yields about 650—700 kilos. of a liquid of b. pt. 34°—38° C., half of which consists of trimethylethylene. Pure isopentene is obtained by agitating the product with concentrated aqueous hydrochloric acid, which converts the trimethylethylene into isoamyl chloride of b. pt. 84°—86° C.; this is then separated by distillation from unaltered pentene and small quantities of isopropylethylene, and converted into an isopentene of b. pt. 34°—36° C. by elimination of hydrochloric acid.—T. F. B.

Hydrocarbons of the terpene series; Process for making —— from terpene halogen hydrates. A. Meyer. Fr. Pat. 451,645, Dec. 9, 1912. Under Int. Conv., Dec. 11, 1911.

When the hydrohalides of terpene hydrocarbons, or of the hemiterpenes or polyterpenes, are heated with catalytic agents, such as kieselguhr, charcoal, kaolin, glass powder, etc., the hydrohalogen acid is evolved and the hydrocarbon is liberated. Thus, by boiling pinene hydrochloride with from 1 to 3 per cent. of its weight of kieselguhr for 30 hours, about 35 per cent. of camphene is produced; by removing the hydrochloric acid by passing a current of gas through the liquid during the process, and by using as low a temperature as possible, the yield may be increased. The highest yields are, however, obtained by using blood charcoal or animal charcoal: in this case, a yield of 85 per cent. may be produced. Still higher yields are obtained by adding to the mixture a diluent or a substance which will combine with the nascent hydrochloric acid, *e.g.*, an amine, salt of an organic acid, oxide, hydroxide, etc. —T. F. B.

Desiccation [of scrums, vaccines, etc.]; Process for instantaneous —— in the cold. A. Lumière. Fr. Pat. 450,931, Jan. 29, 1912.

Serums, vaccines, and other organic preparations for medical use, etc., are dried by means of anhydrous inert salts which form dry hydrates on absorption of water, for example, anhydrous sodium sulphite, sodium sulphate, di-sodium phosphate or magnesium sulphate.—H. H.

Nitrohydroxyphenylarsinic acid; Process for obtaining ——. K. Oechslin, and Poulenc frères. Fr. Pat. 451,078, Feb. 3, 1912.

The nitro-*p*-dimethylaminophenylarsinic acid of m. pt. 204° C., described in Fr. Pat. 449,373 (see this J., 1913, 506) is converted by treatment with an alkali into a product which crystallises in yellow rhombohedra or in almost colourless needles, and consisting of a nitro-1.4-hydroxyphenylarsinic acid, which resembles in its crystalline form the nitrohydroxyphenylarsinic acid used for the preparation of "Salvarsan 606."—T. F. B.

Acetone; Process for preparing ——. P. de la Fresnaye and E. Cadoret de la Gabinière. Fr. Pat. 451,374, Nov. 4, 1912.

It is stated that acetone may be obtained in higher yield than by any of the known processes, by the action of a monobasic organic acid on an ester in presence of a reducing agent or an amine, or both. The ester may be formed during the reaction. The following example is given:—700 parts of 40 per cent. acetic acid are mixed with 230 parts of sodium chloride, 210 parts of metallic iron, and 150 parts of methyl or ethyl alcohol, and 275 parts of sulphuric acid are slowly added; when esterification is complete, 100 parts of potassium permanganate and 185 parts of cupric chloride are added, the mixture is allowed to stand for 48 hours, and the acetone is distilled off.—T. F. B.

Tobacco juice; Process for subjecting —— to a treatment similar to the fermentation of tobacco leaves. T. Oelenheinz. Ger. Pat. 258,004, Oct. 18, 1912.

The tobacco juice from the green plants, after being fermented, filtered and preferably concentrated in the known manner, is cooled slowly, then heated, in stages, to a temperature of about 60° C., and kept thereat for a long time. By inoculating with pure cultures of special kinds of fission fungi, it is possible to impart to the juice of low-grade tobaccos the odour and flavour of better kinds. —A. S.

5(4)-*Methyliminazole*-4(5)*carboxylic acid ethyl ester; Process for preparing ——.* O. Gerngross. Ger. Pat. 258,296, Feb. 24, 1912.

By the action of warm dilute nitric acid on 5- or 4-methyl-2-mercapto-iminazole-4- or -5-carboxylic acid ethyl ester, the SH-group is replaced by hydrogen. The product is obtained in a yield of about 80 per cent., and may be used in medicine on account of its action on the blood pressure. —T. F. B.

Iron iodo-p-nucleinate; Process for preparing ——. Knoll und Co. Ger. Pat. 258,297, Jan. 13, 1912.

An iodo-*p*-nucleinate of iron may be obtained: (1) by treating an aqueous solution of *p*-nucleinic acid with a solution of an iron salt and a solution of iodine; (2) by adding a solution of an iron salt to a solution of iodo-*p*-nucleinic acid; (3) by treating iron *p*-nucleinate with iodine solution. The reactions in each case are carried out in neutral solution. Method (3) may be carried out in acid or alkaline solution, with subsequent neutralisation. Another method consists in treating the solution resulting from the digestion of casein with iron-ammonium alum and with an iodine solution, or treating the digestion-solution from iodated casein with iron-ammonium alum, and finally neutralising.—T. F. B.

Catechol ether-hydroxypropanesulphonic acid; Preparation of the alkali salts of ——. A. Wolff. Ger. Pat. 258,473, Sept. 13, 1911.

The chloro-hydroxypropanesulphonic acid salts, obtained from α-dichlorhydrin and normal alkali sulphites, are heated with equimolecular proportions of monoalkali catechols in aqueous solution in absence of air; it is desirable to pass a current of hydrogen through the solution. The products have the constitution, $HO.C_6H_4.OCH_2.CH(OH).CH_2.SO_3Na$, etc., and possess therapeutic properties similar to those of guaiacolsulphonates; they are very readily soluble in water.—T. F. B.

Soap-like products free from water, containing chemically combined sulphur; Preparation of ——. S. Diesser, Chem. Laboratorium und Versuchsstat. f. Handel u. Ind. Ger. Pat. 258,655, April 11, 1911.

Fatty oils or fats are heated with anhydrous sodium thiosulphate at temperatures above 200° C., until they are completely saponified. The products may be mixed with indifferent filling materials or antiseptic substances. —T. F. B.

o-Thymotic acid acetol ester; Process for preparing ——. A. Diefenbach and R. Zahn. Ger. Pat. 258,936, Aug. 29, 1912.

A salt of *o*-thymotic acid is heated with monohalogenacetone, with or without addition of an indifferent solvent. The resulting acetol ester possesses powerful local anæsthetic properties, as do certain other esters of *o*-thymotic acid, *e.g.*, those with acetonyl alcohol, acetyl carbinol, or pyruvic alcohol.—T. F. B.

p-Hydroxyphenylethylamine and its N-alkyl-derivatives; Process for preparing iodo-derivatives of ——. F. Hoffmann-La Roche und Co. Ger. Pat. 259,193, May 5, 1912.

The iodine derivatives are obtained by the action of iodine on *p*-hydroxyphenylethylamine or its N-alkyl derivatives in alkaline solutions. They are applicable to medicine.— T. F. B.

Ketobases and ketodiamines of the formulæ,

$$CH_3.CO.CH(R).CH_2.N(CH_3)_2 \text{ and}$$
$$CH_3.CO.C(R)(CH_2.N.(CH_3)_2)_2;$$

Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,360, May 13, 1912.

See Ger. Pat. 254,714 of 1911; this J., 1913, 380.—T. F. B.

Di[hydr]oxydiaminoarsenobenzene; Alkali compounds of ——. P. Ehrlich and A. Bertheim, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,059,983, April 29, 1913.

See Fr. Pat. 445,325 of 1912; this J., 1912, 1200.—T. F. B

Organic derivatives of arsenic acid ; Process of production of ——. H. Bart, Bad Dürkheim, Germany. U.S. Pat. 1,061,587, May 13, 1913.

See Eng. Pat. 568 of 1911 ; this J., 1911, 1087.—T. F. B.

Pharmaceutical [*mercury*] *compounds.* M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,060,327, April 29, 1913.

See Ger. Pat. 224,435 of 1909 ; this J., 1910, 1037.—T.F.B.

Organic antimony compounds and process of making same. L. Kaufmann, Berlin. U.S. Pat. 1,060,765, May 6, 1913.

See Fr. Pat. 406,138 of 1909 ; this J., 1910, 452.—T. F. B.

Amides of the arylalkyloxyacetic acids and process of making same. E. Preiswerk and W. Bernoulli, Assignors to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 1,061,120, May 6, 1913.

See Ger. Pat. 256,716 of 1911 ; this J., 1913, 450.—T. F. B.

Alkaloid salts ; Art of preparing ——. W. Straub, Freiburg, Assignor to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 1,061,139, May 6, 1913.

See Eng. Pat. 13,293 of 1912 ; this J., 1912, 900.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Cinematographic and photographic films ; Process and machine for applying emulsions to ——. E. Crumière et Cie. Fr. Pat. 451,286, Dec. 3, 1912.

The supports to be coated are caused to travel horizontally or almost horizontally, whilst the emulsion is applied to them ; by this means it is stated that the layer of emulsion is of the same thickness throughout the width of the film. When a perforated film is being coated, the emulsion is removed from the perforations by a cylinder touching the lower side of the film, which rotates in the reverse direction to that in which the film is travelling. The apparatus is fully described and illustrated in the specification.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosion of four guncotton drying stoves ; Circumstances attending the —— *which occurred on March* 10, 1913, *in the factory of Nobel's Explosives Company, Ltd., Ardeer, Ayr.* Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 6814.]

By the explosion of 41,500 lb. of guncotton in four drying stoves, 7 men were killed and 10 were injured. The wet guncotton, before being placed in the stoves, was lightly compressed into cylinders or "primers," each weighing about ½ lb. when dry, and these primers were placed separately on the racks, so that the use of trays was avoided. Each of the buildings was divided into two compartments, each licensed for 6,000 lb. The walls were of wood, and the roofs of corrugated iron, lined throughout with canvas, the floors being of wood covered with linoleum. In each compartment were eight drying racks. Each rack was 6 ft. 4 ins. high, 5 ft. 10 ins. long, and 3 ft. 8 ins. wide, and weighed about 360 lb. The framework was of galvanised iron tubes, connected by horizontal wires of brass, sufficiently near one another to support the primers. At all points where the wires passed through the tubes the holes were countersunk and filled up flush with solder. Each rack stood on six legs, three at either end, and each leg terminated in a footing consisting of a square plate resting on the floor. Eight shelves were thus provided, one above the other, and at each end the tubular frame was extended across to stiffen the rack. The stoves were heated by hot air distributed through each compartment by means of a conduit running round three sides of the building, with inlets at intervals covered with wire gauze. The temperature, whilst drying was in progress, was 43° C. The stove which first exploded contained 9,500 lb. of dry guncotton and was situated 56 yards from the two nearest stoves, which was the distance required by the licence for the maximum of 12,000 lb. of explosive. Some 4 or 5 secs. later the second stove, containing 8000 lb. of guncotton, exploded. The two remaining stoves, each containing 12,000 lb. of guncotton, exploded almost simultaneously. Major Cooper-Key considers that the original explosion was probably caused by one of the workmen in the building falling against one of the racks. As each rack had six points of contact with the floor the slightest inaccuracy in construction, or distortion of the comparatively flimsy metal framing, would result in one or more of the footings failing to make a good contact, a small space being left in which dust might collect, and if, in addition to this, the thin coat of zinc on the underside of the footing plate had worn off, a somewhat precarious situation would arise. It is considered that the communication of the explosion to the other three buildings was not primarily due to the inadequacy of the distances between them, but was due to the faulty construction of the buildings. This construction, however, was in accordance with the requirements of the licence, and was of a character heretofore considered the most suitable for the purpose. On the explosion of the first stove the other three stoves would have been considerably shaken, with the result that the roofs, walls and racks would be left in a very unsafe condition and the buildings would be filled with guncotton dust. The interval of 4 to 5 secs. between the first and second explosions is not incompatible with the hypothesis that the second stove was exploded by the *débris* projected from the first. This second explosion striking the other two already shaken buildings, filled as they now were with explosive dust, could hardly fail to wreck them sufficiently to cause them to explode. Several of the cordite stoves, at distances varying between 80 to 130 yards from the nearest guncotton stove were so shaken that portions of the roof were found lying on the trays of cordite, but no explosion followed. It is suggested that buildings of the nature of guncotton stoves might advantageously be constructed of fine gravel concrete reinforced with expanded metal of light section. The walls might be fairly stout at the ground level, becoming gradually thinner until at the haunch of the arched roof, and on up to the crown, the concrete might be made as thin as it will stand, and, supported by expanded metal, a thickness of 2 to 3 ins. would probably be sufficient. The expanded metal in the interior of the concrete should be brought up on each side to within a few inches of the crown and there stop, so as to leave a line of least resistance extending the whole length of the building. The expanded metal of the end walls should not be connected to that in the side walls and roof. Lined throughout with neat cement and well painted, a structure of this kind would seem to satisfy every requirement of a danger building; There would be no heavy framework and rafters to fly, and the resistance to projected *débris* of even the thinnest ferro-concrete would be considerable. Major Cooper-Key considers that steeply revetted "plate-banks" in close proximity to the buildings are not the best form of protection. The four buildings were surrounded by mounds of two quite different types. The greater part of the mounding consisted of banks of sand revetted with corrugated iron sheeting, and these were in some places bodily shifted as well as flattened out. Where the sand was left in its natural slope, and merely covered with sods, no damage whatever appeared to have been done. Major Cooper-Key considers that the slope of protecting mounds should be comparatively easy in the immediate vicinity of the building they surround, steepening gradually, as the distance increases, until the required height is reached, two or three feet of soft material, such as sods, being employed at the top, unless the soil is of such a nature as to stand alone at a slope of 4 to 1. In the case of buildings containing nitroglycerin, guncotton, cordite paste, and similar explosives, if it is desired to obtain the full reduction of distances, each such building should be separately protected by its own mound.—G. W. McD.

Accident which occurred in E_6, known as a "Packing House" in the "Dynamite System" of the Cape Explosives Works at Somerset West, on the 3rd January, 1913; Report on an ——. Major A. B. Denne, Chief Inspector of Explosives, Union of South Africa.

As a result of the explosion of 4210 lb. of "Ligdyn 40 per cent.," 9 persons were killed and 2 injured. The composition of the explosive is: nitroglycerin (40 parts), sodium nitrate (45), woodmeal (13), and wheat flour (2 parts). Samples from a similar batch showed the presence of only 34·95 per cent. of nitroglycerin, and, as the weighings could not be disputed, it followed that some portions of the mixture must have had more than 40 per cent. of nitroglycerin, and would have been more than normally sensitive. This grade of explosive is very sensitive. The evidence was undoubted that the explosive ignited in the packing machine and the resulting fire shortly afterwards caused the detonation of the explosive in the building. Tests at the factory of similar batches of explosive made on the same day showed that the heat test was perfectly satisfactory, and, consequently, the cause of the explosion could not be attributed to instability of the explosive. The conclusion is arrived at that the ignition occurred in the packing machine and was, in all probability, caused by friction set up between one of the packing sticks and the thimble, owing to some foreign substance having found its way into the dynamite, and that blame attached to no one. The machine in use is known as the Quinan packing machine, and no other machine has ever been used for packing dynamite in this factory, since it began operations in 1903, and this explosion is the first which has ever brought into question the safety and reliability of this particular machine. It is constructed principally of wood and is surmounted by an adjustable hopper or tray lined with zinc, into which the dynamite is placed by means of a wooden scoop. From this tray the explosive is raised by hand as required into a powder box, and a wooden reel rotated by an endless brass chain ensures a constant feed of dynamite in front of the packing sticks, which pass through the powder box. The endless chain is on one side of the machine outside the powder box and well protected from all contact with dynamite. A number of packing sticks, flexibly attached to a yoke at their back ends, pass through a corresponding number of openings in the powder box for the purpose of packing the dynamite into paper shells. The packing sticks pass through a brass nipple plate on the front of the powder box, and a shuttle containing the paper shells to be packed is placed in a receptacle at the front of the machine so that the open ends of the shells fit over the nipples on the nipple plate. The shuttle is held in position by means of a wooden stop operated by a treadle. The process of packing a shuttle full of shells (13 to 15) occupies from 8—13 secs., and requires from 14 to 24 strokes of the machine, depending upon the size of the cartridges being packed.—G. W. McD.

Glyceryl trinitrate in solution in acetone; Partial pressure of ——. Part II. A. Marshall. Chem. Soc. Proc., 1913, 29, 157.

In Part I. (Trans. Chem. Soc., 1906, **89**, 1350) the possible types of vapour-pressure curves were discussed and enumerated, a method of ascertaining the partial-pressure curves from the total-pressure curve was described, and experimental determinations of the total pressures of various mixtures were given, amongst others those of solutions of glyceryl trinitrate (nitroglycerin) in acetone. The curve is of the type to which the author has assigned the designation Ia. One of the peculiarities of this case is that the vapour pressure of acetone is about 160,000 times as great as that of glyceryl trinitrate, and consequently the partial-pressure curve of acetone is identical with the total-pressure curve. This, however, is no way interferes with the calculations to ascertain the form of the partial-pressure curve of glyceryl trinitrate; on the contrary, it makes the calculations somewhat easier. The problem is of some practical importance, as it throws a light on the losses of nitroglycerin, which are liable to occur in the drying of explosives, such as cordite, which contain the two substances. It is usual nowadays to recover part of the acetone used in the manufacture of explosives by drawing air from the stoves through pipes to a suitable recovery plant. These calculations give an indication of the relative amounts of nitroglycerin, which may condense in the pipes and other parts of the plant in the different stages of the drying. Such condensation is, of course, troublesome on account of the explosibility of the substance and the special precautions that have to be adopted to deal with the condensate. The complete elucidation of this problem would, however, also require determinations of the vapour pressures of mixtures of gun-cotton and acetone, and these are not available. The calculations are based on Duhem's equation:

$$\frac{dp_1}{dx}\,\frac{x}{p_1} = -\,\frac{dp_2}{dx}\,\frac{1-x}{p_2}$$

in which p_1 and p_2 are the two partial pressures, and x is the molecular proportion in the liquid phase of the first substance, in this case acetone. For any value of x, p can be obtained from a curve, as also can the differential dp_1/dx. The value of $p_2.dx/dp_2$ is then found by calculation, and the separate values of p_2 and dp_2/dx are obtained by a process of trial and error. The whole course of the partial-pressure curve is thus gradually ascertained. This has been carried out for the pair of substances under consideration, with the results shown in the table below. The temperature of the measurements was 18° C. At this temperature the vapour pressure of glyceryl trinitrate is estimated to be equal to about 0·001 mm. of mercury.

x (acetone).	p_1 (acetone)	dp_1/dx.	$p_2.10^5$ (glyceryl trinitrate).	$-dp_2/dx.10^5$.	Glyceryl trinitrate in liquid phase, per cent.
0	0	—	100	100	100
0·1	8·2	90	89·5	109	97·2
0·2	18·4	106	78·4	113	94·0
0·3	29·5	116	67·1	113	90·1
0·4	41·5	131	55·6	117	85·4
0·5	55·7	149	43·9	117	79·7
0·6	71·3	171	31·4	113	72·3
0·7	90·0	205	20·4	108	62·6
0·8	112·2	255	10·2	93	49·4
0·9	141·0	280	3·0	72	30·3
1·0	162·0	162	0·0	—	0·0

Patents.

Explosives with liquid oxygen as a base. Soc. L'Air Liquide (Soc. anon. pour l'étude et l'exploit. des proc. G. Claude). Fr. Pats. 450,750 and 451,265, Jan. 26. and Feb. 8, 1912.

(1). Aluminium, or a metallic silicide or hydride (150—600 grms.) is intimately mixed with an amount of porous inert material such as kieselguhr, which occupies 1 litre in volume. Liquid air is added, and the mixture is exploded with a detonator. (2). A container for liquid air, intended to be used as an explosive, is made as follows. Kieselguhr and aluminium are mixed with water to form a paste, which is spread on cloth. This is wrapped in successive layers round a former, so as to make a cylinder closed at one end. The cylinder is then dried at a low temperature, or *in vacuo*, and is finally dipped in a solution of potassium or sodium silicate and again dried. The liquid oxygen is poured into the cylinder immediately before it is placed in the bore hole.—G. W. McD.

Detonating composition for primers, caps, and detonators. E. Herz. Fr. Pat. 450,897, Nov. 21, 1912.

The perchlorates of aromatic diazo-compounds are claimed as detonating agents in place of mercury fulminate. It is stated that a detonator containing 0·015 grm. of nitrodiazobenzeneperchlorate will explode picric acid, whilst 0·1—0·3 grm. will completely detonate an ammonium nitrate explosive.—G. W. McD.

Explosive. S. A. G. Nauckhoff, Vinterviken, Assignor to Nitroglycerin Aktiebolaget, Stockholm. U.S. Pat. 1,061,774, May 13, 1913.

See Fr. Pat. 422,727 of 1910: this J., 1911, 573.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Zinc; Estimation of —— as zinc ammonium phosphate and zinc pyrophosphate. T. M. Findley and A. C. Cumming. Chem. Soc. Proc., 1913, **29**, 153.

The phosphate method for the estimation of zinc has been investigated in order to find the reason for occasional unsatisfactory results. It was found that the results were inaccurate (1) if the solution contained more than a trace of acetic acid; (2) if the solution, after the precipitation, was alkaline; or (3) if the solution contained sodium or potassium salts. The method can be modified to give correct results in the presence of sodium and potassium.

Antimony; Rapid methods for the determination of ——. H. Nissenson. Z. anorg. Chem., 1913, **81**, 46—48.

For the determination of antimony in antimony glance, 1 grm. is dissolved in concentrated hydrochloric acid, hydrogen sulphide is expelled, and, after diluting, the boiling solution is titrated with $N/10$ potassium bromate, indigo being added shortly before the end of the titration (see this J., 1903, 967; 1904, 338); a determination is complete in about an hour and a half. The indigo solution is prepared by treating 1 grm. of finely ground indigo with 6 c.c. of cold concentrated sulphuric acid, and, after 2—3 days, adding 100 c.c. of water and pouring off the clear solution. The electrolytic method is rapidly carried out by dissolving 0·5 grm. of substance in caustic soda, adding 80 c.c. of a cold saturated solution of sodium sulphide, heating to boiling, filtering into a tared platinum dish, and electrolysing with a current density $ND_{100}=1{\cdot}5$ amp. Under these conditions, the deposition requires about 75 minutes, and 1 per cent. must be deducted from the weight found (compare Foerster and Wolf; this J., 1907, 644). With oxide ores and slags, in absence of arsenic, 1 grm. is heated for about 10 minutes with 6 grms. of sodium peroxide, the mass is extracted with water, and the solution acidified with hydrochloric acid and evaporated to dryness; silica is filtered off, the filtrate saturated with hydrogen sulphide, the precipitated antimony sulphide dissolved in concentrated hydrochloric acid, and the boiling solution titrated with potassium bromate. In presence of arsenic, the sulphide precipitate is boiled for a long time with water and, after filtering, the solution containing the arsenic is acidified with hydrochloric acid and titrated boiling with potassium bromate, the antimony sulphide being dissolved in hydrochloric acid and similarly titrated. Decomposition with sodium peroxide may also be effected in the presence of arsenic by dissolving the melt in concentrated hydrochloric acid and precipitating the arsenic with hydrogen sulphide; the mixture is filtered through asbestos, the residue washed with hydrochloric acid, dissolved by boiling with water, the solution acidified with hydrochloric acid, boiled, and titrated with bromate. Antimony is precipitated as sulphide from the diluted filtrate, and the precipitate dissolved in hydrochloric acid and titrated as before.—F. Sodn.

Tin and tungsten; Electrolytic separation of ——. W. D. Treadwell. Z. Elektrochem., 1913, **19**, 381—384.

Tin can be separated quantitatively from tungsten in the presence of excess of alkali sulphide, with the addition of sodium sulphite to prevent the formation of polysulphides. Sodium sulphide is more suitable than ammonium sulphide as with the latter it is not possible to get a good deposit with a stationary electrode. The electrolysis is carried out at 50°—60° C. with a current of 0·5—1·7 amp., corresponding to a voltage of 1·7 to 2·3. The tin is deposited free from tungsten but always contains traces of sulphide. For the deposition of 0·1 grm. of tin the process requires 1 hour with a rotating cathode, and about 4 hours with a stationary one. Molybdenum must not be present as it is readily deposited with the tin.—W. H. P.

Aluminium hydroxide; Precipitation of —— and its separation from chromium. W. Jakób. Anz. Akad. Wiss. Krakau, 1913, A, 56—62. Chem. Zentr., 1913, **1**, 1841.

Pure aluminium hydroxide is quantitatively precipitated in a very compact form from a boiling alkaline aluminate solution by means of bromine. The method is of value for the separation of aluminium from chromium. Sulphuric and boric acids have a prejudicial effect on the precipitation.—A. S.

Determination of water in coal. Teed. *See* IIa.

Determination of water formed by combustion of substances containing sulphur and nitrogen in the calorimetric bomb. Rau. *See* IIa.

Determination of water in the volatile products resulting from the distillation of fuels. Lambris. *See* IIa.

Tests distinguishing between lamp oil and varnish spirits (turpentine oil substitutes). Holde. *See* IIa.

Effect of temperature, acid concentration, and time on the bromination of phenol for quantitative determinations. Redman and others. *See* III.

Valuation of malt extracts [for use in the textile industry]. Dreaper. *See* VI.

Detection of hydrocyanic acid. Pertusi and Gastaldi *See* VII.

Contribution to the chemistry of gold. Lenher. *See* VII.

Rapid determination of silver in mill solutions. Clevenger. *See* X.

The American alcohol-insoluble test for shellac. Bragg and others. *See* XIII.

Direct volumetric determination of caoutchouc by means of bromine. Schmitz. *See* XIV.

Direct determination of caoutchouc as tetrabromide. Hinrichsen and Kindscher. *See* XIV.

New method for the direct determination of rubber. Wesson. *See* XIV.

Determination of acid in oak-bark suspenders. Tanzer. *See* XV.

Sulphite-cellulose liquors in tanning extracts. Monnet. *See* XV.

Analysis of chrome leather. Thuau. *See* XV.

Determination of pentoses in presence of other sugars. Pinoff and Gude. *See* XVII.

Polarimetric determination of sucrose in honey by the method of Lehmann and Stadlinger. Sarin. *See* XVII.

Detection of nitrous acid [in waters] in presence of ferric salts. Artmann. *See* XIXb.

Bactericidal testing of disinfectants. Kingzett and Woodcock. *See* XIXb.

Alkaloid silicotungstates. Jensen. *See* XX.

Detection of aloes in admixture with extracts of drugs containing hydroxymethylanthraquinones and identification of the latter by the crystalline form of the isolated hydroxymethylanthraquinones. Mossler. *See* XX.

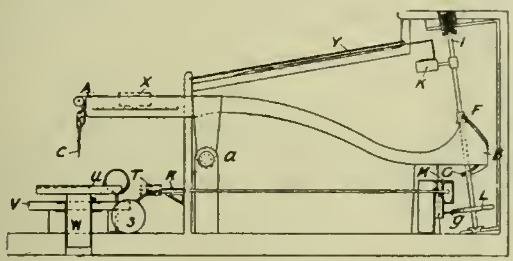
Patents.

Pyrometers. F. Rogers, Sheffield. Eng. Pat. 8486, April 10, 1912. Addition to Eng. Pat. 6364, March 14, 1912.

In order to compensate for the errors which would be caused in pyrometers of the kind claimed in the principal patent by occasional accidental local heating or chilling of the wires or of their sheath, the materials for the thermocouple are chosen so that the change of electromotive force of the couple due to the temporary change in the cooling effect of the cooling fluid counterbalances the change of resistance of the wires due to the same temporary disturbance. The current of cooling fluid is adjusted by trial so that the best effect can be obtained, and the errors are lessened by choosing wires for the whole circuit with as low a resistance as is practicable. Examples are given of the calculations made in order to select a suitable couple for given conditions.—A. T. L.

Testing the consistency of bitumen, tar and like liquids; Apparatus for ——. F. Wood, Purley, Surrey. Eng. Pat. 9603, April 23, 1912.

The material to be tested is placed on the table, *u*, which is adjusted at a suitable height by the screws, V, W, so that the point of the needle, C, is just in contact with the material. The needle, C, is attached to the lever, A, B, supported by the fulcrum, *a*. The pressure is adjusted by the sliding weight, X, and the other end of the lever, B, travels in a helical guiding path, F, G. The lever is connected with the spindle, I, to which is attached a weight, K, and a pointer, Y, which moves over a graduated scale and indicates the depth to which the needle penetrates. The brake, *g*, acting on the drum, L, attached to the spindle, I, stops any movement until released. The release is effected by the pneumatic bulb, M, which is inflated with air either by the pressure ball, S, or the piston, T. When the bulb, M, is filled with air the brake is taken off the drum and the test proceeds. A small adjustable opening, R, allows the air to escape slowly, so that after a definite time the bulb is deflated and the brake coming into force stops the test. The time during which the needle penetrates the material being tested is thus determined by the size of the opening, R, and the amount of penetration is indicated by the pointer, Y. —W. H. C.



Gas-analyser; Automatic ——. A. Mertens, Cruybeke, Belgium. U.S. Pat. 1,060,996, May 6, 1913.

See Ger. Pat. 234,983 of 1910; this J., 1911, 927.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Solubility; A report on ——. *Part II.* J. V. Eyre. Report of the Eighty-second Meeting of the British Assoc., Dundee, Sept., 1912. Appendix II., 795—871.

A brief account of the various researches on solubility, arranged chronologically and, as far as possible, according to subject. Part I. relating to the period 1790 to 1895 was presented at the Sheffield meeting of the Association in 1910. The present report deals with work published up to and during 1911, the matter being classified, just as in Part I., viz., under the following headings:—I. Introduction. II. Methods of determination: A, solids; B, liquids; C, gases. III. Influence of nature of solvent: A, physical; B, chemical. IV. Influence of nature of solute: A, physical; B, chemical; C, molecular weight. V. Solubility in relation to: A, (i) temperature, (ii) heat of dissolution; B, pressure; C, influence of other substances —(i) non-electrolytes and non-electrolytes, (ii) non-electrolytes and electrolytes, (iii) electrolytes and electrolytes. VI. Mutual solubility and distribution coefficients. VII. Theoretical considerations. VIII. Chronological bibliography. IX. Authors' index.—A.S.

New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

I. *Herzog*, S.: Elektrische Apparate u. Apparatenanlagen. Für die Praxis bearb. (VII, 338 S. m. 1447 Abbildgn.). Lex. 8°. Karlsruhe. F. Gutsch. 1913. Cloth M. 20.

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J. R. Blockey	XV.
T.F.Burton, B.Sc.	III., XX., XXI., Patent List.
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G.W.Macdonald, M.Sc.	XXII.
B.G.McLellan, F.I.C.	I., II. XIX
C. A. Mitchell, B.A.	XII., XXII.
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THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDING 31st DECEMBER, 1912.

EXPENDITURE.

				£	s.	d.	£	s.	d.
To Journal — Editorial and Sundry expenses—									
Editor's Salary				542	16	0			
Do. Expenses				29	8	8			
Do. Assistant				130	0	0			
Abstractors				658	4	7			
Sub-Editor's Salary				150	0	0			
Indexing Journal, &c.				129	8	6			
Foreign Journals				33	1	10			
Sundry Journals				36	8	4			
French and U.S.A. Patents and Specifications				53	5	0			
Insurance of Stock				7	3	0			
				1769	15	11			
Publishing expenses—									
General	1730	2	3						
Postage on Copies	752	7	0						
				2482	9	3			
							4252	5	2
,, Sectional expenses—									
Birmingham & Midland				20	0	0			
Canada				47	6	2			
Liverpool				40	4	4			
London				114	17	9			
Manchester				79	6	10			
Newcastle-on-Tyne				29	8	11			
New England				40	0	0			
New York				160	0	0			
Nottingham				30	8	4			
Scotland				19	6	2			
Sydney				11	1	6			
Yorkshire				24	19	4			
							616	19	4
,, Annual Meeting expenses							161	1	2
,, Journey to New York—Mr. Cresswell							150	0	0
,, Expenses in connection with new Offices, including dilapidations in old Office							138	1	6
,, Working expenses—									
Medallists' Portraits	29	8	6						
Shaw Medal	3	2	6						
				32	11	0			
Secretary's Salary				300	0	0			
Assistant to Secretary and Editor				225	0	0			
Honorarium to Treasurer's Assistant and for Clerical Assistance				77	10	0			
Rent, Lighting and Cleaning				216	10	5			
Stationery and Binding				113	15	8			
Postages, Bank Charges, Telephone, and Sundry expenses				157	3	7			
							1122	10	8
,, Excess of Income over Expenditure							778	8	9
							£7219	6	7

INCOME.

£	s.	d.		£	s.	d.	£	s.	d.
			By Entrance Fees				222	12	0
			,, Life Composition Fees				141	10	3
			,, Annual Subscriptions				5096	10	0
			,, Journal Advertisements	355	18	0			
			,, ,, Sales	778	11	8			
							1134	9	8
			,, Collective Index—Subscriptions				1	10	0
			,, Decennial Index—Sales				3	15	0
			,, Dividends and Interest on Investments—						
4476	9	2	Metropolitan 3% Consolidated	126	9	4			
1000	0	0	New Zealand 3% (1945)	28	5	0			
1277	4	8	New South Wales 3% (1935)	36	1	8			
1231	0	10	Consols 2½%	28	19	8			
600	0	0	Gas Light and Coke Co. 3% Debentures	16	19	0			
1084	13	4	North British Rly. 3% Consolidated	30	12	10			
1696	0	0	Midland Rly. 2½% Perpetual Preference	39	18	6			
1509	0	0	Great Eastern Rly. 4% Irredeemable	56	16	8			
673	0	0	South Eastern Rly. 4½% Preference	28	10	4			
1000	0	0	Metropolitan Water Board 3% Debentures	28	5	0			
200	0	0	Nottingham Joint Station 3%	5	13	0			
1250	0	0	Great Western Rly. 5% Guaranteed	58	17	2			
800	0	0	Great Northern Rly. 3% Debentures	22	12	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	17	6	0			
724	8	0	India 3½%	23	17	8			
834	9	2	India 3%	23	11	8			
700	0	0	Canadian Stock 3½%	11	10	9			
			Interest on Deposits	34	13	5			
							618	19	8
							£7219	6	7

London Section.

Meeting held at Burlington House, on Monday, June 2nd, 1913.

DR. W. R. HODGKINSON IN THE CHAIR.

SOME EXPERIMENTS ON THE THEORY OF ELECTROTANNING.

BY DR. E. K. RIDEAL AND U. R. EVANS.

It has for some time been known that the diffusion of tanning substances into hides—a process which is usually rather slow—could be accelerated considerably by causing a current of electricity to flow through the liquid in which the hides are being tanned. Many attempts have been made to utilise this fact in "quicktanning processes."

The first use of "galvanism for tanning purposes" was made as early as 1849 by Crosse, who placed electrodes of zinc and lead in an ordinary tanpit. Rebu in 1861 made further experiments, and de Mertass of St. Petersburg in 1874 designed an electric-tannage process, which continued to be used in nearly 600 pits for some years. Processes for electrical tanning were also worked by Nielson (of Norrköping, Sweden) about 1889, and by Worms and Bale in France in 1887. The latter (this J., 1888, p. 443) used the combination of "electricity and motion."

About 1888 Groth invented his method of electrical tanning; in this process, also, the hides were kept in motion during the electrical treatment; Rideal and Trotter (this J., 1891, p. 425), who examined the process scientifically, found that the acceleration was largely due to the electricity, although partly due to the motion.

But all these processes have been, on the whole, empirical, and very little work has been done to ascertain the exact nature of the forces in action and of the influence of external conditions. Such an investigation, however, must be introductory to an attempt to settle the best conditions under which good leather can be produced both quickly and cheaply. And, until such experiments have been made, it is not possible to condemn electrotannage merely because certain leathers of inferior quality—said to have been "electrically tanned"—have come on to the market.

THE SOCIETY OF CHEMICAL INDUSTRY.

BALANCE SHEET, 31st DECEMBER, 1912.

	£	s.	d.	£	s.	d.
To Sundry Creditors................				827	4	10
,, Subscriptions received in advance .				121	9	0
,, Accumulated Fund—						
Balance—31st December, 1911	18,280	11	11			
Add—Excess of Income over Expenditure, 1911	778	8	9			
				19,059	0	8
				£20,007	14	6

£	s.	d.		£	s.	d.	£	s.	d.
			By Sundry Debtors (Publishers, &c.) ..				985	17	0
			,, Arrears of Subscriptions				41	5	0
			,, Cash at Bank—						
			On Deposit	300	0	0			
			Current Account	371	8	11			
			,, Cash in hand (Secretary)	11	9	1			
							682	18	0
			,, Investments as last year—						
£	s.	d.							
4476	9	2	Metropolitan 3% Consolidated	4163	2	1			
1000	0	0	New Zealand 3% (1945)	870	0	0			
1277	4	8	New South Wales 3% (1935)	1122	3	1			
1231	0	10	Consols 2½%	1031	15	4			
600	0	0	Gas Light and Coke 3% Debentures ..	507	0	0			
1084	13	4	North British Rly. 3% Consolidated	900	5	6			
1696	0	0	Midland Rly. 2½% Perpetual Preference	1187	4	0			
1509	0	0	Great Eastern Rly. 4% Irredeemable	1629	14	5			
673	0	0	South Eastern Rly. 4½% Preference .	747	0	7			
1000	0	0	Metropolitan Water Board 3% Debentures	922	10	0			
200	0	0	Nottingham Joint Station 3%	166	0	0			
1250	0	0	Great Western Rly. 5% Guaranteed ..	1762	10	0			
800	0	0	Great Northern Rly. 3% Debentures ..	696	0	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	495	0	0			
724	8	0	India 3½%........	700	0	0			
834	9	2	India 3%	700	0	0			
			Add—	17,600	5	0			
700	0	0	Canadian Stock 3½% (purchased in 1912)	697	9	6			
							18,297	14	6*
			(* Market value Dec. 31, 1912 £16,900 6 9)				£20,007	14	6

We have examined the above Balance Sheet, dated 31st December, 1912, and have verified the Investments and the balances at the Bank. In our opinion the Balance Sheet shows correctly the position of the Society at 31st December, 1912.

28, Basinghall Street, London,
22nd March, 1913.

(signed) FEASEY & CO.,
Chartered Accountants.

In the following experiments some attempt has been made to find the nature of the transference of tannin by the electric current, and how it is affected by external circumstances. Some inquiry has also been made as to the chemical changes which occur in tannic acid on its electrolysis. In this way it has been possible to outline the conditions which will ensure quick transfer of the tan-substance through the hide, at a low expenditure of electrical energy and tan material.

Theoretical.

A. Modes of Transfer. Three modes of transfer of matter in liquids are known to be possible under the influence of an electric current; these are (1) ionic conduction, which involves the passage of dissolved matter (as ions) in both directions, and also chemical decomposition at the electrodes.

(2) Cataphoresis, which involves the movement of "colloid" particles, apparently, as a rule, in one direction only and without perceptible decomposition.

(3) Electric endosmose, or bodily transfer of a liquid or solution (including the solvent) through a porous wall.

There is no reason why tannic acid solutions should not show all these three modes of transfer.

B. The effect of additions has to be considered since organic acids are in practice formed in the tan-bath as the result of fermentation, and since it has been proposed to add various salts to electrical tan baths. The addition of electrolytes will

(1) greatly alter the concentration of the ions of tannic acid;

(2) often alter the velocity, and sometimes the direction, of the cataphoretic movement;

(3) decrease the endosmotic movement.

But the two most important effects have still to be stated:—

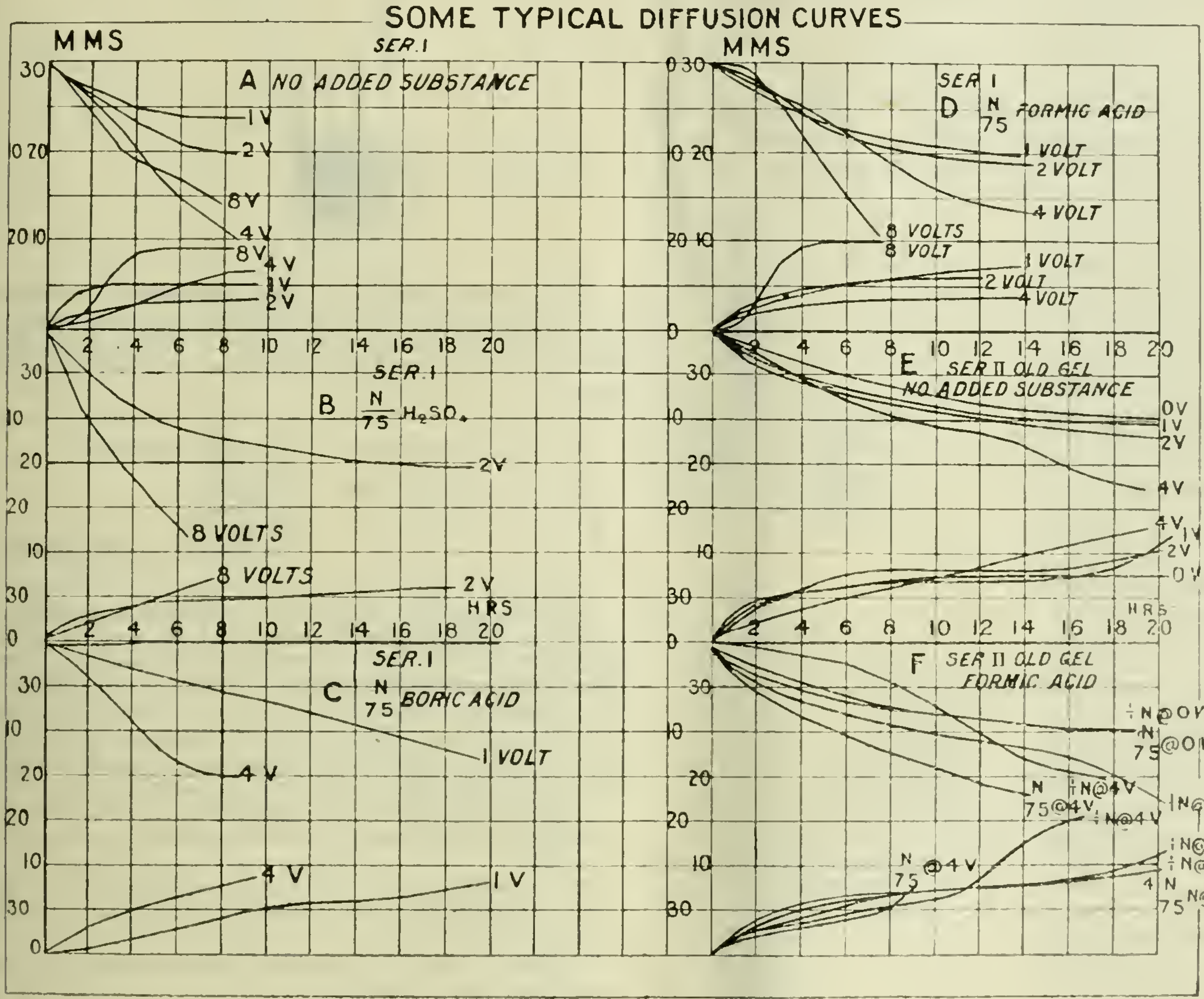
(4) Such additions will greatly increase the conductivity of the solution as a whole. Thus, if an electrolyte be added to a tannin solution, even if the number and mobility of tannin-ions be not reduced, the total conductivity of the solution will be so much increased by the addition of the electrolyte, that the proportion of the current used in the useful work of tannin transference is reduced to a small fraction.

(5) The full "back E.M.F. of polarization" at the electrodes is arrived at more quickly and maintained more completely if the solution as a whole has a high conductivity.

c. The nature of the electrode material will have a large influence upon the amount of electrodic decomposition of the tanning-matter. This is of the utmost importance, both with a view to avoiding loss of tannin, and also because the products of decomposition are often electrolytes and produce the undesirable effects that have been described.

Experimental.

Two classes of experiments were performed. Firstly, experiments were made in cells divided by porous partitions in order to investigate separately the effect of electrodic decomposition at the two poles, and also to note the influence of the electrodic material on this decomposition. At the same time, the phenomenon of electric endosmose was observed and its amount measured.



But for the purpose of examining the migration of tannin through a substance, a porous pot was clearly unsuitable. The greater portion of the work was therefore devoted to tracing the progression of tannin under the influence of an electric current, through narrow tubes filled with gelatine jelly. This jelly contained a trace of ferric chloride, and as the tannin penetrated into it, the colouration (due to the so-called "ferric tannate") was produced, and forms a means of observing its advance quantitatively. In most experiments, additions were made to the tannin solution, for the purpose of ascertaining their effect on the migration.

I. "*Divided cell experiments.*"

It is impossible to describe in detail the various experiments made in porous pots. The general method of procedure was as follows: A known porous pot containing one electrode was placed in a glass jar containing the other electrode; measured volumes of liquid were poured into the two compartments, and a known E.M.F. (usually 4 volts) was applied for several hours; the current passing was measured on an ammeter and the temperature, etc., was noted in each case. The liquid used was generally tannic acid solution in both compartments, but in some cases the outer solution contained only dilute potassium chloride; to test the influence of additions to the tannin liquor, salts were in some experiments added in varying proportion to the tannic acid solution. The conductivity of the solution in both cells was measured before and after the experiment, and in some cases the "acidity" was also determined by the electrometric method of Sand, Wood and Law. (This J., 1911, p. 3, 872.) These numbers gave a clue to the amount of decomposition that was caused at the electrodes, the electrodic material being also varied in different experiments. The volume of liquid in the two compartments was noted after the experiment, and thus the rate of endosmose could be arrived at.

The details of two experiments may be given as an example. They are shown for comparison in parallel columns:—

	Exp. A.	Exp. B.
Electrolyte in both compartments	1 per cent. tannic acid	1 per cent. tannic acid
Electrode material	Carbon	Copper
Electrode area	5½ sq. in.	5½ sq. in.
Temperature	18°	18°
E.M.F. applied	4 volts	4 volts
Current amps.	0·004 sinking to 0·001	0·002 sinking to 0·001
Specific resistance, of solution used, before electrolysis, per cm. cube	7481	10,660
Specific resistance, after experiment, in cathode compartment, per cm. cube	6454	2000
Specific resistance, after experiment, in anode compartment, per cm. cube	567	3253

Similar results were obtained with 4 per cent. tannic acid.

Although no two experiments with porous pots can be exactly comparable, the general conclusions arrived at were clear :—

(1) A copper cathode causes more cathodic decomposition to a tannic acid solution than a carbon cathode ; but a copper anode brings about less anodic decomposition than a carbon anode. This is to be expected.

(2) The addition of salts such as potassium sulphate do not interfere seriously with the rate of endosmose at constant E.M.F. But they reduce the amount of tannin matter which takes part in the endosmose. Thus a pure tannin solution moving through a porous pot carries its tannin with it, but, in the presence of potassium sulphate, the solvent "leaves the tannin behind."

(3) The endosmose takes place in the "positive to negative" direction.

II. "*Jelly Tube*" *Experiments.*

A jelly consisting of 5 per cent. Nelson No. 2 gelatine, dissolved in water containing 0·1 per cent. of ferric chloride (a strength which produces a good colouration with tannin) was introduced into a series of glass tubes (Fig. 1). These glass tubes are 10 cms. long and of 0·2 cms. internal bore; they contain a length of about 3·6 cms. of the jelly situate at about 2 cms. from the top end. The bottom of each tube was placed in a small test-tube (0·6 cms. diam.) and was filled up to the gelatine with a 4 per cent. solution of tannic acid. The space above the gelatine (and also the test-tubes) was similarly filled with the same solution T. By means of copper wires C, C¹ connected to mercury troughs any number of these tubes could be connected to sources of current at different E.M.F.s. The wires at the bottom formed the positive electrodes, and those above the negative electrodes.

A series of such tubes were arranged vertically, attached to a thin board behind. By means of a strip of squared paper placed as a scale behind the row of gelatine containing tubes, the advance of the colouration produced by the interaction of the migrating tannin with the ferric chloride solution could easily be followed. Readings of this advance from both ends were taken over a period of about 30 hours. In some tubes pure tannic acid solution was used, in others small quantities of substances, whose influence we were anxious to investigate, were added to the solution at both ends of the tubes. The E.M.F. applied was varied in the case of different tubes; in the second series of experiments, a number of blank experiments were made in which no E.M.F. was applied, with a view to obtaining separately the transfer due to natural diffusion. In this second series of experiments the concentration of the substance added was varied, while in the third the strength of tannic acid solution employed is also changed. The "age" of the jelly also differs in the three series of experiments, *i.e.*, the gelatine has been permeated for a different time with the ferric chloride.

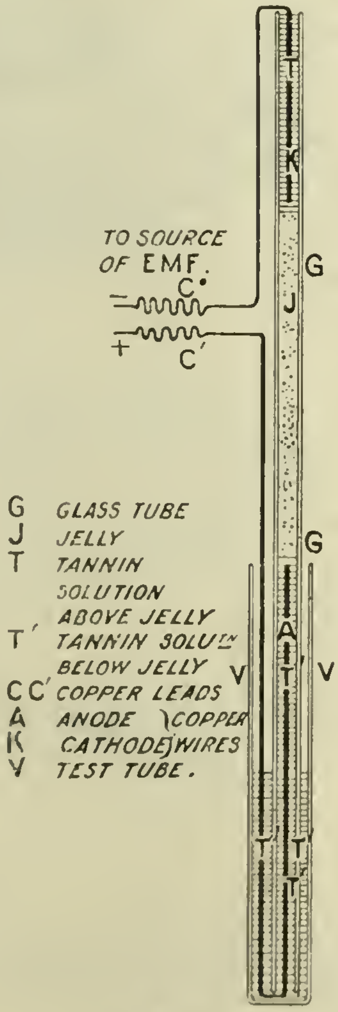


FIG. 1.

In every case the tannin was observed to enter the tube in *both* directions. The most important migration is in the negative to positive direction, and is apparently due to *ionic or cataphoretic* movement. The less rapid entry of the tannin—in the positive to negative sense—is presumably due to the *endosmose* observed in the porous pot experiments; this view is confirmed by the form of the boundary of advance, which supports the view that the solvent as a whole is penetrating the jelly, and taking advantage of any flaws occurring therein. (Fig. 2.) The advance in the opposite direction shows a smooth front.

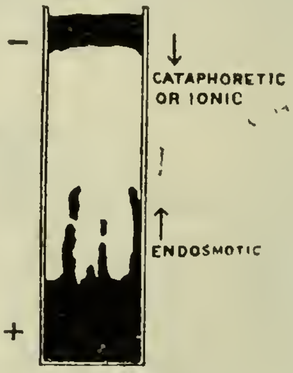


FIG. 2.

Curves were plotted to show the gradual movement of the tannin into the jelly in both directions. A few of these curves are shown as examples. The abscissæ represent the time in hours, the ordinates the position on the tubes.

A	New jelly	No added substance
B	,, ,,	$\frac{N}{75}$ H_2SO_4
C	,, ,,	$\frac{N}{75}$ Boric
D	,, ,,	$\frac{N}{75}$ Formic
E	Older jelly	No addition
F	,, ,,	Formic acid, various strengths

A few of the experiments made in the first series had to be repeated, notably those in which potash, sodium acetate and phenol respectively were added to the tannin solution, since it became evident that the colouration the advance of which had been followed was not due to the formation of ferric tannate, but to ferric hydroxide, acetate and phenate respectively. A few other apparently anomalous results obtained in the first series were subsequently explained.

It was observed that the older the jelly, the slower was the diffusion; this was due to the hardening action of the ferric salt.

Discussing the form of the "negative to positive" movement (ionic or cataphoretic) as shown by the downward curves, we see that

(1) The greater the potential gradient, the quicker the transference, in general;

(2) On the whole, additions to the tannic acid, in concentrations between N and N/75 have very little effect upon the rate of migration of tannin at constant voltage. In one or two cases, *e.g.*, in presence of N/75 formic acid at 4 volts in old jelly, the addition seems to cause a slight acceleration to the transfer; but this is not enough to compensate for the disadvantages caused by such additions.

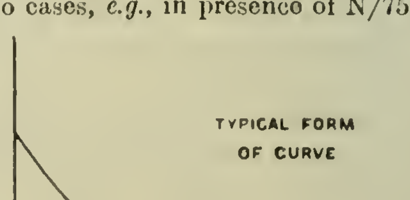


FIG. 3.

(3) The curves tend to approximate to a certain typical form (Fig. 3) in which the gradient falls off at first with the time, finally becoming constant. This is due to two causes :—

a. Natural diffusion at first aids the migration.

β. There is a tendency for polarization to occur. Thus this "typical form" of curve becomes all the more marked when strong electrolytes are substituted for weak ones.

The upward curves show the "positive to negative" (endosmotic) movement.

(1) This is much less rapid than the "negative to positive" migration, being comparable to the rate of natural diffusion.

(2) It is less dependent on the applied E.M.F.

(3) In the presence of comparatively large quantities of such electrolytes as potassium sulphate, sulphuric acid and formic acid, at the lower voltages, tannin does not seem to take part in the endosmose.

Strong tannic acid solutions show a more rapid diffusion (in both directions) than weak ones.

The main conclusions to be drawn from the experiments are as follows :—

(1) Ionic or cataphoretic migration is the main agency involved in the transference of tannin through gelatinous substances and *not* endosmose (which causes a less rapid transfer in the opposite direction).

(2) The addition of acids and metallic salts decrease the transfer per kilowatt hour because

A. They cause conduction of current in a way which does not involve the transfer of tannin.

B. They cause polarization at an unduly early stage, and so reduce the effective E.M.F.

C. They reduce or inhibit the tannin carried by endosmose, especially at high concentrations.

D. Some have a specific slowing action upon the ionic migration.

Incidentally in their presence, when attackable anodes (*e.g.*, of copper) are used, these suffer an undue electrochemical attack.

(3) If we assume that the jelly offers an approximate analogy to the structure of a hide substance it is clear that, in the absence of acids and conducting salts, a very small expenditure of electrical energy can cause a great increase in the rapidity of the transference of tannin through a hide—which is probably the slowest part of the tannin process.

(4) The electrode material has an important influence on the success of an electrotanning process, because if an unsuitable material be used, an undue decomposition will occur at the electrodes, and so (A) tanning matter will be destroyed (B) acids will be produced, which will produce the undesirable effects outlined above.

For this reason it is best to use *cathodes of carbon and anodes of copper*, and to keep the bath sterile ; in this way, an undue wastage of energy and tannin is avoided. But for some purposes the tanner insists upon a bath containing relatively large amounts of organic acids (which *may* be necessary for the reaction between the tannin matter with the hide substance, *after* it has penetrated into the latter) ; in such a case, it would be extravagant to use copper anodes, which would be quickly attacked in the highly conductive solutions, and carbon anodes also may be employed. But so far as possible, every endeavour should be made to keep the total conductivity of the tan bath as *low* as possible.

It must, of course, be remembered that the transference of tannin into the hide substance is not the only part of the tanning process, although it is doubtless the slowest and most unsatisfactory. But, after the tanning substances have entered the hide, there is doubtless some sort of chemical reaction between them and the hide material, and it is for the tanning chemist to settle the conditions most favourable to this combination. Possibly these may not be the conditions which are most suitable for the economical electrochemical transference of the tannin through the hide ; but if the electrochemist clearly states what conditions are most favourable to *his* part of the process, and the tanning chemist will tell us within what limits the chemical interaction will proceed satisfactorily, doubtless some compromise could be arrived at, which would result in a successful tanning process. (For instance, the electrochemist will desire as low a bath acidity as possible ; the tanning chemist may—for some purposes—prefer a high one ; but there may be some intermediate strength which would suit both.)

It may be suggested as a possibility that endosmose—which involves the bodily transfer of the solution through the hide—may prove a destructive form of introduction of tanning matter into the latter ; for, as was observed in the case of the jelly-tube experiments, advantage will be taken of any points of weakness in choosing its path, and this weakness will, therefore, probably be increased. If this is so, it may well be advantageous to avoid endosmose as much as possible, and it is satisfactory to find that it is not the main agency of transport involved in electrotannage. The fact that the entry of the tannin is dissimilar in the two directions, as well as the fact that hides are themselves dissimilar on the two sides, must be taken into account in the settlement of the relative times during which the current should pass in the two directions.

Within the last few months, O. J. Williams has published a research upon the subject of electrotannage. The figures which he quotes have little bearing on the matter since he assumes electric endosmose to be the only agency at work. But he is right in regarding the loss of tannin matter by electrodic decomposition as one of the main problems to be dealt with in an electrotanning process. He proposes the employment of an alternating current, which in his view should cause no decomposition, and yet allow the endosmose to proceed. But it is difficult to see how—unless a valvelike structure be assumed to exist in the hide—an alternating current of sufficiently high frequency to prevent electrodic decomposition could, *per se*, produce any endosmotic movement of tanning liquor through the hide. The best method of preventing the electrodic destruction of tannin is a careful choice of the material and form of the electrodes employed, and a scientific control of the composition of the bath.

DISCUSSION.

Mr. **W. COLEBROOK REYNOLDS** asked whether the movement of the iron of the indicator towards the cathode had been taken into account. If not, the apparent movement of the tannic acid would be partly illusory.

Dr. **PARKER** said that 17 or 18 years ago he had gone over to Sweden to investigate the process of tanning assisted by the electric current, and he was very much impressed with a demonstration of it in a large tannery at Wennersborg, Sweden, where they were tanning some 400 to 500 hides each week. The tanning process was apparently accelerated and the penetration of the tannin into the fibres of the hide was apparently assisted by the electrical current. During the past 18 years, however, great changes have taken place in the processes of leather manufacture. Years ago sole leather required twelve months to be properly tanned. Nowadays that period had been reduced to as many weeks, and good leather could even be tanned in as short a time as twelve days. Some years ago, in Vienna, a tanner, in order to win a bet, undertook to tan some leather and have it made into a pair of boots, all within forty-eight hours. An ox was slaughtered in the city abattoir at six o'clock in the morning. The hide was immediately conveyed to the tannery, tanned, dried and finished, and within forty-eight hours after the tanner appeared in the café wearing the finished boots. In this instance there was no record as to the quality of the leather. If leather could be made and turned into a pair of boots in forty-eight hours, any claim made on behalf of electrical acceleration fell rather flat. For some years he had initiated and carried out in his laboratory various tests connected with electrical tanning, and he had failed to produce a process which offered considerable commercial advantages. In other words, he had never been able to tan on a practical scale quicker or better by the aid of electrical current than he had been able to tan by various mechanical means with chemical assistance, added to which the latter were cheaper. Practical tanners did not worry so much about the quality of the leather as the cost of production. What was wanted to-day was that from a given weight of hide substance a given weight of finished leather should be produced at a certain cost per lb., and they were loath to adopt any process which, if it gave the same results, would add a fraction of a penny to the cost of production, even if the leathers produced by this means were slightly better. Thanks to Procter's work and to the work of other of their members, they had advanced very considerably in their knowledge of the chemistry both of the raw materials and of the process of leather manufacture during the last eighteen years. They now understood more fully the action of the acids and alkalis upon hides. They understood how to accelerate the penetration of the tan through the hide substance—so much so that really good leather could be turned out in the tanyard in fourteen days—therefore, the advantage of speed claimed by those who advocated the use of electricity was not now so important a matter as it was eighteen years ago. The authors, while they had not dealt with the subject from a practical standpoint, had certainly given some theoretical points for consideration, and he was thinking how those theories which they had propounded might be carried out on a practical scale. If they would come to the Leathersellers' Technical College he would provide 20 or 40 hides, or as many as they wanted, and they could fit up their apparatus, and if they got any more weight than he could get, or if they could produce leather more quickly than he could, or better leather, and, last but not least, cheaper, they would have him for a convert at once. He would be prepared to take corresponding hides to them, using the same liquors but using drums or paddles, as the case might be. All that took place in the process of leather manufacture was not yet understood, but much information had been gained by the work of Procter and others in connection with colloidal chemistry, and the researches which had been carried out dealing with the effect of swelling and tanning of hides by means of acids and various salts in the liquors. He did not desire to convey the impression that he looked upon the use of electricity in connection with tanning to be hopeless, but he had tried it with weak currents, alternating and direct, and had tried it all ways, but he had now given it up. Another point, and one on which he bowed to the authors of the paper, was that he was not sure whether his process would conserve the tanning acid as much as they claimed to do. They did not give figures, but they pointed out that there was not the same decomposition of tannic acid by their process as by the ordinary processes, but he had been taught to believe that the decomposition of tannic acids, or rather the hydrolysis of tannin, produced beneficial acids, and the fermentation of the glucoses produced acids. Unless the early liquors were kept acid enough, that is to say, if one did not have a proper fermentation going on in the tanyard which could produce sufficient lactic, acetic and propionic acids, they would not get sufficient swelling. If the leather was not sufficiently swelled in the early processes of tanning they would neither get sufficient weight into the leather, nor would the leather be thick and solid, as it must be to possess good wearing qualities; and unless these acids were present there would not be the deposition of semi-soluble substances inside the hide. It had been claimed as an advantage that the electrical process kept the liquors sterile. He would be rather sorry for the tanner whose liquors were sterile, because, unless he had misunderstood the authors, he was afraid that if the liquors were kept sterile and there was no acidity present, the leather would be flat, tinny and brittle, and practically would not produce a commercial product.

Dr. E. Rideal, in reply, said it had been mentioned that the decomposition at the electrode varied, and it seemed to have been gathered from the paper that the rate of movment in the liquid itself varied with the nature of the electrodes used. That was not what they had intended to convey. What they had intended to say was, that, supposing they had a soluble anode, the decomposition was less than if they had an insoluble anode, because, instead of oxygen being liberated and attacking the tanning substance, the electrode itself went into solution and the tannic acid was left unchanged. The actual actions in the body of the electrolyte itself, the velocity of the tanning, and the rate of diffusion was not influenced very much by the electrodes. With reference to an iron chloride indicator, certainly iron travelled a certain rate with the current, but there was always sufficient iron to give a colouration; and the natural diffusion was also a check on it, because the same error ran through the whole of the results, which were strictly comparable.

With reference to the unsuccessful nature of the past experiments on practical electric tanning on a large scale, he thought a great deal could be attributed to the high conductivity of the bath itself. When they worked on a large scale they got little traces or possibly even large amounts of salts of lime, etc., which got in from the previous treatment undergone by the hides before they were ready for the tan bath; that affected the conductivity and thus permitted a great deal of current to go through which was not aiding the tanning, which in fact acted rather detrimentally to the tannic acid; for the greater current caused greater action at the electrodes themselves, which action decomposed the tannic acid and involved a great waste of tannic acid. If, however, the bath had to be acid, carbon electrodes should be used instead of copper ones. They did not intend to suggest that the liquor was kept sterile by means of electric current itself, but they suggested it should be kept sterile by adding some suitable steriliser, provided that the right quantity of acid which was demanded was kept there. Apparently in practice the baths might get very powerfully acid and the liquor become inefficient, or they might cease to be sufficiently acid. There ought to be some degree of acidity which is the correct acidity for hide treatment. Procter was not quite certain which was the correct acidity, but that should be experimentally arrived at.

THE JOINT ACTIONS OF CATALYTIC AGENTS.

Dehydration of Ethyl Alcohol and Ethyl Ether.

BY GENERAL W. IPATIEW.

In a communication by Sprent (this J., 1913, 32, 171—173) on a technical process for the preparation of ethane is described a method of hydrogenisation of ethylene by hydrogen and reduced nickel under pressure and at a high temperature. The ethylene employed was obtained by passing the vapours of ethyl alcohol over alumina as catalyst.

In this communication no reference was made to the fact that the use of alumina was first made by myself (Ber., 1903, **36**, 2016) in a series of experiments in which it was shown that by means of this agent at temperatures of 350°—360° C. theoretically quantitative yields of ethylenic hydrocarbons could be obtained from the respective aliphatic as well as cyclic alcohols (Ber., 1904, **37**, 2990). Shortly afterwards I showed that the alumina required special preparation, otherwise it was not active. For efficient action it must be precipitated and then gently ignited—only so much that it will still dissolve readily in hydrochloric acid or caustic soda.

I showed that in the presence of alumina ether was first formed, from the alcohol, which then split up into water and ethylene, and this first phase of the catalytic action was a reversible one:—

$$2C_nH_{2n+1}OH \rightleftarrows (C_nH_{2n+1})_2O + H_2O.$$

At the same time I showed that methyl ether could be prepared by heating methyl alcohol and alumina in my high pressure apparatus. Although these results were published in German in the Berichte, publications have appeared from Senderens and Mailhe several years later, since 1908, in which they state that alumina is the most convenient catalytic agent and that this alumina must be heated to redness, and that this ignited oxide converts alcohols into ethers or ethylenic hydrocarbons, depending on the temperature to be subsequently employed.

As Senderens and Mailhe do not refer to my work in their publications, although attention (Ber. 1910, **43**, 3383) was drawn in the Berlin Berichte to this lapse, Sprent naturally, but in error, ascribes the priority of employment of alumina to them. In addition Sprent does not mention my experiments on hydrogenisation of ethylene under the influence of catalysts and high temperature and pressure, which also appeared in the Berichte (Ber., 1909, 42, 2089; this J., 1909, 745).

At present I am continuing work on the simultaneous or joint action of catalytic agents on the hydrogenisation and dehydration of organic compounds: the results so far show that by the simultaneous action of catalysts the temperature necessary, can be reduced and the process proceeds more energetically. For instance when a mixture of nickel oxide and alumina is employed for hydrogenisation the reaction takes place at 200° C. instead of 300° C., and the reduction in the case of ketones (for example) proceeds to the completely saturated hydrocarbons. Camphor is also completely converted at 200° into $C_{11}H_{18}$, isocamphane.

Experiments on the decomposition of alcohols under ordinary pressure in contact with a mixture of alumina and cupric oxide have shown that the temperature at which dehydration takes place is 25°—30° lower than when alumina is the sole agent.

Further work is being continued in this direction.

Yorkshire Section.

Meeting held at the Queen's Hotel, Leeds, on Monday, April 14, 1913.

MR. GEORGE WARD IN THE CHAIR.

PRELIMINARY NOTES ON THE OXIDATION OF OILS.

BY DR. HARRY INGLE.

Many methods have been devised for determining the increase of weight when oils are exposed to air; Kissling (this J., 1894, 117; 1895, 479) has examined this at ordinary temperature and at 100°—105° C. Livache (this J., 1886, 494) spread the oil upon finely divided lead and determined its increase in weight. Bishop (1904) used fine silica, dissolving the oil first in petroleum spirit as a means of offering a large surface for oxidation. The results from all these trials agreed but little with oxygen absorption calculated from the iodine value.

Lippert (Chem. Rev., 1899, 65) modified Livache's experiments and showed that in the case of linseed oil on copper powder an increase in weight of from 13·4 to 19·25 per cent. was obtained.

Max Weger (Chem. Rev., 1898, 213, 236) carefully examined the oxygen absorption of oils by the "plate method," in which weighed quantities of oils were spread on thin glass to nearly equal thickness and the increase of weight noted. For linseed oil the increase was 18 per cent. (calculated from iodine value 11·4). For Chinese wood oil the increase was 14—16 per cent. (calculated from iodine value 10·1). For hemp oil the increase was 13·5 per cent. (calculated from iodine value 9·9).

To ascertain the relationship of the iodine value to the increase of weight of exposed oils, the papers of Weger (Chem. Rev.) and Ingle (this J., 1902—1904) should be consulted.

It has been shown that the gain in weight of an oil on exposure to air differs according to the humidity of the atmosphere (Lippert, Z. angew. Chem., 1905, ii 3). The author has examined cottonseed and linseed oils, the free acids and ethyl esters, with a view to determining the exact relationships between the iodine value and the oxygen absorption; the examination was carried out in ordinary moist air first and then in dried air. First of all samples of the free acids of a Baltic oil of iodine value 198 were prepared and the ether driven off by distillation, coal gas being finally driven through the flask. These acids showed an iodine value of 202·5. An ordinary (probably Plate) oil of iodine value 181·0 was then saponified and the acids removed by ether, which was distilled off as before; their iodine value was 182·5. The acids were converted into their ethyl esters by alcohol and dry hydrogen chloride. Pieces of filter paper were soaked in a 1 per cent. solution of manganese resinate in benzol and dried in a desiccator over calcium chloride. Drops of the acids or their ethyl salts were then distributed over the paper as evenly as possible, exposed to air, dried in the desiccator, and weighed at intervals.

Increase in weight of the free acids and ethyl esters of linseed oils.

	Baltic acid.	Ordinary acids.	Ethyl Esters of ordinary oil.
Iodine value (Wijs) of original oil	198	181	181
Iodine value of sample	202·5	182·5	158
Theoretical oxygen absorption from iodine value:			
$0 = I_2$	12·75	11·5	9·8
$0_2 = I_2$	25·5	23·0	19·6
Found:			
22½ hours	12·7	12·7	10·4
26 ,,	13·0	12 9	—
42½ ,,	—	—	9·8

Weger and Mulder obtained for the liquid acids of linseed oil 15·6 to 17·9 (calculated value of the liquid acids is 15·7; $0 = 2\,I$). The acids used above contained both liquid and solid acids (compare Bauer and Hazura and Ingle; this J., 1902, 594) and so their oxygen absorption is proportionately lower.

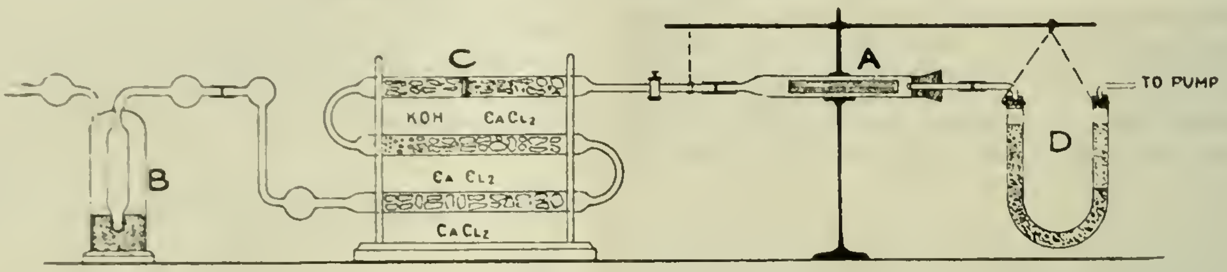
The next experiments were intended to show the actual change in the composition of linseed oil acids on exposure to air. Fahrion has shown that oxidised unsaturated acids are insoluble in low boiling petroleum ether. I have repeatedly tried the method with blown oils, and am convinced of its usefulness. Some of the acids from the ordinary oil were spread upon glass and exposed for 20 months under cover. Even then they remained rather tacky. They were then removed from the glass and extracted with petroleum spirit, ether, and alcohol. The following table gives the results:—

Petroleum spirit soluble	3·26	Iodine value 41·5 Acid value 158 Colour: Yellow
Petroleum insoluble but ether-soluble	80·11	Iodine value 47·0 Acid value 151 Saponification value 328 Amber brown
Petroleum and ordinary ether-insoluble but alcohol soluble	17·42	Iodine value 22 Acid value 95 Saponification value 133·4
	100·79	

It is difficult to explain the above results, for the solid fatty saturated acids of the oil amount to some 10 per cent. (Bauer and Hazura and others).

In order to study the action of dry air upon the oils, the following experiments were carried out—Strips of filter paper 4 in. × 18 in. were dipped into a 1 per cent. solution of precipitated manganese resinate dissolved in benzol and hung up to dry. One of them was then dried in a wide drawn-out tube closed with a tight-fitting rubber stopper through which a tube passed, and a current of dried air drawn through; when constant weight of the tube and filter paper was obtained, the paper was spotted with the oil (weighed) as equally as possible. The tube was then connected with an efficient drying apparatus such as the ordinary "combustion drying set" on the inlet side, and on the other side with a calcium chloride tube and a Bunsen pump, and a slow current of air was drawn through. The tube containing the oil-soaked filter paper was weighed at intervals until the maximum weight was obtained.

A Paper and Oil.
B Sulphuric Acid.
C Calcium Chloride and Potash.
D Calcium Chloride and Potash.



Oxygen absorption of oils in dry air.

	Baltic 1.	Baltic 2.	Plate oil.	Cotton-seed oil.
Iodine value of oil	198	198	175	120
Calculated oxygen absorption: O = 21	12·45	12·45	11·1	7·6
Oil taken	0·1743 grms.	0·1493	0·1826	0·3172
Gain in weight found:				
5 hours	0·0223	0·0309	0·0188	0·0054
24 ,, ...	0·0353	0·0385	0·0416	0·0348
48 ,, ...	0·0397	0·0369	—	0·0462
52 ,, ...	—	—	—	0·0372
Maximum gain	22·77	25·6	22·3	14·7

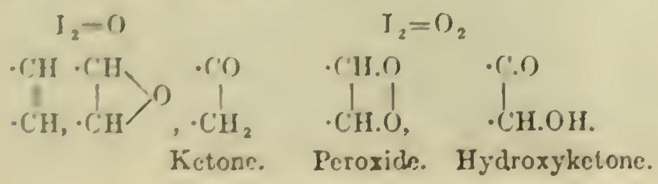
(Note.—In No. 1 Baltic the corks were found to be leaky and to admit some undried air which decomposed the peroxides formed.)

The interesting facts brought out by the above tables are (1) that the maximum oxygen absorption takes place in dry air; moisture tends to lower it, and after the maximum absorption loss begins to take place.

(2) That the amount of oxygen under maximum conditions absorbed is twice that calculated from the iodine value, namely that $I_2 = O_2$. These facts point to the formation of peroxides during the blowing of oils and also explains why Livache, Weger, and others find results much above the theory, $O = 2\ I$.

Lippert's experiments on the drying of oil in moist and dry air are of interest, seeing that in the case of No. 1 Baltic a leakage in the corks was discovered, showing that the moisture in the air acted on the peroxides. In the oxygenation of unsaturated groups Engler and others have shown that each —·CH : CH· group can absorb oxygen to form a peroxide. Engler gives in his paper a method of detecting such peroxides by adding indigo carmine solution and shaking. Two samples of linseed oil, one raw and the other blown at 140° F. for 72 hours, were treated with indigo carmine solution in sealed tubes and shaken for several hours. The blown oil mixture was discoloured in a few hours, while the raw oil did not discolour the indigo carmine for several days.

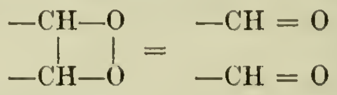
Theory of the oxidation of fatty unsaturated oils. It is generally admitted that unsaturated oils contain in the carboxylic acid chain unsaturated groups of the type, ·CH : CH·; on the number of such groups depends the "oxydisability" of the oil. Each such group, unless prevented by the "steric hindrance" of other groups, as a glyceride, can absorb 2 I (or 2 oxygen, as I have shown above). Their number is best estimated by the iodine value. As free acids, their oxygen absorption is $O = I_2$. That is to say, the following may result from such groups on oxidation:—



$$I_2 = O:\quad \begin{array}{l}\cdot CH\\ \\ \cdot CH,\end{array}\ \begin{array}{l}\cdot CH\diagdown\\ \;|\qquad\; O\\ \cdot CH\diagup\end{array},\ \begin{array}{l}\cdot CO\\ \;|\\ \cdot CH_2\end{array}\qquad I_2 = O_2:\quad \begin{array}{l}\cdot CH.O\\ \;|\quad\;|\\ \cdot CH.O,\end{array}\quad \begin{array}{l}\cdot C.O\\ \;|\\ \cdot CH.OH.\end{array}$$

Ketone. Peroxide. Hydroxyketone.

By the action of heat on the peroxides aldehydes may result:—



$$\begin{array}{l}-CH-O\\ \;\;|\qquad\;|\\ -CH-O\end{array} = \begin{array}{l}-CH = O\\ \\ -CH = O\end{array}$$

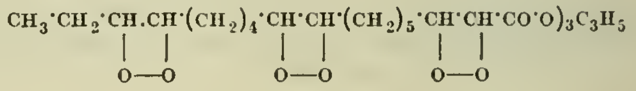
Much evidence is available in support of the existence of such aldehydes. A great deal of the "acrolein" supposed to be formed by the oxidation of the glycerides is no doubt due to the decomposition of the peroxides of the unsaturated fatty acids.

Thus, linolenin may be formulated in this way:—

Linolenin.

$$(CH_3\cdot CH_2\cdot CH{:}CH\cdot(CH_2)_1\cdot CH{:}CH\cdot(CH_2)_5\cdot CH{:}CH.COO)_3\cdot C_3H_5$$

This may be oxidised to form



$$CH_3\cdot CH_2\cdot \underset{\underset{O-O}{|\quad|}}{CH.CH}\cdot(CH_2)_4\cdot \underset{\underset{O-O}{|\quad|}}{CH\cdot CH}\cdot(CH_2)_5\cdot \underset{\underset{O-O}{|\quad|}}{CH\cdot CH}\cdot CO\cdot O)_3C_3H_5$$

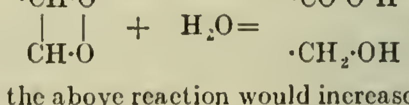
Heat may decompose this as follows:—

$$(CH_3CH_2\cdot CHO)_3{:}\,(OCH\cdot(CH_2)_4CHO)_3\ CH{:}O(CH_2)_5\cdot CHO)_3 \text{ and } (CHO\ COO)_3C_3H_5$$

Such decompositions are hardly to be expected, but they doubtless take place in part on heating oxidised oils, especially in linoleum cement making.

By treating an oxidised oil with phenylhydrazine, definite hydrazines have been obtained by the author, but these were not further examined.

As hinted before, the oxidised oils show a distinct acetyl value. Lewkowitsch and others have held that the acetyl value of oxidised acids indicates the presence of lactones. The writer thinks, however, that the increase of the acetyl value may be due to other causes. Under hydrolysis, the peroxides formed may break up and doubtless do (as witness the exceedingly inconstant results obtained with oxidised oils in doing their saponification figure) in the following manner.



$$\begin{array}{l}\cdot CH\cdot O\\ \;\;|\quad\;\;|\\ CH\cdot O\end{array} + H_2O = \begin{array}{l}\cdot CO\cdot O\,H\\ \\ \cdot CH_2\cdot OH\end{array}$$

Of course the above reaction would increase the acid and acetyl value of the products. Aldol derivatives too might well be formed. This is well brought out in the case of the drying of the free acids of the oils as mentioned earlier in the paper.

The oxidation products of the exposure of free oil acids to air for 20 months gave in the petroleum spirit insoluble, i.e., oxidised acids, an acid value of 151. These were amber brown in colour but saponifying them with standard sodium hydroxide the colour changed to dark brown and a saponification value of 328 was obtained, more than double the acid value. According to theory as free acids they should have no saponification value. As the original acids were free from lactones, it is difficult to see how these could be formed by mere drying in air. The explanation seems to be that the peroxides are broken up by the caustic alkali as formulated above into aldehydes and aldehyde-acids, these undergo aldol condensation and resinise. As a result there is an increase of the saponification figure. The hydroxy-acids formed increase the acetyl values. I hope in a future paper to say more about this.

Composition of linoxyn. Linoxyn requires twice as much oxygen for its formation as linolenic acid will absorb.

Secondly linolenic acid does not dry while linolenin does in 4 days or so. Why should the glyceride dry and not the free acid? The only explanation that presents itself is that the parallel groups of the linolenic acid in linolenin combine with the oxygen at their unsaturated groups to form rings (six and eight).

Leaving the discussion of linoxyn itself and "Polyolin" to a future paper, I think I may claim to have established the following points. (1) In the oxidation of a drying oil in air the amount of oxygen absorbed in dry air is in the ratio of 2 *I to* 2 *O*, but if the air be moist the peroxides thus formed are decomposed with production of volatile compounds—aldehydes and acids. (2) That the free acids of linseed and other oils only absorb half the amount of that absorbed by their glycerides. The same remarks also apply to their ethyl salts, these only absorbing one atom of oxygen for every 2 atoms of iodine absorbed.

Discussion.

Mr. G. **Ward** said that in works using paints in large quantities care was usually taken to keep a moderately dry atmosphere and slightly higher temperature than normal since it was known that humidity interfered with the drying of oils. Baltic oil was considered the best, possibly because the seed from which it was obtained was more thoroughly cleaned from foreign seeds before crushing. These seeds gave soft oils, and a small percentage of such an oil would materially affect drying qualities.

Mr. F. W. **Richardson** said that it often seemed impossible to get consistent results for the iodine value of fatty acids, because it gradually decreased and the refractive index gradually increased with the time occupied in drying such fatty acids in the boiling water bath or in the hot oven. He suggested that standard methods and specific conditions should be adopted to exclude oxygen in the drying process. It might then be hoped that concordant results would be obtained by different analysts. The fatty acids should be dried as quickly as possible.

Dr. H. **Ingle** said that owing to oxidation during the preparation of the fatty acids in the soaps formed and also of their ethyl esters, the iodine value was reduced below the theoretical value, and referred to Fahrion's work on rosin. The conditions of experiment had probably not been of the best and, if repeating these experiments, he should perform the saponifications in an atmosphere of coal gas.

Dr. L. L. **Lloyd** thought it curious that the iodine value and oxygen absorbed were in equivalent masses. Did oleic acid readily absorb oxygen under conditions similar to the absorption of oxygen by oils or their fatty acids? Sulphur dioxide and oxygen in presence of oleic acid (iodine value 89·7) gave no sulphuric acid, even on standing six months. but with the fatty acids from olive oil, treated under similar conditions, sulphuric acid was produced. Similar results were obtained with ricinoleic acid and the fatty acids obtained from castor oil. If drying oils were treated under similar conditions, relatively large quantities of sulphuric acid were produced. From these results he assumed that only oxidisable oils, those containing more than one double bond, were capable of acting as oxygen carriers to form sulphuric acid, and from that it followed that there were acids in olive and castor oils that contained more than one double bond. Perhaps the absorption of oxygen by fatty acids was due to the presence of the manganese drier, which acted as a catalytic agent. If fatty acids did not oxidise so readily as oils, why did they often give rise to firing, although in this case moisture aided the production of heat?

Dr. H. **Ingle** said the iodine value must be taken to represent the amount of double bonds, and it must be assumed that all oils which absorbed iodine would absorb oxygen also. The conditions were different when oxidising olein, which was present as mixed glycerides, from those when dealing with oleic acid, but it must be assumed, as proved in the paper, that the latter absorbed oxgen. When the maximum points of oxidation were reached the oils began to decompose spontaneously giving acrolein, aldehydes, and acids of these, and finally carbon dioxide. He did not think that there was any doubt that oleic and ricinoleic acids contained only one double bond.

Mr. F. W. **Richardson** said it was too commonly assumed that olive oil was a non-drying oil, but frequently the viscosity increased in proportion to the time of heating. The so-called oleic acid from olive oil was not pure oleic acid.

Mr. T. **Fairley** referred to Dr. Lloyd's paper delivered before this Section on the bleaching of fibres by sulphur dioxide. It was there proved that this treatment was injurious to the fibres owing to the formation of sulphuric acid which caused rotting. He had thought that many natural oils must probably contain small quantities of substances which carried oxygen from the air and handed it over to the oil. The weak point in the work described that night was that it had been done on natural mixtures which were in unknown proportions and varied from season to season and according to the climate. As a consequence a complex series of results was obtained. A simple test for safety in use was very much required. The only trustworthy one at present was based on Mr. Mackey's plan, but the Insurance Committees would prefer that it should be done on the same kind of fibre as was used with the oil. Hitherto cotton fibre had been used in the laboratory but it did not follow that it was the best for getting really valuable results.

Mr. W. McD. **Mackey**'s experience of spreading olive oil on cotton fibre at high temperatures was that fatty acids showed remarkable firing qualities, although the free fatty acids of olive oil did not show much oxygen absorption. Olive oils containing a good deal of fatty acids browned tops, which appeared to be contrary to Dr. Ingle's contention. Water vapour increased the liability to firing. Where tops were in contact with leakages of steam from steam pipes, fires had often originated. It was quite feasible to do firing tests on any kind of fibre, but cotton wool could always be got of uniform quality.

Dr. H. **Ingle** thought that the browning and firing of tops, etc., treated with cloth oils might in part be due to traces of sulphuric acid carried over by the steam distillation of the "cracked suds" from which "oleines" were in the Yorkshire district mainly obtained. Free fatty acids at a high temperature might cause browning and even charring of the fibre and this action might be increased by the action of steam (especially if cottonseed soaps were used). The rate of the oxygen absorption depended on the double bonds as measured by the iodine value, and he placed great value on this test. These points were not really pertinent to the subject matter of the paper, which dealt mainly with drying oils. Mr. Fairley's remarks on the fact that he had dealt only with natural products were true enough, but that was the object in view. He had no doubt that Mr. Mackey's oil tester gave very satisfactory results as to the heating of oils on fibres, but that again was not pertinent to the paper. The Chairman had spoken about Baltic seed being freer from non-drying oleaginous seeds than others; that was not his experience. The quality of Baltic oil depended on the linseed itself (Ingle; Transvaal Agric. J., Oct. 1902) and that largely on the soil and climate. The rotting of the fibres in Dr. Lloyd's experiments on the action of sulphurous acid on goods was doubtless due to the oxidation of this by the peroxides of the oils to sulphuric acid. Many years ago he had come across a similar case where oil stains on blankets in bleaching with SO_2 produced similar results.

Meeting held at Leeds on Monday, May 5th, 1913.

MR. GEORGE WARD IN THE CHAIR.

THE FASTNESS TO LIGHT AND OTHER AGENCIES OF AZO-SALICYLIC AND AZO-HYDROXY-NAPHTHOIC ACID DYES.

BY ANUKUL CHANDRA SIRCAR AND EDWIN ROY WATSON.

In two previous papers (this J., 1912, **31**, 968—971; and "Azo-dyes derived from 2.3.hydroxy-naphthole acid") the preparation has been described of a series of azo-salicylic, azo-*o*-hydroxy-naphthoic and azo-2.3. hydroxy-naphthoic acid dyes. They were prepared with the definite object of obtaining dyes of different shades of colour, especially red, violet, blue and black, and possessing the good all round fastness of benzene-azo-salicylic acid. The object of the investigation has been attained in so far as dyes of various shades, including red, violet and black have been produced. Their fastness to various agencies has now been examined systematically by methods already described (this J., 1911, 30, 196) and the results are given in the following table. The dyeings were made on wool from an acid bath, using 2 per cent. dye reckoned on the weight of wool. Owing to the insolubility of many of the dyes in neutral solvents they were only obtained in a condition suitable for dyeing by dissolving in cold strong sulphuric acid and precipitating by water. Fuller shades can be obtained by using a larger quantity of dyestuff (up to 4 per cent. reckoned on weight of wool). Very good effects can also be obtained by producing the dyestuffs direct on the fibre.

	Fastness to light on British Association Committee's scale.	Intensity of shade after soaping expressed as percentage of original intensity.	Intensity of shade after alkali test expressed as percentage of original intensity.	Intensity of shade after acid test expressed as percentage of original intensity.
m.Xylene-azo-salicylic acid	V	<25	<25	unchanged
Ditto Chrome mordant	V	unchanged	unchanged	,,
Benzene-azo-benzene-azo-salicylic acid	III	25	75	,,
Ditto Chrome mordant	III	unchanged	unchanged	,,
Disulpho-naphthalene-azo-naphthalene-azo-salicylic acid	II	<25	<25	,,
Ditto Chrome mordant	IV	unchanged	unchanged	,,
m-Xylene-1.azo-4.hydroxy-3.naphthoic acid	II	50	75	,,
Ditto Chrome mordant	I	75	80	,,
Ethoxy-benzene-1.azo-4.hydroxy-3.naphthoic acid	II	33	75	,,
Ditto Chrome mordant	II	unchanged	unchanged	,,
Benzene-azo-benzene-1.azo-4.hydroxy-3.naphthoic acid	II	<25	50	,,
Ditto Chrome mordant	I	unchanged	unchanged	,,
Disulpho-naphthalene-azo naphthalene-1.azo-4.hydroxy-3.naphthoic acid	II	<25	33	,,
Ditto Chrome mordant	II	unchanged	unchanged	,,
Benzidine-bis-(1.azo-4.hydroxy-3.naphthoic acid) .	I	0	5–10	,,
Ditto Chrome mordant	I	<25	<25	,,
Naphthalene-.1.azo-2.hydroxy-3.naphthoic acid ..	II	<25	<25	,,
Ditto Chrome mordant	II	unchanged	50	,,
m-Xylene-1.azo-2.hydroxy-3.naphthoic acid	III	<25	<25	,,
Ditto Chrome mordant	III	85	25	,,
p-Ethoxy-benzene 1.azo-2.hydroxy-3.naphthoic acid	IV	<25	<25	,,
Ditto Chrome mordant	III	66	66	,,
m-Nitro-benzene-1.azo-2.hydroxy-3.naphthoic acid	III	<25	<25	,,
Ditto Chrome mordant	III–IV	33	33	,,
p-Nitrobenzene-1.azo-2.hydroxy-3.naphthoic acid .	V	<25	0	,,
Ditto Chrome mordant	V	<25	<25	,,
Benzene-azo-benzene-1.azo-2.hydroxy-3.naphthoic acid	V	0	<25	,,
Ditto Chrome mordant	V	0	<25	,,
Disulpho-naphthalene-β-azo-naphthalene-α.1.azo-2.hydroxy-3.naphthoic acid	V	66	85	
Ditto Chrome mordant	V	80	66	,,
Benzidine-bis-(1-azo-2.hydroxy-3.naphthoic acid) .	V	<25	0	,,
Ditto Chrome mordant	IV	33	25	,,

Discussion of Results.

As expected, the azo-salicylic acid dyes on chrome mordant have excellent fastness to light. There is a marked difference between the derivatives of α.hydroxy-naphthoic and 2.3.hydroxy-naphthoic acids, the derivatives of the former being all fugitive whilst the majority of the derivatives of the latter have very good fastness. The effect of chrome mordanting is in the majority of cases either beneficial or not harmful, but there are one or two cases in which the chrome mordanting actually decreases the fastness to light.

All the salicylic acid and hydroxy-naphthoic acid derivatives, excepting the benzidine compound, give dyeings on chrome mordant fast to soaping and alkalis. The derivatives of 2.3.hydroxy-naphthoic acid are not so good. The beneficial effect of the chrome mordant is well-marked in the salicylic and α.hydroxy-naphthoic acid series, the presence of sulphonic acid groups not destroying the effect. But in the 2.3.hydroxy-naphthoic acid series the chroming has so little effect that it is doubtful whether the mordant can produce any real fixation.

All the dyeings have excellent fastness to acid.

From a practical point of view the chief interest lies in the derivatives of 2.3.hydroxy-naphthoic acid, as these only give the shades of colour which it was desired to obtain. Several of them satisfy all requirements except as regards fastness to soaping and alkali.

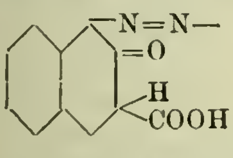
AZO DYES DERIVED FROM 2.3.HYDROXY-NAPHTHOIC ACID.

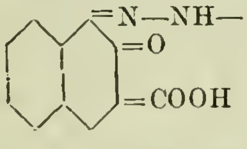
BY ANUKUL CHANDRA SIRCAR AND EDWIN ROY WATSON.

In a previous paper (this J., 1912, 31, 968—971) some attempts were described to prepare dyestuffs of similar constitution to benzene-azo-salicylic acid which would possess the same all-round fastness as this dye but with the colour deepened to red, violet, blue or black. These attempts were not, however, successful as the colour was deepened towards maroon and brown instead of towards violet and blue as desired.

In view of the red, violet, blue and black shades of many azo-dyes of not more complicated structure than those described it seemed remarkable that no better success was attained. A list of the well-known azo-dyes prepared from naphthol sulphonic acids was examined in order to see whether the relative positions of the hydroxyl and sulphonic acid groups had any obvious effect on the colour. This examination seemed to indicate that it was rather the relative positions of the hydroxyl and chromophore groups which was the determining factor, the *o*-position favouring red, violet and blue shades and the *p*-position giving brownish shades. This led to the preparation of the dyes described in this paper, as the coupling of a diazo-salt with 2.3.hydroxy-naphthoic acid produces azo-dyes with the hydroxyl-group in the *o*-position to the azo-group. 2.1.Hydroxy-naphthoic acid cannot be used, as on coupling with diazo-salts it loses carbon dioxide and gives the azo-derivatives of β-naphthol (Nietzki and Guiterman, 20, 1275). The following dyes have been prepared :—Naphthalene-.1.azo 2.hydroxy-3.naphthoic acid, *m*.xylene-1.azo-2.hydroxy-3.naphthoic acid, *p*.ethoxy-benzene-1.azo-2.hydroxy-3.-naphthoic acid, *m*.nitro-benzene-1.azo-2.hydroxy-3.naphthoic acid, *p*.nitro-benzene-1.azo-2.hydroxy-3.naphthoic acid, benzene-azo-benzene-1.azo-2.hydroxy-3.naphthoic acid, disulpho-naphthalene-β.azo-naphthalene-α.1.azo-2.-hydroxy-3.naphthoic acid and benzidine-bis-1.azo-2.-hydroxy-3.naphthoic acid. Naphthalene-*α*.1.azo-2.-hydroxy-3.naphthoic acid has been already described (Ber. 28, 3090), but the method now adopted for its preparation is somewhat simpler and gives a substance melting at 236° whilst Mohlau and Kriebel's product began to decompose at 182°. The other dyes in this list have not been previously described in scientific literature, but *m*.xylene-1.azo-2.hydroxy-3 naphthoic acid is mentioned in D.R.P. 145913.* Unlike the corresponding compounds described in the previous paper (*loc. cit.*) all but the last two of these compounds crystallise readily. They are very slightly soluble in water or alcohol and to bring them into a suitable condition for dyeing they were dissolved in cold strong sulphuric acid and precipitated by water. It was also found that very satisfactory dyeings could be obtained by coupling directly on the fibre (wool).

The shades obtained are very satisfactory, including fiery red, claret, cherry-red, brownish-purple, bluish-purple and black. The systematic determination of the fastness to light, etc., of these new dyes will be communicated later. But it may here be mentioned that whilst the dyeings on chrome-mordanted wool are quite satisfactory as regards fastness to light and acid test, they are not so resistant to soaping, alkalis and milling as they were expected to be. In this respect there is a clear difference between the derivatives of 2.3.hydroxy-naphthoic acid and the corresponding dyes from α-hydroxy-naphthoic acid. This difference suggests that perhaps these compounds only exist in the forms





both of which are o-quinonoid, and whilst these are favourable for deep colour they do not satisfy Liebermann and Kostanecki's rule and consequently the dyes are not perfectly fixed by mordanting.

Experimental.

Naphthalene-α.1.azo-2.hydroxy-3.naphthoic acid.

$$C_{10}H_7(1).N=N(1).C_{10}H_5OH(2).COOH(3).$$

7·15 grams. of α-naphthylamine were dissolved with 12·5 c.c. of hydrochloric acid (sp. gr. 1·16) in 200 c.c. of water, cooled, and diazotised by gradually adding a solution of 3·7 grams of sodium nitrite in 20 c.c. of water. After half an hour's standing the mixture was coupled with an alkaline solution of 9·4 grams of 2.3-hydroxy-naphthoic acid. There was a brown precipitate formed—the mixture was left over night. Next day it was acidified with dilute sulphuric acid, boiled for a few minutes and filtered. The substance was then pressed on a porous plate and crystallised out of boiling acetic acid.

Properties :—Greenish-red rhombic prisms melting at 236° (the M.P. given in the original literature (B. 28, 3090) is about 182°) easily soluble in acetic acid, benzene, toluene, chloroform, nitro-benzene and acetone, moderately soluble in ethyl and methyl alcohols, slightly soluble in ether and insoluble in ligroin and water. It dissolves slightly in boiling caustic alkali with a red colour, and easily in strong sulphuric acid to a deep blue solution from which on dilution it is deposited as a brown precipitate. It dyes unmordanted wool reddish-brown and chrome-mordanted wool dark brown.

m.Xylene-1.azo-2.hydroxy-3.naphthoic acid,

$$(CH_3)_2.C_6H_3N_2.(1)C_{10}H_5OH(2)COOH(3)$$

m.Xylidine was diazotised in the usual way and coupled with the calculated quantity of an alkaline solution of 2.3.hydroxy-naphthoic acid, when a deep red precipitate appeared. The mixture was kept over night. Next day it was acidified with dilute hydrochloric acid, boiled for a few minutes, filtered and pressed on a porous plate. It was dissolved in boiling acetic acid and crystallised out on cooling in uniform deep-red needles.

Properties :—Melts between 240°—242° C., easily soluble in acetic acid, chloroform, alcohol and nitro-benzene, moderately soluble in benzene, toluene, xylene, acetone and methyl-alcohol, insoluble in water, ligroin and ether even on boiling. It dissolves to some extent in warm caustic alkali with a red colouration, and easily in strong sulphuric acid to a magenta-red solution from which, on dilution, it is precipitated as a red precipitate. The substance dyes a full cherry-red shade on chrome-mordanted as well as unmordanted wool.

·1746 gave ·4584 CO_2 and ·0835–H_2O; C=71·56, H=5·30.
·1999 gave 16 c.c. moist N at 31° C. and 751 mm. ; N=8·73.
$C_{19}H_{16}O_3N_2$ requires C=71·25, H=5·00 ; N=8·75 per cent.

p.Ethoxy-benzene-1.azo-2.hydroxy-3.naphthoic acid.

$$(1)C_2H_5O.C_6H_4(4)N=N(1)C_{10}H_5.OH(2)COOH(3)$$

3·4 grams of *p*.phenetidine with 7·5 c.c. of hydrochloric acid (sp. gr. 1·16) were dissolved in 250 c.c. of water, boiled and filtered in order to get rid of some insoluble impurity. It was next cooled to 0° by surrounding with ice and diazotised by slowly adding a solution of 1·9 gram of sodium nitrite in 12 c.c. of water. When the diazotisation was complete it was coupled with an alkaline solution of 4·7 grams of 2·3.hydroxy-naphthoic acid when a blood-red precipitate was formed. The mixture was tested to be alkaline and kept over night. Next day it was boiled with dilute hydrochloric acid when the colour of the precipitate changed to magenta-red. It was filtered and pressed on a porous plate and crystallised out of boiling acetic acid when it was obtained in deep-red needle-shaped crystals with a green reflex.

Properties :—Melts at 231° but begins to soften a little below this temperature, soluble in acetic acid, benzene, toluene, chloroform, acetone and nitro-benzene, slightly soluble in methyl and ethyl alcohols, insoluble in ether, ligroin and water even on boiling. It dissolves slightly in boiling caustic alkali with an orange colouration and easily in strong sulphuric acid to a magenta-red solution from which on dilution it is deposited as an orange-coloured precipitate. It dyes claret shades both on chrome-mordanted and unmordanted wool.

·1846 gave ·4543 CO_2 and ·0813 H_2O ; C=67·62 H=4·89.
·2112 gave 16·6 c.c. moist N at 31° C. and 751 mm. ; N=8·56.
$C_{19}H_{16}O_4N_2$ requires C=67·79, H=4·76. N=8·33 per cent.

m.Nitrobenzene-1.azo-2.hydroxy-3.naphthoic acid.

$$(3)NO_2C_6H_4(1)N=N(1).C_{10}H_5OH(2)COOH(3).$$

2·76 grams of *m*.nitraniline with 8 c.c. of strong hydrochloric acid were dissolved in 100 c.c. of water, cooled by surrounding with ice and diazotised by gradually adding a solution of 1·5 gram of sodium nitrite in 10 c.c. of water when a precipitate of the diazo-compound was deposited. After 40 minutes stirring it was coupled with 3·76 grams. of an alkaline solution of 2.3.hydroxy-naphthoic acid when a red precipitate was formed. The mixture was kept over night and next day acidified with dilute hydrochloric acid and warmed. The precipitate was filtered and dried on a porous plate. It was crystallised out of boiling nitrobenzene from which solvent on cooling it was deposited as beautiful red needles. It was finally washed with a little alcohol in order to purify it from adhering nitrobenzene.

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* This patent is for the preparation of lake-pigments consisting of the barium, calcium, aluminium and magnesium salts of azo-compounds from diazotised unsulphonated amines of benzene and 2.3.hydroxy-naphthoic acid. Of recent years several similar patents have been taken out, but the possibility of using such compounds as dyes does not seem to have been considered. 2.3.Hydroxy-naphthoic acid has, however, recently gained importance for the production of azo-dyes, especially such as have hydroxyl groups in both nuclei in the *o*-position to the azo-linking *e.g.*, J.S.C.I., 1911, **30**, 796).

Properties:—Does not melt at 275°, easily soluble in nitrobenzene, moderately soluble in benzene, very slightly soluble in methyl and ethyl alcohol, acetic acid, acetone, chloroform and ligroin, insoluble in ether and water, It dissolves in caustic alkali with a red colouration and in strong sulphuric acid to a deep red solution, from which, on dilution, it comes out as an orange precipitate. It dyes unmordanted as well as chrome-mordanted wool fiery red.
·1691 gave ·3499 CO_2 and ·0500 H_2O ; C=60·46, H=3·28.
·1961 gave 22·6 c.c. moist N at 31° and 751 mm. ; N=12·44.
$C_{17}H_{11}O_5N_3$ requires C=60·53, H=3·26, N=12·46 per cent.

*p.Nitro-benzene-*1.*azo-*2.*hydroxy-*3.*naphthoic acid.*

$$(4)NO_2C_6H_4(1)N{=}N(1)C_{10}H_5OH(2)COOH(3).$$

*p.*Nitraniline was diazotised in the usual way, coupled with the calculated quantity of an alkaline solution of 2.3.hydroxynaphthoic acid and the product treated as in the last preparation. The substance crystallised out of nitrobenzene in fine hair-like red needles. It was washed as in the last experiment with a little alcohol.

Properties:—Does not melt at 285°, easily soluble in nitrobenzene, slightly soluble in chloroform, acetone, benzene, toluene and xylene, scarcely soluble in methyl and ethyl alcohols and acetic acid, insoluble in ether, ligroin and water. It dissolves in boiling caustic alkali with a bluish-violet colouration and in strong sulphuric acid to a deep-red solution from which on dilution it comes out as an orange coloured precipitate. It dyes both unmordanted and chrome-mordanted wool brownish-red.
·1796 gave ·3975 CO_2 and ·0559 H_2O ; C=60·20, H=3·45.
·2084 gave 23·4 c.c. moist N at 28° and 749 mm. N=12·38.
$C_{17}H_{11}O_5N_3$ requires C=60·53, H=3·26, N=12·46 per cent.

*Benzene-azo-benzene-*1.*azo-*2.*hydroxy-*3.*naphthoic acid.*

$$C_6H_5N{=}N.C_6H_4N{=}N(1).C_{10}H_5.OH(2)(COOH(3).$$

5·49 grams. of *p.*amino-azo-benzene were diazotised (Hewitt, J.C.S. Trans. 1909, **95**, 1394) and the product allowed to drop upon an alkaline solution of 5·64 grams. of 2.3.hydroxynaphthoic acid. A reddish-brown precipitate was formed. The mixture was kept over night and next day acidified, warmed, and filtered. The precipitate was dried on a porous plate and crystallised out of benzene.

Properties:—Magenta-red needles with a green reflex, does not melt below 275°, soluble in benzene, chloroform, acetic acid and acetone, difficultly soluble in methyl and ethyl alcohols, insoluble in ether, ligroin and water even on boiling. It dissolves in caustic alkalis with a violet colouration and in strong sulphuric acid to a deep-green solution from which on dilution it is deposited as a brownish-red precipitate. It dyes brownish-purple both on chrome-mordanted and unmordanted wool.
·1660 gave ·4233 CO_2 and ·0620 H_2O ; C=69·54, U=4·14.
·1583 gave 20·4 c.c. moist N at 28·5° and 751 mm.; N=14·14.
$C_{23}H_{16}O_3N_4$ requires C=69·69, H=4·05, N=14·14 per cent.

*Disulpho-naphthalene-β.azo-naphthalene-α.*1.*azo-*2.*hydroxy-*3.*naphthoic acid.*

$$(SO_3H)_2C_{10}H_5(2)N{=}N(1)C_{10}H_6(4)N{=}N(1)C_{10}H_5OH(2)COOH(3).$$

Disulpho-naphthalene-*β*.azo-*α*.naphthylamine was prepared by diazotising 17·05 grams. of G-salt and coupling with 7·2 grams of *α*.naphthylamine. 5 grams of this base (Na salt) with 3 c.c. of strong hydrochloric acid were dissolved in 80 c.c. of water, and diazotised by slowly adding a solution of 0·78 grams. (theory required 0·69 grams) of sodium nitrite. After stirring for some time the mixture was kept over night. Next day it was coupled with an alkaline solution of 1·88 grams. of 2.3.-hydroxy-naphthoic acid. After an hour's stirring the mixture was heated to 80° for some time. It was found that the precipitated sodium salt could not be converted into the free acid by boiling with any mineral acid, so it was filtered off and washed with a little water to purify it from adhering sodium carbonate and sodium chloride.

Properties:—Black powder, fairly soluble in water and caustic alkalis. It dissolves in strong sulphuric acid with a greenish-black colouration and on dilution it is deposited as a bluish-black precipitate. It dyes both mordanted and unmordanted wool black.
·1898 gave ·0583 Na_2SO_4 ; Na=9·44.
·2433 gave 15·8 c.c. moist N at 29° and 751 mm. ; N=7·15.
$C_{31}H_{17}O_9N_4S_2Na_3$ requires Na=9·55, N=7·75 per cent.

*Benzidine-bis-*1.(*azo-*2.*hydroxy-*3.*naphthoic acid*).

$$(3)COOH(2)HO.C_{10}H_5(1).N_2C_6H_4.C_6H_4.N_2(1)C_{10}H_5OH(2)COOH(3).$$

3·68 grams. of benzidine with 6 c.c. of concentrated hydrochloric acid were dissolved in 80 c.c. of hot water, cooled by surrounding with ice and diazotised by slowly adding a solution of 2·9 grams. of sodium nitrite in 30 c.c. of water and tested by iodised starch paper. The solution was clear and of a browish-red colour. It was then coupled with a solution of 8·5 grams. of 2.3.hydroxynaphthoic acid (theory required 7·52 grams.) in 2·5 grams. of caustic soda and 100 c.c. of water. There was at once a violet precipitate. The whole mixture was stirred for about 3 hours during which time a solution of 2 grams. of caustic soda was gradually added. The mixture was left over night. Next day the precipitate was filtered off, washed first with a dilute solution of caustic soda and then with water. It was found that the sodium salt could not be converted into the free acid by boiling with any mineral acid.

Properties:—Greenish powder, insoluble in water and caustic alkali even on boiling, but soluble in strong sulphuric acid to a blue solution from which on dilution it is deposited as a magenta-coloured precipitate. It dyes both unmordanted and chrome-mordanted wool purple
·2209 gave ·0490 Na_2SO_4 ; Na=7·20.
·2338 gave 17·8 c.c. moist N at 27° and 751.mm. ; N=8·47.
$C_{34}H_{20}O_6N_4Na_2$ requires Na=7·37, N=8·63 per cent.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Refrigerating and like systems. F. W. S. Stokes, London. Eng. Pat. 10,721, May 6, 1912.

In order to ensure economical working, a valve is interposed between the separator and the evaporator, which only opens when the pressure in the former exceeds that in the latter by a definite amount.—W. H. C.

Refrigerating by ammonia expansion and absorption; Process and apparatus for ——. J. S. Withers, London. From Smith Refrigerating Co., New Orleans, La., U.S.A. Eng. Pat. 11,347, May 13, 1912.

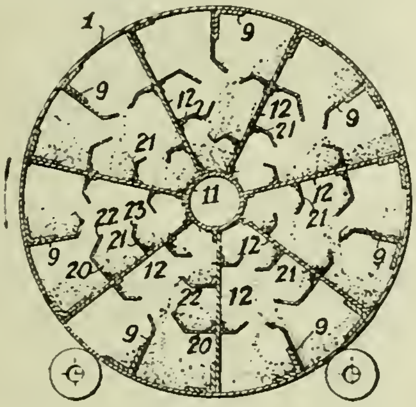
The apparatus consists of a lower tank connected with a number of upper transverse tanks by circulating tubes. The apparatus being filled with ammonia water, the lower tank is heated and the vapours of ammonia and water pass through the upper tanks, where the water vapour is condensed and only ammonia vapour goes forward to the condenser and receiver. When the ammonia has been driven off, the heating is stopped, the outlet is closed, and the weak liquor or water allowed to cool. Then the valves between the receiver and expansion coils and between the latter and the tanks are opened and the ammonia expands, producing the refrigerating effect, and is re-absorbed by the weak liquor in the tank. The heat given off during absorption is dissipated by the arrangement of circulating pipes and the large radiating surface of the tanks.—W. H. C.

Evaporating apparatus. P. Kestner, Lille, France, Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pat. 1,060,607, May 6, 1913.

A VERTICAL tubular evaporating apparatus has a liquid-distributing chamber above and a receiving chamber for the concentrated liquid below. Both the latter and the upper part of the heating chamber are connected with the injector and pipe supplying liquid to the distributing chamber.—W. H. C.

Drying substances; Apparatus for ——. W. Lierfeld, Dortmund, Germany. U.S. Pat. 1,061,762, May 13, 1913.

THE dryer consists of a horizontal drum, 1, rotated on rollers, and provided with shelves, 9, projecting inwards from the periphery, which lift up the material, and drop it again. Further, the drum has a central tube, 11, from which radial partitions, 12, extend to the periphery, dividing the drum into a number of chambers. The partitions are provided with numerous shelves and projections, 20, 21, 22, 23, etc., which assist in the lifting up and dropping of the material.—W. H. C.



Dryer. A. Hoffman, Baltimore, Md., Assignor to P. D. Lowe, New York. U.S. Pat. 1,061,941, May 13, 1913.

THE dryer, which is detached from the fire-box of the furnace, is divided into an upper and a lower chamber, the former being tapered. The two chambers communicate at the smaller end of the upper one, and the material is caused to pass from the larger to the smaller end of the upper chamber by a suitable conveyer. Hot gases from the stack are drawn through the two chambers, and expelled from the larger end of the upper one.—W. H. C.

Saturation apparatus. W. Feicks, Bloomfield, N.J. U.S. Pat. 1,062,960, May 27, 1913.

A NUMBER of concentric annular chambers are arranged within a vessel containing liquid. Spiral baffles project from the walls of the annular vessels to co-operate with the gas in agitating the liquid. The gas is delivered below the level of the liquid and after coming into intimate contact with it, is discharged above.—W. H. C.

Gases; Apparatus for the separation of solids or liquids from ——. O. Ellinghaus. Ger. Pat. 258,795, Feb. 28, 1912.

THE apparatus consists of a rotating drum divided by radial partitions into compartments through which the gas is passed, and having at its periphery narrow slits through which the solids or liquids are thrown outwards by centrifugal force. On the front side (in relation to the direction of rotation of the drum) of the radial partitions are ribs, extending from the axis to the periphery of the drum, and the narrow slits are between these ribs. In an alternative form, the side walls of the compartments are helical.—A. S.

Distilling apparatus. H. Hafner. Ger. Pat. 259,111, Oct. 22, 1911.

THE still is enclosed in an oil heating jacket heated by a fire beneath. The jacket communicates with a vertical tube, in the upper enlarged portion of which is a float. When the oil jacket is heated, the oil rises in the vertical tube and operates the float which controls a damper regulating the opening through which the products of combustion from the fire pass to the stack or other means of producing draught. If the temperature falls, the level of the oil also falls, and the float opens the damper, thereby increasing the draught and hence the intensity of the fire. —A. S.

Packing material for rectifying columns. K. Kubierschky. Ger. Pat. 259,362, Jan. 16, 1912.

WIRES wound into spirals or the like are interwoven so as to form plates of a thickness several times as great as the diameter of the wire.—A. S.

Sludge, etc.; Process for the treatment of ——. W. Boehm and A. Milch. Ger. Pat. 259,500, July 22, 1911.

THE vessels used for transporting the sludge have walls which are capable of serving as electrodes in the subsequent dehydration of the sludge by the electro-osmotic process. —A. S.

Drying material for gases. F. von Meyenburg and F. Lossen. Ger. Pat. 259,574, Sept. 26, 1911.

The drying material is composed of a porous substance with a deliquescent salt (calcium chloride, potassium carbonate) in its pores. The porous substance is used in small pieces and contains only a small quantity of the deliquescent salt, so that the volume of the maximum quantity of water capable of being absorbed by the salt can be accommodated by the available pore-space; the absorption of water takes place mainly on the surface, the water then penetrating the material by diffusion. The material after use may be revivified by means of hot air at temperatures rising to about 125° C.—A. S.

Tridymite-filter; Preparation of a ——. Sand- und Steinzeugwerke C. Grosspeter Ges. m. b.H. Ger. Pat. 259,910, July 13, 1912.

A FRAME of earthenware or porcelain having a definite fire-shrinkage, before the second firing, is used as a support for a tridymite filter-mass having the same fire shrinkage, and the two parts (frame and filter-mass) are then fired so as to form a solid unit.—A. S.

Separators; Centrifugal ——. H. de Raasloff and T. E. Brown, New York. Eng. Pat. 26,045, Nov. 13, 1912.

SEE U.S. Pat. 1,044,570 of 1912; this J., 1913, 11.—T.F.B.

Concentrating, drying, and crystallising; Apparatus for ——. M. Prager, Berlin. U.S. Pat. 1,062,030, May 20, 1913.

SEE Fr. Pat. 449,572 of 1912; this J., 1913, 525.—T. F. B.

Tunnel-furnace. A. Ramén, Olympia, Sweden. U.S. Pat. 1,062,606, May 27, 1913.

SEE Eng. Pat. 4386 of 1912; this J., 1912, 761.—T. F. B.

Drying apparatus. J. E. Hobbs. Fr. Pat. 451,958, Dec. 16, 1912. Under Int. Conv., Dec. 29, 1911.

SEE Eng. Pat. 29,313 of 1911; this J., 1913, 221.—T.F.B.

Pumping elastic fluids; Apparatus for ——. H. A. Humphrey and W. J. Rusdell. Fr. Pat. 452,358, March 12, 1912. Under Int. Conv., June 2, 1911.

SEE Eng. Pat. 28,187 of 1911; this J., 1912, 860.—T.F.B.

Classifying finely divided materials; Process and apparatus for ——. H. K. Hitchcock. Fr. Pat. 452,384, Dec. 26, 1912.

SEE Eng. Pat. 1212 of 1913; this J., 1913, 587.—T. F. B.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Vertical retorts; Temperatures in the centre of ——. R. Ross and J. P. Leather. J. Gas Lighting, 1913, **122**, 720.

THE retorts (Woodall-Duckham continuous) are 25 ft. from base to top, and the temperatures (see table) were measured by means of a pyrometer 25 ft. long.

Depth below rodding holes.	Temp.	Depth below rodding holes.	Temp.	Depth below rodding holes.	Temp.
ft. in.	°C.	ft. in.	°C.	ft. in.	°C.
21 4	891	15 6	745	7 6	715
19 4	894	13 6	735	5 6	520
17 4	905	11 6	875	3 6	316
15 4	667	9 6	791	2 6	298
16 8	600				

—A. S.

Gaseous mixtures; Combustion of —— and the lag in their inflammation. Taffanel and Le Floch. Comptes rend., 1913, **156**, 1544—1546.

THE occurrence of a lag in the inflammation of methane-air mixtures is not due to the presence or absence of moisture. The probable cause is the relatively slow rate at which the velocity of reaction increases with the temperature, compared with the rate in other inflammable mixtures which do not exhibit the lag.—W. H. P.

Sulphur in illuminating gas; Determination of ——. R. S. M'Bride and E. R. Weaver. J. Gas Lighting, 1913, **122**, 598—600.

GRAVIMETRIC, volumetric and turbidimetric methods are described and compared for determining the sulphate present in solutions obtained in the Gas Referees' type of sulphur-testing apparatus. For accurate work, gravimetric methods are preferred. The gravimetric methods are: (1) precipitation with barium chloride in presence of hydrochloric acid, followed by evaporation to dryness, and washing of the residue with hot water, and (2) precipitation with barium chloride in nearly neutral solution. The volumetric method consists in precipitating with a known amount of standard barium chloride solution in presence of hydrochloric acid, adding an equivalent amount of potassium bichromate solution with a few drops of ferric chloride, precipitating with ammonia, filtering, acidifying the filtrate, adding potassium iodide, and titrating with thiosulphate. The turbidimeter is a portable apparatus consisting of a glass cylinder, graduated in centimetres, held in place above a 16-candle power carbon filament lamp. The solution from the sulphur apparatus is neutralised with hydrochloric acid, and an additional 2 c.c. of acid (1 : 1) is added. The volume is measured, and 90 c.c. taken for the test. 10 c.c. of 10 per cent. barium chloride are added to the solution which should be at 25° to 30° C. (77°—86° F.) and the whole stirred for 1 minute. The suspension is poured gradually into the turbidimeter until the filament of the lamp cannot be seen. The suspension is poured back and the turbidity again tested until the point is fixed within 1 mm. The amount of sulphur is then ascertained from tables or curves obtained previously. The method is accurate to within 2 to 3 per cent. of the quantity of sulphur present.

—A. T. L.

Liquid fuel. V. B. Lewes. J. Roy Soc. Arts, 1913, **61**, 666—673, 690—695, 702—707.

THE author deals with the origin, composition, production, uses, and future supply of petroleum. He considers that the main bulk of petroleum has been formed by the slow decomposition of marine vegetation (seaweeds, etc.). A table from "Petroleum Mining" (A. Beeby Thompson) showing the specific gravity and ultimate composition of the various kinds of petroleum is reproduced, whilst in another table the sp. gr., flash point, calorific value, and actual evaporative power of various kinds of liquid fuel are given: heavy tar oil is shown to be considerably inferior to a good petroleum fuel oil as a fuel. It is pointed out that air carburetted with petrol vapour gives good results in the Bone and McCourt system of flameless surface combustion (this J., 1911, 527; 1912, 61, 524), and experiments have also indicated that fuel oil finely atomised with air in the correct proportion and then blown into the tubes containing the granular material, will also prove efficient if the granular material be previously heated.—A. S.

Ethylene; Polymerisation of —— at a high temperature and pressure in presence of catalysts. W. Ipatiew and O. Routala. Ber., 1913, **46**, 1748—1755. (See also this J., 1911, 1367.)

ON heating ethylene under 70 atmospheres pressure in presence of zinc chloride, polymerisation began at 275° C., a mixture of gaseous and liquid products being obtained. The gas contained C_nH_{2n}, 36; C_nH_{2n+2}, 61; H_2, 3 per cent. The liquid (sp. gr. 0·7512 at 15° C.) resembled petroleum and the lighter portions (b. pt. 20°—85° C.), obtained by fractional distillation, consisted chiefly of paraffin hydrocarbons. In the higher-boiling fractions (up to 300° C.) the proportion of unsaturated hydrocarbons increased with the boiling point. In the fractions up to 145° C. only ethylenic hydrocarbons were present in addition to paraffins, but in the higher-boiling fractions polymethylenes (naphthenes) were present in quantities increasing with the boiling point. A fraction (b. pt. 256°—265° C.) obtained by distillation after treatment with fuming sulphuric acid consisted almost exclusively of naphthenes. A review of these results and those obtained previously by Engler and Routala (this J., 1910, 10, 338) shows that by suitable choice of temperature, pressure, and catalyst, there can be produced artificially from ethylenic hydrocarbons products similar to the three chief types of petroleum, viz., American, poor in naphthenes; Baku, rich in naphthenes, and Galician petroleum, intermediate between the other two. Using freshly prepared aluminium chloride as catalyst, ethylene, under a pressure of 70 atmospheres, polymerised at the ordinary temperature to liquid products, whilst at 200° C., no liquid products were obtained, but a carbonaceous residue was left. The liquid condensation products were richer in paraffin hydrocarbons and poorer in naphthenes than those obtained with zinc chloride.—A. S.

Bitumens and their residuals; Characteristics and differentiation of native ——. C. Richardson. Eng. Record, April 26, 1913. (See also this J., 1909, 419, 710.)

IMPORTANT considerations for characterising the native bitumens are the determination of the series of hydrocarbons of which they are composed, the proportion of saturated hydrocarbons (not absorbed by strong sulphuric acid), the sulphur content and, in the case of petroleums, the quantity of sulphur removable by steam distillation, and finally the quantity of ash-free coke left on ignition in absence of air. Tables are given showing the results of analyses of "fluxes," condensed or blown oils, glance pitches and solid native bitumens other than asphaltum. The "fluxes" (viscous oils used for fluxing asphaltum or for direct application to road surfaces) are the residuals left after distilling various petroleums until the product contains little or nothing volatile on heating 50 grms. for 5 hrs. at 325° F. (163° C.). The fluxes derived from paraffin petroleums have the sp. gr. 0·92 to 0·94 and contain 14·5 to 4 per cent. of hard paraffin scale containing 85·6 to 74·1 per cent. of saturated hydrocarbons. They yield little residual coke and contain little sulphur. They are of no value on roads except for fluxing true asphaltums. Fluxes from semi-asphaltic petroleums have the sp. gr. 0·95 to 0·97 and contain less paraffin scale, which consists mainly of saturated hydrocarbons. They will satisfactorily dissolve and flux solid bitumens such as gilsonite and grahamite which are not true asphaltums. Fluxes from asphaltic petroleums have the sp. gr. about 1, yield no hard paraffin scale, and 6 to 7 per cent. of ash-free coke. They consist mainly of unsaturated hydrocarbons. A flux obtained from Mexican petroleum is differentiated from all of the preceding by high sulphur content and yield of residual coke, and high paraffin scale content, while less of it is soluble in "88° naphtha." Condensed or blown oils are obtained by treating the fluxes with sulphur or air at high temperatures. They are lacking in ductility and are non-adhesive. The products from different petroleums resemble one another closely; they yield much coke and the solubility in naphtha and the percentage of saturated hydrocarbons are less than in the fluxes. The solid residual pitches as used for road making differ in their characteristics according to origin. Those from Texas petroleum contain little paraffin scale, less than 1·25 per cent. S, and yield much coke. They contain very much less saturated hydrocarbons than the corresponding fluxes. California pitches yield much less coke and contain much less saturated hydrocarbons than Texas pitches. They contain less than 1·5 per cent. S and only traces of paraffin scale. Trinidad pitches contain about 2 per cent. S and less saturated hydrocarbons than the Californian pitches. Mexican pitches contain 5 to 6 per cent. S, 1 to 2 per cent. of paraffin scale and yield much coke. The Trinidad and Mexican crude oils contain 3·60 and 3·28 per cent. S respectively, but on distillation the former yields hydrogen sulphide and the distillates contain 0·65 and 2·31 per cent. S respectively and the residual pitches 2·10 and 5·38 per cent. It is very difficult to obtain products of uniform quality from the Mexican crude oil. The bitumen of the native asphaltums contains 4 to 8 per cent. S, no paraffin scale, and less than 25 per cent. of saturated hydrocarbons. The glance pitches contain only 6 to 7 per cent. of saturated hydrocarbons, gilsonite contains 6 per cent. and grahamite practically none.—A. T. L.

Egypt. Petroleum production in 1912. Cd. 6602. [T.R.]

The first exportation of Egyptian crude petroleum from the mining areas in the Red Sea took place last year, the total amount being 14,400 tons, valued by the Custom House for the assessment of the 1 per cent. export duty at £E.10,500. When the refineries at present under construction at Suez have been completed, the crude petroleum will probably be brought to that port for refining, instead of being exported direct to the Far Eastern refineries as at present.

£E = £1 0s. $6\frac{1}{2}$d.

Patents.

Rendering coal and other dust non-explosive; Preparation for ——. J. Arnott and F. W. Goodall, Leeds. Eng. Pat. 18,801, Aug. 16, 1912.

A composition for spreading over the dusty roadways and galleries in mines consists of sodium chloride, 12 parts, powdered kaolin or other clay containing free alumina, 6 parts, aluminium sulphate, $1\frac{3}{4}$ parts, and carbolic disinfecting powder, $\frac{1}{4}$ part.—A. T. L.

Furnaces; Process of burning fuel in ——. T. Grieve, Perth Amboy, N.J., U.S.A. Eng. Pat. 12,544, May 28, 1912. Under Int. Conv., June 10, 1911.

A grate for burning low-grade fuels such as small anthracite, screenings, coke-breeze, etc., with forced draught comprises a number of sections or plates perforated so as to distribute the air uniformly in fan-shaped jets, formed by gathering the air below the fuel-bed in circular openings, and discharging it into the fuel-bed through elliptical mouths tapering upwards. The total area of the jets should not exceed 12 per cent. of the grate area, and the blast should be at a pressure of $1\frac{1}{2}$ to 2 inches of water.—A. T. L.

Coke-oven with vertical heating flues; Device for heating a —— *by means of poor gas, rich gas, or a mixture of the two.* Dr. C. Otto und Co., Ges. m. b. H. Ger. Pat. 258,248, Sept. 1, 1912.

The poor gas is supplied directly to the conduit from which the burner nozzles project, whilst the rich gas is supplied to hollow members or plugs movable in this conduit so as to open or close as desired the orifices of the burner nozzles. In this way rich gas alone, or a mixture of rich gas and poor gas in any desired proportions can be supplied to the heating flue.—A. S.

Carbonaceous material; Process for treating [*carbonising*] ——. O. J. Parker, London. Eng. Pat. 28,582, Dec. 11, 1912.

The carbonaceous material is heated in a suitable retort to a temperature between 460° and 700° C. under a vacuum of from 20 to $29\frac{1}{2}$ inches of mercury. The vacuum is maintained throughout the condensing apparatus and such products as are capable of condensation under the vacuum employed, are recovered by condensation. The gas and uncondensed vapours are then passed through suitable scrubbing apparatus to recover the remaining vapours. (Reference is directed to Eng. Pat. 7732 of 1906; this J., 1907, 461.)—W. H. C.

Gas-producer. W. Hammick, Pittsburg, Kans. U.S. Pat. 1,060,755, May 6, 1913.

Air is blown into the lower part of the producer, and gas withdrawn from the upper part thereof, by two fans placed one above the other upon a framework at the side of the producer and coupled together by a belt. The upper fan is also coupled by means of bevel gear and a belt with a vertical shaft, which passes through the top of the producer, and carries rotating arms to act as a fuel leveller.—W. H. C.

Gas; Process of manufacturing ——. R. Miller, Woodlawn borough, Pa., Assignor to Superior Gas Improvement Co., Pittsburgh, Pa. U.S. Pat. 1,061,861, May 13, 1913.

One or more beds of coke are blown to incandescence, then the air blast is cut off, a layer of coal is spread over the incandescent coke, and steam is blown through the coke so as to produce water-gas, which mixes with the gas given off from the coal; the latter is well agitated during the steaming period.—W. H. C.

Gas producer. W. F. Luick and A. J. Bassett, Milwaukee, Wis., Assignors to Luick Bassett Producer Co. U.S. Pat. 1,062,721, May 27, 1913.

A perforated baffle-ring is interposed between the jacket and the shell of the producer, below the air-supply pipe, and also a second baffle-ring at the lower end of the shell. Layers of refractory material are fitted within the shell to form a "fire-pot." Both the air chamber and the fire-pot are provided with steam-supply pipes.—W. H. C.

Gas-producer. C. M. Garland, Collingswood, N.J., Assignor to Camden Iron Works, Camden, N.J. U.S. Pat. 1,063,024, May 27, 1912.

The lower body-section of the producer is arranged so that it can be rotated by suitable means with respect to the fixed top section. The latter encloses the body-section, and is stepped so as to form an upper and a lower portion. The upper portion has a gas outlet and a fuel-charging hopper and the lower portion has several openings adjacent to the vertical wall, joining the two portions through which vertical slicers project into the body of fuel. The slicers are water cooled and are supported by brackets from the vertical wall and can be adjusted at any desired height.—W. H. C.

Gas producer. P. A. J. Cousin. First Addition, dated Dec. 9, 1912, to Fr. Pat. 435,532, Oct. 17, 1911 (see Eng. Pat. 23.256 of 1912; this J., 1913, 413.)

The water-trough forming the base of the producer described in the chief patent is made rectangular in plan, and the front wall of the producer, which is sealed in this trough, is continued downwards in the form of a stepped grate, so that by lowering the water level the producer can work with natural draught. An annular air-supply chamber is also provided in the lower part of the producer walls, with blast orifices discharging below the water level, and this peripheral blast can be used in addition to or in place of the blast from the central tuyère.—A. T. L.

Gas-producer; Suction —— for wood and other waste. L. L. Pentagaine. Fr. Pat. 452,609, Dec. 30, 1912.

The producer works with a down-draught, the air being introduced through a cylindrical grate forming part of the wall of the producer chamber. The gas-outlet is by way of a similar grate at a suitable distance below the air inlet, and a third and smaller grate below the gas outlet serves for the admission of air for reducing the matter incompletely burnt in the upper part of the producer, whereby the gas-outlet is kept free. These cylindrical grates form the inner walls of annular chambers in the thickness of the producer lining. In large producers an additional air inlet is provided by means of a central tuyère extending from the base of the producer and discharging at the level of the upper air inlet.—A. T. L.

Oil-gas; Process for the production of ——. H. Blau. Ger. Pat. 258,610, July 7, 1912.

In the process of producing oil-gas at relatively low temperatures, the tar produced being re-introduced into the system, in order to obtain gas and pitch (or coke) as sole final products, it is proposed to add hydrogen, methane, or mixtures of the two to the oil vapours, whereby the separation of soot and the consequent irregularities of working are avoided.—A. S.

Gases; Illuminating, coke-oven and other ——. W. B. Davidson, Birmingham. Eng. Pat. 12,720, May 30, 1912.

A large proportion of the carbon dioxide present in the crude gas is first removed by bringing it into contact with ammonia in a primary washer, and the gas is further washed with ammonia so as to absorb hydrogen sulphide and any remaining carbon dioxide. The liquor from the primary washer is withdrawn and distilled, preferably as described in Eng. Pat. 23,696 of 1911 (this J., 1913, 78), and the gases from the still may be passed through iron oxide so as to remove hydrogen sulphide and obtain carbon dioxide sufficiently pure for the manufacture of ammonium carbonate. The liquor from the subsequent washing is distilled and the sulphur recovered from the gas either as sulphur or as sulphuric acid.—A. T. L.

Iron oxide used in gas purification; Process of regenerating [revivifying] ——. D. McDonald, Louisville, Ky. U.S. Pat. 1,061,859, May 13, 1913.

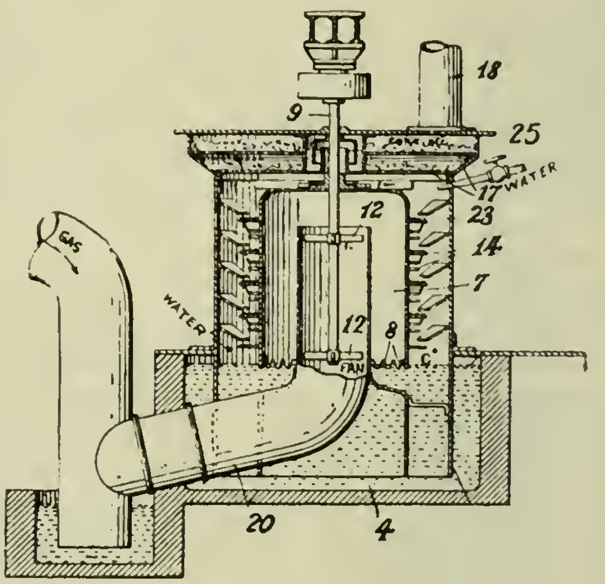
The spent oxide is piled up in a conical heap beneath a hood connected with a stack and ignited on the outer surface. The revivified oxide gradually flows down the sides of the heap and exposes a fresh surface to be burned.
—W. H. C.

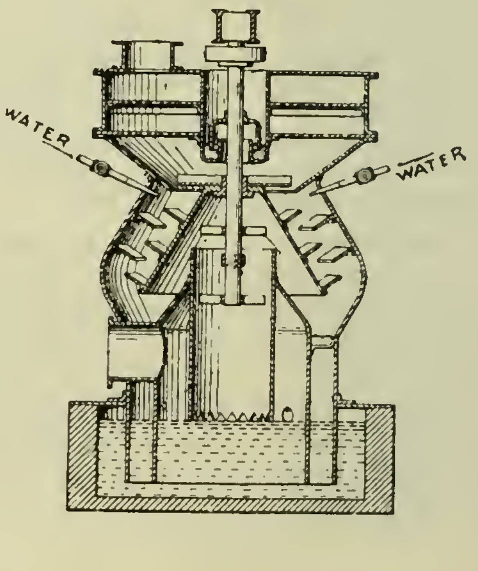
Gas producers; Obtaining ammonia and other by-products in ——. Montania Brennstoffverwertung Ges. m. b. H. Fr. Pat. 452,648, Dec. 30, 1912.

The patent relates to gas producers suitable for burning wood, peat, lignite, olive refuse, etc., with recovery of by-products, such as calcium acetate, methyl alcohol, tar and ammonia. The producer is arranged to provide more than one zone of combustion, or more than one producer is used, and the gases evolved in the zone where carbonisation occurs are led away separately and treated for the recovery of the by-products, and then returned to the other zones of the producer, or to another producer, so as to destroy the tarry impurities which they still contain.—A. T. L.

Gas cleaner. A. Ernst, Pittsburgh, Pa. U.S. Pats. 1,062,445 and 1,062,446, May 20, 1913.

The gas enters through the pipe, 20, into the bell, 7, which together with the blades, 12, is rotated by the shaft, 9. The gas passes downwards and outwards through the serrations, 8, at the level of the water seal, 4, which is provided with an overflow at about the level of the serrations. The gas then passes upwards and has a centrifugal motion imparted to it by the blades, 14, on the rotating bell, 7, and on the fixed outer casing, 23, upon which water or other suitable liquid can be sprayed from the nozzle, 25. The gas then passes through suitable drying materials in the chambers, 17, and away by the pipe, 18. A modification of the apparatus is shown in the second figure.
—W. H. C.





Ammonia; Process for the direct recovery of —— from distillation gases. H. Borgs. Ger. Pat. 258,975, Oct. 29, 1912.

The ammoniacal gases and the vapours from the gas-liquor are treated separately, the former being passed into a vat or tank and the latter through a tower. The absorbing liquor is circulated between the tank and the tower, the fresh acid being introduced into the upper part of the tower. Water is also introduced into the tower above the acid inlet, and serves to remove suspended particles of acid, etc., from the escaping gases and to promote the uniform distribution of the acid.—A. S

Ammonia; Process for obtaining —— from distillation gases. C. Still. Ger. Pat. 259,630, June 17, 1911. Addition to Ger. Pat. 255,432.

In carrying out the process described in the chief patent (this J., 1913, 414), the liquor from the first saturator, in which the ammoniacal vapours from the gas-liquor are treated, is led continuously into the second saturator, where the ammoniacal gases are treated, and from the second saturator, so much liquor is returned continuously to the first that there is no possibility of the separation of solid ammonium sulphate in the latter. By working in this way either all the fresh acid can be introduced into the first saturator, or a part can be introduced into one and a part into the other.—A. S.

Ammonia; Process for the separate recovery of volatile and fixed —— from hot crude gases. Gewerkschaft Messel. Ger. Pat. 259,817, Nov. 24, 1910.

The gases are cooled to such a degree that on mechanical treatment in a suitable device the non-volatile ammonium salts are deposited in the form of a concentrated aqueous solution. For example, between the hydraulic main and the ordinary coolers, a small cooler and a disintegrator device for the removal of mist are interposed. There issues from the latter a hot mixture which in a suitable separator yields hot tar and a hot aqueous solution containing the non-volatile ammonium salts. If the quantity of this solution be too small, more water is introduced into the small cooler, whilst if it be too large, the cooler is put out of action.—A. S.

Heavy oils and other hydrocarbons; Clarification of ——. B. Guillard. Fr. Pat. 452,167, Dec. 14, 1912.

The oil is mixed with from one-tenth to one-third of petroleum or of "shale" according to the fluidity required and is treated with magnesium chloride or chloride of lime, whereby tar is precipitated. The oil is decanted and treated with zinc chloride, whereby any remaining tar is precipitated.—A. T. L.

Oils; Apparatus for the recovery of acid used in refining ——. A. Gellen, Glinik Maryampolski, Galicia. U.S. Pat. 1,063,025, May 27, 1913.

The waste acid is fed continuously into a decomposing vessel, arranged within an outer vessel, heated by a steam coil. The decomposing medium is also fed continuously into the decomposing vessel from a store tank provided with a heating coil. The resulting mixture overflows into the outer vessel, whence it is continuously discharged into a settling chamber provided with a heating coil; the acid and the hydrocarbon oils are continuously discharged from the settling vessel at different levels.—W.H.C.

Acid tar from petroleum refining; Process for the conversion of —— into water-soluble products. Rütgerswerke-A.-G. Ger. Pat. 258,608, March 12, 1912.

The tar is washed repeatedly with water or dilute alkali, and the washing liquid then replaced by fresh liquid. It is stated that the tar becomes soluble after from five to eight thorough washings, and can then be used for the production of dust-binding preparations (for roads), for the emulsification of neutral mineral oils, etc.—A. S.

Peat; Processes for utilising ——. Wetcarbonizing, Ltd. Fr. Pat. 451,687, Aug. 1, 1912. Under Int. Conv., Aug. 3, 1911.

See Eng. Pat. 17,610 of 1911; this J., 1912, 1171.—T. F. B.

Peat; Process and apparatus for utilising ——. Wetcarbonizing, Ltd. Fr. Pat. 451,711, Nov. 21, 1912. Under Int. Conv., Nov. 24, 1911.

See Eng. Pat. 26,349 of 1911; this J., 1913, 353.—T. F. B.

Fuel; Process and apparatus for making artificial ——. Graigola Merthyr Co., Ltd. Fr. Pat. 452,284, Dec. 23, 1912. Under Int. Conv., Dec. 28, 1911.

See Eng. Pat. 29,220 of 1911; this J., 1913, 224.—T.F.B.

Gas producer. A. von Kerpely. First Addition, dated Dec. 18, 1912, to Fr. Pat. 434,322, Sept. 18, 1911. Under Int. Conv., Dec. 22, 1911.

See Eng. Pat. 29,182 of 1912; this J., 1913, 278.—T. F. B.

Heat, a flame which emits heat, and inflammable gases; Process and apparatus for producing —— by fractional combustion. A. G. Meeze. Fr. Pat. 452,746, Nov. 7, 1912.

See Eng. Pat. 2941 of 1911; this J., 1912, 1172.—T. F. B.

Petroleum distillation residues; Process for treating ——. Standard Oil Co. (of Indiana). Fr. Pat. 452,604, Dec. 28, 1912.

See U.S. Pat. 1,055,707 of 1913; this J., 1913, 414.—T.F.B.

Method of oxidising hydrocarbons with the help of moving surfaces. Fr. Pat. 452,344. *See* III.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Filaments [for electric incandescence lamps]; Shaping ——. R. O. Poag and W. W. Kirk, Cleveland, Ohio, Assignor to General Electric Co., New York. U.S. Pat. 1,057,088, March 25, 1913.

The apparatus consists of two rotatable drums, upon one of which the filament is coiled, the other serving to keep the filament taut, so that very close coils are formed. The apparatus is enclosed in a casing, which is filled with a protective gas, and means are provided by which a current can be passed through the coiled portion of the filament in order that it may retain its form.—W. H. C.

Carbon; Method of purifying —— for carbon filaments. J. Billiter, Vienna. U.S. Pat. 1,062,431, May 20, 1913.

Carbon containing less than 0·1 per cent. of impurities is obtained by preparing colloidal carbon by disintegration with an electric current, or by two successive heat disintegrations, and afterwards separating the colloidal carbon.—T. St.

Incandescence filaments; Manufacture of coated ——. C. H. Fischer. Fr. Pat. 451,824, Dec. 12, 1912. Under Int. Conv., Dec. 13, 1911.

Filaments are made of very finely drawn metallic tungsten and are afterwards coated with a white enamel containing for example zinc white mixed with oxides of the rare earth metals. These filaments can be woven into a mantle and heated to incandescence by the passage of a current or by a gas flame. The mantle may be mounted so that either method of heating can be used at will.—A. T. L.

Incandescence bodies for electric incandescence lamps; Manufacture of ——. R. Heller. Fr. Pat. 452,047, Dec. 19, 1912. Under Int. Conv., Mar. 11, 1912.

The manufacture of ductile tungsten filaments as described in Eng. Pats. 21,513 of 1906 and 23,499 of 1909 (this J., 1907, 1132; 1911, 291) is carried out with tungsten originally in the crystalline condition, obtained by reducing a halogen or oxy-halogen compound of tungsten by means of hydrogen or by causing the dissociation of such a compound by heat.—A. T. L.

Photometers. Eng. Pat. 15,660. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Patents.

Hydrocarbons; Method of oxidising —— with the help of moving surfaces. Soc. Anon. "Cava." Fr. Pat. 452,344, Dec. 24, 1912. Under Int. Conv., Dec. 30, 1911.

The patent relates to a method of treating hydrocarbons such as mazout (petroleum residuum) or tar so as to distil off the volatile constituents and at the same time oxidise the heavy hydrocarbons and form pitch. The hydrocarbon is heated in a horizontal cylindrical retort, and a current of air is passed through the retort above the level of the liquid. The liquid is exposed to the action of the air by means of blades, with a large surface, mounted on a revolving shaft.—A. T. L.

Aminonaphtholsulphonic acids; Process for producing substitution products of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,872. Dec. 13, 1912. Under Int. Conv., Dec. 21, 1911.

See Eng. Pat. 14,152 of 1912; this J., 1913, 355. The 1-chloro- or 1-bromo-2-amino-5-naphthol-7-sulphonic acid is obtained in an analogous manner.—T. F. B.

Cresolsulphonic acids; Process for obtaining condensation products of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 451,877, Dec. 13, 1912. Under Int. Conv., March 16, 1912.

The condensation products of cresolsulphonic acids for use in the tanning process described in Fr. Pat. 451,875 (see XV., p. 668), can be obtained by heating the cresolsulphonic acid under reduced pressure, either alone or with a condensing agent. For example, the product obtained by cold sulphonation of *o* cresol is heated at 130° C. and under a pressure of 20 mm. for about 24 hours, *i.e.*, until a sample dissolved in water does not show increased powers of precipitating glue from solution. The product is then dissolved in water, the solution filtered and neutralised by means of caustic soda and evaporated to dryness. The resulting substance dissolves readily in water: its acidified solutions strongly coagulate glue solutions. The products may be finally treated with condensing agents at the ordinary pressure.—T. F. B.

Anthraquinone series; Process for preparing compounds of the —— *containing chlorine.* Chem. Fabr. Griesheim-Elektron. Fr. Pat. 451,936, Dec. 14, 1912.

Anthraquinone derivatives containing chlorine, of undetermined constitution, are obtained by treating β-diazoanthraquinone and its derivatives with hypochlorites. The compounds are not very stable, since they are decomposed when heated or on keeping; on treatment with reducing agents the compound from β-diazoanthraquinone furnishes o-diaminoanthraquinone.—T.F.B

Anthraquinone-α-carboxylic acids; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 259,365, April 17, 1912. Addition to Ger. Pat. 250,742 (see this J., 1912, 1023).

α-Methylanthraquinone or a derivative thereof is treated with chlorine at a high temperature in presence of nitrobenzene. In this way it is possible to obtain, besides anthraquinone-α-carboxylic acid, 3-methylanthraquinone-1-carboxylic acid, 1-chloroanthraquinone-4-carboxylic acid, etc., in good yield and in a state of purity.—T. F. B.

Nitro-N-alkylcarbazoles; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 259,504, Dec. 17, 1911.

By treating N-alkylcarbazoles with nitrous acid in presence of indifferent solvents, mononitro-N-alkylcarbazoles are produced.—T. F. B.

Phenols; Process for the manufacture of monovalent —— *from monochloro-substitution products of aromatic hydrocarbons.* K. H. Meyer, Munich, and F. Bergius, Hanover, Germany. U.S. Pat. 1,062,351, May 20, 1913.

See Fr. Pat. 450,305 of 1912; this J., 1913, 592.—T. F. B.

Amino-anthraquinones and derivatives thereof; Producing ——. C. Rampini (by W. E. Warland, Administrator), Brooklyn, N.Y., Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,063,172 and 1,063,173, May 27, 1913.

See Eng. Pat. 21,710 of 1911; this J., 1912, 578.—T. F. B.

Aminonaphtholsulphonic acids; Process for producing substitution products of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Dec. 28, 1912, to Fr. Pat. 451,872, Dec. 13, 1912. Under Int. Conv., Jan. 12, 1912.

See Eng. Pat. 14,151 of 1912; this J., 1913, 416.—T. F. B.

Process for improving the antiseptic, insecticidal, and fungicidal properties of tar oils for use in preserving wood. Ger. Pat. 259,665. *See* IX.

IV.—COLOURING MATTERS AND DYES.

Violanthrene; Synthesis of ——. C. Seer and R. Scholl. Annalen, 1913, **398**, 82—96.

1.1′-Dinaphthyl-4.4′-dicarboxylic acid prepared from naphthidine by way of the 4.4′-dicyano-1.1′-dinaphthyl, is converted first into the corresponding acid chloride and then into the 4.4′-dibenzoyl-1.1′-dinaphthyl. This is heated for five and a half hours to 95°—100° C. with 8 parts of anhydrous aluminium chloride, forming the dyestuff Violanthrene. With 5.5′-dibenzoyl-1.1′-dinaphthyl no such condensation occurs, for the hydrogen when in the para position to the carbonyl group is not split off on heating with aluminium chloride.—G. H. F.

New reaction for the detection of aniline dyes in foods, especially in wines. Malvezin. *See* XVIII.

Patents.

o-Hydroxymonoazo dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated Feb. 16, 1912, to Fr. Pat. 361,649, July 26, 1905.

Blue wool dyestuffs similar to those described in the principal patent (see U.S. Pat. 827,468 of 1906; this J., 1906, 922), are obtained by combining a monoalkylether of 1.8-dihydroxynaphthalene-4-sulphonic acid with the diazo compounds of *o*-aminophenol or its derivatives containing a sulphonic group, and containing no nitro group except in the *p*-position to the amino group. (Compare Ger. Pat. 245,280; this J., 1912, 483.)—T. F. B.

Monoazo dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Dec. 9, 1912, to Fr. Pat. 441,044, March 6, 1912. Under Int. Conv., March 23, 1912 (see this J., 1912, 809).

Fast brown dyestuffs, similar to those described in the principal patent, are obtained by combining the diazo compound of an aromatic aminosulphoxide or aminosulphide with an aryl-2-amino-8-naphthol-6-sulphonic acid. The aminosulphoxides are obtained by condensing aromatic sulphinic acids with aromatic amines; on reduction they are converted into the aminosulphides. *p*-Tolyl-*p*-aminophenylsulphoxide, obtained by condensing *p*-toluenesulphinic acid with aniline, is easily soluble in hot alcohol, and almost insoluble in water; its m.pt. is 168°—170° C.: *p*-tolyl-*p*-aminophenylsulphide is insoluble in water and soluble in alcohol, from which it crystallises in colourless needles of m.pt. 81°—83° C.—T. F. B.

Vat dyestuff of the anthraquinone series; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 259,881, Feb. 11, 1912.

When 4-chloro-1-methylanthraquinone is treated with bromine, a vat dyestuff is produced.—T. F. B.

Disazo dyestuffs; Process for preparing yellow ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 451,973, Dec. 16, 1912.

When *m*-dichlorobenzidine ($NH_2 : Cl = 1 : 3$) is treated with fuming sulphuric acid at about 120° C., a new disulphonic acid is formed. Yellow dyestuffs, suitable either for dyeing wool or for use in preparing lakes, are obtained by combining the tetrazo derivative of this sulphonic acid with two mols. of *o*-chlorophenylmethylpyrazolone or of 2.5-dichlorophenylmethylpyrazolone.—T. F. B.

Anthraquinone dyes and process of making them. P. Nawiasky, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,062,990, May 27, 1913.

See Ger. Pat. 251,709 of 1911; this J., 1912, 1117.—T.F.B.

Anthraquinone dyes. C. Müller, Ludwigshafen, and M. H. Isler, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,062,988, May 27, 1913.

See Fr. Pat. 438,606 of 1912; this J., 1912, 581.—T. F. B.

Dibenzanthrone derivatives and vat dyestuffs derived therefrom. Badische Anilin und Soda Fabrik. Fr. Pat. 451,798, Dec. 11, 1912. Under Int. Conv., April 19, 1912.

See Ger. Pat. 259,370 and Eng. Pat. 14,498 of 1912; this J., 1913, 593.—T. F. B.

Anthraquinone derivatives; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 452,409, Dec. 26, 1912. Under Int. Conv., Feb. 19, 1912.

See Eng. Pat. 8509 of 1912; this J., 1913, 418.—T. F. B.

Azo dyestuffs and lakes produced therefrom. Badische Anilin und Soda Fabrik. Fr. Pat. 451,878, Dec. 13, 1912. Under Int. Conv., June 26. 1912.

See Eng. Pats. 15,146 and 15,147 of 1912; this J., 1913, 480, 593.—T. F. B.

1.2.4-*Purpurin-3-carboxylic acid; Process for producing ——.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,927, Dec. 14, 1912. Under Int. Conv., Dec. 27, 1911.

See Eng. Pat. 29,506 of 1912; this J., 1913, 593.—T. F. B.

Quinizarin; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 452,244, Dec. 20, 1912. Under Int. Conv., Jan. 2, 1912.

See Ger. Pat. 255,031 of 1912; this J., 1913, 189.—T. F. B.

Preparation of derivatives of cyanhydrins of aldehydes and ketones containing sulphur. Ger. Pat. 259,502. *See* XX.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Partial hydrolysis of ——. G. Zemplén. Z. physiol. Chem., 1913, 85, 180—191.

Cellulose and hydrocellulose, when subjected to acetolysis, preferably under the conditions described by Klein (this J., 1912, 713), both yield practically the same amount (50—55 per cent.) of cellobiose octacetate. The author has prepared three products of partial hydrolysis of cellulose by the action of 70 per cent. sulphuric acid at 20° C. The time required for the complete solution of cotton wool in this acid was 1 hour 40 mins. Starting from this point, the first product (amyloid) was obtained by interrupting the reaction by pouring the solution into water after 1¼ hours, the second product after 2¼ hours, and the third product after 6¼ hours. In the two latter cases alcohol was employed to obtain a more complete precipitation. The three products were purified by washing and boiling with alcohol and were finally dried over phosphorus pentoxide. These three products, when submitted to acetolysis, each yielded crystallised cellobiose octacetate in approximately the same proportions (15—20 per cent.), independently of the degree of hydrolysis previously effected by the sulphuric acid. These results show that amyloid is not identical with hydrocellulose, and that hydrolysis by 70 per cent. sulphuric acid, even after prolonged action, does not extend to the cellobiose groups, for even the third product yielded no dextrose pentacetate as the result of acetolysis.—J.F.B.

Cork; Studies on the chemical composition of ——. G. Zemplén. Z. physiol. Chem., 1913, 85, 173—179.

The cork, in the form of meal, was first extracted by boiling for 2 hours under a reflux condenser with a large volume of 96 per cent. alcohol four times in succession. After concentration of the extract, 3 per cent. of crystalised cerin was obtained; on pouring into water, the extract yielded 5 per cent. of a precipitate consisting largely of tannin; whilst the dark solution when evaporated, gave 2·5 per cent. of amorphous residue mainly composed of tannin. The cork residue, although not fully exhausted by the above treatment, was next saponified by cold alcoholic potassium hydroxide for 12 hours. This operation was performed three times and the fatty acids were separated after acidifying and concentrating the extracts. Next the saponified cork residue was again extracted twice with boiling alcohol, the extract yielding 13·5 per cent. of non-reducing products not further investigated. The residue was then digested for 1 hour with water on the water-bath. The aqueous extract was acidified and precipitated with alcohol; the precipitate, when hydrolysed with dilute sulphuric acid, was for the main part insoluble, but yielded an extract which reduced Fehling's solution. The cork residue also yielded an extract on hydrolysis which reduced Fehling's solution and gave a crystalline osazone melting at 120° C.; the sugar was probably a mixture of pentoses. The residue, which was now reduced to 24·5 per cent. of the original cork, gave the reactions for lignin and the percentage of ash had increased from 4·12 per cent. in the cork to 8·47 per cent. in the residue. Treated by Cross and Bevan's chlorination process it yielded a product which contained 12 per cent. of ash and resembled cellulose in most of its properties. It was soluble in cuprammonium but differed from cellulose and hydrocellulose in the fact that, on acetolysis by Skraup's method, it yielded no cellobiose octacetate. The quantitative results of the resolution of the cork substance, expressed in percentages of the cork, are summarised as follows:—Moisture, 6·21; ash, 4·12; alcoholic extract, 10·5; fatty acids by cold saponification with alcoholic potassium hydroxide, 19·0; alcoholic extract of the saponified residue, 13·5; aqueous extract of the residue, 14·0, from which were obtained on hydrolysis 1·24 of sugar calculated as dextrose; extract on hydrolysis with 1·5 per cent. sulphuric acid, 1·5, calculated as dextrose; lignocellulose residue, 24·5; final product resembling cellulose, 4·17.—J. F. B.

Swedish filter paper; Manufacture of ——. G. Fornstedt. Chem. News, 1913, 107, 269—270.

Chemical filter papers are generally made on hand-moulds, whilst those used for technical purposes are manufactured on cylinder machines. The carefully sorted rags, freed from metallic impurities, are boiled with caustic soda and are preferably bleached in chambers with gaseous chlorine after washing and breaking. The ash in the purified bleached half-stuff ranges from 0·177 for coloured cotton rags down to 0·039 per cent. for new shirt cuttings. The water employed must be of the purest description, but even then it generally introduces 0·02 to 0·05 per cent. of mineral matter into the paper. The beating is regulated according to the rapidity of filtration and fineness of retention desired. For analytical work the paper is extracted with hydrofluoric and hydrochloric acids and washed until the washings give no opalescence with silver nitrate. It is then pressed and hung in open sheds, where it is frozen to increase its porosity. If dried before freezing, the desired effect cannot be obtained. Extracted filter paper contains about 0·015 per cent. of ash. Extreme precautions are taken for the determination of the ash in chemical filter papers; the chief constituents are silica and calcium, aluminium and magnesium oxides. The rate of filtration is determined on a paper 6 ins. in diameter, through which 6 cub. ins. of water at 90° F. (32° C.) should pass in 140 secs., as a maximum, to 90 secs., as a minimum.—J. F. B.

Sulphite pulp waste lyes : Recovery of sulphur dioxide, calcium sulphate and a fuel from ——. R. W. Strehlenert. Papierfabr., 1913, **11**, 645—649, 666—672.

THE chief organic constituent of the waste lyes is the calcium salt of ligninsulphonic acid: this is soluble in water and is decomposed in acid solution at a high temperature in presence of air, yielding sulphuric and sulphurous acids and insoluble lignin. It is necessary to regulate the temperature and quantity of air to avoid carbonisation of the precipitated lignin on the one hand and its formation in a gelatinous condition on the other hand. Under suitable conditions the lignin is precipitated in a granular form, which is easily separated and dried for use as a fuel ; this fuel has a heating value of 7000 cals., calculated on the ash-free substance. In order to obtain the lignin as free from ash as possible, the calcium should first be precipitated by sodium bisulphate. The hot lyes from the digesters are treated with 1·5—2 per cent. of sodium bisulphate and the calcium sulphate is separated and dried for sale. The clear solution of sodium ligninsulphonate is charged into pressure-vessels to about 60 per cent. of their total capacity and heated to 100° C. Air is then forced in up to a pressure of about 18 atm. The temperature rises about 20° C. as the result of the reaction and is slowly raised to 160° C. The sulphurous acid liberated from the lye is oxidised to sulphuric acid which induces the decomposition of the lignin salt between 160° and 170° C. After a temperature of 200° C. or higher has been reached, which should be in about 40—60 minutes, measured from the time of starting from 100° C., the digestion is finished. At the critical moment when decomposition sets in (160°—170° C.) the pressure in the vessel rises very rapidly and the sulphur dioxide liberated is blown off through absorption towers for recovery. At the close of the heating period a feeble current of air must be blown through the liquid in order to granulate the precipitate. This air together with the excess of steam, is utilised to heat the contents of a second digester. The precipitate of lignin is washed and drained in the centrifuge until it contains about 50 per cent. of water. It may be dried further by any convenient source of waste heat, but should retain 20 per cent. of moisture when used for fuel, as when dry, it burns too rapidly. From the manufacture of 1 ton of cellulose, about 10 cub. m. of lye are obtained, containing, when the digestion is performed with indirect steam, 11·6 per cent. of dry substance. From such a lye there were recovered 5—6 grms. of sulphur dioxide per litre, the original waste lye containing 8·6 grms. per litre ; this corresponds to a recovery of 25—30 kilos. of sulphur per ton of pulp. There were also obtained, with a heating of 65 minutes, 74 grms. of dried lignin precipitate per litre ; the final waste liquor contained 0·19 per cent. of sugars. The cost of treatment is estimated at about 5 kr. (5s. 6d.) per ton of lignin. The quantity of lignin recovered is capable of furnishing the whole of the fuel requirements of the pulp mill. In addition, there are obtained 140—150 kilos. of commercial calcium sulphate per ton of cellulose produced.—J. F. B.

PATENTS.

Wood pulp ; Treatment of ——. B. T. Nase, Assignor to Stanley Paper Fiber Co., San Francisco, Cal. U.S. Pat. 1,061,316, May 13, 1913.

A PROCESS for removing the liquor from pulp after digesting, consisting in compressing the pulp, allowing it to expand, spraying on water at the moment of expansion, and finally compressing again to remove the washing water. The apparatus used comprises a series of disintegrators consisting of corrugated pressure rollers in combination with a digester and the necessary mechanism for feeding pulp and washing water, also means for evaporating and recovering the soda.—J. B.

Wood-pulp digester. J. C. W. Stanley, Assignor to Stanley Paper Fiber Co., San Francisco, Cal. U.S. Pat. 1,061,767, May 13, 1913.

A VERTICAL cylindrical digesting chamber has a feed opening at its upper and a discharge opening at its lower end, both closed by suitable covers. A perforated dome is arranged above the lower cover, and is provided with a perforated pipe with perforated horizontal and vertical branches, which extends upwards into the material in the vessel. The space below the perforated dome is connected with a supply of steam and compressed air so that either may be forced through the material in the digester. It is also connected with a cooler into which the liquid from the digester is discharged.—W. H. C.

Wadding from cellulose, closely resembling cotton wadding ; Process of manufacture of ——. C. Metenett et Cie. Fr. Pat. 452,088, Feb. 27, 1912.

CELLULOSE pulp is run in an extremely thin sheet on a tissue paper machine with single drying cylinder. The dried sheet of pulp is peeled off the cylinder by means of a doctor of special shape and reeled up between rollers to form a sheet of wadding of any desired thickness and of the size determined by the circumference of the collecting roll from which it is cut off from time to time.—J. F. B.

Celluloids and solutions of cellulose esters ; Manufacture of new non-inflammable and inflammable ——. H. Dreyfus. First Addition, dated Nov. 19, 1912, to Fr Pat. 432,264, July 15, 1911 (this J., 1912, 24).

IN the manufacture of solutions and plastic products from cellulose esters it is proposed to employ the products of the action of salts of phenolates or alcoholates upon the chloro derivatives of ethylene or acetylene. Such products may be prepared, for example, by evaporating a solution of sodium phenolate to dryness *in vacuo* and heating it with an excess of tetrachloroethane. According to the proportions used, mono- or poly-phenolic derivatives are obtained. Silicon and boron derivatives of phenols may also be used for the preparation of plastic masses ; such derivatives may be obtained by the acton of dry sodium phenolate upon silicon tetrachloride or boron trichloride, preferably suspended in a neutral medium such as benzene. —J. F. B.

Acetylcelluloses ; Process for modifying the solubility of ——. Chem. Fab. auf Actien, vorm. E. Schering, and A. Loose. Fr. Pat. 452,374, Nov. 16, 1912. Under Int. Conv., May 31, 1912.

CELLULOSE acetates soluble in chloroform and insoluble in, or but little affected, by acetone, and which contain 55—59 per cent. of combined acetic acid, are heated with aromatic amines, *e.g.*, aniline, at temperatures ranging from 90° to 220° C. A modification of the acetate gradually takes place, so that in the first stage it retains its solubility in chloroform but becomes soluble in acetone and in ethyl acetate. On further heating, the solubility of the substance in chloroform and ethyl acetate decreases, but it remains soluble in acetone and in a mixture of benzene and alcohol. At still later stages the substance becomes soluble in aqueous acetone or alcohol. These changes may be interrupted at any desired stage of solubility ; they take place more rapidly if a small quantity of a strong acid or the amine salt of such an acid be added to the aniline or other amine employed. Example : 20 parts of cellulose acetate are heated with 200 parts of aniline at 190° C. After 4—6 hours the product becomes soluble in acetone. If 0·2 part of aniline phosphate be added, the same result is obtained in 1 hour.—J. F. B.

Plastic masses and films ; Manufacture of non-inflammable ——. Soc. anon. Le Camphre. Fr. Pat. 452,432, March 6, 1912.

WHEREAS camphor itself is unsuitable for producing plastic masses with the non-inflammable esters of cellulose, *e.g.* cellulose acetate, formate, etc., and even imparts to these esters a certain degree of inflammability, the halogenated derivatives of camphor, particularly with the addition of phenols or derivatives of phenols, are suitable for reducing these esters to a plastic condition. The halogenated derivatives of camphor are themselves non-inflammable and may be employed also for reducing the inflammability of nitrocellulose masses, in which they are likewise capable of being used to produce a plastic condition.—J. F. B.

Pseudo-solutions of cellulose or its derivatives; Process for preparing —— suitable for making artificial silk, tulle, or films, or plastic masses. E. Berl. Ger. Pat. 259,248, June 11, 1912.

Cellulose or a derivative thereof is dissolved in 60—77 per cent. sulphuric acid at a temperature not exceeding —10° C.; the solutions thus obtained are coagulated by means of an aliphatic alcohol, such as methyl or ethyl alcohol or their solutions, or solutions of ammonium sulphate or other sulphates, or dilute sulphuric acid, these being also cooled to —10° C. or lower.—T. F. B.

Formylcelluloses; Process for the production of ——. E. Bronnert, Niedermorschweiler, Assignor to Verein Glanzstoff Fabriken A.-G., Elberfeld, Germany. U.S. Pat. 1,061,977, May 20, 1913.

See Addition of March 13, 1911, to Fr. Pat. 420,856 of 1910; this J., 1911, 1050.—T. F. B.

Cellulose formations; Process for producing ——. R. Linkmeyer, Bremen, Germany. U.S. Pat. 1,062,106, May 20, 1913.

See Eng. Pat. 11,700 of 1909; this J., 1909, 1246.—T.F.B.

Cellulose; Process for the preparation of concentrated solutions of ——. A. Chaumat, Fresnoy-le-Grand, Assignor to Comp. Franç. des Applications de la Cellulose, Paris. U.S. Pat. 1,062,222, May 20, 1913.

See Fr. Pat. 429,841 of 1910; this J., 1911, 1308.—T.F.B.

Paper pulp; Process for producing ——. W. Hellwig. Fr. Pat. 451,957, Dec. 16, 1912. Under Int. Conv., Dec. 18, 1911.

See Eng. Pat. 28,489 of 1911; this J., 1912, 1075.—T.F.B.

Wood and analogous materials; Process for disintegrating ——, for obtaining useful products. R. von Walther, Fr. Pat. 452,336, Dec. 24, 1912.

See Ger. Pat. 258,180 of 1912; this J., 1913, 597.—T.F.B.

Black liquors of soda-pulp mills; Process of precipitating ulmic [humic] compounds from the ——. N. A. Langlet, Gottenborg, Sweden. U.S. Pat. 1,062,016, May 20, 1913.

See Fr. Pat. 406,744 of 1909; this J., 1910, 556.—T.F.B.

Process of treating maize. [Sugar and paper pulp.] Fr. Pat. 451,961. *See* XVII.

Combination of substances for use as a cattle-food or for insulating purposes, and for the preparation of coated fabrics and artificial boards. Eng. Pat. 17,554. *See* XIXa.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Patents.

Threads; Apparatus for treating ——. C. S. Althouse, Reading, Pa. U.S. Pat. 1,061,652, May 13, 1913.

The thread is passed through a tube along which flows also the liquid with which it is being treated. As the thread emerges from the lower end of the tube it meets a travelling band which picks it up and sheds the liquid. From the travelling band or separator the thread is brought into contact with another stream of liquid and into another tube, after which it is separated as before.—J. B.

Vegetable fibres; Treating ——. R. R. Roberts, Assignor to E. E. Allwine, Washington, D.C. U.S. Pat. 1,062,187, May 20, 1913.

The fibrous material is boiled under pressure, in an alkaline solution containing ammonia, animal fat and soap, then washed, and subsequently treated under pressure, in a boiling solution containing "borated" soap, vegetable oil and oleic acid.—B. N.

Silk hanks; Apparatus for treating —— in a froth of soap or other substance. Färberei u. Appretur-Ges. vorm. A. Clavel and F. Lindenmeyer. Third Addition, dated Feb. 22, 1912, to Fr. Pat. 387,796, Feb. 19, 1908 (this J., 1908, 854; 1911, 950).

An arrangement is described for holding the reels in an upwardly inclined position while the hanks are being placed on or taken off. It consists of an elbow-lever pivoted on the side of the tank, which on being depressed raises the reel to an inclined position and is there locked by a hook at its lower end engaging with a hook on a smaller elbow-lever pivoted to the tank below it. On further depressing the large lever, a tail-piece extending from its lower end knocks against a trigger which raises the free end of the smaller lever thereby disengaging the hooks and allowing the reel to be dropped to the horizontal position.—J.F.B.

Silk; Process for fixing or rendering insoluble the sericin on the fibroin of ——. Färberei und Appretur-Ges. vorm. A. Clavel and F. Lindenmeyer. Fr. Pat. 451,897 Feb. 22, 1912.

Raw silk, souple or half-boiled-off silk or imperfectly de-gummed silk, in the form of yarn, fabrics or knitted goods, is treated with a solution containing formaldehyde and a weak acid, for instance, a bath containing 11 per cent. of 40 per cent. formaldehyde, 15 per cent. of a 50 per cent. aqueous solution of lactic acid, 4 per cent. of crystal alum and 70 per cent. of water. The silk, after steeping, is drained and dried at about 60° C. for 5—6 hours in an atmosphere rendered as dry as possible by the presence of sulphuric acid or the like. The brilliance of silk thus treated may be enhanced by treatment whilst under tension in hot soap baths, either in the liquid or in the froth.—J. F. B.

Dyeing, impregnation, application of preparations, etc.; Improvement of the initial and final operations in ——. R. von Walther. Fr. Pat. 452,583, Dec. 17, 1912. Under Int. Conv., Jan. 6, 1912.

In the impregnation of tissues by aqueous salt solutions, by salts in suspension, by mordants, by caustic materials or other preparations, or in the initial and final operations of dyeing, finishing, etc., an improvement in the action is obtained by the co-operating action of saponin or of substances acting in an analogous manner.—B. N.

Colouring matters, pigments or metallic powders on fabrics; Fixation of —— by means of condensation products of formaldehyde with phenols, amines or their derivatives. Soc. de la Manufacture D'Indiennes E. Zundel à Moscou. Fr. Pat. 452,677, Dec. 16, 1912.

The condensation products of formaldehyde with phenols, amines or their derivatives serve to fix colouring matters both on vegetable and animal fibres. Instead of incorporating the condensation product with the colouring matter, the separate components may be mixed with it, so that on steaming the condensation takes place, thus fixing the colour.—B. N.

Dyeings on cotton fast to washing; Process for producing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 259,700, Dec. 20, 1911.

Cotton is dyed with a dyestuff containing 1-amino-2-naphthyloxyacetic acid or 2-aminophenyloxyacetic acid, and having a meta alkyl or alkyloxy group in the end position, but having no sulphonic or carboxyl group other than the above acetic acid grouping, and is finally treated with hot dilute acid. Dyeings fast to washing and to chlorine are produced.—T. F. B.

Brown shades on vegetable fibres in dyeing and printing ; Process for producing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 259,701, Aug. 3, 1912.

Fibres dyed with the nitro- or amino-compounds obtained according to Ger. Pat. 175,067 (*e.g.*, by nitrating dimethyldianthraquinonyl, and reducing to produce the amino compound) are treated with an oxidising agent, such as bleaching powder, persulphate, potassium bichromate, or nitrous acid ; where nitrous acid is used, the shades may be further modified by treatment with a phenol or an aromatic amine.—T. F. B.

Dyeing Aniline Black ; Process for ——. J. Steynis. Ger. Pat. 259,823, Jan. 4, 1912.

Fibres impregnated with the usual Aniline Black mixture are treated with ozone ; the impregnated fibres may be dried, and then moistened before or during the treatment with ozone. A catalytic agent may be added to the Aniline Black mixture. This process is stated to produce excellent results on spun goods, such as silk and cotton, or mixtures of silk, cotton, and wool.—T. F. B.

Calico printing and like machines. F. Walker, Accrington. Eng. Pat. 14,319, June 19, 1912.

The "wash blanket" used in calico printing machines for absorbing the excess of colour, is made from a suitably finished two-ply fabric, with a wool face and a silk back. —B. N.

Grey shades in calico printing ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 258,979 and 259,293, May 14, 1912. Additions to Ger. Pat. 253,293 (see Eng. Pat. 9510 of 1912 : this J., 1912, 1176).

In place of using a chromium compound for developing the dyestuff from the isatin derivative and the naphthol or anthrol, a salt of another metal, such as iron, nickel, cobalt, or copper may be used. In either case, a reducing agent, *e.g.*, Rongalite C., may also be added to the printing paste, to produce grey effects on dischargeable dyeings.—T. F. B.

Discharging dyed goods by means of sulphoxylates ; Process for ——. L. Cassella und Co. Ger. Pat. 259,699, May 10, 1912.

After being printed with the sulphoxylate discharge paste, the goods are passed through a hot, very dilute solution of an acid, *e.g.*, sulphuric acid. An advantage of this process is that no steaming is required.—T. F. B.

Finishing textile fabrics ; Machines for ——. J. B. Whiteley, W. Peace and J. E. Bradshaw, Huddersfield. Eng. Pat. 21,681, Sept. 24, 1912.

A radiator tube and an outlet tube for condensed water are fitted inside the perforated roller used for steam-blowing textiles, so that a preliminary heating is possible and condensation is reduced to a minimum.—J. B.

Metal coatings upon materials of organic origin [textiles, etc.] ; Process of producing ——. R. Rafn, Nürnberg, Germany. Eng. Pat. 23,959, Oct. 19, 1912. Under Int. Conv., Oct. 21, 1911.

The organic materials, for instance yarn, textile fabrics, feathers, etc., are passed in a vacuum through an electric field of such intensity that the metal of one of the electrodes is disintegrated and deposited on the organic material. Portions of the organic material may be protected by suitable screens.—W. H. C.

Textile fibres ; Metallisation of ——. E. Dannhauser. Fr. Pat. 452,727, March 15, 1912.

The material is immersed in a bath composed of metallic powder with a liquid agglutinant. The first bath contains casein and borax dissolved in water, the second and third being similar but with metallic powder in suspension, and the fourth bath consists of collodion containing about 6 per cent. of amyl acetate.—B. N.

Stains ; Product for removing ——. H. and O. Ockelmann. Ger. Pat. 259,360, Dec. 14, 1911.

A solution of sugar, an alkali, and alcohol in water, with or without addition of turpentine or a turpentine substitute, is used for removing stains from fabrics. The sugar is stated to have a powerful action in this respect, and also to prevent the destruction of the dye by the alkali.—T.F.B.

Fabric ; Apparatus for treating [bleaching] —— with liquids. W. Mathesius and M. Freiberger, Charlottenburg, Germany. U.S. Pat. 1,062,245, May 20, 1913.

See Eng. Pat. 28,485 of 1911 ; this J., 1913, 20.—T. F. B.

Dyeing vegetable fibrous material [with azo dyestuffs]. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 25,239, Nov. 4, 1912. Under Int. Conv., Dec. 19, 1911.

See Ger. Pat. 259,700 of 1911 ; preceding.—T. F. B.

Dyeing hairs, furs, feathers, etc., in grey shades. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 452,735, March 16, 1912.

See Eng. Pat. 7245 of 1912 ; this J., 1912, 681.—T. F. B.

Printing fabrics with vat dyestuffs of the anthraquinone series ; Process for ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,974, Dec. 16, 1912. Under Int. Conv., Dec. 23, 1911.

See Eng. Pat. 22,201 of 1912 ; this J., 1913, 531.—T. F. B.

Grey to black shades on vegetable fibres ; Process for producing —— by printing. Badische Anilin und Soda Fabrik. Fr. Pat. 452,410, Dec. 26, 1912. Under Int. Conv., April 25, 1912.

See Ger. Pat. 258,293 of 1912 ; this J., 1913, 484.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Exports of phosphates from Egypt. Board of Trade Journal, June 12, 1913. [T.R.]

The exportation of phosphates from the Red Sea littoral is developing rapidly, the figures being 52,100 tons, valued at £E.43,500, as against 4900 tons, valued at £E.4,000, in 1911.

£E. = £1 0s. 6½d.

Hypophosphorous acid and hypophosphites ; Volumetric determination of ——. L. Marino and A. Pellegrini. Gaz. chim. ital., 1913, **43**, I., 494—497.

Hypophosphorous acid may be readily determined by oxidation with permanganate in alkaline solution. A known quantity of the hypophosphite, in dilute solution, is neutralised with a solution containing 20—25 grms. of potassium carbonate and 0·4 grm. of potassium hydroxide per litre, and a further quantity of the alkali solution is added, equal in volume to the known excess of $N/10$ permanganate subsequently used. The solution is now heated to boiling, treated with the known excess of permanganate, then acidified with sulphuric acid (1 : 3), and the excess of permanganate titrated with $N/10$ oxalic acid.—A. S.

Hypochlorites; Titration of ——. F. Ducelliez. Bull. Soc. Chim., 1913, **13**, 494—497.

Two grms. of finely ground bleaching powder and 50 c.c. of boiled water are introduced into a test-tube, which is connected by means of a rubber tube with a measuring vessel, inverted under water, the water inside and outside the measuring vessel is brought to the same level, and the volume of air in the vessel is noted. 0·05 grm. of cobalt chloride is then introduced into the test-tube and the latter is placed in boiling water for half an hour, after which it is cooled, the water in the tube, the measuring vessel, and the vessel surrounding it, is brought to a common level, and the volume of the oxygen, which has been evolved, is measured, corrections being made for temperature, tension of aqueous vapour, and barometric pressure. An additional correction is necessary for the volume of oxygen absorbed in oxidising the precipitated cobaltous oxide to cobalt sesquioxide, which amounts to +1·2 c.c. in the case in question, the corrected volume of oxygen then representing the volume of available chlorine in the weight of substance examined.—O. R.

Ammonium and alkali nitrates and nitrites, and the corresponding salts of some substituted ammonium compounds; Behaviour of —— *towards reducing agents.* W. Vaubel. Chem.-Zeit., 1913, **37**, 637—638.

No separation of sulphur is found to occur on passing hydrogen sulphide into aqueous solutions of nitrates of ammonium, sodium, potassium, calcium, aniline and *p*-toluidine, when acidified with hydrochloric acid, and it is suggested that a distribution of the base between the two acids, according to the usual laws, cannot in this case take place, and that free nitric acid is not present in the solutions. The method of neutralising free nitric acid with ammonia and then acidifying with hydrochloric acid before passing hydrogen sulphide, is recommended for preventing the separation of sulphur in the course of qualitative analysis, instead of the usual method of evaporation. The reducing action of metals on ammonium and alkali nitrates, yields nitrites in all cases with the exception of that of iron. Here too, under special conditions fleeting traces of nitrites could sometimes be detected but, in contradiction to the statement of Kaufmann (this J., 1901, 999), ammonia is quantitatively formed as the final product of the reaction. The concomitant oxidation of the iron results variously in the deposition of oxides, and in the formation of yellow to red solutions in which iron cannot be identified by the ordinary reagents but from which it separates as oxides on concentration. Solutions of aniline or *p*-toluidine nitrate are converted by iron first into nitrites, and eventually diazo-amino-compounds separate out. (See also Hodgkinson, this J., 1913, 519.)—G. F. M.

Baryta; Technical preparation of ——. *Parts I, II, and III.* L. Marino and D. Danesi. Gaz. chim. ital., 1913, **43**, I., 416—439.

The object of the investigation was to devise a method for the conversion of barium sulphate at a low cost into baryta for use in the desaccharification of molasses. The present communications deal with the conversion of the barium sulphate into sulphide. It is shown that reduction may be effected by various gaseous reducing agents and that per ton of barium sulphide produced, the cost of fuel (for reduction and for maintaining the requisite temperature) is Lire 18·25 (14s. 6d.) less when water-gas (at 600°—625° C.) is employed than by the known method of reduction with solid carbon. Moreover with the gaseous reducing agent, a purer product is obtained in a shorter time, and less labour is required. It is recommended that a long rotary furnace of iron, lined with refractory material, and slightly inclined to the horizontal, be employed, water-gas freed from carbon dioxide being used both as reducing agent and heating agent. (A detailed description of a small experimental furnace of this type is given.) Working at a temperature of 600°—650° C., the size of the discharge opening and the speed of rotation of the furnace are so regulated that the barium sulphate remains in the furnace for 1 hour; a yield of 95—98 per cent. of barium sulphide is obtained. The escaping gases contain only traces of hydrogen sulphide. Strontium sulphate and calcium sulphate can be reduced in a similar manner, but somewhat higher temperatures are necessary, and in the case of calcium sulphate small quantities, and in that of strontium sulphate, traces, of oxide and thiosulphate are formed in addition to sulphide.—A. S.

Calcium oxide, boric acid, and water; The system —— *at* 30° *C.* U. Sborgi. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 636—642, 715—719.

The investigation was carried out on the same lines as in the case of the system, ammonia, boric acid, and water (this J., 1913, 230). In some of the experiments mixtures of lime, boric acid and water were used, and in other mixtures of calcium metaborate ($CaO,B_2O_3,6H_2O$) with either lime and water or boric acid and water. With mixtures of lime and boric acid equilibrium was not attained even after a long time, except when the quantity of boric acid was sufficient or more than sufficient to form the triborate. In the experiments in which equilibrium was not attained amorphous products separated. Using calcium metaborate, equilibrium was attained more quickly. The detailed results of the experiments are tabulated. Starting with lime, boric acid, and water, in the experiments in which a stable equilibrium was attained, the only compound of lime and boric acid which separated as a solid phase was the triborate. In the experiments in which the metaborate was used, there were obtained as solid phases the compounds, $2CaO, 3B_2O_3, 9H_2O$ and $CaO, 3B_2O_3, 12H_2O$, in addition to lime, the metaborate, and boric acid.—A. S.

Chromic oxide; Iodometric determination of free and combined ——. M. Gröger. Z. anorg. Chem., 1913, **81**, 233—242.

The sample, containing not more than 0·3 grm. of chromic oxide, is heated on the water-bath with 10 c.c. of nitric acid (sp. gr. 1·4), and 1 grm. of potassium chlorate is added in small portions during one hour, after which the liquid is further heated for one hour to drive off all the chlorine, allowed to cool, and diluted to 250 c.c. To 50 c.c. of the diluted solution, 50 c.c. of dilute sulphuric acid (40 c.c. of acid of sp. gr. 1·84 per litre) and 10 c.c. of potassium iodide solution (1 : 10) are added, the mixture is covered with a clock-glass, allowed to stand for 5 minutes, diluted to 100 c.c. and titrated with $N/10$ sodium thiosulphate. Control analyses carried out with pure chromic oxide gave results varying from 99·8 to 100·7 per cent., the same degree of accuracy being obtained in the presence of most other metals with the exception of manganese. In the presence of iron or copper, the diluted solution is boiled with caustic potash to remove ferric and cupric hydroxides, before proceeding with the separation of iodine. In the case of (artificial) chromites, heating with nitric acid for 2 hours, with the addition of 1·5 grms. of potassium chlorate, sufficed for complete solution. The method was not available for chrome iron ore, which was not entirely dissolved by nitric acid in 4 hours with the addition of 4 grms. of potassium chlorate.—O. R.

Platinum chlorides; Range of stability of the four anhydrous ——. *Volatility of platinum in gaseous chlorine. Preparation of oxygen-free chlorine.* L. Wöhler and S. Streicher. Ber., 1913, **46**, 1591—1597.

In a stream of chlorine at 1 atmosphere pressure the temperatures of formation and decomposition of the four platinum chlorides are—tetrachloride 370° C. (364°—374°), trichloride 435° C. (430°—440°), dichloride 582° C. (it is stable, but rapidly volatilises, at 560°, and loses chlorine rapidly at 590°), monochloride 582° C. (same as dichloride, but exists only over a narrow range, 581°—583°). The monochloride certainly exists, though it was not possible to free it completely from dichloride and from metal. The volatility of the metal in chlorine was studied: it was found that the chlorides might exist in the vapourous condition at temperatures outside of their range of existence as solids. Contrary to Wedekind (this J., 1909, 424), the authors find that chlorine prepared from hydrochloric acid and permanganate always contains oxygen, and that to obtain a gas free from oxygen, hydrated manganese peroxide must be used.—J. T. D.

Radium-barium-chlorides ; Purification and enrichment of ——, by fractional precipitation with hydrochloric acid. E. Ebler and W. Bender. Ber., 1913, **46**, 1571—1573.

WHEN hydrochloric acid gas is led into mixtures of barium and radium chlorides till precipitation begins, the first fractions precipitated are richer in radium than the later ones; and practically the whole of the radium is precipitated before three-quarters of the barium is. This method of enrichment presents great advantages, from every point of view, over fractional precipitation as sulphate.—J. T. D.

Potassium ; Reduction of certain volatile halogen compounds by means of powdered ——. A. C. Vournasos. Z. anorg. Chem., 1913, **81**, 364—368.

CERTAIN halogen compounds, such as the chlorides of phosphorus, arsenic, antimony, bismuth, tin, and titanium, are readily reduced to the elementary state, when heated with potassium powder under toluene or xylene. The potassium powder is prepared as follows: a clean regulus of the metal, obtained by fusing it twice or oftener under neutral paraffin, is fused, mixed with 500 grms. of boiling toluene, and introduced into a litre flask, which has been heated to 100° C. The flask is rapidly closed with a ground glass stopper, wrapped in a cloth, and violently agitated until its contents are cool, whereby the potassium is reduced to a very fine state of division.—O. R.

Oxygen wanted in Canada. Board of Trade Journal. June 12, 1913. [T.R.]

INQUIRY is made for the names of U.K. manufacturers of oxygen able to ship immediately to Quebec in cylinders, the quick return of which is promised. Full quotations required. Apply to the High Commissioner for Canada, 17, Victoria Street, London, S.W.

(1) *Ozone in aqueous solution ; Rate of decomposition of ——.* (2) *Determination of ozone and hydrogen peroxide.* V. Rothmund and A. Burgstaller. Monatsh. Chem., 1913, **34**, 665—704.

(1) A STUDY of the decomposition of relatively strong solutions of ozone in dilute acids (see this J., 1912., 1030) at 0° C. has shown that, in all cases, oxygen is the sole ultimate product, though the rate of decomposition, under apparently identical conditions, varies widely. In alkaline (sodium carbonate) solution the same irregularities are not observed. Decomposition is slow in relatively acid solutions, but the speed increases as the concentration of the hydrogen ions is reduced, although not in the same proportion. The ozone concentration of the solution is ascertained by allowing it to react with potassium iodide in presence of sodium carbonate, and then acidifying and titrating with thiosulphate. (2) Hydrogen peroxide may be accurately determined by the iodometric method, in the presence of molybdic acid as catalyst, and the method is suitable also for the estimation of ozone (see above), but it cannot be applied when both these substances are present together. This may be done, however, by allowing the solution to react first with potassium bromide in the following manner. The faintly acid solution (about 0·01 N) is treated at 0° C., in a stoppered vessel, with potassium bromide (sufficient to ensure the ultimate presence of about 1 per cent.), and then rather more potassium iodide is added than corresponds to the ozone present (about 3 c.c. of $N/10$ iodide generally suffices), and the liberated iodine is titrated with $N/100$ thiosulphate. This gives the amount of ozone, and the hydrogen peroxide is determined by subsequently adding 10 c.c. of $N/2$ potassium iodide, 1 c.c. of $N/10$ ammonium molybdate, and 15 c.c. of dilute sulphuric acid (1 : 5), and, after 5 minutes, again titrating with thiosulphate.—F. SODN.

Graphite [and boneblack] ; Colloidal suspensions of ——. H. L. Doyle. J. Phys. Chem., 1913, **17**, 390—401.

THE experiments were made with Acheson graphite and with a commercial boneblack yielding 83·5 per cent. of ash. In general the graphite or boneblack was ground with a small quantity of the suspending medium and then diluted. An aqueous solution of sodium oleate proved capable of holding the boneblack and graphite in suspension; concentrated solutions of sugar or gelatin had only a slight effect. A sample of dried "aquadag" was found to contain 3·2 per cent. Fe_2O_3 and 1·2 per cent. Cu (total ash, 8 per cent.). A hydrolysed solution of ferric chloride proved fairly effective in holding boneblack and graphite in suspension. A good aqueous suspension of graphite was obtained by using a solution of casein in sodium phosphate, and also by using an ammoniacal suspension of catechu and then shaking with iron filings and air. Better suspensions of catechu were obtained by adding ammonia before heating the catechu with water, than when ammonia was added after the heating. For suspending graphite in "machine oil," the best results were obtained by use of an iron soap prepared by heating ferric chloride solution with sodium oleate (no water should be present) or of magnesium or sodium oleate (15 c.c. of oil, 0·1 grm. of magnesium or sodium oleate, and 1 drop of water). Fairly good results were obtained by use of a gummy product prepared by heating paraffin for about 100 hours in the air.—A. S.

Graphite industry of Madagascar. Board of Trade Journal, June 12, 1913. [T.R.]

H.M. CONSUL at Antananarivo reports, on the authority of the Chief of the Mining Department of Madagascar, that the graphite industry in the island is making considerable progress, the quantity exported during the first quarter of this year amounting to 980 kilogs., as compared with 474 kilogs. during the corresponding period of last year, and 259 kilogs. for the corresponding period in 1911. It is believed that by 1916 the quantity exported will reach 20 metric tons annually.

Argon and its place in nature. Sir W. Ramsay. Chem. Society of Rome, June 2, 1913. Chem. Trade J., 1913, **52**, 595.

AFTER referring to earlier work on the action of niton (radium emanation) on various substances, and the formation of helium and neon by the bombardment of the glass of a vacuum tube by cathode rays in the presence of hydrogen (this J., 1913, 231), the author stated that he had confirmed the results of Collie and Patterson, and believed that under the experimental conditions, dry hydrogen polymerised into helium, whilst for the formation of neon oxygen was necessary; this might be derived from moisture or from the bombarded glass. On allowing the electric discharge to pass for 5 or 6 hours between an aluminium cathode and an anode of aluminium coated with sulphur in a vacuum tube into which dry hydrogen was introduced, evidence was obtained of the formation of argon, but no trace of neon or helium could be detected. In an analogous experiment, using selenium instead of sulphur, the gas after the experiment, when examined spectroscopically, showed very faintly the characteristic yellow and green lines of krypton.—A. S.

PATENTS.

Oxides of nitrogen or of nitrogen and sulphur ; Process for the continuous production of —— from gaseous mixtures containing nitrogen and oxygen, or nitrogen, oxygen, and sulphur compounds. O. Bender. Ger. Pat. 258,935, Jan. 31, 1912.

IN the production of oxides of nitrogen by means of flames burning under pressure, fuels which form large quantities of water on burning are used, and air is employed as the mixture of nitrogen and oxygen. The air is supplied in such quantities, and the velocity of the gases in the combustion chamber is so regulated, that with an excess of oxygen of 7—10 per cent., the combustion gases contain 11—14 per cent. by vol. of carbon dioxide. Steam is introduced for the conversion of any sulphur compounds present into sulphuric acid.—A. S.

Lead oxide in the form of an impalpable powder ; Apparatus for the continuous production of ——. E. Weil. Ger. Pat. 259,104, April 1, 1911.

In the production of lead oxide by the action of a mixture of superheated steam and air on molten lead kept in agitation, the reaction-chamber is provided with a series of gratings against which the crusts and lumps of oxide, mixed with metal, floating on the surface of the molten lead, are pressed by the slowly rotating agitator.—A. S.

Salt-boiling installation with shallow pans. Königlich Württembergische Saline Friedrichshall. Ger. Pat. 259,152, May 29, 1912.

The sides of the pans where the solid salt is removed are inclined and have raised rounded rims. The salt is removed by means of rakes fixed to long wooden handles and is transferred to mechanical conveyors which discharge it directly into draining wagons, whence it passes to a centrifugal dryer.—A. S.

Calcium-magnesium carbonate ; Process for the preparation of a basic —— *by the action of gases containing carbon dioxide on milk of lime containing magnesia.* G. Rossetti and E. Rodolfo. Ger. Pat. 259,627, Nov. 16, 1911.

Milk of lime containing about 10 parts of unslaked magnesian lime to 100 parts of water is treated with gases containing carbon dioxide under such conditions that the partial pressure of the carbon dioxide is about 0·4 atmosphere, the temperature being so regulated that it is about 50° C. at the end of the reaction. The product is cheaper than the light basic magnesium carbonate prepared by Pattinson's process and is an efficient substitute for the latter.—A. S.

Nitrogen compounds of tungsten ; Preparation of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 259,647, Dec. 21, 1911. Addition to Ger. Pat. 246,554.

The process described in the chief patent and the earlier addition thereto (see Eng. Pat. 12,662 of 1911 ; this J., 1912, 431) for the preparation of nitrogen compounds of molybdenum, may also be applied to the preparation of nitrogen compounds of tungsten.—A. S.

Nitrogen compounds of molybdenum ; Preparation of —— *from its oxygen compounds.* Badische Anilin und Soda Fabrik. Ger. Pats. 259,648 and 259,649, Jan. 31, 1912. Additions to Ger. Pat. 246,554.

(1). The process described previously (see Eng. Pat. 12,662 of 1911 ; this J., 1912, 431) is modified in that the action of reducing gases on the oxygen compounds of molybdenum is caused to take place at temperatures not appreciably exceeding 1000° C., and the subsequent treatment with nitrogen is effected at atmospheric pressure. (2). The several modifications of the process are carried out in presence of catalysts, *e.g.*, iron, cobalt, nickel, or their compounds.—A. S.

Polysulphides ; Production of odourless preparations of ——. C. Thieme. Ger. Pat. 259,650, Aug. 6, 1912.

Polysulphides are treated with starch or amylaceous materials in presence of water. It is stated that the alkalinity of the polysulphides is diminished and the evolution of hydrogen sulphide prevented.—A. S.

Ammonium nitrate ; Preparation of —— *from ammonium sulphate and sodium nitrate.* E. Naumann. Ger. Pat. 259,995, May 16, 1911.

The mixture of ammonium nitrate and ammonium-sodium sulphate obtained in the fractional crystallisation and by strong cooling of the mother-liquors is mixed with hot mother-liquors relatively poor in ammonium nitrate under such conditions that a solution saturated with ammonium nitrate at 25°—55° C. is obtained, from which after removal of the separated double salt of ammonium sulphate and nitrate, ammonium nitrate is recovered by cooling to the ordinary temperature, with or without addition of water. The double salt of ammonium sulphate and nitrate may be used in place of, or in addition to, the mixture of ammonium nitrate and ammonium-sodium sulphate, but in this case the treatment is first effected at 75° C., at which temperature the double salt of ammonium sulphate and nitrate is decomposed. After removal of the separated ammonium sulphate, the further treatment is as described above.—A. S.

Hydrogen ; Process for obtaining ——, *together with carbon dioxide from carbon and water.* F. Bergius. Ger. Pat. 259,030, June 24, 1911.

Liquid water at a high temperature is caused to act upon carbon in presence of a catalyst soluble in water. For example, 100 kilos. of coke and 200 kilos. of water containing in solution 1 kilo. of thallium chloride are placed in a strong iron vessel provided with a valve, and the vessel is heated to 340° C. The mixture of hydrogen and carbon dioxide which collects in the upper part of the vessel, is blown off through the valve at intervals of half an hour, and the carbon dioxide is absorbed by lime. Under the conditions described a daily production of about 5 cb. m. of pure hydrogen is possible.—A. S.

Graphite ; Process for the preparation of ——. G. Rupprecht. Ger. Pat. 259,424, Sept. 6, 1911.

The crude material is freed from pyrites and other heavy gangue-constituents by washing on tables in the known manner, and is then subjected to an oil-flotation process, whereby it is separated from the other gangue-constituents not capable of being coated with oil.—A. S.

Oxygen ; Mixture containing a chlorate or perchlorate and a metal, metallic oxide or metallic carbonate, which evolves —— *on heating.* C. Zeiss. Ger. Pat. 259,575, Feb. 3, 1912.

The metal used, preferably in the form of its oxide, hydroxide or carbonate, is one which in its highest stage of oxidation does not possess the character of an acid and the chloride of which is not decomposed at the temperature at which oxygen is evolved from the mixture. Barium in the form of its oxide, peroxide, or hydroxide is specially suitable. It is stated that in this way the chlorine content of the oxygen (usually at least 0·2 per cent.) can be easily reduced to 0·01 per cent.—A. S.

Nitrogen and oxygen gases ; Effecting oxidation of mixed ——. F. Russ and L. V. Ehrlich, Vienna. Eng. Pat. 10,992, May 8, 1912. Under Int. Conv., May 10, 1911.

See Fr. Pat. 443,620 of 1912 ; this J., 1912, 1031.—T. F. B.

Ammonia from aluminium cyanonitride ; Manufacture of ——. S. Peacock, Philadelphia, U.S.A. Eng. Pat. 11,391, May 13, 1912.

See U.S. Pat. 1,031,582 of 1912 ; this J., 1912, 773.—T.F.B.

Aluminium, carbon, and nitrogen ; Manufacture of compounds of or compositions of matter consisting of ——. S. Peacock, Philadelphia, U.S.A. Eng. Pat. 11,393, May 13, 1912.

See U.S. Pat. 1,031,581 of 1912 ; this J., 1912, 773.—T.F.B.

Aluminium, carbon, and nitrogen ; Manufacture of compounds of ——. S. Peacock, Philadelphia, U.S.A. Eng. Pat. 11,395, May 13, 1912.

See U.S. Pat. 1,035,727 of 1912 ; this J., 1912, 875.—T.F.B.

Sulphur from smelter-gases ; Process of obtaining ——. H. Sanborn, H. G. McMahon, and J. T. Overbury, San Francisco, and S. W. Young, Palo Alto, Assignors to The Thiogen Co., San Francisco. U.S. Pat. 1,062,120, May 20, 1913.

See Eng. Pat. 18,202 of 1911 ; this J., 1912, 287.—T. F. B.

Sulphur ; Process for extracting —— *from mixtures containing tarry matter.* Chance and Hunt, Ltd. Fr. Pat. 452,034, Dec. 18, 1912.

See Eng. Pat. 8097 of 1912 ; this J., 1913, 602.—T. F. B.

Monozinc formaldehyde sulphoxylate; Crystalline ——. M. Bazlen, E. Rieger, and T. Wohlfahrt, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,063,004, May 27, 1913.

See Eng. Pat. 12,157 of 1911; this J., 1912, 72.—T. F. B.

Ammonium sulphate; Production of ——. C. Bosch, A. Mittasch, and L. Hecht, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,063,007, May 27, 1913.

See Eng. Pats. 12,845 and 14,114 of 1912; this J., 1913, 363.—T. F. B.

Alkali hydroxides; Direct preparation of —— *by treating alkali chlorides with lead hydroxide.* J. Kersten. Fr. Pat. 452,544, Oct. 7, 1912.

See Ger. Pat. 255,688 of 1911; this J., 1913, 424.—T. F. B.

Salt; Manufacture of ——. International Salt Co., Ltd. Fr. Pat. 452,758, Dec. 19, 1912.

See Eng. Pat. 20,706 of 1911; this J., 1912, 773.—T. F. B

Process for the direct recovery of ammonia from distillation gases. Ger. Pat. 258,975. *See* IIa.

Process for obtaining ammonia from distillation gases. Ger. Pat. 259,630. *See* IIa.

Process for the separate recovery of volatile and fixed ammonia from hot crude gases. Ger. Pat. 259,817. *See* IIa.

New application of [*iron-boron, etc.*] *alloys* [*for apparatus resistant to chlorine*]. Fr. Pat. 451,903. *See* X.

Electric furnace for fixing nitrogen from the air. Eng. Pat. 866. *See* XI.

VIII.—GLASS; CERAMICS

Volume alteration of ceramic raw materials in burning. II. Silica. R. Rieke and K. Endell. Silikat-Zeits., 1913, **1**, 48—52, 67—72, 85—89.

Volume alteration may occur from three causes: transformation from a crystalline into the amorphous state, decomposition into new substances, and transformation into another crystalline system. Felspar belongs to the first of these types, kaolin to the second, and quartz to the last. The authors describe the behaviour of various forms of silica during heating (this J., 1912, 983) and apply the results to practical ceramics. Different sources of raw material, such as the interchange of flint and quartz, without doubt affect the behaviour of the body, quite apart from their degree of subdivision, and the case may be further complicated by transformation from one form of silica into another during burning. The action of glaze on body is greater when the latter is compounded with flint than with quartz or cristobalite. Numerous references to previous investigations are given.—H. H. S.

Patents.

Furnace for the fusion of glass and metals; Tilting ——. J. Lambot. Fr. Pat. 452,578, March 9, 1912.

The furnace can be tilted in two directions, for removing slag, and for tapping respectively. Communication between the gas and air flues of the furnace and the conduits of the regenerating chamber is ensured, during the tilting of the furnace, by means of special coverings, comprising a kind of muff, arranged in the upper part of each conduit and with which the lower portion of the flue engages; the opening of the shutter or partition is kept in contact with the walls of the muff to ensure that the space is gas-tight during inclination of the flue over the conduit, the muff or one of its walls being removable or jointed.—W. C. H.

Furnace; Electric —— *for the continuous manufacture of glass.* M. Sauvageon, Colombes, France. U.S. Pat. 1,062,362, May 20, 1913.

See Fr. Pat. 401,744 of 1908; this J., 1909, 1200.—T. F. B.

Glass; Preparation of a liquid for cleaning ——. H. Schrœr. Fr. Pat. 452,516, Dec. 30, 1912. Under Int. Conv., Oct. 28, 1912.

See Eng. Pat. 222 of 1913; this J., 1913, 488.—T. F. B.

Preparation of a tridymite-filter. Ger. Pat. 259,910. *See* I.

IX.—BUILDING MATERIALS.

Trass; Hardening process of ——. P. Rohland. Silikat-Zeits., 1913, **1**, 89—90.

The author suggests classifying binding materials as pneumatic or hydraulic, according to whether their hardening is due to other causes or to colloids. In the first class are lime, where the action is carbonate formation, and plaster, where hydration takes place. The second class comprises trass, puzzuolana, and Roman and Portland cements. The amount of combined water in trass may vary from 2·8 to 12·7 per cent.; it is all expelled at red heat, the hardening capacity of trass being thereby lost. This loss of water may occur slowly in the natural condition in outcrops, for which reason trass from the deeper strata is more suitable as binding material. The content of chemically combined water is a measure of the hardening capacity. Sea-water is detrimental to cements through the action of magnesium salts and of sodium chloride on the lime, but the action gradually lessens as a protective coating of colloids is formed. The hardening of trass is a process of coagulation.—H. H. S.

Lime-trass-cement mortars; Effect of filling materials on the hardening (*strength*) *of* ——. H. Burchartz. Mitt. Kgl. Materialprüfungsamt, 1913, **31**, 69—79.

Various bituminous products, in the form of liquids, pastes, and emulsions, as well as alum and potash soap, were added to the mortars, both by application to the set mortars and by incorporation with the wet mixtures. All the protective materials which were tried, had a detrimental and retarding effect on the mortars.—O. R.

Mortars and concretes; Effect of the addition of trass, as well as of gauging with lime-water and soap solution on the strength and watertightness of ——. H. Burchartz. Mitt. Kgl. Materialprüfungsamt, 1913, **31**, 80—92.

The addition of trass slightly retards the setting of mortars and concretes, increases their watertightness, greatly increases the strength of mixtures gauged with lime-water, and militates against the detrimental effect of soap solution. Lime-water increases the strength of trass mortars, but has no influence on the strength and watertightness of mixtures which do not contain trass. Soap solution, whilst rendering mortars and concretes watertight, diminishes the hardening of mortars free from trass, which weakening effect is counteracted by the addition of trass.—O. R.

Characteristics and differentiation of native bitumens and their residuals. Richardson. *See* IIa.

Patents.

Artificial stone; Process for the production of ——. W. J. de Bas, The Hague, Holland. Eng. Pat. 27,632, Nov. 30, 1912.

A mould, the bottom of which is covered with a sheet of mica, aluminium or other material capable of resisting pressure, is filled with (1) a pasty layer of cement, colour and isinglass, (2) a layer of dry cement powder with or without sand, and (3) moistened loose cement mortar. The moulded block is subjected to a pressure of 250 to 400 kilos. per sq. cm., then loosened in the mould, re-compressed, and after being set aside for say 24 hours, is soaked in water and allowed to dry and harden.—W. C. H.

Cement; Special —— *and its process of manufacture.* C. L. Carlson. Fr. Pat. 452,399, Dec. 26, 1912. Under Int. Conv., Aug. 19, 1912.

Dust separated from blast-furnace gases by a dry process and freed from the largest and heaviest particles, is mixed with quicklime or slaked lime, or with ordinary hydraulic cement or hydraulic lime.—W. C. H.

Cement mastic; Process of manufacture of a ——. M. Hohn. Fr. Pat. 452,671, Nov. 29, 1912.

A quantity of Tyre resin, equal to about 40 to 50 per cent. of the total product to be obtained, is heated in a suitable receptacle till completely melted (135° to 140° C.), and while being continuously stirred with an iron stirrer, about an equal quantity of very fine cement, preferably Amöneburg cement, is added.—W. C. H.

Cement raw materials; Preparation and burning of a furnace-charge of —— *formed into small lumps.* F. C. W. Timm. Ger. Pat. 258,970, Jan. 31, 1912.

The raw material is mixed with burnt or slaked lime, or hydraulic binding agents, or both, moistened with water, formed into small lumps, and charged into the furnace before the binding agents have time to develop their full activity. The mass of small lumps is spread in a relatively thin layer on a permeable support, and carried through the furnace, in which the burning proceeds from above downwards by means of a current of air, the fuel being incorporated with the furnace charge.—A. S.

Cement clinker; Process for the treatment of —— *with steam and carbon dioxide.* F. C. W. Timm. Ger. Pat. 259,343, Nov. 24, 1911.

The cement clinker is distributed on or under a layer of moistened cement raw material mixed with fuel, which is ignited by a flame projected in a plane inclined to the surface of separation of the two layers. The combustion gases from the burning of the cement raw material pass through the two layers in a direction perpendicular to the surface of separation. It is stated that at the prevailing high temperature the gases (containing steam and carbon dioxide) have the same favourable action on the cement clinker as pure steam under pressure.—A. S.

Furnace charge; Production of an easy-burning or -sintering —— *from finely powdered raw materials, such as cement mixtures, lime, magnesite, dolomite.* F. C. W. Timm. Ger. Pat. 259,344, Nov. 24, 1911.

The raw material, moistened with a small quantity of water, and formed into small lumps, is pressed into a thin strip by means of rolls, and the strip is then broken into small pieces. Or, only the larger lumps of the moistened raw materials, may be thus rolled into a strip. The same rolls used for pressing the material into a strip may be used for breaking the strip into pieces and distributing these directly on to the support on which they are subsequently burnt or sintered.—A. S.

Furnace-charge; Preparation of a —— *from fine raw materials, such as cement, lime, and magnesite, formed into small lumps.* F. C. W. Timm. Ger. Pat. 259,410, Nov. 24, 1911.

The fuel is mixed with the raw material and the charge is burnt by means of air forced through it. A part or the whole of the fuel is added after the raw materials have been moistened with water and formed into small lumps. For instance, the finer portion of the fuel may be added before or during the moistening with water, and the coarser portion after the moistened material has been formed into small lumps.—A. S.

Burning, sintering or roasting; Preparation of fine materials, mixed with or to be mixed with fuel, for ——. F. C. W. Timm. Ger. Pat. 259,480, Nov. 24, 1911.

The materials are moistened with water and formed into small lumps, the larger of which are charged directly into the furnace, whilst the smaller are moistened with a further quantity of water, with or without the addition of fresh raw material, and again formed into lumps. Also, of the portion charged into the furnace, any lumps too large to be properly burnt are separated, mixed with fresh raw material and water, and formed into a mass of small lumps, which is separated into finer and coarser portions, as described above.—A. S.

Tar oils; Process for improving the antiseptic, insecticidal, and fungicidal properties of ——, *for use in preserving wood.* Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 259,665, Sept. 28, 1911.

Hydroxyl derivatives of the naphthalene or anthracene series are dissolved in coal-tar or wood-tar oils: the lower phenols may be removed from the tar oils before or after adding the higher phenols; for example, the higher phenols may be added in the form of solutions of their alkali salts, and the salts of the lower phenols thus formed are removed by washing.—T. F. B.

Artificial stones; Process for making ——. Naamlooze Vennotschap Handel Maatschappy de Bas & Co. Fr. Pat. 451,211, Nov. 30, 1912. Under Int. Conv., Dec. 23, 1911.

See Eng. Pat. 27,632 of 1912; preceding.—T. F. B.

Concrete; Process for rendering —— *impermeable to liquids.* Nederlandsche Betonijzerbouw, and J. Mijs. Fr. Pat. 452,185, Dec. 19, 1912. Under Int. Conv., July 4, 1912.

See Eng. Pat. 16,157 of 1912; this J., 1912, 878.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Oxygen; Determination of —— *in iron and steel.* J. A. Pickard. Carnegie Scholarship Report. Iron and Steel Inst., May, 1913, 70—85.

About 20 grms. of steel contained in a nickel boat, are heated in a silica tube in an atmosphere of hydrogen free from oxygen and moisture, and the water formed is absorbed by phosphorus pentoxide contained in a small glass boat placed near the mouth of the tube, which is closed at the end where the steel is heated. The steel should be in turnings of 0·2 mm. thickness or less, and is heated to 1000° C. by an electric furnace which slides over the closed end of the tube but does not extend to the part in which the phosphorus pentoxide boat is placed. The tube is connected with the hydrogen supply and with a Fleuss pump, by means of a glass tube extension to which a glass T-piece is attached. A blank test is first made, using an unweighed boat of phosphorus pentoxide placed in the cold end of the tube. When the tube has cooled, the sample is weighed into the nickel boat, which is then replaced in the tube near the closed end, and an unweighed boat of phosphorus pentoxide is placed near the open end. The tube is then exhausted and allowed to remain so for a minute or two. Hydrogen is next admitted up to atmospheric pressure, and a weighed boat of phosphorus pentoxide substituted for the other. A small correction amounting to 1 or 2 mgrms. has always to be made for the moisture absorbed by the phosphorus pentoxide from the air which enters the tube during changing. The air is then replaced by hydrogen by successively exhausting and filling with hydrogen two or three times. Finally the tube is filled with hydrogen at about two-thirds atmospheric pressure, and heat applied by moving the electric furnace, already heated to 1000° C., over the end of the tube. Heating is continued for three-quarters of an hour, after which the tube is allowed to cool, hydrogen is admitted up to atmospheric pressure, and the phosphorus pentoxide boat is removed and weighed. Tests made to ascertain the reducing action of hydrogen on various oxides under the conditions of test showed that (1) carbon dioxide is completely reduced when its volume is less than 2 per cent. of the volume of hydrogen; (2) ferric oxide is completely reduced; (3) manganese peroxide is only reduced to manganous oxide; (4) ladle slag is unreduced.—T. St.

Iron-silicon alloys; Separation of graphite from ——. G. Charpy and A. Cornu. Comptes rend., 1913, **156**, 1616—1618.

Silicon in steels, as in pig-iron, tends to facilitate the separation of the carbon as graphite when the alloy is heated to a suitable temperature. The phenomenon in steels, however, is complicated by the fact that the total carbon may be lower than the maximum quantity that the steel is capable of dissolving at a high temperature. The separation of graphite in this way from a steel is therefore observable through a range of temperature rising from T, the temperature at which separation begins, and which is lower as the percentage of silicon is higher, to T′, at which the solubility of graphite in steel corresponds to the total carbon present, and which is higher as the percentage not only of carbon, but also of silicon, is higher. In steels low in both carbon and silicon, T′ may be below T, and then no separation of graphite occurs.—J. T. D.

Steels; A study of the constitution of carbon-molybdenum ——. T. Swinden. Carnegie Scholarship Report, Iron and Steel Inst., May, 1913, 100—168.

A series of 18 steels containing per cent. C up to 1·36 and Mo up to 8 was examined. Recalescence curves are given. With increasing Mo the electrical resistivity of the annealed steels was slightly increased in the 0·2, unaffected in the 0·45, and decreased in the 0·9 and 1·20, per cent. C series; the resistivity of the quenched samples indicated that at 800° C. carbon existed in solution and molybdenum not, but, of the latter, at 1200° C. a considerable proportion was present in solid solution. When the carbon content remained constant the Brinell hardness of the steels was not increased by molybdenum whether the samples were annealed or quenched from 800° C., but the hardness of samples quenched from 1200° C. increased with the molybdenum content. A tabulated statement is appended showing the results obtained in the mechanical testing of a series of steels containing from 0·5 to 1 per cent. Mo with and without Ni, Cr, V. —W. E. F. P.

Iron; The preservation of ——. J. N. Friend. Carnegie Scholarship Report, Iron and Steel Inst., May, 1913, 1—9.

Iron plates coated with various liquid vehicles and paints, were exposed to the action of air and water respectively, for 9 to 10 months. The results showed that (1) the surface of a paint film is not always a true indication of the extent of corrosion; (2) a little paraffin wax in the paint reduces corrosion in air, but appears to assist corrosion in water; (3) fine pigment (rouge) is more protective than coarse, but good commercial grades are finely enough ground for all practical purposes; (4) double coats of paint may be less protective than single coats; (5) slightly rusted plates, if quite dry when painted, are less liable to corrode than plates freed from rust before painting.—T. St.

Silver and gold; The rôle of certain metallic minerals in precipitating ——. C. Palmer and E. S. Bastin. Trans. Amer. Inst. Min. Eng., 1913, 843—857.

Small pieces of different minerals were suspended in dilute aqueous solutions of silver sulphate and gold chloride respectively, and the progress of the reactions observed. Certain sulphides, arsenides, and sulpharsenides of copper, nickel and cobalt precipitate metallic silver from dilute aqueous solution. Results obtained with niccolite and chalcocite indicated that the essential chemical changes in reactions of this type are due to oxidation through the hydrolytic action of water. Most of the minerals found to be very active precipitants of silver were also found to act similarly with gold, and other minerals such as galena, pyrite, stibnite, and millerite, precipitate gold, but not silver.—T. St.

Silver; Precipitation of —— by aluminium. E. M. Hamilton. Eng. and Min. J., 1913, **95**, 935—939.

At the Nipissing mine, Cobalt, Ontario, aluminium in the form of powder and in a solution kept alkaline with caustic soda, is now used instead of zinc to precipitate silver from cyanide solutions. It does not foul the solution like zinc, is not affected by the presence of arsenic, is twice as effective, and as it forms no cyanide, loss from this cause is avoided. The apparatus is in principle the same as for zinc-precipitation; but the first precipitating tank proper is provided with mechanical stirring appliances to keep the precipitate in suspension, which with the solution passes out through a pipe to a second tank and is finally filter-pressed, the solution being tested with sodium sulphide; the aluminium is added till the silver reaction just disappears. With aluminium dust at 35—39 cents (1s. 5½d.—1s. 7½d.) per lb., caustic soda at 2¼ cents (1·1d.), and zinc-dust at 7 cents (3½d.), the cost of treating a ton of the same ore is, with zinc 14 cents (7d.), with aluminium 18·5 cents (9¼d.); but the saving in cyanide and in the working up of the precipitate more than compensate for this extra cost.—J. T. D.

Manganese-silver; The system ——. G. Arrivaut. Comptes rend., 1913, **156**, 1539—1541.

Thermal analysis, microscopic examination, electromotive forces and attack by acids, all lead to the conclusion that manganese and silver form the compound $MnAg_2$ (m.pt. 980° C.). This is contrary to the observations of Hindrichs (this J., 1908, 1066). The compound gives a continuous series of solid solutions with silver, and the limit of its miscibility in the liquid state with manganese occurs in an alloy containing about 30 per cent. Mn.—W. H. P.

Ferrites; Notes on the formation of —— in roasting blende. G. S. Brooks. Trans. Amer. Inst. Min. Eng., 1913, 829—842.

During the roasting of blende containing iron, zinc ferrites of varying composition are formed, ranging in works-products from a normal ferrite, (ZnO,Fe_2O_3), to an extremely basic one. Interaction may occur between grains of zinc sulphate and ferric oxide, or between the two oxides, and a third method of formation is by the oxidation of the zinc-iron matte produced by overheating. The presence of zinc ferrite interferes with the success of such processes as leaching and magnetic separation. Its formation may be checked by reducing the contact surfaces and by suitably controlling the rabbling. Highly oxidising atmospheres, favouring quicker roasting and lower temperatures, lessen the tendency to formation of ferrites, which occurs in practice somewhat below 1000° C. Where iron and zinc occur together in molecular contact, as in marmatite, a high proportion of ferrite is formed under all conditions of commercial roasting. —T. St.

Lead; Determination of the surface tension of molten —— against molten mixtures of lead chloride and potassium chloride. A contribution to the theory of the formation of metal mist. R. Lorenz and A. Liebmann. Z. physik. Chem., 1913, **83**, 459—480.

The authors have determined by the capillary tube method the surface tension of molten lead against its molten chloride and the influence of the addition of potassium chloride thereon. It had been suggested previously (this J., 1907, 1016) that the action of potassium chloride in preventing the formation of metal mist during the electrolysis of fused lead chloride, was due to its effect on the surface tension of the lead, and the experimental results now obtained show that potassium chloride has such an effect, the surface tension of the fused lead against fused lead chloride increasing with increasing additions of potassium chloride to the latter.—A. S.

Calcium alloys and calcium ; Electrolytic preparation of ——. W. Moldenhauer and J. Andersen. Z. Elektrochem., 1913, **19**, 444—447.

Matthiessen in 1855 (Annalen, **93**, 277) found that when fused mixtures of calcium chloride and alkali chlorides were electrolysed, only the alkali metal, with a trace of calcium, was deposited. These results were confirmed by Ruff and Plato (this J., 1902, 1458), but the authors have succeeded in obtaining metallic calcium and alloys of calcium with zinc and lead, almost free from potassium, by electrolysing mixtures of potassium chloride and calcium chloride. These two salts appear to form a double compound, $KCl,CaCl_2$, m. pt. about 740° C., and two eutectics both melting at about 630° C., and containing respectively 85 and 40 per cent. $CaCl_2$. The calcium alloys were prepared by using molten zinc or lead as cathode in an iron crucible, the outer wall of which was cooled so that an insulating layer of the solidified electrolyte formed on its inner surface. Using the mixture containing 85 per cent. $CaCl_2$, zinc alloys containing 8·5 and 10·5 per cent. Ca and quite free from potassium were obtained with a current density of 4 amp. per sq. cm., and an E.M.F. of 24 volts (current yield, 50—57 per cent.). Using an electrolyte containing 60 per cent. $CaCl_2$ (m. pt. 740° C.), a zinc alloy containing 66·98 per cent. Ca and 0·12 per cent. K overlying an alloy containing 13 per cent. Ca and 0·09 per cent. K was obtained, the current yield being 25 per cent. In similar experiments with a lead cathode, alloys containing 5·8, 10·2, 3·4, and 81·9 per cent. Ca and only small proportions of potassium were obtained. In the preparation of metallic calcium, an iron rod which could be gradually raised, was used as cathode, as described by Rathenau (compare also Goodwin, this J., 1905, 1179). With an electrolyte containing 85 per cent. $CaCl_2$ and a current density of 60—110 ampères per sq. cm., rods of from 9 to 18 mm. diam. were obtained which, apart from the small quantity of included electrolyte, contained Ca 96·09—98·18, K 0·00—0·14, Fe 0·30—0·40, and Si 0·40—0·70 per cent. The current yield varied from 65 to over 90 per cent., average 75 per cent. The proportion of potassium chloride in the electrolyte could be increased to about 25 per cent., but above this it was no longer possible to obtain calcium in the rod form.—A. S.

Beryllium [*Glucinum*] ; *Metallic* ——. F. Fichter and K. Jablczynski. Ber., 1913, 46, 1604—1611. (See also Bleyer, this J., 1913, 600.)

The metal was obtained by the electrolysis of a fused mixture of the fluorides of beryllium and sodium (2 mols. : 1 mol.). The product was purified from adherent oxides by centrifuging the fine powder in a mixture of ethylene bromide and alcohol of sp. gr. 1·95. It was then compressed into cylinders and fused. The metal after fusion has a sp. gr. of 1·842, melts at 1280° C., and does not volatilise at 1900° C. Its electric conductivity at 20° C. is $5{\cdot}41 \times 10^4$ reciprocal microhms per cm. cube, and its hardness 6—7 on Mohs' scale. Its apparent inertness towards water is due to a film of oxide.—J. T. D.

Palladium : Behaviour of hydrogen towards ——. A. Gutbier, H. Gebhardt, and B. Ottenstein. Ber., 1913, **46**, 1453—1457.

When spongy palladium was exposed to hydrogen at temperatures from —50° C. upwards, the amount of occluded gas steadily decreased from —50° C. (917 volumes to 1 of palladium) to a minimum at 20° C. (661 : 1) then slowly rose to 105° C. (754 : 1). The hydrogenised palladium was pyrophoric.—J. T. D.

Canadian ore-dressing and metallurgical laboratory. Mining World, Chicago, May 31, 1913. [T.R.]

The Mines Branch of the Canadian Department of Mines has installed at Ottawa a modern well-equipped laboratory for purposes of experimental concentration and metallurgical tests with Canadian ores and minerals. The installation of an experimental roasting and sintering plant will be undertaken some time during the year. The plant will be operated free of all charges, including assays necessary for test purposes, on Canadian ores, under the following conditions :—

(*a*) Samples must be bagged and delivered to the plant free of all transportation and unloading charges.

(*b*) For small scale tests, not less than 200 lbs. will be accepted. For large scale tests, not less than 5 tons will be accepted.

(*c*) All testing products are to become the property of the Mines Branch, unless otherwise arranged before commencement of tests.

(*d*) Reports of tests will be incorporated in the publications of the Mines Branch, but single copies will be given to owners of samples when their tests are completed.

Under ordinary conditions tests will be made by the Mines Branch officials, but arrangements may be made whereby engineers or other competent persons may supervise their own experiments.

It is expected that the plant will be ready for operation by the first week in July, 1913.

Cobalt, nickel, and arsenic from Canada. Board of Trade Journal. June 12, 1913. [T.R.]

A smelting company in Ontario seeks a market for cobalt oxides, nickel oxides, and grey arsenic, and asks to be placed in correspondence with buyers in the United Kingdom of these products. Apply to the Canadian Government City Trade Branch, 73, Basinghall Street, London, E.C.

Reduction of certain volatile halogen compounds by powdered potassium. Vournasos. *See* VII.

Influence of addition of colloids on the cathodic and anodic processes in the electrolysis of metallic salt solutions (*lead and zinc*). Marc. *See* XI.

Patents.

Iron and steel electrodes and other articles ; Means for obtaining a protective layer on ——. A. E. Gibbs, Wyandotte, Mich., U.S.A. Eng. Pat. 15,852, July 6, 1912.

A layer of magnetic oxide is formed upon the articles by heating them in a furnace fired with hydrogen, insufficient air being employed for the complete combustion of the latter ; the excess of hydrogen is regulated to bring the temperature of the reaction between the limits of 600° and 1100° C.—W. E. F. P.

Sheet iron pipe for subterranean uses. C. A. Allison, London. From International Metal Products Co., Newark, N.J., U.S.A. Eng. Pat. 691, Jan. 9, 1913.

A seamed pipe, circumferentially corrugated, and formed of sheet iron containing not less than 99·60 per cent. Fe. —W. E. F. P.

Alloys [*ferrosilicon*] ; *Process of making* ——. R. A. Hadfield, Sheffield. U.S. Pat. 1,061,373, May 13, 1913.

Ferrosilicon (50 per cent. Si) is heated to redness in a ladle, and pure iron in a molten condition is then added. The ferrosilicon melts and disseminates itself rapidly and effectively through the mass. Just before pouring, not more than 1 per cent. of aluminium is added, and the mixture is then cast into ingots. The ferrosilicon thus obtained is characterised by low hysteresis, high magnetic permeability and electric resistance.—T. St.

Steel ingots ; Process of making dense ——. H. W. Lash, Assignor to The Liquid Forged Steel Co., Cleveland, Ohio. U.S. Pat. 1,061,760, May 13, 1913.

The ingot is cast in a mould having the wide end uppermost, and as it solidifies, it is subjected to a succession of impacts applied vertically.—T. St.

[*Iron-boron, etc.*] *Alloys ; New applications of* —— [*for apparatus resistant to chlorine*]. A. J. B. Jouve. Fr. Pat. 451,903, Feb. 23, 1912.

The use of borides or alloys of boron (whether of definite composition or not) is claimed for the construction of apparatus resistant to the action of chlorine—particularly of that employed in the electrolysis of solutions of alkali chlorides.—W. E. F. P.

[*Iron and steel.*] *Metals ; Process and apparatus for the electrical cementation of* ——. A. Fauchon-Villeplée. Fr. Pat. 452,214, Mar. 2, 1912.

The metal is embedded in the cementing material in a closed chamber of refractory material provided internally with end-plates to which the leads of a transformer are connected and between which a low-tension alternating current is caused to pass.—W. E. F. P.

Precious metals ; Extraction of fine or —— *from their ores.* E. C. R. Marks, London. From T. Dobbie, Selukwe, S. Rhodesia. Eng. Pat. 11,244, May 11, 1912.

To a mixture of the ore with a strongly alkaline cyanide solution, during or after crushing, chlorine or bromine is added with the object of producing chloro- or bromocyanide in the presence of the precious metals and thus facilitating the solution of the latter. The solution obtained is agitated with zinc dust containing a small percentage of freshly prepared silver carbonate.
—W. E. F. P.

Tin ; Extraction of ——, *from ores or slags.* W. E. Gibbs, Birkenhead. Eng. Pats. 11,643, May 16, and 26,364, Nov. 16, 1912.

The ore, fused with soda or other flux, or the molten slag, is electrolysed between an anode of carbon or suitable metal and a cathode of liquid tin.—W. E. F. P.

Furnace ; Calcining or roasting ——. M. Prager, Berlin. Eng. Pat. 14,464, June 20, 1912.

In a mechanical calcining furnace the vertical shaft is divided into a number of separate channels for the cooling agent, corresponding to the number of agitating arms. Stopper-like projections on the arms fit into recesses in the agitator shaft and carry partitions which divide the recesses into upper and lower compartments. The cooling agent passes from one compartment to the other by way of the hollow arm. The arms are fixed by means of keys, actuated by vertical rods attached to them, the keys engaging in slots in extensions on the arms.—T. St.

Kiln or furnace employed for calcining or roasting ore, limestone, or other material. A. L. Leigh, Scunthorpe, Lincoln. Eng. Pat. 17,724, July 31, 1912.

Gas from a blast-furnace or other source is burnt in the kiln at a number of burners which penetrate the wall of the kiln, the necessary air being admitted at the discharge-openings. The burners are fed from an annular gas main encircling the kiln, the gas being forced into the main by means of a motor-driven fan. (Reference is directed to Eng. Pats. 657 of 1871, 1865 of 1881, and 18,291 of 1889.)
—T. St.

Cowper apparatus in blast furnaces ; Device for utilising the waste heat of the ——. J. Prégardien, Cöln-Lindenthal, Germany. Eng. Pat. 1169, Jan. 15, 1913.

An apparatus in which regenerators for the blast air and the combustion air, respectively, are arranged side by side, in parallel, in the two branches of the common exhaust channel for the Cowper combustion gases, the latter channel being divided by a longitudinal wall; and in which the supply and exhaust chambers for the heating pipes of both groups of regenerators are formed in one piece and divided by a partition wall similar to that of the exhaust channel.—W. E. F. P.

Metallurgical apparatus [*furnace*]. W. Bryant, Massillon, Ohio. U.S. Pat. 1,061,446, May 13, 1913.

The furnace is composed of a mixing chamber above, a refining chamber below, and an intervening smelting chamber. An air tube opens into the upper chamber, and an outlet flue leads from the lower chamber. The wall of the smelting chamber is tapered from a larger upper end to a smaller middle portion, and contains a series of spaced radial ribs, which form channels affording communication between the upper and lower chambers. The edges of the lower portions of the ribs are bevelled to form a bosh.
—T. St.

Furnace ; Gas-fired —— *for the fusion of metals.* L. Rousseau. Second Addition, dated Dec. 12, 1912, to Fr. Pat. 404,287, June 22, 1909 (see Eng. Pat. 27,600 of 1909 ; this J., 1910, 1255).

The furnace is provided at the top with an extension in the form of a cylindrical chamber communicating with, and jointed to, the crucible chamber. The extension is provided with charging doors, and, at its upper end, is connected with the chimney by means of a side pipe a portion of which is removable so that the furnace may be free to move during the pouring of the charge.—W. E. F. P.

Furnace ; Siemens-Martin ——, *for the treatment of materials containing iron or iron oxides and volatile metals with the object of extracting the latter and the iron at the same time.* K. Albert. Fr. Pat. 451,797, Dec. 11, 1912.

To the usual Siemens chambers are added easily accessible channels or chambers through which the gaseous products pass during the volatilisation stage of the ore treatment ; provision is also made whereby, during this period, the gases pass through an "air" and not through a "gas" regenerator. After the expulsion of the volatile constituents, the furnace is operated in the usual manner for the production of metallic iron from the residual ore.
—W. E. F. P.

[*Copper-melting*] *Furnace.* D. W. Blair, Assignor to Metallurgical Research Co., New York. U.S. Pat. 1,061,964, May 13, 1913.

Copper is melted in a vertical rectangular furnace provided with a laterally projecting combustion chamber into which a burner projects. The molten copper is run off by means of a gutter, at right angles to the length of the burner, into a long, low, narrow, horizontal furnace, which is also provided with a laterally projecting combustion chamber. By this arrangement the heating medium of each furnace is substantially prevented from contaminating the atmosphere of the other furnace.—T. St.

Copper ; Process for tempering ——. W. H. White, Assignor to W. B. White, Hazleton, Pa., and J. M. and M. Schappert, Dorranceton, Pa. U.S. Pat. 1,062,067, May 20, 1913.

The copper is heated to a high temperature, and immersed until it "blows" in a bath containing lime water and a cleansing ingredient of a vegetable nature. It is then withdrawn, placed on a hard surface, and struck a hard blow with another hard surface, the upper surface being permitted to remain on the piece of copper until the latter turns from red to a golden tint. Both surfaces are preferably iron, steel, or stone plates.—T. St.

Electrolytes for use in electro-metallurgy. N. H. M. Dekker, Paris. Eng. Pat. 17,836, Aug. 1, 1912.

The electrolyte consists of a salt of the metal to be deposited, dissolved exclusively in its water of crystallisation by heating, and water is added from time to time in such quantities as are necessary to replace that lost by evaporation. The electrolyte may in addition comprise one or more salts which can be electrolysed in the presence of water, but which do not give a metallic deposit.—B. N.

Ores; Agitator for use in the treatment of —— by solvents and the like. J. Van Nostrand Dorr, Denver, Colo., U.S.A. Eng. Pat. 21,944, Sept. 26, 1912.

The apparatus consists of a flat-bottomed cylindrical vessel with a hollow central rotating shaft provided with radial arms fitted with scrapers. The heavier particles of the pulp sink to the bottom and are slowly moved by the scrapers to the bottom of the hollow shaft, up which they are raised by means of compressed air, so as to overflow into a launder, whence they are again delivered into the tank. The discharge opening is surrounded by an adjustable baffle-plate whereby the density of the pulp discharged from the tank can be regulated.—T. St.

Ores, minerals and the like; Apparatus for washing, grading and concentrating ——. G. Michel, Paris. Eng. Pat. 29,617, Dec. 23, 1912. Under Int. Conv., Dec. 26, 1911.

A hydraulic apparatus consisting of a vertical, cylindrical tank provided near the bottom with an inverted, conical, perforated screen and at the top with an annular discharge trough, and fed by means of a hopper or spout connected with a central tube from which the ore is supplied in a regulable manner to the outer edge of the conical screen. Below the screen is a receiver for the washed particles and at the top a float cistern for supplying water to the tank, in which a constant level is maintained.—W. E. F. P.

Ore concentration. Minerals Separation, Ltd. Fr. Pat. 452,299, Dec. 23, 1912. Under Int. Conv., June 18, 1912.

A froth-flotation process in which the water is agitated with a small quantity of an essential oil, amyl acetate or cresol, before the addition of the ore, mineral frothing agent and acid. The same water is used, with the addition of mineral frothing agent only, for the treatment of subsequent charges of ore.—W. E. F. P.

Crushed-ore products; Separation of liquids from ——. W. A. Caldecott, Johannesburg, Transvaal. U.S. Pat. 1,061,660, May 13, 1913.

The pulp, containing sands and slimes, is subjected continuously to a settling and decanting operation so as to separate the slimes and the bulk of the water from the sands. The sands are continuously discharged, and afterwards subjected to vacuum filtration to remove any liquid still admixed with them.—T. St.

Ore smelting and refining apparatus. E. Fink, Milwaukee, Wis., Assignor to Fink Smelters Co., Chicago, Ill. U.S. Pat. 1,061,279, May 13, 1913.

Ore is fed into a rotary heating barrel at one end, and is discharged at the other into a rotary smelting barrel, the opening in the latter being at the centre of one of the end walls. A flue connects the opening in the smelting barrel with the opening at the ore-discharge end of the heating barrel. Fuel and air supply pipes also pass into the opening of the smelting barrel. The opening at the ore-entrance end of the heating barrel communicates with a chimney.
—T. St.

Lead alloy for tapes. Western Electric Co., Ltd., London. From Western Electric Co., New York, U.S.A. Eng. Pat. 25,090, Nov. 1, 1912.

For winding electrical conductors, tapes made of the alloy given below are more economical than lead tapes, as for the same strength the thickness may be reduced to one-half, and the width may be increased by one-third. The most suitable composition of the alloy and the maximum and minimum permissible proportions are: Pb 95·00 (96·75—93·25), Sb 4·50 (6·00—3·00), and Sn 0·50 (0·75—0·25) per cent.—T. St

Electrometallurgical products; Treating ——. Manufacture of silicon. T. B. Allen and F. J. Tone, Assignors to The Carborundum Co., Niagara Falls, N.Y. U.S. Pats. 1,061,255 and 1,061,256, May 13, 1913.

(1) The bonding qualities of electrometallurgical products, used for abrasive or refractory purposes, are improved by removing the carbides and silicides, present as impurities, by treatment with sulphur under the action of heat. (2) A finely-divided mixture of silicious ore and carbonaceous material is briquetted, and the mixture charged into the reaction zone of an electric furnace so as to subject it to the direct heat of an electric arc. The volatile reduction products carried by the outgoing gases permeate and preheat the charge.—B. N.

Zinc oxide and sinter; Method of obtaining —— from alloys containing zinc. H. M. Burkey, Newark, N.J., Assignor to Metallurgical Co. of America, New York. U.S. Pat. 1,061,447, May 13, 1913.

Waste brass turnings are mixed with fine coal and the mixture ignited and blown, so that the zinc is volatilised and oxidised. A copper "sinter" is left as a residue and the zinc oxide is recovered.—T. St.

Zinc; Process and apparatus for the manufacture of metallic ——, and incidentally of zinc white. P. Ferrere. Fr. Pat. 451,680, Feb. 17, 1912.

The ore is subjected to a chloridising or sulphating roast and leached with water, the solution, after purification, being treated with calcium bisulphite. Calcium sulphate, if present, having been removed by filtration, the solution of zinc bisulphite is boiled. The precipitated normal sulphite is subsequently calcined for the production of zinc oxide, the sulphur dioxide evolved during this and the boiling operation being recovered. Alternatively, the precipitation of the zinc may be effected by means of ammonia. The reduction of the zinc oxide is effected by carbon monoxide in an apparatus comprising a series of retorts from the condensers of which the metal is delivered into two collecting pipes arranged one along either side of the heating chamber. The various parts of the apparatus are heated by electrical means or by means of special gas burners, the latter being also employed, in conjunction with air and steam, for the production of zinc white by the combustion of zinc vapour.—W. E. F. P.

Zinc retorts; Process for the continuous removal of the residues from vertical ——. A. Roitzheim and W. Remy. Fr. Pat. 451,806, Dec. 12, 1912.

The lower end of each cylindrical retort is provided with a vertical screw-conveyor surmounted by a horizontal scraper adapted to be raised and lowered during rotation for the purpose of detaching crusts, etc., from the sides of the vessel; the conveyor is mounted upon a hollow shaft through which that of the scraper extends.
—W. E. F. P.

Alloy. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pat. 1,062,430, May 20, 1913.

The alloy contains manganese and titanium together amounting to over 50 per cent., and either silicon or carbon, or both the latter.—T. St.

Antimony ores; Process for the treatment of ——. V. Lassalle. Fr. Pat. 451,905, Feb. 23, 1912.

A mixture of ore, coke and flux, with or without metallic iron according as the ore is sulphide or oxide, is smelted in a blast-furnace of the type employed for the reduction of lead ores, the products being metallic antimony (regulus) and antimony oxide.—W. E. F. P.

Armour plates for the protection of ships and other steel objects; Manufacture of ——. F. Giolitti, Rome, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 1,061,998, May 20, 1913.

See Eng. Pat. 17,935 of 1906; this J., 1907, 1012.—T.F.B.

Separation of substances by the wet magnetic process. G. Ullrich, Assignor to Fried. Krupp Akt.-Ges. Grusonwerk, Magdeburg, Germany. U.S. Pat. 1,062,522, May 20, 1913.

See Eng. Pat. 17,459 of 1909 ; this J., 1910, 1208.—T.F.B.

Ores ; Plant or apparatus for the sampling of ——. A. S. Clift, London. U.S. Pat. 1,062,636, May 27, 1913.

See Eng. Pat. 2416 of 1912 ; this J., 1913, 94.—T. F. B.

Crucible-furnace ; Portable ——. M. Harvey, Walsall. U.S. Pat. 1,062,970, May 27, 1913.

See Eng. Pat. 2166 of 1910 ; this J., 1911, 367.—T. F. B.

Tungsten wires ; Process for making drawn ——. C. H. Fischer. Fr. Pat. 451,788, Dec. 11, 1912. Under Int. Conv., Dec. 12, 1911.

See Eng. Pat. 9981 of 1912 ; this J., 1913, 540.—T. F. B.

Sulphite or sulpho-carbonate slimes and ores ; Process for treating —— by the flotation process. K. Schick. Fr. Pat. 452,346, Dec. 24, 1912.

See U.S. Pat. 1,055,495 of 1913 ; this J., 1913, 431.—T.F.B.

Manganese manure with a base of blast-furnace slag. Fr. Pat. 452,602. *See* XVI.

XI.—ELECTRO-CHEMISTRY.

Electrolysis of metallic salt solutions (lead and zinc) ; Influence of addition of colloids on the cathodic and anodic processes in the ——. R. Marc. Z. Elektrochem., 1913, **19**, 431—444.

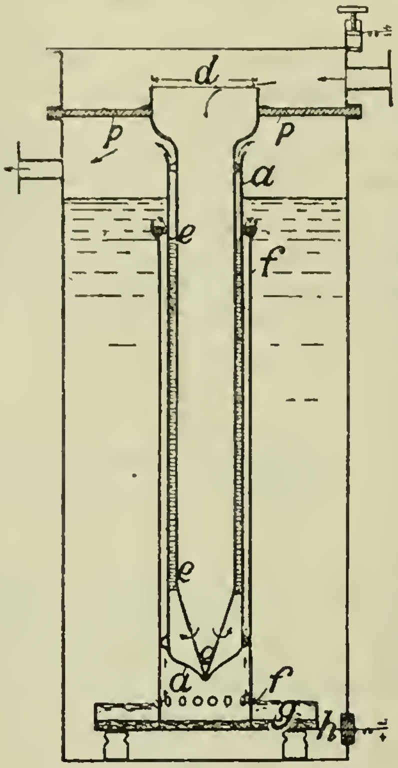
The author has examined the effect of additions of gum arabic, gelatin, gum tragacanth, dextrin, starch and albumin on the electrolytic deposition of lead and zinc from different electrolytes. The results are described in detail and tabulated, but cannot be generalised, for whilst colloids act favourably by diminishing the size of grain of the deposit, they frequently have an injurious effect on the coherence and strength of the deposit. The favourable effect of clove oil (compare Mathers and Overman, this J., 1913, 429), on the character of electrolytically deposited lead is confirmed. Clove oil is non-colloidal in character ; it causes a diminution in the size of grain of the deposit, but apparently has no other effect. In general, colloids appeared to cause an increased liberation of hydrogen at the cathode, but their effect on anodic reactions varied according to the nature of the electrolyte and of the colloid.—A. S.

Patents.

Ozone ; [Electrical] Apparatus for the production of ——. W. Dubilier, New York. Eng. Pat. 11,090, May 9, 1912.

The apparatus comprises an inductance coil, an interrupter or current-varying device, an oscillating current across the latter, and a high-tension high-frequency transformer and condenser in connection with the oscillating current. The transformer is built up of primary and secondary coils wound in a number of concentric layers of short axial length in the known way, and separated by heavy or thick insulation and embedded in wax or like insulating compound, so as to form a disc-shaped structure, the whole being enclosed in a casing. The ozone-generating device consists of at least one insulating tube, with electrodes on the inside and outside connected respectively with the high and low tension coils of the transformer. The outer electrode is of gauze or a rough metallic surface, and the inner one is smooth or substantially so. The ozone producer is mounted on or against the casing. —B. N.

Ozone ; Tubular apparatus for the production of —— by means of electric discharges. F. Hombach. Ger. Pat. 259,434, Feb. 18, 1912.



A glass tube, *a* (see fig.), closed below and floating in a liquid, separates the two electrodes, and the inner electrode, *e*, is so shaped, or provided with projections or the like, that the glass tube is centred automatically. When the glass tube contains a dielectric liquid, it may be centred by means of the outer electrode, *f*, the lower end of which slides on a conducting surface, *h*, on which there may be a layer, *g*, of an electrically conducting liquid. The opening, *d*, in the plate, *p*, separating the gas inlet and outlet chambers is made so large that the discharge-unit can be lifted out bodily. —A. S.

Resistance bodies ; Manufacture of electric ——. G. Cooper, Birmingham. Eng. Pat. 11,380, May 13, 1912.

The metallic resistance body is coated with a surface layer of one or more of the noble metals, by impregnation of the outer portion with a colloidal solution of the metal or metals. A layer of oxide, or other compound of an absorbent nature, is formed on the surface of the resistance body, and the coating solution is then applied by means of pressure, so that after impregnation there is actual engagement by interpenetration between the particles of the outer layer of the resistance body and the surface layer of the noble metal. The impregnation may also be effected by subjecting the body during the coating operation to the combined action of heat and great pressure. —B. N.

Conductors for sealing into electrical apparatus ; Leading-in ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 15,342, July 1, 1912.

An Fe-Cr alloy containing 20 to 30 per cent. Cr is used for leading-in conductors. It may be sealed into articles or containers of vitreous material, such as lead glass, the coefficient of expansion of the glass and alloy being substantially the same.—B. N.

Electrodes for secondary alkaline cells ; Negative ——. H. P. R. L. Pörscke and J. A. E. Achenbach, Hamburg, Germany. Eng. Pat. 29,848, Dec. 27, 1912.

Finely-powdered metals, or mixtures of metals, such as iron and cadmium, are boiled in an excess of concentrated ammonia solution, until a dry mixture is obtained, and this is pressed into the perforated pockets of the electrodes, and reduced by electrolysis in an alkaline solution.—B. N.

Furnaces ; Electric —— for fixing nitrogen from the air. G. Harker, London, and E. K. Scott, Bromley, Kent. Eng. Pat. 866, Jan. 11, 1913.

The furnace, of the multiphase type, is provided with an arrangement for rapidly cooling the gases leaving the arc, by forcing water in a finely-divided condition into the envelope surrounding the arc. The water is in such

quantity as rapidly to reduce the temperature, for the purpose of permanently fixing the nitric oxide. The furnace may be provided with horn-shaped electrodes.
—B. N.

Synthesising gas; [Electrical] Device for ——. W. Siebert, Charlottenburg, Germany, Assignor to General Electric Co. U.S. Pat. 1,061,786, May 13, 1913.

Means are provided for starting an arc between concentric electrodes at a point of least separation by means of high voltage discharges, the upper surfaces of the co-operating electrodes being practically in the same plane. The gases are passed with a whirling motion, or in a spiral path, in a general forward direction at right angles to the arc, thereby shifting the same to a point at which the separation of the electrodes is greater than the striking distance of the operating voltage. This causes the arc to glide along the annular space, and form a disc-like flame in a plane at right angles to the axis of the electrodes.
—B. N.

Electric arcs for the treatment of gases; Production of long ——. F. H. A. Wielgolaski, Christiania, Norway. U.S. Pat. 1,061,892, May 13, 1913.

The apparatus comprises an elongated furnace chamber, having a pair of branching channels in which the walls contain or comprise a pair of tubular electrodes within the chamber. The arc is formed between the inner ends of the electrodes which are adjacent, the outer ends being separated or remote from each other and secured in the ends of the chamber. The tubular electrodes form with the chamber an outer space between the electrodes and the wall of the chamber, and an inner space within the electrodes, the furnace body being provided with channels communicating with these spaces. The roots of the arc are blown back from the inner ends toward the outer ends by separated currents of gas, substantially continuously adjacent and parallel to the respective electrodes.
—B. N.

Furnaces; Regulating electric ——. P. L. T. Héroult, La Praz, Assignor to Soc. Electro-Metallurgique Franc., Froges, France. U.S. Pat. 1,061,612, May 13, 1913.

The apparatus comprises a regulating circuit for bringing the furnace to the desired operation, with means for changing the course of the current in the circuit and holding it continually in its course until the regulation is effected. An interrupter, comprising a rotating ring of sectors, is connected with one branch of the circuit, and an arm with the other branch, the arm carrying a brush overlying the segments. Means are provided for rotating the arm, and for disconnecting some of the segments.—B. N.

Electrolytic cell. R. Threlfall, Birmingham. U.S. Pat. 1,062,058, May 20, 1913.

See Eng. Pat. 10,142 of 1911; this J., 1912, 824.—T.F.B.

Electrolytes [for electric batteries]. The Float Electric Co. Fr. Pat. 451,891, Dec. 14, 1912. Under Int. Conv., May 10, 1912.

See U.S. Pat. 1,043,328 of 1912; this J., 1912, 1136.
—T. F. B.

Extraction of juice or water from animal, vegetable, or mineral substances; Apparatus for the [electro-osmotic] ——. Ges. f. Elektro-Osmose m. b. H. First Addition, dated Dec. 21, 1912, to Fr. Pat. 439,271, Jan. 22, 1912. Under Int. Conv., Dec. 4, 1912.

See Eng. Pat. 29,826 of 1912; this J., 1913, 295.—T.F.B.

Electric motor boats; Process for avoiding evolution of chlorine as a result of the entry of sea water into ——. Société de l'Accumulateur Tudor. Fr. Pat. 451,779, Dec. 11, 1912.

See Eng. Pat. 28,518 of 1912; this J., 1913, 369.—T. F. B.

Tungsten anticathodes for Röntgen tubes; Process for making ——. Siemens und Halske A.-G. Fr. Pat. 451,849, Dec. 13, 1912.

See Eng. Pat. 25,052 of 1912; this J., 1913, 542.—T. F. B.

XII.—FATS; OILS; WAXES.

Hardened marine animal oils. C. Grimme. Chem. Rev. Fett Ind., 1913, 20, 129—134.

Two samples of hydrogenised marine animal oils had the following characters:—

Sp. gr. at 15° C.	M. pt.	Solidifying pt.	Refractive index at 40° C.	Acid value.	Saponification value.	Iodine value (Wijs).
	°C.	°C.				
0·9271	47·2	34·9	1·4529	1·94	189·3	23·24
0·9256	38·5	31·5	1·4575	1·00	188·8	58·34

Hardened marine animal oils give characteristic colour reactions (*e.g.*, with nitric acid, sulphuric acid, nitric and sulphuric acid (1 : 1), *aqua regia*, phosphomolybdic acid, syrupy phosphoric acid and sodium hydroxide), the intensity of the colourations varying with the degree of hydrogenation. The colour reactions of particular hardened oils, however, do not agree with those published as specific for the untreated oils. Nickel may be readily detected in hardened marine animal oils by Fortini's dimethylgloxime reagent (this J., 1913, 28). (See also this J., 1912, 996; 1913, 201, 370.)—C. A. M.

East Indian beeswax ("Ghedda" wax) and so-called China wax. G. Buchner and H. Fischer. Z. öffentl. Chem., 1913, 19, 147—158, 188—195. (See also this J., 1904, 828.)

Results of analyses of a large number of samples of East Indian beeswax are given. This wax (derived from *Apis indica*, *A. dorsata* and *A. florea*) differs widely in composition from ordinary beeswax (chiefly the produce of *A. melifica*) and gives abnormal analytical figures; thus, the ratio number (acid value : ester value) is generally 12 or higher, further the wax contains glycerides and neutral substances and might consequently from analytical data be mistaken for ordinary beeswax containing adulterants. Tables of analyses of mixtures of known quantities of East Indian and ordinary normal beeswax are given. With regard to China wax it appears that this name may be applied to (1) normal beeswax from China; (2) insect wax produced by *Coccus* spp.; (3) beeswax giving abnormal analytical results similar to those of East Indian wax and probably coming from Annam and French Cochin-China.
—R. G. P.

Patents.

Soaps and soapy emulsions; Process of manufacturing ——. G. Petroff. Fr. Pat. 452,054, Aug. 31, 1912.

Sulphonic acids of petroleum hydrocarbons or mixtures thereof with fatty acids or fats are treated with alkali carbonates, caustic alkalis or ammonia, and boiled until of the desired concentration. To obtain homogeneous preparations the sulphonic acids may be mixed, in an aqueous or alcoholic medium, with mineral oils, liquid fatty acids, carbon tetrachloride or other substances insoluble in water but capable of forming emulsions with the sulphonic acids.—C. A. M.

Producing dry pulverulent or pulverisable compounds of fats and fatty oils and malt extract or malto-dextrin. Eng. Pat. 29,481. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Preservation of iron. Friend. *See* X.

Patents.

Paint or the like; Manufacture of ——. G. L. Davies and W. E. W. Richards, London. Eng. Pat. 3008, Feb. 6, 1912.

A soluble pitch-like residuum, obtained from the "lighter oils" of tar, etc., by removal of the lighter portions, is claimed as suitable for use as the basis of paints, varnishes and the like. The residuum may be obtained according to the process claimed in Eng. Pat. 16,908 of 1909 (this J., 1910, 1368), by distillation or by adding to the "lighter oils" turpentine, kerosene, or similar substances which throw down a black residuum that may be utilised as a black paint or varnish, while the supernatant fluid on distillation yields the above-mentioned soluble brown residuum.—W. C. H.

Preservative products for impregnating substances, mixing with paints, etc., more especially with the object of protecting metals from rust; Process of manufacturing ——. R. Eberhard. Fr. Pat. 451,719, Nov. 25, 1912. Under Cont. Conv., Nov. 27, 1911.

The compositions contain compounds of chromium soluble in oils or fats and of the same degree of oxidation as chromic acid. Or they are prepared with the products of the interaction of chromic acid, perchromic acid or chromium phosphate with oils, fats, waxes, or their products of oxidation or distillation, or with lacs, varnishes, resins, bituminous compounds, oil of turpentine, wood tar, aniline, etc. Compounds obtained by treating chromium compounds with other metallic compounds may also be used. Or small quantities of other metals may be dissolved in the paints to increase their toxic action upon mollusca, etc. Any free chlorine is removed in the usual way. —C. A. M.

Lithopone resistant to light; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 259,953, March 24, 1911.

Lithopone is subjected to the action of an electric current, if necessary after the addition of a small quantity of an electrolyte (alkali sulphate or chloride, which is subsequently washed out) to render it a sufficiently good conductor. It is stated that treatment for 1—2 hours renders the lithopone resistant to light without affecting its physical properties.—A. S.

Plastic material and process of preparing such plastic material. F. G. Wiechmann, New York, Assignor to Fenoform Corporation, Hastings-upon-Hudson, N.Y. U.S. Pat. 1,061,346, May 13, 1913.

Vegetable albumin is treated with phenol or a phenolic substance, and subsequently with formaldehyde, the reactions between the substances being aided by heat and pressure.—W. P. S.

Varnish and process of making the same. H. Rosenberg, New York, Assignor to Standard Varnish Works, Port Richmond, N.Y. U.S. Pat. 1,062,419, May 20, 1913.

A "varnish base" is heated in the presence of a metallic oxide until a dry film of the base deposited from a suitable solvent exhibits a wax-like or semi-gloss finish. The heated base is then dissolved in a solvent so as to produce a liquid having a viscosity of about 140° Tagliabue.—W. P. S.

Oil or spirit of turpentine; Process of treating ——. G. Reynaud. Fr. Pat. 452,688, March 12, 1912.

The oil is treated with boron fluoride until of paste-like consistence. The product may be used alone or in admixture with raw or vulcanised rubber in the preparation of varnishes, etc. A rubber substitute may be made by incorporating finely divided raw rubber with the oil of turpentine and exposing the mixture to a current of boron fluoride, the resulting product being then heated to 25°—30° C. Preferably an addition of lime and sulphur is made to the final product.—C. A. M.

Furnaces adapted to be employed for enamelling and other similar operations; Impts. in ——. C. Verwer. Fr. Pat. 451,848, Dec. 13, 1912. Under Int. Conv., Oct. 28, 1912.

The articles are carried through the furnace by an endless conveyor composed of a continuous series of individual supporting elements, each of which is jointed with the support immediately adjacent to it. The conveyor may consist of a continuous series of supporting arms mounted freely and arranged in pairs on a single horizontal band, and attached on both sides to an endless chain, with the adjacent horizontal bands locked with one another by means of tie-pieces, and curved to allow of the passage of the hot gases.—W. C. H.

Antimony cinnabar; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 452,406, Dec. 26, 1912. Under Int. Conv., Jan. 5, 1912.

See Eng. Pat. 14,355 of 1912; this J., 1913, 297.—T. F. B.

Linseed oil; Process for rendering soluble the oxidation products of ——. K. L. F. Friedemann. Fr. Pat. 451,646, Dec. 9, 1912.

See Ger. Pat. 258,853 of 1912; this J., 1913, 614.—T. F. B.

Rosin soap and rosin; Process for obtaining ——. J. Aktchourin. Fr. Pat. 451,819, Dec. 12, 1912.

See Ger. Pat. 257,015 of 1912; this J., 1913, 499.—T. F. B.

Enamelling and analogous coating operations; Stoves for use in ——. C. Verwer, Bloemendaal, Holland. Eng. Pat. 24,661, Oct. 28, 1912.

See Fr. Pat. 451,848 of 1912; preceding.—T. F. B.

Manufacture of metallic zinc and, incidentally, of zinc white. Fr. Pat. 451,680. *See* X.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Plantation Para rubber; Preparation of ——. B. J. Eaton. India Rubber J., 1913, 45, 1097—1099 and 1140—1142.

The author has determined the minimum quantity of various coagulants necessary to coagulate Hevea latex, which was fresh and undiluted except in the laboratory. For acetic acid this amount is 0·1 grm. per 100 c.c. of latex. The author considers that there is no maximum limit above which coagulation does not occur, contrary to the opinions of Crossley (this J., 1911, 816) and Parkin (this J., 1910, 1464). Crossley's experiments were made in Europe with latex which had been diluted and treated with formalin. In connection with Parkin's experiments it is pointed out that if an excess of dilute coagulant is added, coagulation may not occur on account of the dilution of the latex; if strong coagulant is added, it may be occluded by the local clots formed at once. The author finds that dilution of the latex up to a certain amount (*e.g.*, double) does not affect the minimum quantity of coagulant required, but contrary to Parkin he states that beyond a certain dilution, the dilution is of great importance since more coagulant is required. The practice of adding water to the collecting cups for latex is deprecated. For latex diluted to a rubber content of 15 per cent., 1½ fluid oz. of 5 per cent. acetic acid per gallon is recommended. The rubber when coagulated is best left overnight, out of contact with air, before separating from the serum. Coagulation can be inhibited by alkali in the case of salts such as aluminium sulphate, or by sodium acetate in the case of acetic or hydrochloric acids, indicating that the phenomenon is due to the dissociated ions. Some samples of rubber were examined by drying in and out of the sun, and it was found that sunlight caused tackiness. Darkening of the rubber may be prevented by steaming the latex, or to some extent by thorough washing. An addition of 2 oz. of sodium bisulphite per 10 gallons of latex was very effective. Four samples of rubber were made by coagulating with increasing amounts of acetic acid: the resin and ash were constant, but the protein content steadily decreased with increasing amount of coagulant.—H. E. P.

Patents.

Rubber latex; Process for the coagulation and disinfection of ——. M. Hohl. Ger. Pat. 258,899, April 7, 1911.

The claim is for the use of suitably purified pyroligneous acid (wood vinegar).—A. S.

Filler for caoutchouc and process of manufacturing same. L. Elfrink, Modjokerto, Java. U.S. Pat. 1,062,958, May 27, 1913.

"Powdered insoluble flesh" of fish or aquatic animals is mixed with caoutchouc.—W. H. C.

Caoutchouc; Manufacture of a substance resembling ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Dec. 18, 1912, to Fr. Pat. 441,655, Mar. 22, 1912 (this J., 1912, 888). Under Int. Conv., May 25, 1912.

The product of polymerisation of β-γ-dimethylerythrene (Kondakow, J. prakt. Chem., **64**, 109) is transformed into a substance similar to caoutchouc by treatment with tannin or other tanning agents, or with natural rubber. —E. W. L.

Caoutchouc; Manufacture of synthetic —— and intermediate products. H. Dreyfus. First Addition, dated Oct. 28, 1912, to Fr. Pat. 448,711, Aug. 5, 1912 (this J., 1913, 437).

The polymerisation referred to in the main patent may be brought about by means of carbon dioxide in the presence of organic polymerising agents—more particularly those containing nitrogen—such as albuminoids, cyanamide, guanidine, etc., or of inorganic polymerising agents such as sodium.—E. W. L.

Plastic substance similar to rubber substitutes; Composition and process of manufacture of ——. G. Frétard. Fr. Pat. 452,579, Mar. 9, 1912.

One thousand grms. of a vegetable oil are mixed with 1—2 grms. of denitrated nitrocellulose and 6—10 grms. of a gum resin, and 60—80 per cent. of a mixture of about equal parts of petrol and rectified sulphur monochloride is added. The mixture is made in a closed vessel and is subjected therein to thorough mastication, the gases evolved being allowed to escape through a safety valve. After 12—15 hours the mass is neutralised by 150—200 grms. of magnesia, a further quantity of petrol and sulphur chloride being added at the same time. The substance thus obtained sets slowly to a mass of the consistence of rubber. It can be used for insulating purposes, etc., or for incorporation in rubber mixings.—E. W. L.

Caoutchouc-like substance and process of making same. F. Hofmann, C. Coutelle, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,062,828, 1,062,912, 1,062,913, 1,062,914 and 1,062,915, May 27, 1913.

See Eng. Pat. 6450 of 1911; this J., 1911, 1076.—T. F. B.

Rubber-like compounds; Producing ——. H. S. A. Holt, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,062,973, May 27, 1913.

See Fr. Pat. 434,587 of 1911; this J., 1912, 349.—T. F. B.

Caoutchouc; Production of a substance similar to ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 452,006, Dec. 17, 1912. Under Int. Conv., March 14, 1912.

See Eng. Pat. 13,591 of 1912; this J., 1913, 204.—T. F. B.

Process of treating oil or spirit or turpentine. Fr. Pat. 452,688. *See* XIII.

Producing aliphatic hydrocarbons containing two double linkages. Fr. Pat. 451,827. *See* XX.

Process for producing isoprene. Fr. Pat. 452,246. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Hide and leather; Microscopic examination of —— applied to the study of salt stains. G. Abt. Bull. Soc. d'Encour., 1913, **119**, 646—666. (See also this J., 1908, 414.)

Details are given of the methods of preparing and staining sections of hide and leather for microscopic examination, and of their application to the elucidation of the nature of salt stains (see this J., 1912, 735; 1913, 616). A number of photomicrographs, some coloured, are given.—A. S.

Deliming process; The acid ——. H. R. Procter. Tanners' Year Book, 1913, 75—79.

The author discusses the acid deliming process in the light of recent investigations on the action of acids and salts on gelatin and hide substance (see this J., 1911, 818; 1912, 1193; 1913, 231). With careful chemical control, the cheap mineral acids (hydrochloric and sulphuric) may be used, the chief conditions for satisfactory working being a large quantity of clean water, a slight deficiency of acid, gentle agitation, and sufficient time. When excess of acid is used, it is necessary to employ weak acids (organic acids or boric acid) for safe working, and by using a certain proportion of old liquor, the effect of neutral salts of weak acids in reducing the acidity (and swelling power) of the acid may be utilised. The use of mineral acids to liberate the weaker acids from their calcium salts, so that they may be used again, has been suggested, but it is necessary to devise some means of preventing the accumulation of soluble salts of strong acids in the liquors, for as the author has shown previously, if they be present, a certain proportion of the weak acid in combination with the hide substance is displaced by the strong acid. This difficulty can be overcome by using sulphuric acid, the calcium salt of which is only slightly soluble, and by retaining in the liquor a sufficient excess of the calcium salt of the weak acid. The following method is suggested. The hides are first treated in a solution of an organic acid, avoiding a large excess. For the second pack, the amount of acid consumed by the first is determined by titration, and the liquor is made up with the organic acid to a somewhat greater strength than at first. For subsequent strengthening a mixture of say 3 molecular proportions of sulphuric acid to 1 of organic acid may be used, the final strengthening being with sulphuric acid alone. If the hides plump too much, the proportion of sulphuric acid is lessened.—A. S.

Sole leathers; The composition of some ——. F. P. Veitch and J. S. Rogers. U.S. Dept. Agric., Bureau of Chem., Bull. No. 165, May 6, 1913. 20 pages.

Analyses of well-tanned scoured leathers of various tannages, both American and foreign, should give results on a moisture-free basis falling between the following limits: Leather substance, 75—93; hide substance, 43—57; combined tannins, 31—42; water-soluble matter, 5—15; oils and fats, 1—6, and ash, 0·25—1 per cent. Properly dried sole-leather should not contain, even in very damp weather, more than 20 per cent. of water and the average for the year should fall below 15 per cent. The magnesia in the ash, when calculated to $MgSO_4,7H_2O$, the form present in air-dry leather, should not exceed 1 per cent. It is doubtful if as much as 2 per cent. of glucose is ever present in normal leathers from which the excess of tanning material has been properly washed out. Of loading materials, glucose, soluble organic materials containing little or no tannin, magnesium sulphate, barium sulphate and lead sulphate are much more objectionable than a small excess of actual tanning material; the latter may even be of temporary advantage as the slowly-soluble tannins make the leather more water-resistant and impede the removal of combined tannin. The amount of materials found in loaded leathers were: Ash, 0·2—2·7; ether extract, 0·4—5·6; glucose, 0·2—12·4; water-soluble matter, 13·4—34·3, and water-soluble tannin, 6·1—17·8 per cent. Approximately 63 per cent. of the leathers examined were weighted with glucose, magnesium sulphate or both. The loading varied from 1—7·5 with an average of 3 per cent. of magnesium sulphate, up to 10·4 with an average of 5·5 per cent. of glucose and the total maximum loading, when both were present, was 16 per cent. with an average of 8 per cent. Approximately one-third of the tannin in the leathers examined was uncombined, the quantity varying from 9 to 17 per cent. Formerly all sole leather made in America was tanned with oak or hemlock bark or a mixture of the two (union tannage) but now nearly one-half of the total production is tanned with other materials; practically all vegetable-tanned leathers, however, are still termed oak-, hemlock-, or union-tanned leather. The tannin-free water extract from leather tanned with chestnut-oak is fluorescent when made slightly alkaline but many of the so-called oak-leathers failed to give the test. Quebracho had been used in many cases where no intimation of the fact was given in the branding of the leather. Comparison of analyses of samples taken during 6 years indicates no material change in tannery practice with regard to loading.—D. J. L.

PATENTS.

Tannage of glazed leathers. Soc. Anon. des Matières Tannantes et Colorantes. Third Addition, dated March 5, 1912, to Fr. Pat. 396,025, Jan. 13, 1908. (See this J., 1909, 804, 996; 1912, 292.)

THE completely tanned skins, after leaving the drum, are left in pile for 48 hours and then dipped in water to which a small quantity of acid has been added. After draining for 2 or 3 days they are returned to the drum and treated with (1) a solution of glucose, barium sulphate or chloride and dextrin or (2) a solution of glucose, magnesium sulphate and dextrin.—D. J. L.

Tanning products and method of tanning. Badische Anilin und Soda-Fabrik. Fr. Pats. 451,875 and 451,876, Dec. 13, 1912. Under Int. Conv., Feb. 3, March 16, und Nov. 5, 1912.

(1) THE products of condensation of cresol-sulphonic acids obtained by heating the latter, either with or without agents facilitating condensation, such as phosphorus oxychloride or phosphorus trichloride, are suitable for tanning skins. Any one of the three cresols or a mixture of the three may be used. The tanning products obtained are, in the free state, syrupy liquids easily soluble in water, and their alkali salts are colourless, amorphous and very soluble in water. Example: 225 parts of *o*-cresolsulphonic acid are heated to 60° C. for 4 hours with 262·5 parts of phosphorus oxychloride, the excess of oxychloride is removed by distillation under reduced pressure and the residue washed with dilute hydrochloric acid. The degree of acidity of the solution of the products of condensation is regulated so that the skins do not swell unduly and the solution made up to 0·6° B. (sp. gr. 1·004). The skins are suspended in the solution and the strength gradually raised during 10 days till it reaches 5° B. (sp. gr. 1·037). After 14 days the skins are tanned and may be finished as usual. The tanning may be done in the drum in which case the liquor is used stronger at the commencement (2—4° B., sp. gr. 1·014—1·029) and tanning will be complete in 6—8 hours. (2) Phenolsulphonic acids may also be used and in preparing the condensation products the temperature, the duration of action and the amount of condensing agent, if any be used, are regulated so that the minimum quantity of solid products is produced. Example: Phenol-*p*-sulphonic acid is heated to 130° C. for 24 hours under a pressure of 20 mm. or in a current of dry air at atmospheric pressure. The product so obtained may be used directly or purified by dissolving in water, neutralising with caustic soda, filtering and evaporating to dryness. A white powder is obtained which is completely soluble in water and, when acidified, the solution has all the properties of a tannin solution. Or the mixture obtained by warming phenol with strong sulphuric acid is heated to 140° C. for 72 hours under 20 mm. pressure and the process continued as above.
—D. J. L.

Leather or leather-like products; Process for preparing ——. Chem.-Technologische Studienges. m.b.H. Ger. Pats. 258,992 and 258,993, Feb. 22 and May 23, 1911.

(1) THE moisture is removed from unhaired hides by repeatedly washing with alcohol of increasing strength, and the hides are then treated with a solution, containing no water, which leaves a homogeneous residue on evaporation; thus, non-aqueous solutions of shellac or other resin, or tar or cellulose derivatives may be used. (2) A solution of asphaltum in a non-aqueous solvent may be used in place of those mentioned. The products are very tough and resistant to water, and their electrical resistance is very high.—T. F. B.

Leather and analogous products; Process for making ——. Chemisch Technologische Studienges. m. b. H. Fr. Pat. 452,380, Dec. 14, 1912.

SEE Ger. Pats. 258,992 and 258,993 of 1911; preceding. The dried skin may be immersed, immediately after tanning or after the treatment with the solutions specified, in a bath of molten asphaltum, pitch, paraffin, ceresin, etc. the melting point of which is above that to which the finished leather is to be subjected.—T. F. B.

Chrome leather; Process for preparing ——. A. Wolff. Ger. Pat. 259,922, Sept. 4, 1912. Addition to Ger. Pat. 255,110 (see Eng. Pat. 27,900 of 1911; this J., 1912, 292).

IN the process described in the principal patent, an aqueous solution of a strongly (from 7/12 to 2/3) basic chromium formate may be used. This may be prepared by adding 13·6 kilos. of sodium formate to 100 kilos. of semibasic chromium chloride solution, containing 15·2 per cent. of chromic oxide; after standing until the solution has assumed a blue-violet colour, 5·3 kilos. of calcined soda dissolved in 20 litres of water is added, and the solution is diluted to 15° B. (sp. gr. 1·116), when it will contain about 5 per cent. of chromic oxide. The hides are pickled and immersed in this liquid for one to five hours, according to their thickness.—T. F. B.

Chrome leather; Process for impregnating ——. J. Winther. Fr. Pat. 452,029, Dec. 18, 1912.

SEE Eng. Pat. 17,228 of 1912; this J., 1913, 38.—T. F. B.

Process for obtaining condensation products of cresolsulphonic acids. Fr. Pat. 451,877. *See* III.

XVI.—SOILS; FERTILISERS.

Ammonium sulphate; Influence of —— on the phosphate manuring of oats. E. A. Mitscherlich and W. Simmermacher. Landw.-Vers.-Stat., 1913, 79 and 80, 71—96. Chem. Zentr., 1913, 1, 1999—2000.

AMMONIUM sulphate increased considerably the solubility of di- and tri-calcium phosphate in water saturated with carbon dioxide, and, within narrow limits, also enhanced the manurial value of these two phosphates. When used as an auxiliary manure, ammonium sulphate had no effect on the utilisation of the phosphoric acid of superphosphate or basic slag by oats, and it also appeared to have no action on the phosphoric acid of the soil.—A. S.

Exports of phosphates from Egypt. *See* VII.

Sugar beetroot; Action of sulphur on the growth of ——. Urban. *See* XVII.

Patents.

Manures; Manufacture of enriched phosphate ——. H. Naegell. Fr. Pat. 452,572, March 8, 1912.

Natural phosphates, poor in phosphoric acid, are treated with dilute aqueous solutions of volatile acids in convenient proportions, thus dissolving the tricalcium phosphate and separating it from the insoluble impurities. The resulting solution may be boiled to decompose the volatile acid, such as sulphurous or carbonic acid, and precipitate the dissolved phosphate.—B. N.

Manures; Manganese —— with a base of blast-furnace slag. P. Variot. Fr. Pat. 452,602, Dec. 28, 1912.

The employment of blast-furnace slag as a manganese manure is based on a preliminary determination of manganous oxide, which varies from 0·3 to 40 per cent. according to the origin of the slag.—B. N.

Weeds and parasites; Process for preparing compounds, soluble in water, for destroying ——. Z. Böcker. Ger. Pat. 259,767, Nov. 26, 1909.

By treating calcined ferrous sulphate with concentrated sulphuric acid, a very stable and easily soluble compound is obtained, in a compact form, which may be used as a weed-killer and parasiticide.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beetroot; Action of sulphur on the growth of ——. J. Urban. Z. Zuckerind. Böhm., 1913, **37**, 441—444.

In view of the favourable results on various plants reported to have been obtained by using sulphur as fertiliser (this J., 1912, 293), an experiment was made with sugar beetroot in a field manured with potassium sulphate, ammonium sulphate and Chile saltpetre. Flowers of sulphur equal to 200 kilos. per hectare (178 lb. per acre) were strewed on the ground immediately behind the sowing machine and hoed in. The result was a slight increase in the yield, but no difference was observed in the colour of the leaves during growth, and the sugar content and quality of the pressed juice showed no improvement.—L. J. de W.

Reducing sugars; Determination of —— by Lehmann's method. L. Grimbert. Ann. Chim. analyt., 1913, **18**, 187—189.

Various modifications of Lehmann's method have been proposed (see this J., 1898, 499; 1899, 76, 524), but the author now describes what he considers a more accurate method.—W. P. S.

Patents.

Maize [Sugar and paper pulp]; Process of treating ——. F. L. Stewart. Fr. Pat. 451,961, Dec. 16, 1912.

See U.S. Pats. 811,523 of 1906, 923,088 of 1909, and 1,018,994 of 1912 (this J., 1906, 226; 1909, 737; 1912, 352). The fibrous residues from the stalks and ears are boiled with an equal volume of a 15 per cent. solution of sodium hydroxide for about 3 hours under a pressure of about 3 atmospheres. The pulp thus obtained serves for the manufacture of paper.—L. E.

Starch; Apparatus for drying ——. L. P. Bauer, Pekin, Ill., Assignor to Corn Products Refining Co. U.S. Pat. 1,061,720, May 13, 1913.

The starch is conveyed through a drying tunnel in a carrier having foraminous walls and divided by vertical screens into a number of narrow compartments, open at the top, and closed at the bottom by devices which can be displaced so as to allow the discharge of the dried starch by gravity. Hot air is circulated through the tunnel and through spaces, extending the whole length of the carrier, left between the compartments containing the starch. (See also U.S. Pat. 1,035,302 of 1912; this J., 1912, 1089.) —A. S.

Cane sugar industry; Impts. in the ——. E. E. Battelle. Fr. Pat. 452,734, March 16, 1912.

See U.S. Pats. 1,044,003 and 1,044,004 of 1912; this J., 1912, 1195.—T. F. B.

Textile and other manufactures; Product [gum] for use in ——. P. C. D. Castle, St. Margarets on Thames. U.S. Pat. 1,063,118, May 27, 1913.

See Eng. Pat. 20,648 of 1911; this J., 1912, 1141.—T. F. B.

Producing compounds of formaldehyde with sugars. U.S. Pat. 1,062,501. *See* XX.

XVIII.—FERMENTATION INDUSTRIES.

Invertase; Action of hydrogen chloride and ammonia gas on ——. *VI.* T. Panzer. Z. physiol. Chem., 1913, **85**, 225—230. (See also this J., 1913, 41, 441, 547, 620.)

Invertase was treated with gaseous hydrogen chloride and ammonia under the conditions described for diastase (*loc. cit.*). The absorption of ammonia was in excess of the equivalent of the hydrogen chloride by approximately the amount which is absorbed when invertase is treated with ammonia alone. A certain amount of ammonium chloride is lost so that the increase in weight does not correspond accurately with the decrease in acidity and the increase in the nitrogen found by titration in presence of formaldehyde. The increase in this titration value is smaller than would be required by the ammonium chloride absorbed, an anomaly which is accounted for by the fact that under the action of hydrogen chloride gas the invertase undergoes dehydration producing an anhydride. Apart from the formation of the anhydride and the formation of ammonium chloride, the combined action of hydrogen chloride and ammonia upon invertase does not differ essentially from the action of ammonia alone. The percentage of amide nitrogen in the treated product is considerably smaller than in the original; this fact again is connected with the formation of an anhydride. The enzymic activity of the invertase, which is destroyed by the action of hydrogen chloride, is not restored by the subsequent action of ammonia, as in the case of diastase. Thus the destruction of the enzymic activity is not due to the combination of the acid with one of the characteristic groups of the invertase, but is explained by the formation of the anhydride which is not reversible by ammonia.—J. F. B.

Alcoholic fermentation; The reaction phases of ——. H. Euler and D. Johansson. Z. physiol. Chem., 1913, **85**, 192—208.

The authors' researches confirm the separate existence of a yeast enzyme which converts the ordinary hexose sugars into a carbohydrate capable of combining with inorganic phosphates under the esterifying action of another enzyme (phosphatese). The solubility of the various enzymes varies with different yeasts and different conditions. In certain extreme cases the aqueous infusion of a dried yeast will be abolutely devoid of esterifying or fermenting action on a solution of pure dextrose, whilst acting vigorously on a solution of dextrose previously modified by the action of living yeast for a short time. In the majority of cases the aqueous infusion has a slight action on pure dextrose but its action on the modified sugar is far more powerful. The quantitative validity of Harden and Young's equation: $2C_6H_{12}O_6+2PO_4HR_2=2CO_2+2C_2H_6O+2H_2O+C_6H_{10}O_4(PO_4R_2)_2$ was tested, and the fact confirmed that the ratio of phosphate combined to carbon dioxide evolved approaches unity under normal circumstances. In presence of toluene, it is higher than unity in the early stages, because the evolution of carbon dioxide is restricted by excess of uncombined phosphate, but it falls to unity as this excess disappears. In the absence of toluene this ratio is always considerably lower than unity, owing to the restriction of the amount of combined phosphate by the reversal of the esterification by enzymatic hydrolysis. With the interaction of equimolecular proportions of dextrose and phosphate in presence of dried yeast, the free phosphate disappears entirely, but gradually re-appears owing to the hydrolysis of the carbohydrate-phosphate ester. At the moment when all the free phosphate has combined, all sugar will have disappeared, the rotatory power becoming zero. In presence of toluene the evolution of carbon dioxide is largely suppressed as soon as all the sugar is combined with phosphate, but in absence of toluene the evolution of carbon dioxide continues strongly. Thus the enzymatic hydrolysis of the phosphate ester is strongly inhibited by antiseptics. All the above phenomena occur almost as markedly with dried-yeast suspension without the addition of sugar as with sugar, the phenomena in such a case depending on the autofermentation of the higher carbohydrates of the dried yeast substance. The mechanism of alcoholic fermentation and the spheres of activity of the various individual yeast enzymes are by no means completely elucidated by Harden and Young's formula.—J. F. B.

Port wine; Production, composition and standards of genuineness of ——. A. Kickton and R. Murdfield. Z. Unters. Nahr. u. Genussm., 1913, **25**, 625—675.

Following a description of the method of production of port wine are the results of analysis of more than 500 samples, from various classified sources, imported into Germany in 1910 and 1911. These data are discussed fully and the conclusion drawn that genuine port wines (from the Douro region in Portugal) possess, within certain limits, a uniformity of composition which renders it possible in many cases to distinguish them from dessert wines of other origin. The normal composition of port wines imported into Germany is as follows:—Alcohol 14·5—17·5 grms. per 100 c.c., extract (including sugar) 8·0—11·5 grms., total acids (calculated as tartaric acid) 0·3—0·5 grm., sugar-free extract 1·5—2·5 grms., ash 0·15—0·3 grm., glycerin 0·5—0·7 grm. and phosphoric acid 15—30 mgrms. per 100 c.c. Particularly characteristic is the distinct preponderance of lævulose over dextrose in genuine samples. The analytical results obtained for red and white port wines are practically the same.—J. H. L.

Aniline dyes; New reaction for the detection of —— in foods and especially in wines. P. Malvezin. Ann. Chim. analyt., 1913, **18**, 193.

The wine is treated with animal charcoal (an excess being avoided), the mixture is filtered, and 3 c.c. of the colourless filtrate are mixed with 3 c.c. of a reagent prepared by passing sulphur dioxide through a 40 per cent. formaldehyde solution. If the wine contains fuchsin or other aniline dye, a violet colouration develops gradually. Natural wines yield a faint pink colouration. The test is rendered more sensitive by heating the mixture of the filtrate and reagent.—W. P. S.

Acetic bacteria; Permanent cultures of ——. H. Frings, jun. Dtsch. Essigind., 1913, **17**, 114—115. Chem. Zentr., 1913, **1**, 1995.

Cultures of acetic bacteria will usually keep only for a few months. This is considered to be due to the injurious effect of the acetic acid produced, and the author recommends the use of a liquid nutrient medium in narrow-necked flasks of Jena glass of 500 c.c. capacity. The flask is filled to a point half-way up the neck, the latter being 20 mm. inside diam. and 15 cm. long, and closed by a glass cap packed with cotton-wool. Under these conditions the surface of the culture in contact with air is very small in relation to the bulk of the liquid and hence the rate of formation of acetic acid will be very low.—A. S.

Methyl and ethyl alcohols; Determination of —— in mixtures of the two. J. Meyerfeld. Chem.-Zeit., 1913, **37**, 649—651.

The total alcohol-content of mixtures of methyl and ethyl alcohols containing not much water, can be found from the sp. gr. at 15°/15° C. by reference to Windisch's gravity tables, the tables for both alcohols being almost identical over a considerable range (cp. Hetper, this J., 1913, 103). About 5 grms. of the mixture are then diluted to 100 c.c., and 10 c.c. of the solution added to a cold mixture of 50 c.c. of $2N$-chromic acid and 20 c.c. of concentrated sulphuric acid in a 500 c.c. flask on which rests a small funnel. The liquid may be heated at once, and after boiling for a short time, it is cooled, diluted to a litre and titrated with $N/10$ sodium thiosulphate solution in presence of potassium iodide, to determine the unreduced chromic acid (cp. Blank and Finkenbeiner, this J., 1906, 500). The titre of the $2N$-chromic acid employed is best found by boiling 50 c.c. with 20 c.c. of concentrated sulphuric acid, cooling, diluting to 1 litre, and titrating with $N/10$-thiosulphate solution. Under the conditions prescribed methyl alcohol is completely oxidised to carbon dioxide and water, and ethyl alcohol to acetic acid. If a is the weight of the mixed alcohols used for the determination, and b is the weight of oxygen corresponding to the chromic acid reduced, then the weights of methyl and ethyl alcohols present are respectively $(46b-32a)/37$ and $(69a-46b)/37$. The whole determination can be carried out in an hour and the results are accurate, *e.g.*, in a test liquid containing 50·42, 48·88 and 0·70 per cent. respectively of ethyl alcohol, methyl alcohol and water, the percentages found were 50·76, 48·58 and 0·66. (See also Hehner, Analyst, 1887, **12**, 25).—J. H. L.

Determination of lactic acid. Bellet. *See* XXIII.

Patents.

Musts and other saccharine liquids; Process of de-sulphitation applied to ——. M. Depaty. Fr. Pat. 451,904, Feb. 23, 1912.

The liquid, at a constant temperature of, say 70° C., is circulated through a series of connected, open vats, each of which is fitted, at the bottom, with a perforated, arched plate. The last vat of the series has an overflow, so that the level of liquid in each vat is kept constant at the same height. A large volume of air (sterilised by heating if desired) is forced at a low pressure, *e.g.*, by a fan, into the space beneath each perforated plate, and ascends through the liquid; the air may be heated by subjecting it to increased pressure at the outlet from the fan.—L. E.

Denaturant for alcohols. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 258,243, May 25, 1912.

Allyl formate is proposed as a denaturant for alcohols, particularly ethyl alcohol. Allyl formate is soluble in water and has a boiling point (82°—83° C.) close to that of ethyl alcohol, which renders its separation by distillation very difficult. It imparts a distinctive flavour to the alcohol, without rendering it highly toxic.—T. F. B.

XIXa.—FOODS.

Milk samples; Preservation of ——. G. Denigès. Ann. Chim. analyt., 1913, **18**, 189—192.

Milk samples may be preserved for future analysis by the addition of 1 c.c. of a mixture of 50 grms. of crystallised phenol and 10 c.c. of 95 per cent. alcohol to each 100 c.c. of milk. The treated milk may be kept for 10 years without alteration, but requires to be heated to about 40° C., well shaken, and then cooled before it is ready for analysis. The presence of the phenol does not interfere with the determination of the various constituents, but a correction must be made for the increase in volume caused by its addition.—W. P. S.

Whey from cheese-making; Treatment of ——. O. Allemann and W. Müller. Milchwirtschaftl. Zentr., 1913, **42**, 225—234. Chem. Zentr., 1913, **1**, 1995—1997.

The fat still present in whey from cheese-making is recovered by "creaming," by centrifuging, or by a special treatment ("*Vorbrechen*") whereby a portion of the protein is coagulated. For this treatment, "acid" (prepared by a pure lactic acid fermentation) is added, the proportion varying according to the degree of "ripeness" of the original milk; usually 20—30 litres of "acid" (corresponding to about 250 grms. of lactic acid) are added per 1000 litres of milk. After the addition of the acid the whey is heated to about 80° C.; the coagulated protein (probably the lactoglobulin) encloses the globules of fat and carries them to the surface. The coagulum ("*Vorbruch*") can be worked up into whey butter ("*Vorbruchbutter*"). The separated whey is now treated with a further quantity of "acid" (5—8 litres per 100 litres of whey) and heated nearly to boiling, whereby the remainder of the protein (the albumin) separates, leaving a clear liquid free from protein, which can be utilised in the preparation of "acid" and rennet. The coagulum from the second stage of the treatment forms the basis of whey cheese ("*Ziger*").—A. S.

New reaction for the detection of aniline dyes in foods, especially in wines. Malvezin. *See* XXIII.

Patents.

Margarine. S. A. Blichfeldt, Southall, Middlesex. Eng. Pat. 8227, April 4, 1912.

An emulsion of water and fats, containing up to 85 per cent. of the latter, is produced according to the process described in Eng. Pat. 4505 of 1912 (this J., 1913, 445), and, after cooling, is converted into margarine in the ordinary manner.—W. P. S.

Cereal foodstuff and method of producing the same. J. Lewis and S. J. Thomas, London. Eng. Pat. 11,992, May 20, 1912.

Cereal grain is soaked in water for 10 hours, then boiled for 2 hours, drained, cooled to 40° F. (4° C.) and mixed with malt extract in the proportion of about 4 lb. to 100 lb. of grain. The mixture is well stirred, allowed to stand, then heated to 200° F (93° C.) for 2 hours, dried, and rolled into flakes.—W. P. S.

Dough; Treatment of ——. G. Lunt, Formby, and The Patent Dough Aerator Co., Ltd., Liverpool. Eng. Pat. 14,291, June 19, 1912.

The dough, after the expiration of about three-quarters of the usual period of fermentation, is permeated by the passage through it of large volumes of air containing a minute proportion of nitrogen peroxide.—W. P. S.

Cattle-food; Combination of substances for use as a ——, or for insulating purposes, and for the preparation of coated fabrics and artificial boards. A. S. Rowe, London. Eng. Pat. 17,554, July 29, 1912.

Peat moss is mixed thoroughly with three or more times its weight of brewers' pressed or liquid yeast, the mixture is dried, and pressed into cakes or sheets. The dried mixture may also be ground to a powder and mixed with other food materials, or the moist material may be passed between rollers and generally treated in the manner usual with pulp when manufactured into millboard.—W. P. S.

Condensed milk; Process of manufacturing ——. M. Vouga, Cortaillod, Switzerland. U.S. Pat. 1,062,133, May 20, 1913.

See Fr. Pat. 441,489 of 1912; this J., 1912, 835.—T. F. B.

Soya; Treatment of —— to convert it into food products. N. Bergey. Fr. Pat. 452,082, Feb. 26, 1912.

See Eng. Pat. 5169 of 1912; this J., 1913, 446.—T. F. B.

Albumins; Process for restoring coagulated —— to their original condition. A. H. Rasche. Fr. Pat. 452,565, Dec. 12, 1912.

See Eng. Pat 28,613 of 1912; this J., 1913, 621.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Phenol; Determination of —— in presence of organic matter. E. M. Mumford. Chem. News, 1913, **107**, 253.

For the determination of relatively small amounts of phenol, such for instance as are present in peptone media containing phenol, used in bacteriology, the liquid under examination is heated for 1 minute to from 80° to 90° C. with a few c.c. of concentrated sulphuric acid; a quantity of 10 per cent. potassium nitrate solution, sufficient to oxidise the organic matter and nitrate the phenol, is then added and the mixture is boiled until it becomes straw-yellow in colour. After cooling, an excess of ammonia is added, and the colouration obtained (due to ammonium picrate) compared with that of a standard phenolsulphonic acid solution which has been nitrated and rendered ammoniacal. As little as 0·0001 grm. of phenol may be determined by the method and the results obtained are sufficiently accurate for ordinary purposes.—W. P. S.

Patents.

Permutite; Process for regenerating ——. G. Schweikert and A. Czeczowicza. Fr. Pat. 452,079, Nov. 14, 1912.

See U.S. Pat. 1,054,460 of 1913; this J., 1913, 377.—T.F.B.

Preparing compounds soluble in water for destroying weeds and parasites. Ger. Pat. 259,767. *See* XVI.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids of the atropine group; Quantitative study of the absorption of ultra-violet radiation by ——. M. Gompel and V. Henri. Comptes rend., 1913, **156**, 1541—1544.

Atropine has three absorption bands at $\lambda=2645$, 2580, and 2505 respectively, with general absorption increasing rapidly below 2493. The three bands are apparently those of the benzene ring displaced about 30 units towards the red. The remaining benzene bands are masked by the strong absorption of the rest of the molecule. Apoatropine has one band at $\lambda=2626$, while cocaine has bands at $\lambda=2814$, 2722 and 2314. The last is remarkably prominent and can be used to detect $\frac{1}{20}$ mgrm. of cocaine in 10 c.c. of solution. The cocaine bands are apparently those of benzoic acid displaced a little towards the red. This method of absorption spectra can be used for the quantitative estimation of the alkaloid with an accuracy of 5—10 per cent.—W. H. P.

Carbon tetra-iodide; Properties of ——, and its determination in presence of iodoform. M. Lantenois. Comptes rend., 1913, **156**, 1629—1631. (See this J., 1913, 624.)

Hydrogen begins to reduce carbon tetra-iodide at 100° C. Iodoform is the first product, but the hydriodic acid also formed reduces this to methylene iodide and methyl iodide. Alcoholic potassium hydroxide also reduces it at 30°—40° C., a small quantity of methane being amongst the products. Sodammonium dissolved in liquid ammonia reacts readily with carbon tetra-iodide; methane is produced, but no ethylene nor acetylene. A portion of the carbon is found as sodium cyanide, and traces of methylamine and probably guanidine. Oxygen at the ordinary temperature, even in the dark (and less rapidly air) decomposes the tetra-iodide completely, yielding iodine and carbonyl iodide, which dissociates into iodine and carbon monoxide (with some carbon dioxide from the excess of oxygen). Many metallic chlorides yield with the tetra-iodide metallic iodides and carbon iodochloride. Silver nitrate in 20 per cent. solution reacts partially according to one, partially according to the other of the following equations–(1) $CI_4+4AgNO_3+2H_2O=CO_2+4HNO_3+4AgI$; (2) $3CI_4+12AgNO_3+6H_2O=3CO+AgIO_3+11AgI+12HNO_3$ The volume of gas formed from a given quantity of tetra-iodide is the same in either case; and a determination of this volume affords a means of determining tetra-iodide in presence of iodoform. From 1 grm. of tetra-iodide the volume of gas is 42·9 c.c., from 1 grm. of iodoform 56·6 c.c.; whilst the percentages of iodine in the two, 97·7 and 96·7, are so close that gravimetric determination of the composition of a mixture is practically impossible.—J. T. D.

PATENTS.

Phenylcinchoninic acid and homologues or derivatives thereof; Manufacture of derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning, and R. Schwabe, Höchst on Maine, Germany. Eng. Pat. 10,443, May 2, 1912. Addition to Eng. Pat. 10,352, dated Jan. 16, 1912 (see this J., 1913, 624).

IN place of the aliphatic amines described in the principal patent, complex aliphatic amines or aromatic amino-compounds may be combined with the chloride of α-phenylcinchoninic acid or a homologue or derivative thereof; the following amino-compounds are mentioned:—Ethanolethylamine, glycocoll methyl ester, *p*-aminobenzoic acid ethyl ester, *p*-aminobenzoic acid, *p*-phenetidine, and 1-phenyl-2.3-dimethyl-4-amino-5-pyrazolone. The products are stated to be tasteless and "of great therapeutic value."—T. F. B.

Hexamethylenetetramine and hydrogen peroxide; Process of producing a solid stable compound of ——. Diamalt Akt.-Ges., Munich, Germany. Eng. Pat. 29,373, Dec. 20, 1912. Under Int. Conv., Jan. 27, 1912.

FINELY powdered hexamethylenetetramine is added to a cooled concentrated (*e.g.*, 30 per cent.) hydrogen peroxide solution, the mixture is well stirred, and the double compound of hexamethylenetetramine and hydrogen peroxide is precipitated by adding alcohol-ether or other precipitant. Another method consists in adding concentrated hydrogen peroxide, with cooling, in the usual process for preparing hexamethylenetetramine, and isolating the compound by known methods. The product is soluble in cold water and in alcohol, but is not easily soluble in ether. It may contain up to 35 or 40 per cent. of active oxygen, the best results being obtained by using two mols. of hydrogen peroxide to one of hexamethylenetetramine.—T. F. B.

Fats and fatty oils, and malt extract or maltodextrin; Process of producing dry pulverulent or pulverisable compounds of ——. M. Hamburg, Bishop's Stortford, Herts. Eng. Pat. 29,481, Dec. 21, 1912.

THE fat or oil (25 parts or more) is emulsified with highly concentrated malt extract or maltodextrin syrup (75 parts), the mixture is dried, *e.g.*, by spreading it on plates in a vacuum chamber at 40°—50° C., and the dried mass is granulated or powdered.—L. E.

Copper compounds of lecithin and analogous compounds; Process of producing complex ——. M. von Linden, Bonn, E. Meissen, Hohenhonnef, and A. Strauss, Barmen, Germany. Eng. Pat. 3950, Feb. 15, 1913. Under Int. Conv., March 21, 1912.

LECITHIN and analogous compounds, such as jecorin, cuorin, kephalin, etc., can be combined with inorganic or organic copper salts to form complex compounds, which are applicable as remedies for infectious diseases, particularly tuberculosis. For example, one part of the dry copper salt of cinnamic acid is triturated at a moderate temperature with two parts of lecithin until the blue colour has disappeared, and a uniform light green paste is obtained; the product is soluble in ether and chloroform. Similarly, a brownish-green mass, soluble in ether or oil, is obtained by adding an alcoholic solution of one part of cupric chloride to two parts of lecithin.—T. F. B.

Tobacco; Process of treating ——. D. A. Gallagher, York. Pa. U.S. Pat. 1,062,093, May 20, 1913.

TOBACCO is immersed in water at a temperature of 105°—110° F. (41°—43° C.), and then allowed to drain on screens while the temperature is maintained at 115° F. (46° C.). When dripping ceases, the temperature is raised to 135°—160° F. (57°—71° C.) and kept at this point until the tobacco is limp. The tobacco is then shaken to remove impurities, and cooled suddenly.—W. P. S.

Formaldehyde with sugars; Method of producing compounds of ——. F. Quade, Assignor to J. A. von Wülfing, Berlin. U.S. Pat. 1,062,501, May 20, 1913.

COMPOUNDS containing one mol. of a biose with five mols of formaldehyde are obtained by heating the biose with five mols. of formaldehyde or a product which furnishes formaldehyde, in concentrated aqueous solutions at above atmospheric pressure and at temperatures up to 110° C. The water is removed from the resulting solution by evaporation. The compounds may also be obtained by heating the biose with paraldehyde in presence of talc or similar inert diluent. (See also this J., 1911, 982; 1912, 843.)—T. F. B.

Liquids or various substances; Process for augmenting the emollient properties of —— *by the addition of saponin.* R. von Walther and W. Dederich. Fr. Pat. 451,446, Nov. 30, 1912.

SAPONIN is added to liquids, toilet preparations, powders, ointments, antiseptics, etc., in order to augment their emollient power.—W. P. S.

Aliphatic hydrocarbons containing two double linkages; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,827, Dec. 12, 1912. Under Int. Conv., Dec. 23, 1911.

ERYTHRENE, isoprene, and analogous hydrocarbons with two double linkages, are obtained by heating with dehydrating agents the 1.3-glycols of the formula, $R_2C(OH).CHR.CR(OH).CH.R_2$, where R represents hydrogen or alkyl: the process must be carried out in such a manner that the hydrocarbon formed is continuously removed from the influence of the dehydrating agent. *Example.* A mixture of 1000 parts of β-methylbutane-1.3-diol with 10 parts of potassium bisulphate is heated to 160°—170° C., and the isoprene is separated from the distillate: the yield is stated to be about 20 per cent. of theory.—T. F. B.

Isoprene; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 452,246, Dec. 20, 1912. Under Int. Conv., June 11, 1912.

THE fraction of petroleum hydrocarbons consisting essentially of normal pentane and isopentane, *e.g.*, the fraction of gasoline of b. pt. 40°—45° C., is treated with chlorine in such a way as to produce chiefly the monochloro compounds, the mixture of which is freed from polyhalogen compounds and unchanged hydrocarbon by distillation, collecting the fraction of b. pt. 75°—105° C.; this fraction is passed in the form of vapour over quicklime heated to 375°—450° C., or otherwise treated to remove the elements of hydrogen chloride. The mixture of olefines thus obtained is treated with hydrochloric acid in the cold; this converts the trimethylethylene into 2-chloro-isopentane, but does not react with the other olefines; these are separated by distillation and converted into trimethylethylene by repeated treatment with alumina at a temperature of 400°—450° C., the trimethylethylene formed being converted after each treatment into chloroisopentane. The whole of the 2-chloro-isopentane is now converted into the dichloro-compound, $(CH_3)_2.CCl.CHCl.CH_3$, by treatment with chlorine under the influence of ultra-violet light, etc., and this is converted into isoprene by passing it slowly in the form of vapour over a catalytic agent, *e.g.*, barium chloride, heated to about 350° C.—T. F. B.

Halogen compounds; Transformation of —— [into aldehydes and ketones]. Fabriques de Produits de Chimie Organique de Laire. Fr. Pat. 452,537, March 7, 1912.

Aliphatic or aromatic halogen compounds are capable of reacting with hexamethylenetetramine, when heated in aqueous or aqueous-alcoholic solutions, the elements of the hydrogen-halogen acid being replaced by oxygen, and the corresponding aldehyde or ketone is obtained in high yield. Thus benzyl chloride is converted into benzaldehyde, the monobromo-xylenes into the toluic aldehydes, allyl iodide into acrolein, and chloroethylbenzene into acetophenone. The aldehydes derived from the higher aliphatic hydrocarbons (*e.g.*, nonanal, decanal, etc.), can be readily obtained from the corresponding alkyl iodides. —T. F. B.

Nitriles from thioureas; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 259,363, April 5, 1912.

Thiourea or a derivative thereof is heated with a metal (copper, iron, etc.), in presence of a diluent, such as paraffin oil or anthracene. For example, when 10 parts of *o*-ditolylthiourea are heated with 100 parts of paraffin oil and 20 parts of iron to 280° C., a yield of 64 per cent. of *o*-tolunitrile is obtained. Similarly benzonitrile is produced from diphenylthiourea.—T. F. B.

Nitriles from mustard oils; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 259,364, April 5, 1912.

Mustard oils are converted into nitriles by heating with a metal in presence of paraffin, anthracene, naphthalene, xylene, or other diluent. Thus, *o*-tolyl-isothiocyanate is converted into *o*-tolunitrile.—T. F. B.

Cyanhydrins of aldehydes and ketones; Preparation of derivatives of —— containing sulphur. A. Albert. Ger. Pat. 259,502, May 1, 1912.

When a cyanhydrin of an aldehyde or ketone is treated with hydrogen sulphide, addition of the latter to the cyano group does not take place owing to the presence of the hydroxyl group. If, however, this hydroxyl group is acetylated, the normal addition of hydrogen sulphide occurs. In place of hydrogen sulphide, a metallic sulphide, thioacetic acid or its salts, or phosphorus sulphide, etc., may be used. The amide of methylenedioxy-3.4-O-acetylthiomandelic acid and of *o*-nitro-O-benzoylthiomandelic acid (which gives a violet dyestuff on treatment with alkali) are described. The sulphur compounds from the cyanhydrins of ketones may be used as antiseptics. —T. F. B.

Hydrastinine from berberine; Process for preparing ——. E. Merck. Ger. Pat. 259,873, Nov. 28, 1911. Addition to Ger. Pat. 241,136.

The quaternary compounds of α-aryltetrahydroberberine are treated with reducing agents, and the bases thus obtained are converted into hydrastinine by oxidation. —T. F. B.

p-Hydroxyphenylethylamine; Process for preparing N-alkaryl compounds of ——. F. Hoffmann-La Roche und Co. Ger. Pat. 259,874, Oct. 13, 1912.

p-Hydroxyphenylethylamine is condensed with an aromatic aldehyde, and the resulting Schiff's base is converted into the corresponding secondary amine by reduction; the products, which have the general formula, $HO.C_6H_4.CH_2.CH_2.NH.CH_2.aryl$, are applicable to medicine.—T. F. B.

Beta-methyl-gamma-[hydr]oxybutyldimethylamine of the formula $CH_3.CH(OH).CH(CH_3).CH_2.N(CH_3)_2$; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,588, May 15, 1912.

See Ger. Pat. 254,713 of 1911; this J., 1913, 380.—T. F. B.

Hydrocupreine; Manufacture of alkyl derivatives and substituted alkyl derivatives of ——. H. Thron and C. Freund, Assignors to Verein. Chininfabr. Zimmer und Co., Frankfort, Germany. U.S. Pat. 1,062,203, May 20, 1913.

See Ger. Pat. 254,712 of 1911; this J., 1913, 213.—T. F. B.

Acidylsalicylic acid ester and process of making same. R. Wolffenstein, Berlin. U.S. Pat. 1,063,099, May 27, 1913.

See Eng. Pat. 27,562 of 1911; this J., 1912, 661.—T. F. B.

Cyclic ketones [from adipic acid, etc.]; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 451,828, Dec. 12, 1912. Under Int. Conv., Dec. 21, 1911.

See Ger. Pat. 256,622 of 1911; this J., 1913, 450.—T. F. B.

Hydrogen peroxide and hexamethylenetetramine; Preparation of a solid stable compound of ——. Diamalt-Akt.-Ges. Fr. Pat. 451,990, Dec. 17, 1912. Under Int. Conv., Jan. 27 and March 4, 1912.

See Eng. Pat. 29,373 of 1912; preceding.—T. F. B.

Dichloro-derivatives of hydrocarbons having the chlorine atoms united to different carbon atoms; Manufacture of ——. W. H. Perkin, C. Weizmann, and H. Davies. Fr. Pat. 452,503, Dec. 28, 1912. Under Int. Conv., Jan. 3, 1912.

See Eng. Pat. 277 of 1912; this J., 1913, 212.—T. F. B.

1-*Dimethylaminobutene*-3 *and* 1-*dimethylamino*-2-*methylaminobutene*-3; *Process for producing ——.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 452,785, Dec. 31, 1912. Under Int. Conv., Jan. 12, 1912.

See Ger. Pat. 254,529 of 1912; this J., 1913, 212.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Dyestuffs used in photography; Process for sensitising —— by means of thiosinamine derivatives. A. Just. Ger. Pat. 256,186, June 14, 1912.

To increase the sensitiveness to light of dyestuffs for use in producing coloured photographs, it is proposed to use derivatives of thiosinamine containing one or more allyl groups and one or more fatty or fatty-aromatic heterocyclic substituents, with or without other sensitisers. Such products may be obtained by the action of allyl mustard oil on an aliphatic primary or secondary amine or amide, or on a benzylamine base or a piperidine derivative, or again on an aminoalcohol, aminoaldehyde, or aminoketone, or on an aliphatic diamine, or on hydrazine or hydroxylamine or a substituted hydrazine or hydroxylamine. Thus, the interaction of allyl isothiocyanate and allylamine furnishes diallylthiourea (*sym.* allylthiosinamine), whilst when diethylamine is used in place of allylamine, diethylallylthiourea is formed. Aminoalcohols give rise to compounds of the type, $C_3H_5.NH.CS.NR.CH_2OH$, and hydrazines to the compounds $C_3H_5.NH.CS.NH.NHR$. —T. F. B.

Colour photographs; Process for producing ——. Neue Photographische Ges. A.-G. Ger. Pat. 257,160, June 14, 1911.

The primary colours are produced by the oxidising action of the exposed emulsified silver halide on suitable oxidisable organic compounds which are converted into insoluble coloured products. Three-colour photographs may be produced by successive exposures beneath suitable line screens, and subsequent development with the appropriate colour-forming agent. Three emulsions sensitised to the primary colours may be superposed, or they may be tanned and then mixed to form a single film. The blue-sensitiveness of the emulsions sensitised for green and red may be diminished by placing over them a layer of a yellow dyestuff in a suitable binding agent.—T. F. B.

Photographic paper and process for the preparation of same. T. del Fabro, Rome. Eng. Pat. 11,193, May 10, 1912.

See Fr. Pat. 443,633 of 1912; this J., 1912, 1008.—T.F.B.

XXII.—EXPLOSIVES; MATCHES.

Nitrous fumes in firing "cheesa" sticks; Notes on the quantitative determination of ——. L. Heymann, J. Chem. Met. and Min. Soc., S. Africa, 1913, **13**, 464—467.

Regulations were introduced in South Africa on Jan. 1, 1913, prohibiting the use of "cheesa" sticks made with blasting gelatin, and permitting the use only of such lighters as do not produce any nitrous fumes. The following method is used by the author for determining the amount of nitrous fumes produced. A glass bottle of 10 to 15 litres capacity with a tubulure at the bottom is connected at this point with absorbing flasks. About 75 c.c. of a 1 per cent. solution of sodium hydroxide are placed in the bottle, and shaken to wet the sides, and a further amount of the solution is contained in the absorption flasks. The neck of the bottle is then closed with a rubber stopper, through which pass three thick copper wires. One of the wires carries a small porcelain crucible containing the substance to be tested, and the other two wires are connected by a small piece of thin platinum wire, which is placed in the crucible in contact with the material. The other ends of these wires are connected with an accumulator. From 0·2 to 0·8 grm. of material is taken for a test and it is ignited by turning on the current. The whole apparatus is then allowed to stand for 2 hours, and, after removing the crucible, the jar is re-corked and well shaken, and the whole of the liquid in the large bottle and the absorbing bottles is washed out and made up to 250 c.c. From 25 to 50 c.c. of this solution are transferred to a litre flask and reduced by the addition of 1½ grms. of zinc filings and 15 c.c. of sulphuric acid. After the addition of sodium hydroxide solution, the ammonia is distilled off and determined either by titration with $N/100$ acid, or by nesslerising. Using several different brands of "cheesa" sticks the amount of nitrogen peroxide found was between 0·0045 and 0·030 grm. per grm. of material burned, whilst two samples of blasting gelatin gave from 0·3 to 0·38 grm. per grm. of material burned.
—G. W. McD.

Patents.

Explosives, fuses, detonators, percussion caps and the like; Manufacture of ——. A. Jaques, Polmont Station, Scotland, and G. Wells, St. Albans, Herts. Eng. Pat. 23,450, Oct. 14, 1912.

Benzoyl peroxide is placed adjacent to, in contact with, or mixed with suitable explosive or flashing materials, thus producing mixtures having a lower temperature of ignition than the explosive material alone. Such mixtures may be used for the production of priming compositions, or other materials, for purposes where a low flash point is desirable, *e.g.*, in the manufacture of electric fuses or detonators.—B. N.

Gelatinised powders having nitroglycerin for their base and all other powders manufactured with a mixture of nitric and sulphuric acids; Method of stabilising ——. P. Allyre. First Addition, dated Sept. 16, 1912, to Fr. Pat. 443,555, Mar. 25, 1912 (this J., 1912, 1095).

Starch may be used as a base for nitrating, and the finished material may be dried in a stove at 65° C. instead of in sunlight.—G. W. McD.

Explosive, and method of making it. Soc. Universelle d'Explosifs (ancien. Berges, Corbin et Cie). Fr. Pat. 451,754, Feb. 19, 1912.

Ammonium nitrate explosives non-sensitive to shock, and somewhat difficult to detonate, are stated to be improved by adding to the granulated explosive an aqueous solution of gum containing gunpowder in suspension and rotating the mixture in a drum. The material is then dried.—G. W. McD.

Detonating compositions; Method for the preparation of ——. C. Claessen. Fr. Pat. 451,925, Dec. 14, 1912.

Nitropentaerythritol is added to such explosives as tetranitromethylaniline, trinitrotoluene, and lead azide. The following composition is given:—Nitropentaerythritol (1 part), and lead azide (0·2 part).—G. W. McD.

Powder B [French Service]; Method for converting —— into a yellow powder which becomes yellowish orange to violet red in presence of traces of nitric acid, is uninfluenced by light, and does not decompose at a temperature of 140° C. E. Lajoanio. Fr. Pat. 452,154, Dec. 10, 1912.

Nitrocellulose intended for the manufacture of the French service powder B is dipped in water, containing 0·5—1 per cent. of the sodium salt of aminobenzenesulfoazodiphenylamine, for 10 to 15 minutes. The nitrocellulose is then dried in a stove, or dehydrated with alcohol, and gelatinised by incorporating with a mixture of ether-alcohol in which is dissolved 0·5—1 per cent. of the compound previously mentioned. If the powder is to be heated with water, this should also contain the same quantity of this substance. When the powder begins to decompose it becomes violet red in colour.
—G. W. McD.

Explosives containing picric acid as a base; Method for manufacturing high ——. R. Kolowratnik. Fr. Pat. 452,554, Nov. 26, 1912.

The explosives contain picric acid in admixture with various carbonaceous and oxidising materials. Some of the examples are:—Picric acid (45 parts), sodium nitrate (40), woodmeal (9), and lignite (6 parts); Picric acid (52 parts), potassium chlorate (30), starch (5), and woodmeal (13 parts).—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Reactions; Sensitiveness of certain chemical ——. M. Górski. Z. anorg. Chem., 1913, **83**, 315—346.

After a discussion of the different methods of representing the sensitiveness of a chemical reaction, the author recommends the use of the term "atomic sensitiveness," which is defined as that (maximum) volume in litres, in which at least one atomic- or formula-weight (in grms.) of the substance must be present, in order to give a recognisable reaction (precipitation, colouration, etc.) under definite conditions. The reactions studied were precipitation of barium as sulphate, of calcium as oxalate, of mercuric and mercurous chlorides, and of silver as bromide and iodide, and the colour reaction of cobalt with potassium thiocyanate and alcohol. The results, together with a number of earlier results by other workers, are tabulated. —A. S.

Tin; Delicate reagent for ——. C. Zenghelis. Pharm. Zentralh., 1913, 510; Pharm. J. 1913, 839.

One gram of molybdenum trioxide is dissolved in a dilute solution of sodium hydroxide, the liquid made acid with hydrochloric acid in slight excess, and the volume made up to 200 c.c. with distilled water. A blue colouration is formed when solution of tin chloride is added to the reagent, and the delicacy of the reaction is such that 0·000001 grm. of tin may be recognised.

Lactic acid; Determination of ——. A. Bellet. Bull. Soc. Chim., 1913, **13**, 565—572.

For the determination of lactic acid in such substances as blood, urine, fermented liquids, etc., the liquid is freed from proteins by means of Patein and Dufau's reagent [an acid solution of mercuric nitrate], and is then neutralised, and evaporated to a syrupy consistence. This syrup is acidified with sulphuric acid, mixed with anhydrous sodium sulphate and sand, and extracted with ether in a Soxhlet apparatus which is provided with a tap on its stem so that the ether may be allowed to flow back continuously into the extraction flask. After the ethereal solution has been evaporated, the residue is dissolved in water, transferred to a flask, and diluted to 200 c.c. The flask is connected with a condenser, the lower end of which passes into an absorption vessel, this in turn being connected with a second similar vessel and condenser. The absorption vessels contain a definite volume of a solution prepared by dissolving 15 grms. of silver nitrate in water, adding 150 grms. of ammonia and 100 c.c. of sodium hydroxide solution, and diluting the mixture to 500 c.c. The liquid in the flask is acidified strongly with sulphuric acid, heated to boiling, and a 1·5 per cent. potassium permanganate solution is added drop by drop at such a rate that each drop is decolourised before the next is introduced, a current of air being meanwhile drawn through the apparatus, to carry over the acetaldehyde produced. When the permanganate added is no longer decolourised, the solution is boiled for a further period of 3 minutes the contents of the receivers are mixed, filtered, and the excess of silver is titrated. The presence of β-hydroxybutyric, succinic, and oxalic acids does not interfere with the determination of the lactic acid.—W. P. S.

Determination of sulphur in illuminating gas. M'Bride and Weaver. *See* IIa.

Volumetric determination of hypophosphorous acid and hypophosphites. Marino and Pellegrini. *See* VII.

Titration of hypochlorites. Ducelliez. *See* VII.

Behaviour of ammonium and alkali nitrates and nitrites and the corresponding salts of some substituted ammonium compounds towards reducing agents. Vaubel. *See* VII.

Iodometric determination of free and combined chromic oxide. Gröger. *See* VII.

Determination of ozone and hydrogen peroxide. Rothmund and Burgstaller. *See* VII.

Determination of oxygen in iron and steel. Pickard. *See* X.

Determination of reducing sugars by Lehmann's method. Grimbert. *See* XVII.

New reaction for the detection of aniline dyes in foods, especially in wines. Malvezin. *See* XVIII.

Determination of methyl and ethyl alcohols in mixtures. Meyerfeld. *See* XVIII.

Determination of phenol in presence of organic matter. Mumford. *See* XIXb.

Quantitative study of the absorption of ultraviolet radiation by alkaloids of the atropine group. Gompel and Henri. *See* XX.

Properties of carbon tetraiodide and its determination in presence of iodoform. Lantenois. *See* XX.

Determination of nitrous fumes in firing "cheesa" sticks. Heymann. *See* XXII.

Patents.

Photometers. Siemens Bros. Dynamo Works, Ltd., London, and S. H. Callow, Harringay, Middlesex. Eng. Pat. 15,660, July 4, 1912.

In photometers of the type in which the intensity of illumination of a screen by a source of light is compared with the intensity of illumination of a second screen by a movable standard lamp the latter is fed at considerably below its normal voltage so that the rate of blackening of the bulb is reduced and the candle power of the lamp remains practically constant for a considerable period. To modify the colour and to reduce the intensity of the illumination being measured, tinted and smoked glasses may be used, the requisite corrections being applied.—L. E.

Gases; Process for determining the specific gravity of flowing ——. F. Meyer. Ger. Pat. 258,858, May 10, 1912.

A measuring device (*e.g.*, a so-called "*Rotamesser*") of the type which registers the specific gravity of a gas when this is passed through at a definite velocity, or registers the velocity when a gas of known specific gravity is passed through, is used. Preferably two similar measuring devices, connected by a long tube, are used. The whole is filled with the gas under examination and a gas, *e.g.*, air, of known specific gravity, is led into the first measuring device, thus causing an equal quantity of the gas under examination to pass through the second measuring device. In this way the first measuring device indicates the velocity of the known gas, and hence also of the gas under examination, whilst the sp. gr. of the latter can be ascertained from the indication of the second measuring device.—A. S.

Gas mixtures; Apparatus for the determination of the composition and velocity of ——. W. Heckmann. Ger. Pat. 259,600, Sept. 26, 1912. Addition to Ger. Pat. 252,538.

The apparatus described in the chief patent (this J., 1913, 112) is modified in that the throttle-chamber, in front of which the one connection to the differential manometer branches off, is combined with a separate vessel containing an absorbing medium, from the further side of which branches off the second connection to the differential manometer.—A. S.

Determination of substances which give a characteristic emission spectrum when introduced into a flame; Process for the quantitative ——. R. L. von Klemperer. Ger. Pat. 259,598, Aug. 15, 1912.

The quantity of the substance is determined from the intensity of the emission spectrum, or of a portion of the same, measured by means of a thermo-element, or a bolometer, or photographically.—A. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Law of volatility in chemical reactions. C. Matignon. Comptes rend., 1913, **156**, 1536—1538.

THE author generalises Berthollet's "law of volatility" in the following form. "Every system of liquid or solid bodies, which is capable of giving rise to a system containing volatile substances, will undergo reaction in that sense at a convenient temperature." The reaction $2Al + 3MgO = 3Mg + Al_2O_3$ is possible because magnesium is quite volatile at comparatively low temperatures. In the same way it is probable that baryta will be reduced by silicon, owing to the relative volatility of the barium produced. The law can also be extended as follows: A reaction which has volatile bodies in its initial stage and also in its final stage, is facilitated when the number of volatile molecules in the final stage is greater than that in the initial one, *i.e.* of two reactions which are equally endothermic, the one complying with this condition will proceed at a lower temperature.—W. H. P.

Books Received.

SHALE OILS AND TARS AND THEIR PRODUCTS. By Dr. W. SCHEITHAUER. Translated from the German by CHAS. SALTER. Scott, Greenwood and Son, 8, Broadway Ludgate, London, E.C. 1913. Price 8s. 6d. net.

THIS volume (8⅝ by 5½ ins.) contains 176 pages of subject matter, with 70 illustrations and 4 diagrams, followed by an alphabetical index. The subject matter is classified as follows:—I. History of the shale and lignite-tar industry. II. The bituminous raw materials. III. Production of distillation tar. IV. Distillation products. V. Distillation of the tar and tar-oils. VI. Chemical treatment of tar and its distillates, with utilisation of refinery waste. VII. Manufacture of paraffin. VIII. Products furnished by shale oil and lignite tar. IX. Candle making. X. Composition of tars and their distillates, etc. XI. Statistics.

PHYSIKALISCHE CHEMIE DER HOMOGENEN UND HETEROGENEN GASREAKTIONEN. UNTER BESONDERER BERÜCKSICHTIGUNG DER STRAHLUNGS- UND QUANTENLEHRE SOWIE DES NERNST'SCHEN THEOREMS. Von Dr. KARL JELLINEK. S. Hirzel's Verlag. Leipzig. 1913. Price M. 30. Bound, M. 32.50.

THIS volume (9¾ by 6¾ ins.), contains 816 pages of subject matter with 221 illustrations and 104 tables, followed by alphabetical indexes of authors and subjects.

I. Statics (thermodynamics) of gas reactions. A. Theoretical and B. Experimental. II. Kinetics of gas reactions (i), Homogeneous, and (ii), Heterogeneous. III. Electrochemistry of gas reactions (i), Homogeneous and (ii), Heterogeneous. IV. Photochemistry of gas reactions. (i), Experimental (Methods, etc.), (ii), Law of photochemical equivalence. (iii), Photochemical kinetics and statics of gas reactions. (iv), Black body temperature of a radiation and its photochemical activity.

A DICTIONARY OF APPLIED CHEMISTRY. By Sir EDWARD THORPE, C.B., LL.D., F.R.S., Emeritus Professor of Chemistry, Imperial College of Science and Technology, South Kensington, London, etc., etc. Assisted by eminent contributors. Revised and enlarged edition. In five volumes. Vol. IV. Longmans, Green, and Co. 39, Paternoster Row, London. 1913. Price £2 5s. net.

THIS volume (9¼ × 6¼ ins.) contains 727 pages of subject matter, with 232 illustrations. It commences with a table of abbreviations of the titles of journals and books and a list of the contributors. The first subject treated of in Vol. IV is Oilstone; the last, Soda Nitre. Amongst the articles described in considerable detail are "Olive, Rape and Colza oils," "Opium," "Oxygen," "Ozone," "Paper," "Paraffin," "Petroleum," "Photography," "Platinum," "Polarimetry," "Potassium," "Quinones," "Rubber," "Saponification," "Sewage," "Silicon," "Silver and Silvering." (See also this J., 1912, 1098, 561, and 155.)

UNTERSUCHUNG DER KOHLENWASSERSTOFFÖLE UND FETTE SOWIE DER IHNEN VERWANDTEN STOFFE. Von Prof. Dr. D. HOLDE. Abteilungsvorsteher an Kgl. Materialprüfungsamt zu Berlin-Lichterfelde W. Julius Springer's Verlag. Berlin. 1913. Price M. 12.

THIS volume (8¼ × 5¾ ins.) contains 575 pages of subject matter, with 117 illustrations and alphabetical indexes of subjects and names of authors, etc. Though the classification of the text is practically the same as that of the 3rd edition (see this J., 1909, 1227) the work is considerably extended in this edition. Chapter I. Petroleum and its products. II. Natural asphaltum. III. Ozokerite and Montan wax. IV. Tars from Coal, Lignites, Shales and Peat. V. Saponifiable Fats and Oils, etc. VI. Technical products prepared from saponifiable fats and oils. VII. Waxes. APPENDIX. Distinguishing turpentine substitute (Varnish spirit) from petroleum spirit. Physical tests for asphaltums for road making, etc.

BIBLIOGRAPHIE DER AN DEN DEUTSCHEN TECHNISCHEN HOCHSCHULEN ERSCHIENENEN DOKTOR-INGENIEUR-DISSERTATIONEN IN SACHLICHER ANORDNUNG 1900 BIS 1910. Bearbeitet von CARL WALTHER. Kommissionsverlag von Julius Springer. Berlin. 1913. Price M. 2.

THIS volume (10⅜ × 7⅝ ins.) contains 131 pages of subject matter, with tables, and a preface by Prof. W. Franz, of Charlottenburg. It embodies (1) A comparative statistical review of the promotions to the doctor degree, and (2) Other promotions of the German technical Hochschulen. (3) Alphabetical lists of the authors of the papers, essays, etc., winning the promotions during the years 1900 to 1910. (4) Bibliographic arrangement of the researches, papers, etc., classified and grouped according to the general subjects, and with authors' names numbered, so as to be at once referable to the alphabetical list of names, similarly numbered.

GASANALYTISCHE METHODEN. Von WALTHER HEMPEL. Vierte neubearbeitete Auflage. Verlag von Friedr. Vieweg und Sohn. Braunschweig. 1913. Price M. 11. Bound M. 12.

THIS volume (8¾ by 5¼ ins.) contains 422 pages of subject matter with 167 illustrations, numerous tables, and an alphabetical index of subjects. The subject matter is classified as follows:—I. GENERAL METHODS. II. SPECIAL METHODS. III. USES AND EMPLOYMENT OF GAS ANALYSIS. (i.) Combustion gases; smoke gases. (ii.) Illuminating gases. (iii.) Acetylene gas. (iv.) Gases of the sulphuric acid process. (v.) Atmospheric air. (vi.) Calorimetric method for determining the heating power of fuels. (vii.) Sulphur in coals and organic substances. (viii.) Volumetric determination of the carbon in iron and steel. (ix.) Volumetric valuation of chloride of lime, manganese ores, sodium peroxide, etc., etc.

EINFÜHRUNG IN DIE SPEKTROCHEMIE. Von G. URBAIN, Professor der Chemie an der Sorbonne (Paris). Uebersetzt von Dr. Ulfilas Meyer. Theodor Steinkopff's Verlag. Dresden und Leipzig. 1913. Price M. 9. Bound M. 10.

THIS volume (9 by 6¼ ins.) contains 207 pages of subject matter, with 67 illustrations, and 9 tables, followed by alphabetical indexes of names of authors, and subjects. The text is subdivided under the following class headings: I. Introduction. II. Light and the Spectrum. III. The emission caused by heat. Flames. IV. Luminescence of gases at low pressures. Geissler tubes. V. The light arc and spark discharge. The electric light arc. VI. Electric sparks. VII. Luminescence (Phosphorescence). VIII. Absorption. IX. Constitution of the spectra.

Journal of the Society of Chemical Industry.

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London Section.

Meeting held at Burlington House on Monday, 5th May, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

EXPERIMENTS ON THE HYDROMETALLURGICAL TREATMENT OF COPPER SLIMES.

BY W. R. SCHOELLER.

(Abstract.)

Many attempts have been made to find effective methods of dealing with slimes, the formation of which is one of the problems of ore dressing. Whilst in the United States, I undertook laboratory experiments on the recovery of copper from slimes by a hydrometallurgical process, chiefly with a view to working them up at the same rate as they are produced at the concentrating plant. The material experimented upon was obtained from the dressing plant of one of the large western smelters, and contained: Total copper, 2·85 per cent.; soluble copper, 0·32 per cent.; sulphide copper (by difference) 2·53 per cent. Atmospheric oxidation had practically no effect, the quantity of soluble copper being unchanged after 3 months. The rate of solution in water was found to be 0·10 per cent. per 3 months, somewhat less than at Rio Tinto. The behaviour of the material was tested towards solutions of ferric sulphate and cupric chloride, the solvents proposed in the Siemens und Halske and the Hoepfner processes.

(Exper. 4). 200 c.c. of 10 per cent. ferric sulphate acidified with sulphuric acid were made to act on 100 grms. slimes in an agitation flask and shaken from time to time. After 16½ hours, 0·347 per cent. sulphide copper was dissolved. Even under such favourable conditions of agitation the rate of solution is too slow to admit of the copper being recovered from day to day. (See also Exper. 14.)

(Exper. 5). Action of cupric chloride. Used 5 per cent. $CuCl_2$+12 per cent. NaCl. Even after 70 hours' contact and frequent agitation, the insoluble copper was still as high as 2·51 per cent. Electrometallurgical tests were next made.

(Exper. 10). After trying several forms of electrolysers, the following arrangement was found to effect the greatest saving in current: The anode consisting of three carbon rods connected by means of insulated iron wire rested in the slime mud, and a floating copper sheet cathode was suspended in the clear liquid above.

(Exper. 12). 50 grms. slimes electrolysed for 16 hours in dilute sulphuric acid gave 0·186 per cent. copper, all of which was no doubt originally present as sulphate, and the condition of the deposit was satisfactory. After another 48 hours' electrolysis 0·645 per cent. had deposited, but the metal was now discoloured and powdery.

(Exper. 13). Cathode: Copper spiral in dilute sulphuric acid in porous compartment to prevent copper from dropping off and re-dissolving. After 87 hours, the residue assayed 2·10 per cent.

(Exper. 14). 10 grms. slimes were extracted for 10 hours with cold 10 per cent. sulphuric acid. The extracted material which assayed 2·175 per cent. was then electrolysed for 20 hours as in Exper. 13: the residue contained 2·01 per cent. In Exper. 4 an acidified solution of ferric sulphate dissolved 0·347 per cent.; in this experiment, the quantity dissolved by sulphuric acid without the use of the electric current is 0·355 per cent. This makes it appear questionable whether the ferric salt took any part in the reaction.

(Exper. 16). Electrolysis in sodium chloride solution, carbon anode, copper cathode in porous compartment filled with dilute sulphuric acid. Insoluble copper after 96 hours: 2·13 per cent. The rate of extraction per 12 hours in the above experiments is given in Table I.

Table I.

Exper.	Duration.	Sulphide Cu oxidised.	Rate of oxidation per 12 hrs.
	hrs.	per cent.	per cent.
4	16½	0·347	0·252
12	64	0·325	0·061
13	87	0·43	0·059
14	20	0·165	0·099
16	96	0·40	0·050

Ferric sulphate treatment so far showed the best result; the extraction is shown to be much more effective after the material has undergone a light calcination. This circumstance and the failure of the electrolytic experiments induced me to revert to what it was at first thought desirable to avoid, *i.e.*, roasting previous to leaching. In each of the following tests 5 grms. were roasted in a porcelain dish over a Bunsen burner.

(Exper. 18). Roasted until smell of SO_2 was gone. Copper soluble in cold 10 per cent. sulphuric acid: 2·28 per cent.

(Exper. 19). Exper. 18 repeated. Electrolysis of filtrate gave perfect deposit, 2·40 per cent. In another portion, the precipitate produced by ammonia was weighed as $Fe_2O_3+Al_2O_3$: 2·33 per cent.

(Exper. 20). Roasted for 20 minutes, transferred to a beaker, added cold water and passed SO_2 for 10 minutes. Copper in filtrate: 2·50 per cent.

(Exper. 21). Roasted for 40 minutes; extracted with cold water, filtered and electrolysed. Perfect deposit, 1·81 per cent. Table II. gives the percentage of extraction by roasting and leaching.

Table II.

Exper.	Solvent.	Total soluble Cu.	Percentage of extraction.
		per cent.	
18	cold 10% H_2SO_4	2·28	80
19	cold 10% H_2SO_4	2·40	84
20	cold water + SO_2	2·50	90
21	cold water	1·81	63

No deduction has here been made for copper originally present as sulphate, the ease with which the copper is extracted justifying the assumption that the absence of copper sulphate would have made no difference. On a large scale these slimes would doubtless give up over 90 per cent. of their copper; this means a recovery of 2·57 per cent., which at 14 cents per lb. represent a value of $7.20 per short ton; against this the working costs would have to be considered. The process of extraction involves the following five operations.

1. Collecting slimes. There would have to be two settling-ponds, one of which is filling while the other is drained and its contents removed. Draining and evaporation going on while the mud is being dug out, the material is dry enough to be at once charged into the roasting furnace.

2. Roasting. The minute size of the slime particles makes the material suitable for rapid and thorough roasting, while its low sulphur content will further shorten the time required for calcination. On the other hand, there may be considerable production of flue-dust unless care is exercised in the working. The reverberatory type of furnace is known to be best suited for fines; the MacDougall, Allen, O'Hara, Wethey, and Pearce furnaces * are normally used

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* Hofman, Transact. Amer. Inst. Min. Eng. 1903, p. 258.

on moist fines, and the total cost for roasting low-grade material does not exceed 50 cents per ton. In places where actual smelting is done by reverberatory, it may be possible to use the waste heat of the latter for carrying out a sulphatising roast, as a smelting reverberatory requires an intense heat throughout its entire length to liquefy the charge, and the fire gases on leaving it carry more than the degree of heat required for effecting calcination.

3. Leaching. A cheap solvent is the main consideration: it is possible for a smelter to supply its own want of acid by erecting a bye-pass flue leading to absorption towers filled with coarse coke down which water is trickling. The acid so obtained is very dilute, but strong acid is undesirable in leaching. As another source of acid I would suggest the fume from the stack end of the flue, which always contains more or less sulphuric anhydride. Thus in one case I found more than 15 per cent. SO_3, and of this material there were many tons available. On mixing with water and decanting, a strong acid is obtained which may be used to strengthen the liquor from the tower. The roasted slime would require but little acid as a considerable part of the copper is soluble in water. Thus in Exper. 21, 70 per cent. of the recoverable copper was present as sulphate. The roasted material is dropped quite hot into a weak liquor, raising its temperature and assisting solution.

4. Precipitating. The chief source of expense is the iron required for cementation; this may be considerably reduced by using broken-up low-grade matte to precipitate the copper. If necessary the precipitation is completed with scrap iron in a separate launder.

5. Refining the precipitate. In the majority of cases the impure precipitate goes back to the blast-furnace to be converted into matte.

Cost of process. It is of course impossible to make a general statement as to costs, as expenditure varies greatly according to the country or even district. At Natrona (Pa.) the total cost is $1.87 per ton of ore; at another plant in the Western U.S. it amounts to $2.96.* These two plants use the Longmaid-Henderson process on pyritic cinders. This is done at the same temperature as the sulphatising roast and in a reverberatory or muffle furnace. No acid is needed, but the amount of salt required is 7½ to 20 per cent. of the weight of ore treated. An approximation of the cost may be arrived at by compiling statements of cost of the various operations and of the initial cost of the plant divided by the number of tons treated in one year:—

	Per ton.
Initial cost of plant	$1.50—3.50
Collecting slimes	0.20
Roasting	0.40—0.60
Leaching	1.60
Precipitating and collecting	0.60
Smelting, refining	0.10

By taking the average of these figures, the total expenses are found to be $5.60. Thus, assuming that all the acid and iron had to be purchased and making the plant pay for itself at the end of the first year, there would remain a profit of $1.60, and for the succeeding years $4.10 per ton of the material experimented upon.

Concerning the time required for treatment, roasting and leaching can be done in 24 hours, while precipitation takes one day or more, according to capacity; and while there is necessarily an accumulation of slimes about equal to the quantity required to fill one settling-pond, the plant can cope with the slimes at the rate at which they are produced in the mill; it is really part of the latter.

In conclusion, I may mention that I have applied roasting and leaching by nitric acid to the copper assay of pyritic ores. 10 grms. are roasted in a porcelain dish over a Bunsen burner for 20 minutes with occasional stirring. After cooling the dish is covered, 15 c.c. of strong nitric acid added and most of the acid evaporated. The roasted ferric oxide remains unattacked. Take up with 10 c.c. nitric acid (1 : 1), add hot water, transfer to a graduated 200 flask, fill up, filter 100 c.c. and electrolyse.

On account of the ferric oxide retaining a little copper the results are about 0·02 per cent. low, but keeping this in mind the method is very rapid and has proved extremely useful in technical work.

Meeting held at Burlington House on Monday, June 2nd, 1913.

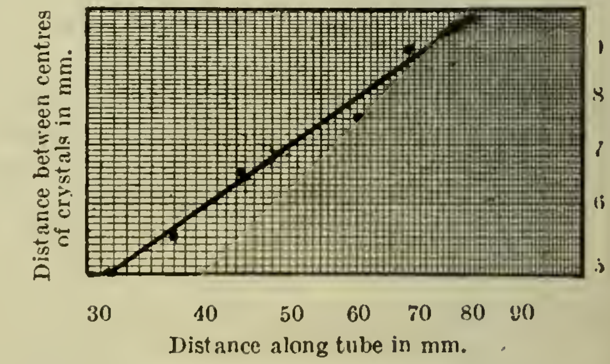
PROF. W. R. E. HODGKINSON IN THE CHAIR.

REACTIONS IN AQUEOUS AND COLLOIDAL SYSTEMS.

BY W. P. DREAPER, F.I.C.

The precipitation of insoluble compounds in solutions, under conditions which somewhat resemble those previously obtained in gels, has been considered in order to see if the results in the gels are dependent upon, or confined to conditions which involve precipitation in such media.

The experiments now recorded involve precipitation in solutions where the reacting substances are contained in glass capillary tubes, preferably set in a horizontal position. Disturbing influences (cross currents, etc.), are thus reduced to a minimum, and the course of the reactions can be conveniently followed under the microscope. Certain insoluble salts are produced by slow diffusion in aqueous solutions of suitable concentration. One solution is drawn up into the capillary tube to its total length, and the top end sealed. The open end is then inserted into a second and larger one containing the other solution. This outer tube has a bulb blown at its closed end, which acts as an additional receiver for the necessary supply of the second solution.



The results obtained under these conditions, indicate that the formation of stratified layers is not necessarily due to the reaction taking place in a gel, but that the diffusion process itself is primarily responsible for it. The strata obtained in aqueous solutions may be thus as clearly defined as in a gel. Precipitation in the form of spherulites has not yet been observed in the absence of gels.

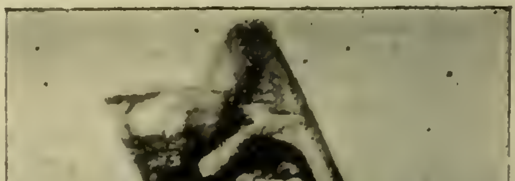


FIG. 1. ←

Lead chloride.—A capillary tube contained a 3 per cent. lead acetate solution, and the outer one a 5 per cent. solution of hydrogen chloride. At the open end of the capillary tube, the lead chloride gradually precipitated in long needle-shaped crystals at certain intervals. Their length and position in the direction of the length of the capillary tube, is indicated in the tables given below. These were followed at definite intervals by single crystals of lead chloride, the intervening spaces being free from precipitate. The form of the crystals obtained is shown in the accompanying photo-micrographs Figs. 1, 2, the direction of flow of the outer solution being indicated by an arrow. Following the long needle-shaped crystals formed at the distance mentioned, from the entrance of the tube, the single crystal (Fig. 1) was observed, which nearly filled the tube. Possibly owing to this, the next crystal (Fig. 2) took the distinctive form observed, which is also fully developed in the next and final crystal. In Fig. 3 are seen original crystals as subsequently removed from the tube.

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* Greenawalt, The Hydrometallurgy of Copper.

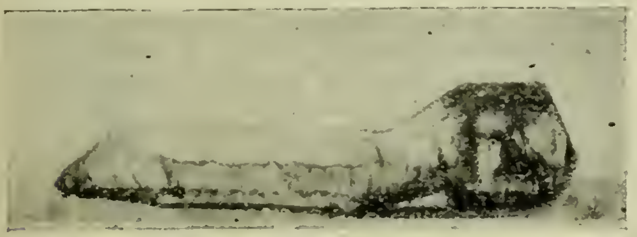

Fig. 2. ⟵

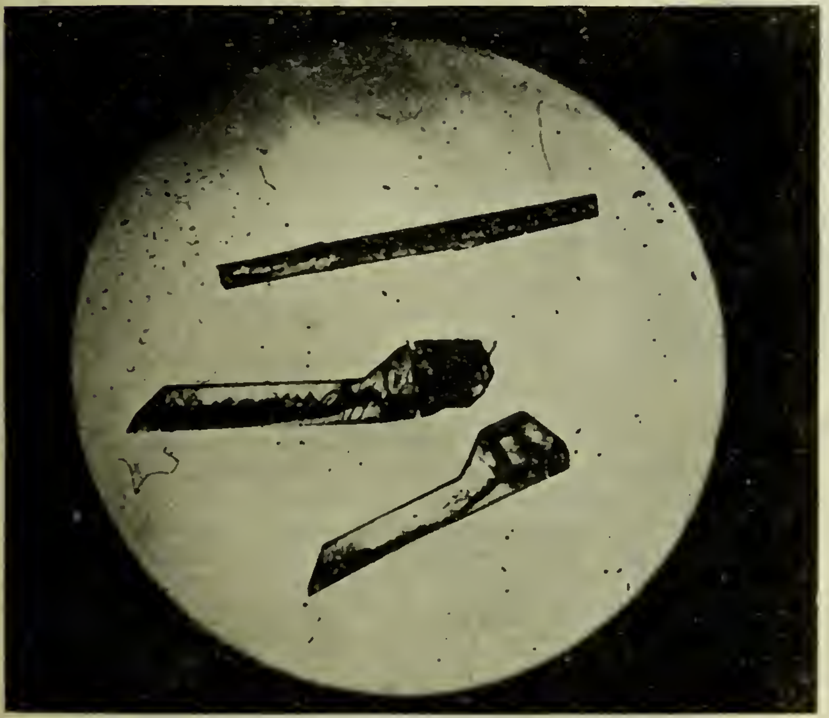

Fig. 3.

The distances between the centres of the crystals in the direction of the length of the tube, are given in the case of two typical cases in the accompanying tables and curve on double log-squared paper. The reaction in the tube was generally complete after an interval of five to six days.

Table A.

Lead chloride in capillary tube. Diam. 0·66 *mm.* (*internal*).

Length of crystals in mm.	Space from centre to centre of crystals.	Actual space between crystals.
(1)..3 mm.	(1—2)..6·5 mm.	(1—2)..3 mm.
(2)..4 mm.	(2—3)..8 mm.	(2—3)..4 mm.
(3)..4 mm.	(3—4)..5·75 mm.	(3—4)..2·5 mm.
(4)..0·7 mm.	(4—5)..5·85 mm.	(4—5)..3·3 mm.
(6)..0·5 mm.	(6—7)..6·0 mm.	(6—7)..5·5 mm.
(7)..1·0 mm.	(7—8)..7·75 mm.	(7—8)..6·5 mm.
(8)..1·5 mm.	(8—9)..7·05 mm.	(8—9)..6·5 mm.
(9)..0·6 mm.	(9–10)..8·2 mm.	(9–10)..7·5 mm.
(10)..1·0 mm.	(10–11)..11·75mm.	(10–11)..9·0 mm.

Table B.

Lead chloride in capillary tube. Diam. 0·42 *mm.* (*internal*).

Length of crystals in mm.	Space from centre to centre of crystals.	Actual space between crystals.
(1)..0·5 mm.	(1—2)..4·0 mm.	(1—2)..2·5 mm.
(2)..1·5 mm.	(2—3)..5·25 mm.	(2—3)..3·5 mm.
(3)..1·5 mm. (2 crystals)	(3—4)..5·75 mm.	(3—4)..4·5 mm.
(4)..0·5 mm.	(4—5)..6·0 mm.	(4—5)..5·5 mm.
(5)..1·0 mm. (2 crystals)	(5—6)..9·5 mm.	(5—6)..8·5 mm.
(6)..0·5 mm.	(6—7)..7·0 mm.	(6—7)..6·0 mm.
(7)..0·5 mm.	(7—8)..6·0 mm.	(7—8)..5·5 mm.
(8)..0·5 mm.	—	—

Hatschek has stated (this J., 1911, **30**, 257) that aggregates of lead salts of 1·0 mm. diameter have been obtained in gels and that "how enormous this size is, need hardly be pointed out to anyone familiar with the microscopic appearance of lead compounds precipitated from aqueous solutions." The crystal (3) in Table A of lead chloride had a length of 4·0 mm. so that such figures may be equalled, if not exceeded, in aqueous solutions under the conditions now recorded (see Fig. 3).

Lead ferrocyanide.—In a capillary tube of 0·6 mm. diam. precipitation rapidly takes place, and for some distance into the tube the deposit is granular rather than crystalline. (Fig. 4.) A more or less sharp change then takes place and the lead ferrocyanide precipitates in well-formed crystals up to a length of 0·8 mm. which in some cases seem to occur in stratified bands. In a finer tube of 0·42 mm. diam. stratification was more pronounced, and ultimately the precipitate became strongly crystalline. There is a tendency for this heavy precipitate to fall to the bottom of the tube in a granular state, and partly obscure the stratification.

Lead sulphate.—When this salt is formed by the diffusion of 5 per cent. potassium sulphate into 2 per cent. lead acetate solution, stratification is very pronounced. On standing for two months a further change is observed. The original stratified area is seen changing into a more crystalline form in Fig. 5.

Silver salts.—Up to the present time no very definite result has been obtained with silver chloride, but in the case of silver ferrocyanide distinct stratification has been observed.

Barium sulphate.—Distinct stratification has been observed when using a 2 per cent. solution of barium chloride in the capillary tube, and a 5 per cent. solution of potassium sulphate in the surrounding one. In this case the intervening spaces are not entirely free from precipitated barium salt, but the stratification is very distinct. At a rough estimate, the proportion present in the space might be 10 per cent. of that present in the rings. After a certain period the precipitate seems to become crystalline.

In this case the reaction proceeds differently to that in the lead chloride experiments. Working with potassium sulphate the barium sulphate may be precipitated in an extremely finely divided, or even gelatinous, state. There is no tendency for it to settle to the bottom of the tube. It occupies the whole area and does not appear crystalline, but granular under a fairly high power (250 diam.). When this precipitate has formed to a length of possibly 80 mm. distinct stratification may occur within this area. This experiment presents conditions possible in nature where the substance precipitated may itself act as a gel or its equivalent in inducing stratification on further precipitation, within that area. It is interesting to compare these results with those obtained with lead chloride.

Barium carbonate.—The results obtained in this case are typical, as the intervening clear spaces may be practically free from deposited barium carbonate. (Fig. 6.)

Change of physical state in insoluble precipitates.—In the presence of a third substance (electrolyte or colloid) in sufficient quantity, certain results have been obtained which it would be difficult to observe in a test tube where the additional cross-sectional area would obscure the effect. Two cases may be cited :—

(*a*) The inner tube contained 2 per cent. barium chloride solution saturated with ammonium chloride. The outer tube 5 per cent. potassium sulphate saturated with ammonium chloride. At the start a copious and opaque precipitate of barium salt formed, extending to 8 mm. into the capillary tube. After 24 hours, this first area up to 10 mm. was apparently quite free from any visible precipitate of barium sulphate although the next section of the tube contained insoluble salt. It is probable that this is not due to actual migration, but is due to a change in the physical state of the precipitate.

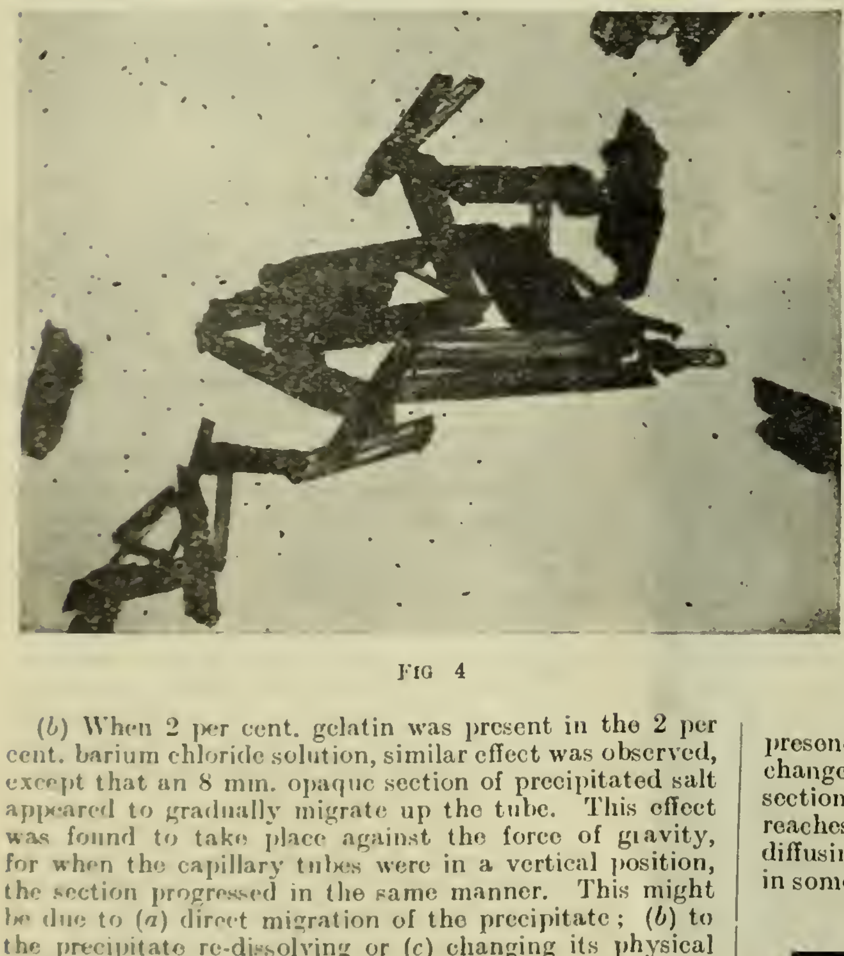

FIG 4

(*b*) When 2 per cent. gelatin was present in the 2 per cent. barium chloride solution, similar effect was observed, except that an 8 mm. opaque section of precipitated salt appeared to gradually migrate up the tube. This effect was found to take place against the force of gravity, for when the capillary tubes were in a vertical position, the section progressed in the same manner. This might be due to (*a*) direct migration of the precipitate ; (*b*) to the precipitate re-dissolving or (*c*) changing its physical or chemical state.

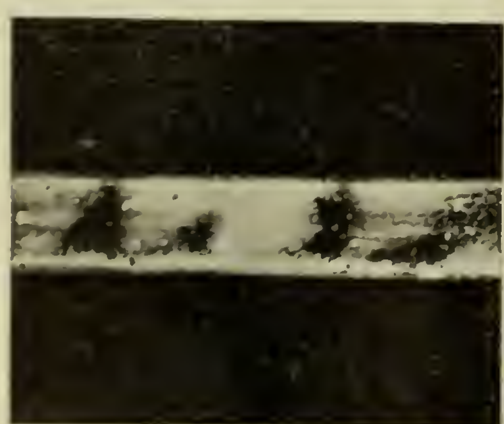

FIG 5.

A short capillary tube, 15 mm. in length, containing a column of the above gel and barium chloride was immersed in 5 per cent. potassium sulphate solution. The usual deposit (8 mm. in length) formed within a few hours. This advanced along the tube leaving an apparently clear space behind it, until it reached within 1 mm. of the surface of the gel which remained permanently clear. On further standing, the opaque area gradually shortened in length, and ultimately disappeared. Under the microscope, the main area of the tube contained well defined large crystals except that the last 1 mm. in which the precipitate (opaque) had never formed, was free from them. This experiment indicates that the opaque area probably contains a colloidal, or at least a finely divided precipitate of an insoluble barium salt of such a nature, that it does not deposit. This is gradually changed into a crystalline salt, and the appearance of migration through the column of the solution or gel of this opaque area is illusory. The actual change is a rapid one and may occur at any one spot within an hour.

In a further experiment where the opaque column was allowed to "advance" into the tube for a distance of 20 mm. the capillary tube was then removed from the outer solution of potassium sulphate. The 8 mm. column had remained opaque and non-crystalline at 200 diam. after 14 days, and did not continue its advance into the tube. Opaque sections were cut out of similarly treated capillary tubes, and placed in a 5 per cent. solution of potassium sulphate. This change to the crystalline state took place in the presence of this further excess of potassium sulphate. An opaque section placed in 2 per cent. barium chloride solution remained opaque, and non-crystalline. A photo-micrograph of the opaque area indicates an exceedingly finely divided precipitate. (Fig. 7.) Further action of diffused potassium sulphate solution is shown in Fig. 8. The absence of any finely divided precipitate in the clean space following the opaque area indicates the complete change which has taken place in the physical state of the deposited salt. Fig. 9 greatly enlarged, shows a peculiar formation of the barium salt which for optical or other reasons may appear in star-like formation.

There is no actual migration, but a progressive formation of an 8 mm. band or column of an extremely finely divided, and apparently non-crystalline precipitate, which in the presence of further potassium sulphate, spontaneously changes into a strongly crystalline one. As the opaque section progresses into the capillary tube, and consequently reaches a point, where the potassium sulphate solution, diffusing up the tube is more dilute, it increases in length in some cases up to 30 mm.

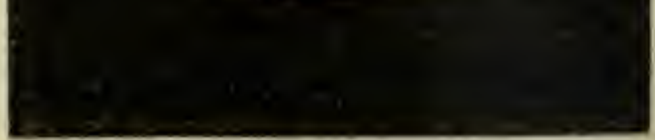

FIG. 6.

This is an interesting record of a change in an insoluble inorganic substance from the amorphous to the crystalline state, within a short period, although similar changes which occur in organic substances have often been observed and have been studied by Hatschek and others. This reaction adds further weight to the argument, that crystalline minerals such as quartz may have been formed from a gel of silicic acid. It has been observed as the opaque area advances into the capillary tube, that it may increase from 8 mm. to 30 mm. if the solution in the tube becomes very weak in potassium sulphate.

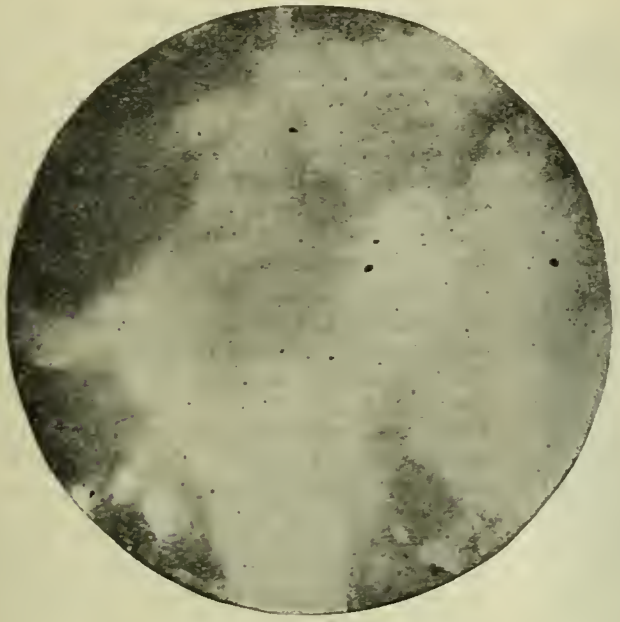

Fig. 7.

An opaque section, as it occurs in stratification in a 3 mm. diam. tube was cut out and immersed in potassium sulphate. In a short time the opaque substance changed into a crystalline one. The rate of change being obviously measurable under the conditions present. As it has been generally acknowledged that the transparent sections in gels, actually contain precipitated salt, it may even be that in some cases an equal amount of the salt is present in a highly crystalline form, as is evidently the case in the one now quoted.

In the presence of a 5 per cent. solution of sodium chloride no further change in the opaque area took place during 10 days. After that time a change occurred of a different order, which indicated that the barium salt had either taken a state of greater aggregation, as judged by the transparency test, or had been removed by solution or otherwise. Under the microscope no actual crystals could be observed. A certain degree of stratification was noticed in the original opaque section which has now become translucent. This was not noticed when the same area was opaque, although it may have been present.

When a solution containing 2 per cent. barium chloride and 1 per cent. gelatin was set to a length of 30 mm. in a 3 mm. tube, and 5 per cent. potassium sulphate solution allowed to react on both surfaces of the gel from each end of the tube, two ordinary 8 mm. opaque sections were first formed. These gradually advanced towards each other, until they were divided by a distance of 3—4 mm. (see Fig. 10). No further action took place, except that each 8 mm. opaque section gradually shortened in length, and was replaced by a practically transparent area containing the usual crystals. No precipitation of any kind occurred in the 3—4 mm. central section. When this was cut out, and placed in a 5 per cent. potassium sulphate solution, it was found to be entirely free from barium chloride. It must have lost its original content of this substance by diffusion in the direction of the incoming sulphate solution. This action may in some way or other also be related to the action which produces stratification.

In another case where 2 per cent. barium chloride was present in a 0·6 mm. tube, and both this and the 5 per cent. potassium sulphate solution outside were saturated with NaCl, precipitation apparently took place for a distance of 50 mm.

The change in crystalline state is evidently not due to the action of an electrolyte, as such, as on the first precipitated barium sulphate, for if this was so, barium chloride should have a more rapid action than potassium sulphate, while in practice the effect produced is hardly observed in the former case, and only very slowly when sodium chloride is present. It is practically confined to the original potassium sulphate used, under the conditions recorded. This is an interesting fact, when visual stratification is in question. It is possible that some additional chemical change may even be involved, and be responsible for the change in crystalline state. It may be ultimately found, that an acid barium sulphate $BaH_2(SO)_4.2H_2O$ may take some part in this reaction, or else the double barium potassium sulphate $BaK_2(SO_4)_2$ is at some stage formed. Under ordinary conditions the latter is prepared by actual fusion. The possibility of the formation of a double salt of potassium or sodium is eliminated where sulphuric acid itself is present in the outer tube and barium chloride in the inner one. A similar effect is produced in this case, but the action is a slower one. The matter is being followed up in detail.

When gelatin is replaced by sodium chloride, a clear space actually replaces the first formed precipitate (10 mm.), but this does not subsequently extend beyond a certain point into a tube of 0·6 mm. diameter, and the deposit formed is obviously in a different physical condition to that obtained in gels.

Cause of stratification.—The ease with which examination is possible in capillary tubes, and the low viscosity of the solutions which can be employed by this method, renders it possible to show that unequal or stratified precipitation is not apparently dependent upon local conditions, *i.e.*, surface tension induced by the walls of the capillary tubes. After diffusion has proceeded so far that a series of stratified sections of lead chloride crystals have been deposited in a hermetically sealed capillary tube, the system was heated to 80° C., when the lead chloride re-dissolved. On slow cooling, re-crystallisation took place, but stratification was absent. The lead chloride precipitated in what might be termed a continuous manner. Thus a general state of super-saturation does not in itself induce stratification in the absence of a direction of flow of at least one of the reacting solutions.

Hatschek states (*ibid*) that the concentration and nature of the gel "is undoubtedly the factor which determines the form and size of the crystals." This may undoubtedly be true, but crystals of varying size can also be obtained in the absence of any secondary gel when working in capillary tubes, and in that case, as possibly in the case of gels, the relative rate of diffusion and concentration of the incoming solution seems to be the determining factor.

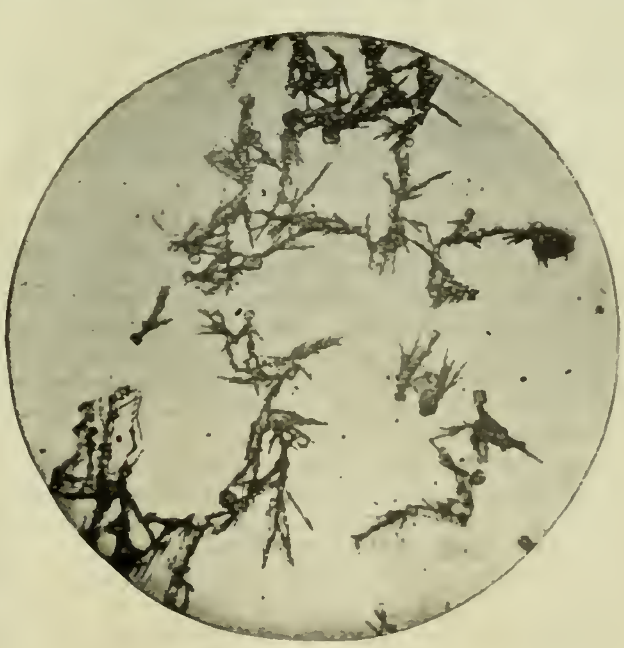

Fig. 8.

Rate of diffusion.—The rate of diffusion has therefore a distinct bearing on the physical condition of the precipitated salt. It is naturally slow under the conditions set out. This may be shown, and actually determined if required, by using a solution of say methyl orange, in the capillary tube, and hydrogen chloride in the outer one. The influence of the size of the bore of the capillary tube, and consequently of the surface action of the walls of the tube itself in terms of diffusion, may also be studied. Where a more or less dense or colloidal precipitate is formed, this may materially retard the process of diffusion. This was noticed in the case of barium sulphate.

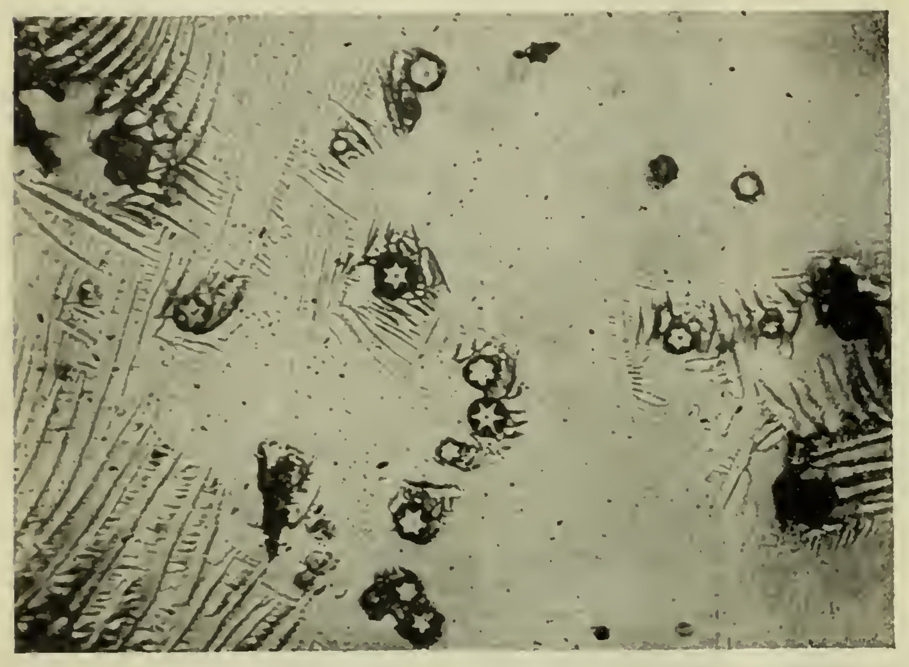

Fig. 9.

General conclusions.—The above results support the suggestion that the actual physical state of the precipitate is primarily due to modifications in the rate of diffusion of the incoming solution, such as is known to take place in gels of varying concentration, and which also occurs in aqueous solutions in capillary tubes under the conditions now indicated. That although certain variations may be due to some inherent property in the structure of the gel itself, the presence of an added gel is not essential to the occurrence of certain phenomena which have been observed. Such a change of condition under which the precipitate is formed may also modify results, in aqueous solutions as seen in the case of lead ferrocyanide where the precipitate is first granular and then further up the tube, entirely crystalline (Fig. 4). Such a change may be due to the increasing dilution of the solution, reduced rate of diffusion, or both. It is possible that this has some bearing on the action of dyeing, the ripening of photographic emulsions, setting of cements, and other similar reactions, where subsequent changes in physical state may come into play.

Ultimately the presence, or absence, of spherulites in a mineral deposit may determine whether a gel was present or not, when certain mineral deposits were produced, but it is now shown that a substance when precipitated may in itself cause stratification. Further attempts to produce these spherulites in the absence of secondary and inactive colloids are being made, especially in saturated solutions of non-reacting electrolytes, which will not interfere with the reaction causing precipitation.

In one case mentioned a deposit of lead sulphate in a capillary tube, has shown after a period of 5 weeks distinct indications of such a formation, which has entirely replaced the original finely divided precipitate over an area of about 5—6 mm. Whether this will extend is at present unknown.

The effect of the diffusion of salts into, or through, a permeable medium (such as sand) may in view of the above experiments be actually anticipated. It may now be assumed that stratification will occur under such conditions. Such experiments are possible where the interstices of the sand in the same correspond to the bore of the capillary tube now used. Experiments are in progress in this direction, with such tubes as have previously been used by Dreaper and Davis (this J., 1912, 31, 100) in other directions, and they should give further direct evidence that such an action is possible. The possibility of such an action has been already suggested by Hatschek and Simon. Such conditions overcome difficulties which present themselves on gel theory lines in estimating the subsequent effect of contraction of the gel area on dehydration.

Stratification does not always occur at increasing intervals, in capillary tubes. In many cases it occurs at practically equal intervals. In one case (Table B) the intervals may apparently first increase and then decrease. In the presence of a reserve of solution, sufficient to keep the solutions fairly constant in composition, stratification will probably occur at equal intervals, but the influence of the products of the reaction may produce variations.

In the discussion which followed Hatschek's paper (*ibid*) G. T. Holloway suggested in connection with certain natural deposits that the "gradual meeting of two solutions through a gel would explain away many difficulties with which no other theory seems able to cope." By precipitation in capillary tubes, these phenomena may be studied, and the influence of a secondary gel, on the formation of certain insoluble salts *in situ* in colloidal media may be determined. Also whether it is necessary to assume the presence of a gel in explaining the formation of stratification in natural deposits.

Possibly the conditions in nature are more closely represented by drawing up the first solution into the tube to 40 per cent. of its length, and then following this up with the second one for a similar distance. The "band" is then represented by the centre area of precipitation, rather than by a more general stratification as obtained by the other methods. The centre area is also stratified in many cases. If the more general explanation is the correct one, some reason must necessarily be put forward to explain why the "bands" are so far apart in nature. Extreme dilution may be the chief factor.

The presence of stratified bands of abnormal crystalline state which occur in nature, may be of a similar order to those observed in the capillary tubes under the conditions recorded. Thus diffusion is sufficient to account for the phenomena of banded deposits and a very pronounced crystalline state, without necessarily assuming the presence of non-reacting gels.

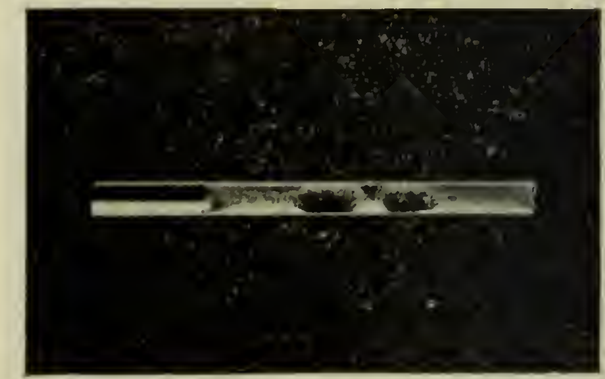

Fig. 10.

The presence of sand or a similarly permeable inorganic medium will naturally allow the cross sectional area of reaction in aqueous solutions being extended indefinitely without materially modifying any tendency to stratification. Thus the diffusion of soluble salts from opposite directions which can by interaction bring about the formation of insoluble salts through or into a porous mineral deposit (or even in the less likely case where the natural deposit contains the second reagent, in a state in which it may be gradually soluble in the first one) with, or without, the actual formation of the precipitate in a gel condition, may offer a simple explanation of the presence of banded deposits. It is, however, evident that the presence of a colloid in the solution, influences the normal distances between the bands, and the form of the deposits as shown by Hatschek. The experiments in capillary tubes indicate that the presence of non-reacting or secondary gels may in some cases act as an inhibitant against stratification, which will not occur within a definite length of the tube in their presence. The influence of colloids in a sol condition are also being investigated.

When working in capillary tubes, the precipitates or crystals may, like those of lead chloride, take a characteristic form, which is obviously influenced by the direction of the flow of the solution entering the tube. This fact may also possibly be applied to the study of the direction of formation of natural deposits. The intervening distances between such crystals as those of lead chloride may certainly increase as in the case of stratified deposits in gels. I am informed by Mr. Hatschek that stratification has not yet been observed with lead chloride in gels.

Stratification has been the subject of much discussion since Liesegang's original observations. The results now obtained agree with the suggestion that this phenomena may be primarily regarded as a diffusion phenomena, and in some way (as suggested by Wo. Ostwald) be influenced by local-supersaturation. A super-saturated column of lead chloride may be first formed, of increasing concentration, which leads to de-solution of the insoluble salt at a certain point in the column of the enclosed liquid. The first crystal as formed supplies a nucleus for further local de-solution. The operation then recommences and by diffusion over a further area in the direction of the tube, causes a flow of the outer solution beyond the first deposit, which would reach a point where further precipitation is inevitable through contact with the inner solution. Even if super-saturation in the ordinary sense of the word does not occur, the lead chloride as formed is obviously soluble, in the first instance, for only in this way can the intermittent nature of the precipitation be accounted for, and the subsequent increase of the single crystals present at certain definite intervals be explained. A condition equivalent to one approaching super-saturation must be assumed, or the salt could hardly be thrown out in the manner indicated. This condition may, or may not apply in the case of very insoluble compounds, *i.e.*, barium sulphate.

The area of precipitation is continually increasing over the length of the tube and therefore the solutions diffusing under such conditions are less concentrated at any one point as the reaction proceeds. This accounts for the length of the column of the intervening clear spaces increasing before a critical desolution point is reached. In a similar manner the actual area of the opaque precipitate of barium sulphate may increase in length as it proceeds up the tube.

The suggestion put forward by Sir J. J. Thomson and others, that the intervening clear spaces are caused by the presence of soluble products of the primary reaction, which inhibit the formation of the precipitate over a certain area has been dealt with in some experiments by E. Hatschek. In one case now mentioned, the only soluble product formed by the reaction is acetic acid, in which the lead chloride as precipitated is not notably soluble, and in which it is easily formed.

Partial stratification in the absence of gels may be traced in tubes of quite large diameter (3—4 mm. bore) when these are set horizontally. Care has to be exercised as the limit has been seemingly reached at which such action is possible, in solutions of low viscosity.

In the case of very heavy precipitates, such as that of silver ferrocyanide, the precipitate sinks to the lower surface in a capillary tube of even 0·7 mm. diameter. The upper surface of the precipitated salt, however takes the form of a series of peaks running in the direction of the length of the capillary tube, which gives much the same appearance as stratification.

These experiments are being extended. Want of time has prevented them being presented in a more complete form. The results already obtained may, however, have some general interest. The method employed readily adapts itself to the examination of reactions which are in actual progress.

Discussion.

After some remarks by the Chairman, Mr. Hatschek said that the experiments chiefly demonstrated that it was possible to get similar results in a variety of ways. Reactions in a capillary tube and reactions in gels resembled each other, although the capillary in the former case was macroscopic, whereas in gels there was a system of microscopic or ultra-microscopic capillaries. Glass capillaries lent themselves readily to examination, but they had rigid walls, while those of the gel structure were readily destroyed. He thought this factor might explain many of the differences in the results obtained by Mr. Dreaper and by himself, and, particularly, that it accounted for the formation of spherulites, which were so readily obtained in gels, but had not been found in the capillaries. On some minor points he was not inclined to agree with Mr. Dreaper; for one thing, he doubted very much whether the barium sulphate could at any stage be described as amorphous. The magnification used by Mr. Dreaper was quite inadequate to settle this point, as magnifications of about 600 to 700 dias. were necessary to resolve lead and barium precipitates. He imagined the barium sulphate was crystalline even in the earliest stages, and the effect of the added electrolyte was largely the usual coagulation effect. The size of lead chloride crystals was purely a question of degree of dilution, etc., but he had succeeded in obtaining needles of lead chloride 15 mm. long in silicic acid gel. He was much interested in the lead ferrocyanide crystals shown by Mr. Dreaper, as he had obtained an entirely different form in agar, as shown in his paper read before this Section in 1911. These variations were a feature of the work, as one could obtain different forms even by changing the gel, *i.e.*, different in agar and in gelatin. He asked whether Mr. Dreaper had used distilled or tap water for some of his reacting solutions; he had obtained magnificent stratifications of lead iodide if tap water was used, whereas they were not nearly so perfect with distilled water. Possibly there was intermediate formation of lead carbonate, which gave rise to stratifications. To suggest supersaturation or a negative catalyst as a probable cause of stratifications, for neither of which direct experimental proof was possible, seemed to him simply a verbal solution, or evasion, of the difficulty. Of course the simpler the arrangements, and the more disturbing factors were eliminated, the more hope there was of getting at the truth, and since Mr. Dreaper could get stratifications without using a gel, that was a step in advance. Stratifications by diffusion in much wider tubes had been obtained by an Italian observer (published in the Kolloid-Zeitschr.). These were transient and due to the different rates of diffusion of the two ions of a highly dissociated salt, a solution of which was placed in the bottom of a long tube and covered with water. As regarded slow reactions, there were also the experiments by one of the Becquerels—published in 1906 in the Zeitschrift für physikalische Chemie. He allowed two solutions to react through a crack in glass, and, *e.g.*, with sodium sulphide and copper sulphate, obtained fine crystals of copper sulphide. He himself had never had any success with metallic sulphides in gels, although he had tried a good many. He would suggest that Mr. Dreaper should experiment in that direction. The sulphides were a very attractive problem, as they were strikingly crystalline in nature, whereas it had not been possible so far to obtain crystals by laboratory methods.

Prof. E. J. Mills referred to some experiments he had performed many years ago between glass plates, without gels. Of two glass plates, the upper had a small hole through which a reagent (such as sulphuric acid) could be introduced; the pair, which lay very close together, contained a precipitant (such as a solution of barium chloride). Other pairs, *e.g.*, ferric chloride and potassium ferrocyanide, were tried. Stratifications were then obtained in ribbon-section, the circular sections being traversed by radial lines. It was one of the most beautiful sights in chemistry to see ribbon after ribbon forming in this way—the process depending partly on diffusion, partly on flow. The process could be carried out on almost any scale, and showed detail better than when performed in a tube. He would venture to suggest trying the gel experiments in this manner. But the plates must be truly plane.

The AUTHOR, in reply, said it was interesting to know that Mr. Hatschek considered that the rigid structure of gels might be the cause of the formation of true spherulites, and that this might account for their non-formation in aqueous solutions. He quite agreed with him that at a higher magnification the barium sulphate might appear crystalline. That led to the larger question whether colloids were not generally crystalline in their ultimate structure. In the case of lead chloride and in all other cases he had used distilled water. Without actually knowing anything of Dr. Mills' work he had previously worked between glass plates under a microscope, but had found it almost impossible to obtain results of a definite order. When working with capillary tubes, one could be certain of measurements, etc.

Manchester Section.

Meeting held at the Manchester University on Friday, February 7th, 1913.

DR. G. J. FOWLER IN THE CHAIR.

THE EFFECT OF INCOMBUSTIBLE DUSTS ON THE EXPLOSION OF GASES.

BY PROF. H. B. DIXON, M.A., PH.D., F.R.S., AND COLIN CAMPBELL, M.SC.

The effect of incombustible dusts on the explosion of gases is of special interest at the present time by reason of the method now being extensively tried in mines for rendering coal-dust non-explosive by mixing it with incombustible dusts.

On the one hand, the opinion is held that such inert dusts as powdered shale, Fuller's earth and flue-dust, act the same part, when mixed with coal-dust, as inert gases do when mixed with explosive gas mixtures: on the one hand it has been contended that the introduction of a finely divided solid into a coalmine might be dangerous owing to its action in promoting the combustion of fire-damp upon its surface, and in particular the experiments of the late Sir F. Abel have been quoted as proving that danger from such catalytic action is by no means remote.

The Committee appointed by the Home Office to carry out experiments on the prevention of explosions in mines have examined this problem at their experimental station at Eskmeals both by trials in a gallery similar to that used by Abel, and also by exploding gases in tubes and bombs with and without the addition of dusts. Meanwhile we have made many laboratory experiments here to test the question whether the presence of a "catalyst," such as platinum, can induce an explosion in an otherwise non-explosive mixture of gases, and whether finely divided magnesia or shale-dust acts catalytically in propagating flame, or merely behaves as an inert substance.

According to the kinetic theory, the molecules of a gas are in a constant state of motion, coming into collision one with another and with the walls of the containing vessel. The temperature of the gas depends upon the "mean velocity" of the moving molecules. But these motions are not uniform. At any moment some molecules are moving faster and others slower than the average. Clerk Maxwell has calculated that about 2 per cent. of the molecules of any gas are moving with a velocity more than twice that of the mean velocity. In an inflammable mixture of gases such as electrolytic gas there is a similar distribution of velocities, so that there are some hydrogen molecules moving more quickly than the other hydrogen molecules, and some molecules of oxygen moving more quickly than the other oxygen molecules. If chemical combination begins as a result of the collisions between two of these more rapidly moving molecules of opposite kind which are comparatively so few in number, this combination would take place here and there at infrequent intervals, and the heat generated would be dissipated among the mass of the surrounding molecules.

When such a mixture is heated up artificially more and more of the molecules will move rapidly enough to produce chemical combination on collision; and finally a state will be reached at which these collisions are sufficiently numerous to overcome the loss of heat by conduction. At this stage the mass of gas as a whole begins to self-heat, *i.e.*, to rise in temperature owing to the chemical action independently of the external source of heat. This is the "Temperature of Ignition." If nothing interferes with the free motion of the molecules, the number of chemically effective collisions increases at an ever-increasing rate until a flame appears and spreads through the mixture. Below the "Ignition temperature" chemical combination is quite slow; above the ignition-temperature combination increases in rapidity until inflammation occurs: in the flame, combination is very rapid. In flame the rapidity of chemical combination may vary greatly: in the most intense form of flame—that of the explosion-wave—the combination is almost instantaneous.

In the explosion-wave the physical pressure-wave generated by the movement of the molecules in the burning layer, is transmitted (by collisions) into the unburnt gases beyond and is continually renovated by the chemical action there set up. The average rapidity of the molecules taking part in the wave is so great that it is probable that a large percentage of the collisions between molecules of an opposite kind result in chemical combination, and the flame travels forward with the forward velocity of the molecules themselves.

In the transmission of flame through a gas mixture the most usual case is for a portion only of the gas to be ignited and for the heat so produced to raise the temperature of the contiguous portion to the ignition point, and so on layer by layer through the mixture.

But in a mixture of gases, such as methane and air, the quantity of inflammable gas present may be insufficient to allow the flame to propagate itself throughout the mixture when a portion of the gas is so raised in temperature by the introduction of a flame or spark. In the portion of gas directly heated by contact with the flame chemical union between the methane and oxygen molecules is set up, and this region of combustion is visible as a halo or "cap" round the source of heat. When a safety-lamp with lowered flame is introduced into an atmosphere in which methane or coal-gas is gradually introduced, a delicate cap shows in a cone above the flame which increases in height and intensity until it reaches the top of the lamp. As the mixture in the lamp becomes explosive the flame expands at the top and creeps down inside the lamp until the whole of the gauze is covered with flame, and the original flame over the wick goes out for lack of air. The phenomena described are well seen in the apparatus constructed by Messrs. Oldham for lamp-testing. In the same apparatus, filled with a mixture below the explosive limit, the naked flame of a taper shows a blue cap, which may be easily detached by a rapid movement of the taper. Detached caps or "flares" of flame may thus be formed which move upwards and die out after a time. Similarly, when a rapid current of air containing inflammable gas is drawn past a flame in a gallery portions of the cap on the lee-ward side of the flame may be detached and float away as "flares." In these caps and flares visible combustion is set up, but it dies down when separated from the original source of heat because the rate of chemical union in the dilute mixture is not rapid enough *per se* to maintain the temperature above the ignition-point.

Since the chemical combination depends upon the collisions between molecules of methane and molecules of oxygen, it will be evident that, just as there is a lower-limit of methane necessary for the propagation of flame, so there must be a lower limit of oxygen also. In mixtures of air and methane the quantity of oxgyen required for complete combustion is present in a mixture containing 9·6 per cent. of methane—and this is about the most sensitive mixture with the lowest ignition point. A diminution either in the quantity of methane or in the quantity of oxygen raises the ignition-point. It would appear also that the lower-limit of methane is raised by a diminution of the oxygen content of the air; so that whereas 5·7 is the least percentage of methane in ordinary air that will explode, a sensible diminution of the oxygen in the air will raise the percentage of methane necessary to propagate a flame to over 6 per cent. of the mixture. We have found that an atmosphere in which the oxygen is reduced from 20·9 to 13·5 per cent., will still propagate flame when mixed with pure methane and fired by a spark or a small detonation. Since the value of the lower-limit mixture of methane and air depends upon the rapidity of chemical action, and since this depends on the frequency of the more violent collisions between the molecules of methane and oxygen, it might be inferred that the higher the initial temperature the lower the lower-limit of methane would be. This inference has recently been confirmed experimentally in our laboratories. Mr. A. Parker has shown, in the case of a number of gases, that a mixture which will not propagate flame at 15° C. will do so at 100° C. under the same pressure: and Messrs. Ramsbottom and Hobson have shown that when mixtures of methane and air are heated up by adiabatic compression above their ignition-point, the whole of the methane is burnt although its percentage may be only one-half that required to propagate a flame at ordinary temperature and pressure.

The presence of a chemically inert gas, such as nitrogen, argon, or carbon dioxide, in a gas mixture retards the rapidity of combustion partly by its "diluting" effect, which prevents the collisions of chemically-active molecules, but mainly by its absorption of heat. The damping effect of an inert gas on the velocity of the "explosion-wave" can be calculated very nearly from its density and its specific heat. An incombustible dust particle might be inert in the same way, and damp down a flame by absorbing heat. On the other hand, it has been shown, as in Prof. Bone's well-known experiments, that the combustion of gases can be concentrated and "hurried up" by means of suitable heated surfaces.

If it be assumed that for the transmission of flame from layer to layer in a mixture of methane and air, there must be sufficient methane in each layer to give out enough heat in burning to raise an equal layer of the mixture to its ignition point, then it is clear from the known heat of burning of methane that a much less percentage of methane in air than 5·6 should be sufficient theoretically to propagate flame under normal conditions. Would it be possible for dust particles suspended in a gas mixture so to concentrate the combustion near their surfaces as to bring down the lower-limit of methane necessary to propagate flame from 5·6 to a point near to this theoretical limit? Such is the question raised by Abel's interpretation of his experiment.

Abel's experiments.

The Seaham disaster in 1880, when it was not generally recognised that coal-dust played any important part in mine explosions, led to an investigation by Abel into the effect of suspending a cloud of coal or other dusts in a current of air containing small quantities of fire-damp. The experiments not only demonstrated that suspended coal-dust made such weak mixtures highly explosive, a fact already insisted on by Galloway, but led Abel to the definite conclusion that a fine cloud of such incombustible dusts as calcined magnesia or kaolin would render explosive a 3 per cent. mixture of fire-damp and air.

The apparatus employed in Abel's experiments was a rectangular gallery, 28 feet long and one square foot in section, provided with a steam-jet to produce a draught at one end, and with the other end open to the air. Near the open end was the gas inlet and a short distance "in-bye" was a drum-sieve to drop the dust into the current from above. Sixteen feet from the drum-sieve a lamp was placed opposite a window in the gallery. The fire-damp was a natural gas issuing as a blower from the Wigan 9-foot seam at the Garswood Hall Colliery.

Abel thus describes the observations made:—

"A gas-mixture having 3 per cent. of firedamp was allowed to pass a lamp-flame, at a velocity of 600 feet per minute for some time; no result was produced, but on causing it to convey calcined magnesia in suspension, long flares of flame were produced within a few seconds of the mixture first passing the lamp, and the inflammation speedily spread throughout the gallery with feeble explosive effect. With only 2·75 per cent. of gas, results quite similar were produced, the *general* ignition following, however, less rapidly after the first production of the flares in front of the lamp-flame. With another sample of calcined magnesia, which was not quite so light as the first one, a corresponding result was obtained with a mixture containing 3 per cent. of firedamp."

"These remarkable results led to the trial of a number of other non-combustible powders or dusts, which are not chemically affected by such heat as they would be exposed to in the flame of a lamp (such as kaolin, powdered flint and other forms of silica, pumice, slate dust, etc.) with results similar to those furnished by the magnesia-dust, but more or less affected by variations in the density, and other physical properties of the dusts."

Abel at first attributed the effect of the incombustible dust to "the localising and intensifying" of the chemical action by the heated particles which he imagined might be carried in a state of intense incandescence into regions of unburnt gas—and so "carry the flame" along. But later on he considered the action was catalytic—similar to that of finely divided platinum on mixtures of hydrogen and oxygen.

In considering Abel's experiments it must be borne in mind that the dust-cloud not only rendered the gas mixture explosive after it had passed *beyond the lamp-flame*, but conferred on the current *before it reached the flame* the power of propagating flame backwards.

In 1882 Mallard and Le Chatelier[*] published an experiment in which they showed that incombustible dust, such as magnesia, when suspended in a rising stream of gas and air, did not render it more inflammable; but when the dust was allowed to fall through a flame into the upward stream, the particles remained incandescent and were surrounded by a blue cap during their fall. This result was quoted by Abel as confirming his conclusions.

During the past year several sets of experiments have been made at Eskmeals in a gallery similar in dimensions to that used by Abel. The gas and air, however, were thoroughly mixed before entering the gallery by means of a powerful Sirocco fan which drove them forward past the lamp-flame placed at a window sixteen feet distant from the fan-drift. The magnesia was introduced in a stream into the gas and air mixture before it entered the fan. Experiments made with coal-gas and air, and with pentane gas and air, failed entirely to show any increased inflammability of the gas mixtures due to the suspended magnesia. Moreover, the "flares" observed in the gallery when the mixtures were brought above the lower-limit were not the halos or clouds described by Abel, nor did the inflammation. when it spread backwards, through the gallery, do so "with feeble explosive effect." The "flares" roared, and rapidly charred wood, and on one occasion set fire to timber near the orifice of the gallery; and the "general inflammations" were very distinct explosions. Experiments made in a small wooden gallery 4 inches square gave precisely similar results; by making one side of the box of glass, the caps and flares and the general inflammation can be readily observed.

Meanwhile. experiments made at Eskmeals by the Home Office Committee and their chemists had shown that the flame traversed explosive mixtures of gas and air more rapidly when dust-free than when laden with magnesia dust, and the pressures attained were also less when incombustible dust was present. In our laboratories here we found that of a number of gaseous mixtures just below the lower-limit and therefore incapable of propagating flame when sparked, none of them could be made explosive by shaking up incombustible dust in them. On the contrary it was found possible to start with a mixture which was just above the lower-limit, and make it non-explosive by stirring up dust in it. We then endeavoured to test Abel's hypothesis in another way. Glass vessels were fitted with fine platinum coils which could be heated up electrically in contact with various mixtures of gases. If magnesia can render a non-explosive mixture of methane and air explosive by its catalytic action, *a fortiori* platinum might effect this result. We found, of course, that mixtures above the lower-limit could be exploded by heating the coils rapidly; but when the coils were heated slowly until chemical action began on the surface and the electric current was then switched off, the coils glowed for some time but no inflammation occurred. Under no conditions that we could produce was it possible to make a non-explosive mixture explosive by inducing combustion of a portion of the mixture.

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[*] Annales des Mines, 1882.

On the other hand it is easy to illustrate the quenching effect of magnesia on an actual explosion by filling a long horizontal glass tube with an explosive mixture of gas and air, and placing a spoonful of magnesia in the tube. A fairly rapid flame on reaching the dust throws it up and is extinguished promptly.

When these, and other experiments, made it impossible to accept the catalytic hypothesis, we endeavoured to produce more nearly Abel's experimental conditions. Dr. W. Kellner, Abel's assistant at the time, was fortunately able to tell us two important details which had not been published—viz., that the gas was admitted through a tube entering the bottom of the gallery, and that no special device was used for mixing the gas and air as they were drawn along the sixteen feet of gallery between the point of entry of the gas and the lamp-flame. On bringing in the gas-supply through the bottom of the gallery so as to mingle with the air current which had passed the fan, we found we could reproduce the appearances described by Abel. The "flares" were attenuated clouds of light—silent, and with hardly any charring effect. Occasionally they progressed along the gallery as detached filaments of flame, distinctly separated from one another. When the gas pipe projected a little into the gallery the stream of entering gas flowed upwards through the air current, so as to fill the upper portion with a feebly explosive mixture while the lower portion was uninflammable. When the gallery was so filled a lamp flame five inches from the floor showed only a small cap, but ignited the mixture above if the flame was raised a few inches. The flame then travelled back against the current with "feeble explosive effect." On pouring the magnesia through a drum-sieve into the gas and air current, just after the point of entry of the gas, the cloud of dust made the flares more luminous, and every now and again a particle of dust passing through the lamp-flame was whirled upwards white-hot into the explosive mixture above and ignited it.

Exactly similar appearances are observed in the small wooden gallery when the gas is admitted from below and the gas and air streams are allowed to mingle as they flow along. This method of mixing seems to result in long "threads" of gas being borne along which break into detached filaments. These threads or filaments may be ignited and the resulting thin detached flames may be carried some distance, although the gas if thoroughly mixed with the air could not be ignited. A sample drawn from the gallery during the "run" would not reveal the heterogeneity of the atmosphere, but would give the average contents of that portion of the gallery. This fact may account for Abel's statement that mixtures of methane and air containing between 3½ and 4½ per cent. of methane, when drawn over a lamp flame, without any dust present, gave lambent flames that increased in size and after some seconds caused a general ignition.

The pretty experiment of Mallard and Le Chatelier may be easily adjusted to show the inertness of magnesia (or other incombustible dusts) when it is carried upwards by the ascending current of gas and air into the Bunsen flame above, and the effect such incombustible particles have when they are dropped through the Bunsen flame and fall red-hot through the rising current. A glass tube 5 feet long and 3 inches in diameter is fed from below with a mixture of gas and air through a Meeker burner and an adjustable orifice. A Bunsen flame burns horizontally across the upper open end. When the gas and air mixture is weaker than the lower-limit the hot particles carry down a small cap with them; but when the mixture is above the lower-limit and would propagate a flame if it were not moving upwards faster than the flame can travel downwards, then a heated dust particle carries a real flame in its wake as it falls, and the flame spreads outwards in an inverted cone.

When the mixture is just strong enough to propagate a flame downwards, the heterogeneity of the mixture is revealed by the curious round films of flame which slide one over another—giving an appearance which has suggested a swarm of luminous jelly-fish.

The Le Chatelier experiment in no way confirms Abel's hypothesis, but on the contrary it adds strength to the contention that incombustible dusts have a cooling and therefore a quenching effect on flame. Their presence in a mine cannot add to the danger of fire-damp explosions.

DISCUSSION.

Mr. **CHARLES PILKINGTON** said he had had some experience of stone dust and coal dust, and he thought that Professor Dixon's explanation of Professor Abel's experiment was exceedingly clear and correct. Professor Abel placed his lamp at the bottom of his little gallery, and so was unable to show a cap at all, but when he lifted it into the higher part of his tube the mixture contained perhaps 6 to 9 per cent. of gas instead of the 2·7 at which Professor Abel thought the mixture exploded. It was, therefore, not remarkable that people conceived a wrong idea of the danger of an explosive mixture in mines. If 3 per cent. of gas was an explosive mixture the mines in Lancashire and South Wales would be very much more dangerous than they were known to be. He was very glad Professor Dixon had been able to clear up the two points, because it would also have been a very great shock to many people if it had been proved that inert incombustible dust suspended in the air actually helped an explosion along. One means by which it was hoped to reduce the danger from explosions was by introducing a large quantity of inert incombustible dust about a mine, so that when an explosion did take place that dust should be stirred up and so prove an extinguisher.

Dr. **W. E. GARFORTH** said that in the Altofts experiment a tube was erected 1000 feet long to represent an underground road, with shelves to hold the coal dust similar to the sides of a road, a fan to produce ventilation, or a current of air similar in quantity to that met with in underground roadways, and also the flame from a shot by firing a cannon. All these were mechanical means. When he, the speaker, was first interviewed with regard to stone dust, and it was pointed out that there was no carbon dioxide to quench the flame, he pointed out that it was not intended to do anything in the way of quenching the flame by introducing deleterious gases into the mine, as there were quite enough natural dangers in a pit without introducing artificial ones. What they were endeavouring to do was to bring millions of stone-dust particles into an atmosphere to extinguish an explosive blast, in imitation of what had taken place in 1886 by an explosion which took place at Altofts, where they found a large quantity of coal dust that was lying on the roads, had been ignited by a blown-out shot. The flame and explosive force travelled over 500 yards, then came in contact with another current of air, and the explosive violence was continued for another 1200 yards, making altogether an explosive flame travelling quite one mile. When that flame came in contact with roads which were covered by fine stone dust, due to the tramping of horses and men over the roads for 20 years, it was found to gradually die away. They were aware this dust had been raised as a cloud in the air, and that therefore millions of particles of inert matter had quenched the flame by mechanical means. They also found from the last point of destruction, and up to the point where the corpses were found, that there was a zone of stone dust, so that the men were not mutilated in any way, neither was their hair singed, showing that the stone dust had been effective in quenching the flame. Such effects occurred on the three main haulage roads. He desired to make it clear that the first (1908) year's experimental work was really mechanical. They had not until 1909 the ingenious instruments that were designed by Dr. Wheeler and Mr. Horace Darwin to indicate the force or the velocity of the flame, which on one occasion registered a velocity at the rate of 1300 miles an hour. They had not any chemical analyses. Recently a roadway about 10 feet by 7 feet, on which there was passing about 42,000 cubic feet of air per minute, had been blocked up in part. They noticed that when the air increased in velocity from 720 feet per minute, when the coal dust was stagnant, to 1600 feet per minute the particles of coal dust were raised in suspension until at 1800 feet they had all gone and left the stone dust exposed. The roadway was then further narrowed, and at 2200 to 2600 feet per minute, the stone dust began to fly away in the same manner, so that at 2700 feet all the stone dust had been taken away and the natural strata were to be seen. To show the natural effect of the dust in the air at such a great velocity he would like to state that the men who were working at 1300 yards' distance from the experiment were troubled with the dust to such an extent that they had to leave their work. This would give an idea of the fineness of the dust they were using. By inserting a sheet of brattice cloth anywhere in a roadway they could follow with stone dust the coal dust which had gone up into the interstices, where it would be impossible to get any other preventive than that of stone dust. It was now known that it was possible to get such a quantity, say, 10 or 14 parts of stone dust to one of coal dust, that there was not the slightest possibility of propagating an explosive blast. As regarded a stagnant atmosphere they had a circular saw cutting a piece of stone, and the atmosphere, not being influenced by currents, gradually became charged with the stone dust, until in the end a complete fog of stone-dust was obtained, which was sufficient to quench any explosive blast.

Mr. Gerrard considered that Professor Dixon's experiments proved his theory. He, personally, could not understand how Professor Abel came to the conclusion he did. Ever since the Seaham disaster in 1880 the question had been a bugbear to mining men. In one of the biggest disasters that had ever occurred in Great Britain it had been agreed that the coal-dust was the chief agent in the terrible destruction that ensued. Very little was being done to cope with the coal-dust danger, but when Professor Dixon's explanation of Abel's results was made known they need no longer have any fear of introducing stone-dust into mines and a very good work would have been performed. It was said by some people that the stone-dust would be soon covered over unless the operation was repeated frequently, but if note was taken of the deposition of the coal-dust it would be clearly established, except in some extreme case, by the colour of the stone-dust that there was not a great amount of coal-dust deposited for some time. Sometimes there was an aggravated instance of a large deposition of coal-dust. It might be an interesting subject for chemists to consider why the predominance of stone-dust should arrest an explosion, if it was by reason of the particles of stone-dust absorbing, abstracting heat, thus lowering the temperature.

The Chairman enquired what particular description of stone was used to make the stone-dust, and what precautions were taken to prevent any undue amount of dust being in the atmosphere when the men were actually working, and whether the dust distribution was performed at stated times. It was known that dust in the mines of South Africa was a rather serious menace to the health of the workers. He could conceive that a great deal depended upon the character of the dust used, and on the method of its use, as to whether it would be harmless or harmful to the coal workers.

Mr. T. H. Byrom said it was universally admitted nowadays that coal-dust was explosive. He would like to have Professor Dixon's opinion as to the relative danger of different coal-dusts as no doubt there was a difference. Assuming there was a difference he would like to know the particular features that made one coal-dust more explosive than another, apart from the mechanical condition. He thought it was reasonable to suppose that the more finely divided the coal-dust happened to be, or the more nearly it approached a gaseous state, the greater the liability of explosion, but there were probably other points in the chemical constitution of the coal which also determined its explosibility.

Professor Dixon, in reply, said he would like to correct Mr. Gerrard on one small point. The facts and conclusions he had been able to bring forward were the result of the work of the Home Office Committee, supplemented by the experiments of his research students in the University laboratories. The credit must not be given to him, therefore, but to the Home Office Committee and their staff at Eskmeals. The question of the deposit of coal-dust upon stone-dust was being very carefully considered by the Committee. They had not yet reached the point of going into the question how best to lay the inert dust, but they had considered how different dusts differed in their power of being raised. Many experiments had been made with regard to the question whether it was possible to have a mixture of inert dust and coal-dust properly put down which was not inflammable, and then have a deposition of coal-dust on the top which might be raised by itself and propagate flame. If a violent explosion took place the whole of the dust, including the top coal-dust and the mixture below, was all stirred up and the flame was put out. It was possible, however, with a heavier stone dust mixed with coal-dust underneath, and a light coal-dust spread on the top, with what he might term a "licking" flame instead of a violent explosion, that some of the light superposed coal-dust would be licked up and so continue the flame. This was a danger which would have to be guarded against. It had to be borne in mind that a gentle licking flame would kill people just as well as a violent explosion, only it would do it more slowly. Dr. Fowler very rightly, from the public health point of view, had raised the question whether the dust would affect the lungs of those who had to breathe it. This was a point which was also under consideration. He thought there was no doubt that all inert dusts were not equally applicable for mines. It might be introducing a serious evil if crushed quartz was used in a mine. Care would have to be exercised in regard to the matter. In answer to Mr. Byrom, he might state that a great deal of work had been done in regard to the relative explosibility and inflammabiilty of coal dusts. As Mr. Byrom had very rightly stated this was largely regulated by the fineness of the dust, but not altogether. The actual first inflammation of coal-dust depended rather largely, he believed, upon the volatile contents and how easily the gas was given off. Given the conditions of a flame and light coal-dust suspended in the air, the first thing done was to distil off gas and light the mixture of gas and air. Only after the flame had run some way did the dust burn as a whole, but after a certain distance, when violence had been set up, it appeared it did burn as a whole and there was no selective combustion, the whole of the solid and gaseous contents being burned at once. Apparently the oxygen hit the coal particle so violently that whatever the oxygen hit against, either the carbon itself or the hydrocarbon enclosed in it, was burned out. Explosions had been produced by anthracite-dust and by actual charcoal-dust which had been previously heated to eliminate volatile matter. It was curious to see how analogous dust explosions were in certain respects to gas explosions. In each case there was the preliminary slow burning, the gradual increase of velocity and pressure, and finally high pressures and great oscillations of flame. Both in gas and dust explosions the effect of constrictions and reflecting surfaces appeared analogous. Fortunately it did not appear to be theoretically possible to have an "explosion-wave" propagated by the dust of a mine.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Filters; Mechanical ——. J. Taylor and A. E. L. Chorlton, Manchester. Eng. Pat. 9668, April 24, 1912.

In a filter of the type in which the filtering medium is adapted to be washed by a reverse current of water, the washing water is forced under pressure through the filtrate-discharge pipe and escapes through a passage containing a turbine driving a mechanical agitator and a centrifugal jet device which are disposed near the bottom of the filter and are adapted to stir and clean the filtering medium. The inlet through which the liquid to be filtered is supplied is closed during the washing process.—H. H.

Vapours and gases, particularly blast-furnace gas; Purification of —— in the dry way. R. Böcking und Co., E. Stumm-Halberg and R. Böcking Ges. m. b. H. Fr. Pat. 451,815, Dec. 12, 1912. Under Int. Conv., April 6, 1912.

To enable blast-furnace gas to be purified by means of cloth filters at a temperature above the dew point of the gas without overheating the cloth, the gas is passed through a spray cooler and over a heating coil regulated by means of a hygrometric device in the gas outlet, which automatically controls the supply of heating and cooling liquids so as to control the hygrometric state of the gas in the desired manner. Alternatively the hygrometric device may control an audible or visible signal for enabling the apparatus to be controlled by hand.—H. H.

Condensing vapours and washing gases; Process and apparatus for ——. V. Gouthière. Fr. Pat. 452,038, Dec. 18, 1912.

An apparatus applicable either for condensing steam or washing gas comprises a vertical cylindrical chamber provided with a large number of horizontal water-spraying jets. The gases are drawn through the apparatus by a pump.—H. H.

Smoke and heated gases; Process and apparatus for removing dust from and cooling ——. H. Lelarge. Fr. Pat. 452,136, Feb. 29, 1912.

Smoke or other heated gas is first treated with streams of warm water to saturate it with water vapour, and then with streams of cold water to remove dust or other solid particles and at the same time cool the gas. The heating of the warm water supply is effected by utilising the waste heat of the gas. Heavy oil or other liquid may be used instead of the water.—H. H.

Evaporator; Horizontal —— with auxiliary heating chambers below the main heating device. Främbs und Freudenberg. Ger. Pat. 260,008, April 7, 1912.

In a horizontal cylindrical evaporator, auxiliary heating chambers, shaped like the segment of a circle in cross-section, are formed by means of inclined plates, which serve also to strengthen the evaporator. The chambers may be heated by steam, waste gases, or the like.—A. S.

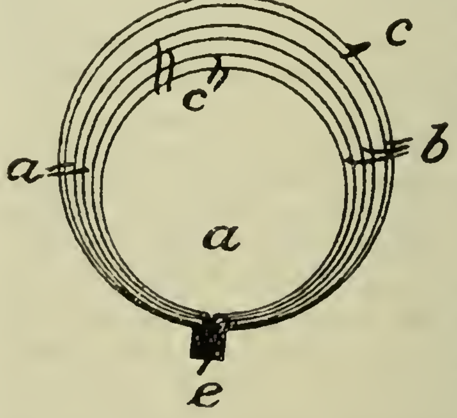
Evaporator. A. G. fur Vakuumverdampfanlagen. Ger. Pat. 260,270, Sept. 17, 1911.

Steam is supplied to the outer surface of the heating tubes through a supply pipe provided with openings, as close together as possible, along the whole length of the heating tubes, the openings being largest at the lower end of the tubes and diminishing from below upwards.
—A. S.

Concentrating liquids; Process for ——. C. H. Meister. Ger. Pat. 260,034, July 20, 1911.

A number of superposed funnel-shaped devices are arranged in a tall chamber, the lowest and uppermost ones having the wide end above, whilst the intermediate ones have the wide end alternately above and below. The lowest one is jacketed and is heated directly but the others are heated by the ascending vapour from the liquid being concentrated. The liquid is sprayed on to the inner surface of the uppermost funnel and flows downwards over the outer and inner surfaces alternately of the others, which are so connected that the ascending vapour does not come in contact with the liquid.—A. S.

Distillation apparatus; Multiplex —— with vapourising and condensing chambers surrounding one another. O. Schmeisser. Ger. Pat. 260,059, April 25, 1912.



The vapourising chambers, *a*, and the condensing chambers, *b*, are separated by partitions, *c*, provided with orifices (not shown) for the passage of the vapour. These partitions have flanges, which all come together at the same place, *e*, so that they can be held together by the same bolts.
—A. S.

Furnaces of the tunnel or channel type. E. C. R. Marks, London. From Electric Smelting and Aluminium Co., Sewaren, N.J., U.S.A. Eng. Pat. 19,607, Aug. 27, 1912.

See U.S. Pat. 1,040,895 of 1912; this J., 1912, 1124.—T. F. B.

Separation of solids; Method of gravity liquid ——. F. I. du Pont, Wilmington, Del. U.S. Pat. 1,064,459, June 10, 1913.

See Fr. Pat. 419,072 of 1910; this J., 1911, 120.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

[*Coal dust explosions.*] *Explosions in Mines Committee.* Fourth Report. [Cd. 6791.] (See also this J., 1912, 974, 1170; 1913, 476.)

Whilst there is no well-defined border line between "inflammation" and "explosive combustion" in the case of gaseous mixtures, a distinction may be drawn in the case of mixtures of coal dust and air. During the "inflammation" of dust from bituminous coals, the flame is propagated largely by the burning of gases distilled from the dust, but during "explosive combustion" the portion of each dust particle that aids in propagating the flame is burned as a whole. A coal dust containing 16 per cent. of volatile matter caused an explosion as violent as one caused by a dust containing 35 per cent. of volatile matter, whilst explosions of equal or greater violence were caused by wood charcoal. Experiments made by R. V. Wheeler in the Altofts gallery (see this J., 1908, 888, 971; 1909, 874, 1024) are described which bear out this conception of two distinct stages—"inflammation" and "explosive combustion"—in the combustion of mixtures of coal dust and air. The combustion of the mixture was of the nature of an "inflammation" until it had travelled some distance along the gallery, when it was suddenly converted into "explosive combustion" marked by a sudden and considerable rise of pressure. Attention is drawn to the connection between these results and the view put forward by Blackett (Trans. Fed. Inst. Min. Eng., 1894, **7**, 54; Proc. Nat. Assoc. Colliery Managers, March, 1891) as to the effect of a "pioneering cloud" in dust explosions. The experiments show that for a propagating inflammation to take place in a mine, the concussion of a blown-out or over-charged shot, or of a firedamp explosion is not essential. A flame, without any concussion, can ignite a ready-formed dust cloud, and the inflammation will spread through the cloud with increasing velocity and if the conditions remain favourable, will ultimately change into "explosive combustion." Constrictions or obstructions cause the transition from inflammation to explosive combustion to take place at a much earlier period than in a smooth gallery, though they do not necessarily increase the ultimate violence of the explosion.—A. S.

Combustion of carbon; Mode of ——: effect of drying the oxygen. T. F. E. Rhead and R. V. Wheeler. Chem. Soc. Trans., 1913, **103**, 1210—1214.

The authors' previous experiments (this J., 1913, 276) were made with air or oxygen dried by contact for several days with concentrated sulphuric acid. Armstrong and Colgate (this J., 1913, 391) have suggested that water (as an electrolyte) plays an all-important part in determining the manner in which carbon burns. Comparative experiments have now been made, on the lines previously described, with undried air and air dried by contact with phosphorus pentoxide for 4 weeks. The results were practically the same in both cases and hence the formation of the "complex" (see this J., 1913, 276) is in no way prevented by the absence of moisture. The experiments of Baker (this J., 1885, 268, 668), however, indicate that the decomposition of the "complex" is accelerated by the presence of moisture.—A. S.

[*Illuminating gas.*] *Coke-oven carbonisation.* W. Chaney. J. Gas Lighting, 1913, **122**, 938—947.

Illuminating gas and furnace coke are manufactured at Saltley by the Birmingham Corporation in a battery of 12 Koppers ovens, each 35 ft. long, 18 to 19½ ins. wide and 8 ft. 10 in. high. The ovens are fired with gas made in Mond producers, which will be worked with recovery of ammonia when the extension of the plant to 66 ovens is completed. Both the air and the gas for the ovens are preheated in regenerators, the currents being reversed every half hour. The coal is first broken to 1¼ ins. cube, and, if a dense furnace coke is required, is ground to fine powder and charged direct into the ovens, or compressed first into a solid cake. The coke is discharged by an electrically driven ram into a quenching machine. The Mond producer is worked with small coal without recovery of ammonia, and the gas burns to waste whilst the change-over valves of the oven are operated. Under these conditions the fuel consumption, calculated as free from moisture and ash, is 15·73 per cent. on the raw coal carbonised. With ammonia recovery, it is estimated that the net cost of heating the ovens, after allowing for labour, repairs, maintenance, depreciation and interest should be 12·4d. to 16·5d. per ton of coal carbonised, compared with 23·9d. for retort ovens heated by regenerative furnaces. The coal for carbonisation must not expand in coking, and the proportions of sulphur, ash, and alkali, must be kept below certain limits. Using a mixture of equal amounts of South Yorkshire and Derbyshire coal, without stamping, containing 4 per cent. of moisture and 4·5 per cent. of ash, 650 tons were carbonised in seven days, and the yield of gas was 12,640 cub. ft. (corrected) per ton. The gas contained: CO_2 2·1, C_nH^m 2·9, O_2 0·7, CO 7·8, H_2 50·0, CH_4 30·0, and N_2 6·5 per cent.; S other than as H_2S, 30·7 grains per 100 cub. ft.; and cyanides, calculated as $Na_4Fe(CN)_6$, 3·34 lb. per 10,000 cub. ft. The calorific value of samples collected over 8-hour periods was 479 to 509 B.T.U. (average, 500), and the illuminating power (CO_2 not removed) 13·03 to 14·68 (average, 14·00) in No. 1 Argand burner, and 15·38 to 18·03 (average, 17·00) in No. 2 Argand burner. The temperature of the ovens was 1032° to 1075° C. The labour costs for the ovens (not including the Mond producers) are estimated to be 7·3d. per ton with stamped charges, and 5·8d. with unstamped charges.—A. T. L.

Dry distillation of fuels: Formation of water in the ——. O. Rau and G. Lambris. J. Gasbeleucht., 1913, **56**, 533—537, 557—564, 589—591.

The relative quantities of different products formed by the dry distillation of coal vary with the rate at which the temperature is increased. If the temperature is raised rapidly, as in practice, the products suffer decomposition before escaping from the retort. The distillation was therefore carried out slowly, the temperature being raised to 1000° C. in 3, 7, 36 and 80 hours in different sets of experiments. For comparison, experiments were also made in which the temperature was raised to 1000° C. as rapidly as possible, *i.e.*, in about 10 minutes. The quantity of water liberated was determined by means of phosphorus pentoxide (see this J., 1913, 588). The fuels used were cellulose, gas coal, coking coal, and anthracite. It was found that the amount of water formed was in proportion to the quantity of oxygen in the fuel, and that the temperature at which water is given off was higher with fuels containing less oxygen. With cellulose, water was given off chiefly at 240°—350° C., and with pit-coal, at 400°—600° C. When the fuel was heated rapidly, only about half as much water was formed. Prolonging the period taken to raise the temperature to 1000° C. beyond seven hours had no effect on the results obtained. Ammonia was formed chiefly at 500°—700° C., or 100° higher than water.—A. T. L.

Ring-generator for the production of heating and power gas from low-grade bituminous fuel. J. Recktenwald. Feuerungstechnik, 1913, **1**, 225—229.

A suction producer installation at the Von der Heydt coal mine comprises 40 producer-chambers arranged in groups of four, each group forming a unit. The four producers of a group are arranged at the corners of a square and are connected at the top and bottom of the producer-chambers by valved conduits with a common vertical chamber in the centre of the group. Each producer-chamber is provided at the upper part with a branched outlet by which the gas is led at will into either of two mains leading to gas-fired boilers or to gas engines respectively. Beneath each producer-chamber is a large ash-chamber, of about three-quarters the capacity, so that the fuel column rests on a deep bed of incompletely burned ash, and this in turn rests on an inclined grate above a similarly inclined hearth from which the ash can be discharged directly into trucks. In operation, three of the four producers of a group contain carbonised fuel and make tar-free producer gas, whilst the fourth contains a charge of raw fuel undergoing distillation. This charge is heated by the heat stored in the walls of the chamber and transmitted from the other three chambers, and also by admitting air through the grate beneath the ash column so as to complete the combustion of the previous charge. The products of distillation are drawn by a steam-jet from the upper part of the producer into the central conduit and are forced together with steam into the combustion zone in the three other producers. The draught through these producers is maintained by a steam-jet exhauster, the air being drawn in through the grate beneath the ash-chamber. Water is injected into the column of ash in order to generate steam and facilitate the removal of clinker. Each chamber takes a charge of 4 tons and requires re-charging after 24—50 hours. The fuel used contains a high percentage of ash and the average heat value is 2400 cals. per kilo. When the working conditions are so regulated that the ash and clinker can be readily removed, the gas contains: CO_2 11—12, O_2 0·2—0·3, CO 9—10, CH_4 2—3, H_2 18—22, and N_2 53—56 per cent. and has a heating value of about 1100 cals. per cb. m. The gas drawn off for burning under boilers contains about 5 grms. of tar per cb. m. As soon as the charge in a producer chamber is all brought to incandescence, the gas from that chamber is led into the power-gas main. This gas contains 1·3 grms. of tar per cb. m. at the inlet of the cooler and 0·5 grm. at the engine.—A. T. L.

Sulphur in illuminating gas; Determination of ——. R. S. McBride and E. R. Weaver. J. Ind. Eng. Chem., 1913, **5**, 474—476.

Three forms of apparatus were compared: (1) the Referees', consisting of a Bunsen burner surrounded by pieces of ammonium carbonate and connected with a condensing cylinder; (2) the Elliott apparatus, which is essentially a large Referees' apparatus with two condensing cylinders; (3) the Hinman-Jenkins apparatus, in which concentrated ammonia solution is used instead of ammonium carbonate. It was found that satisfactory results can be obtained with any one of the three apparatus provided: (1) there is a strongly alkaline atmosphere in the condensing chamber; (2) no rubber connections are used, and (3) a rate of combustion appropriate to the particular apparatus is employed. For the Elliott apparatus, 1 cb. ft., and for the other two forms, 0·5 cb. ft. of gas per hour may be used. By adding a second condenser to the Referees' apparatus the amount of sulphur found therewith was increased by about 1 per cent.—A. S.

Liquid purification [*of crude coal-gas*]. W. B. Davidson. J. Gas Lighting, 1913, **122**, 948—958.

The author reviews the methods in use for the removal of tar, ammonia, naphthalene, hydrocyanic acid, hydrogen sulphide, carbon bisulphide, carbon dioxide and nitrogen. The cost of removal is given as follows: tar, 0·25d. per ton of coal carbonised; ammonia (washing only), 1¾d.; naphthalene, 0·46d.; hydrocyanic acid, 2d. profit; hydrogen sulphide, 7·4d. Experiments in removing the acid impurities from gas by means of ammonia have been carried out with an installation of 18 Dessau retorts carbonising 14—16 tons of coal per day. By a carefully regulated gradation of pressures in the ammonia still the purity of the distillate is increased and the quantity of purified ammonia required for the washing operations is reduced. The washer used is of the vertical centrifugal spray type, and throws little or no back pressure. From 96 to 98 per cent. of the hydrogen sulphide is removed by the ammonia scrubbing and the final traces are removed with ferrous hydroxide sludge, the effluent sludge going to the primary cyanogen washer. The plant required in a large works would be (*a*) a tar extractor reducing the tar to less than 2 grains per 100 cub. ft.; (*b*) a cyanogen washer using iron sludge effluent from the final scrubber and extracting most of the cyanogen, with some ammonia, hydrogen sulphide, and carbon dioxide; (*c*) a first ammonia washer using purified ammonia and extracting most of the hydrogen sulphide and carbon dioxide; (*d*) a second ammonia washer using water and extracting ammonia and carbon dioxide and reducing the hydrogen sulphide to 0·02 per cent. by volume; and (*e*) a final washer using in the lower portion ferrous hydroxide sludge to extract traces of hydrogen sulphide and ammonia, and in the upper portion water or ammonium sulphate and sulphuric acid to extract the last traces of ammonia.—A. T. L.

Patents.

Fuel; Manufacture of ——. J. W. Butler, Eltham, Kent. Eng. Pat. 11,680, May 16, 1912.

Raw peat is disintegrated and heated in a steam-jacketed pan, and during the drying process, from 5 to 7½ per cent. of solidified tar in a heated or melted condition is mixed in to serve as a binder when the mixture is subsequently briquetted. The binder is made in the manner described in Eng. Pat. 4427 of 1906 (this J., 1906, 632).—A. T. L.

Drying peat and similar material; Process for ——. P. Roth. Fr. Pat. 451,864, Dec. 13, 1912. Under Int. Conv., Apr. 6, 1912.

The peat is periodically subjected to mechanical pressure in a chamber with perforated walls surrounded by a vacuum chamber. Each time the pressure upon the peat is relieved, the pressure in the vacuum chamber is allowed to rise to atmospheric, so that the peat cells are alternately compressed and allowed to expand again and the moisture thereby eliminated more readily.—H. H.

Mines, tunnels and other places; Treatment of dust in ——. H. Belger, Cullercoats, Northumberland. Eng. Pat. 6343, Mar. 14, 1913.

A solution of calcium or magnesium chloride (15—35 per cent.) and glue (5—10 per cent.) is applied to the floor, walls and other surfaces in order that particles of dust suspended in the air may adhere permanently.—A. T. L.

Coal; Methods of mining ——, *converting it into gas, and conveying the gas from the mine.* J. H. Hoadley, New York. Eng. Pat. 14,494, June 20, 1912.

The coal is cut from the face of the seam by rotating cutters, driven electrically, which remove the coal in the form of powder. The powdered coal is drawn into a collecting box by a draught of air and is there wetted, and the wet powdered coal is conveyed through a pipe by means of the currents of air and water, aided by a mechanical conveyor if necessary, to the bottom of the shaft. At this point the pipe delivers to a chamber which receives the sludge whilst the air passes on through a screen to the suction pipe of the exhauster used for producing the draught, and is then blown into a gas-producer arranged at the bottom of the shaft. The sludge is raised and drained in a bucket-and-chain conveyor, and delivered on to a heated sloping floor in an enclosed chamber. The steam formed in this chamber is delivered by a fan to the producer at a point near the air inlet, and the dried powdered coal is delivered by a conveyor to the air suction of the exhauster so as to be blown with the air into the producer. The gas from the producer is led out of the mine through suitable mains.—A. T. L.

Gas; Process for obtaining —— *from peat, oil, sawdust or like material.* J. D. Oligny, Montreal, Canada. Eng. Pats. 12,562 and 12,563, May 28, 1912.

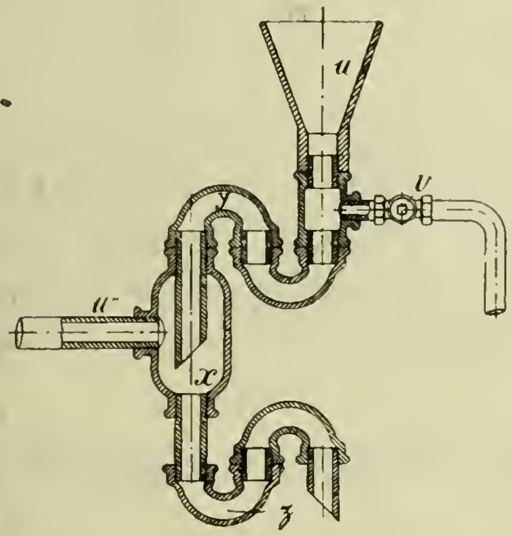
(1) The material is heated in a rotary horizontal retort and the gases evolved are treated so as to condense and separate the lighter and heavier portions of the liquor. The heavier distillates are allowed to run back into the retort by gravity. The lighter distillates run into a tank containing air under pressure, from which they are blown at intervals with air into the retort. (2) Peat or like material, and crude petroleum are heated in separate retorts, preferably rotary ones, and the heavier and lighter distillates are introduced, in the manner described above, into the petroleum retort. The gas outlets from the retorts lead to a common main.—A. T. L.

Coal, shale or the like; Treatment of —— *in vertical retorts.* A. Waddell, Dunfermline, Scotland. Eng. Pat. 21,991, Sept. 27, 1912.

In order to facilitate the heating of the material forming the core of the charge, carbonised material is withdrawn from time to time from the bottom of the retort, and means are provided to ensure that in the falling of the charge which ensues in the retort, the uncarbonised core and the hot coke near the walls shall intermix. For this purpose a temporary support is inserted horizontally through the walls of the retort before a portion of the charge is withdrawn, and the support is removed when the withdrawal has been effected. The support is in the form of an open-ended box which is inserted along the larger diameter of the retort and is narrow enough to ensure that the charge from above can fall past it. In withdrawing the support an inclined plate within it is held fixed so that no part of the charge is removed with the support.—A. T. L.

Gas producers; Open hearth suction ——. Sir K. I. Crossley and F. Fielden, Manchester. Eng. Pat. 1121 of 1913, date of appl. Nov. 14, 1912.

The producer is of the type having a stepped grate on which water is vapourised, as described in Eng. Pat. 26,127 of 1912 (this J., 1913, 413). An external vapouriser is provided in addition, comprising a number of gilled tubes arranged vertically between tube-plates in the vertical gas pipe between the producer and the scrubber. Water-supply tubes leading to the bottom of the gilled tubes and water overflow pipes are connected so that the water circulates upwards in each gilled tube except the last and through all the tubes in series. The water from the bottom of the last gilled tube is led through a siphon bend to the drain. A hot water overflow from one of the tubes leads water to the stepped grate. The water supply for the external vapouriser is shown in the figure. Most of the water running continuously into the funnel, *u*, escapes through an overflow, *v*, but when the engine takes a charge of gas, the pressure is reduced in the chamber, *x*, which is connected at *w*, with the gas main, and water is drawn over the bend, *y*. The bend, *z*, forms a seal for the chamber, *x*.—A. T. L.



Methane; Production of pure —— *from heating or lighting gas containing the same.* A. Wilhelmi. Ger. Pat. 260,477, April 17, 1912.

The gas is led over copper oxide or other oxygen-yielding substance heated to a definite temperature, in order to convert the hydrogen and carbon monoxide into water and carbon dioxide respectively, and the constituents of the gas other than methane are then separated by condensation, absorption, or liquefaction. Claim is made for the use of a contact substance mixed with pumice and permeated by heat-conducting material for carrying out the process.—A. S.

Paraffin wax; Rendering —— *capable of resisting the action of light, and opaque.* F. Gössel, Stockheim, Germany. Eng. Pat. 15,250, June 29, 1912.

The wax is melted and from 0·25 to 1 per cent. of an organic acid or oxyacid such as benzoic or salicylic acid is dissolved in it. The molten mass is rapidly cooled in moulds, or it may be remelted and suddenly cooled at a later time.—A. T. L.

Lubricating oils; Filtering and separating ——. G. H. Lister, Sheffield. Eng. Pat. 27,353, Nov. 28, 1912.

The apparatus comprises three superposed chambers. The oil passes downwards through a layer of filtering material supported on a wire gauze strainer in the top chamber. The filtered oil passes by a central pipe on to a distributing plate in the middle chamber beneath which is a steam coil. This chamber is provided with overflow pipes for the water and oil which separate therein, the oil passing to the lowest chamber which forms a reservoir.—A. T. L.

Gas generators of the blast furnace type. Société des Gazogenes Marconnet, Paris. Eng. Pat. 12,479, May 25, 1912. Under Int. Conv., May 27, 1911.

See Fr. Pat. 430,254 of 1911; this J., 1911, 1303.—T. F. B.

Blast-furnace gas; Method of increasing the calorific value of ——. W. Zimmermann, Dresden, Saxony. Eng. Pat. 21,359, Sept. 19, 1912.

See Fr. Pat. 448,555 of 1912; this J., 1913, 413.—T. F. B.

Device for detecting suspended matter in gases. Eng. Pat. 21,199. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Coke-oven carbonisation. Chancy. *See* IIa.

Dry distillation of fuels; Formation of water in ——. Rau and Lambris. *See* IIa.

Patents.

Retorts for the dry distillation of wood. F. Sykes, Bideford, Devon. Eng. Pat. 12,257, May 23, 1912.

In apparatus of the type described in Eng. Pats. 8542 of 1884 and 12,997 of 1893 (this J., 1894, 518) in which the wood is moved in succession through a series of chambers, the retort is composed of a series of superposed flat annular chambers connected by a central vertical pipe forming a passage for the gases, and also by separate vertical channels, staggered relatively to one another, through which the wood passes from one chamber to the next below. A vertical central rotating shaft with radial blades moves the wood around each chamber until it falls to the chamber below. The shaft is supported in an adjustable foot-step bearing.—A. T. L.

Tungsten filament and process of manufacturing same. J. Hubers, London. From J. Pintsch A.-G., Berlin. Eng. Pats. (1), 5026 and 8758, Feb. 28 and April 13, 1912, and (2) 5027, Feb. 28, 1912.

Ductile filaments, which unlike those prepared from metallic tungsten by drawing or rolling, retain their ductility even after prolonged heating, are prepared by the following processes: (1). A tungsten compound, for instance tungstic anhydride, is mixed with from 1 to 4, or in exceptional cases 5 (but preferably 1·4 to 2) per cent., referred to the weight of reduced tungsten, of an oxide of thorium or other rare earth metal or of an alkaline-earth metal, magnesium, aluminium, or zirconium, or a mixture thereof, or with an equivalent amount of a compound of such metals or the metals themselves, and the mixture is then reduced by hydrogen or other reducing gas at a uniform low red heat so as to obtain the tungsten in the form of an extremely fine amorphous powder, free from crystalline particles. Or, fine amorphous tungsten powder may be used as starting material and mixed with the substances mentioned. In either case, the mixture is formed into a paste with a suitable binding agent and squirted into filaments, which are finished in the usual way. By using colloidal tungsten and mixing it with the substances mentioned in the colloidal condition, filaments may be prepared without the use of a binding agent. In the finished filament the tungsten is alloyed with the thorium or other added metal. (2). Squirted filaments, prepared as described above, are subjected to a drawing or rolling operation, preferably so that the filament is compressed without undergoing any material elongation.—A. S.

[*Tungsten*] *Metal filament; Drawn —— and process of manufacturing same. Manufacture of filaments of alloys of tungsten.* J. Hubers, London. From J. Pintsch A.-G., Berlin. Eng. Pats. (1). 5028, Feb. 28, 1912, and 3749 of 1913, date of appl., April 13, 1912, and (2). 12,752, May 30, 1912.

(1). A rod or relatively thick wire is prepared from a paste made as described in Eng. Pat. 5026 of 1912 (preceding), and a filament is produced from this by drawing or rolling. (2). In the carbonisation and decarbonisation of filaments prepared as described in Eng. Pat. 5026 of 1912 (preceding), filaments of long aggregate length are used, and are afterwards cut to the desired length.—A. S.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,220, Aug. 7, 1912.

Claim is made for a luminous or flaming arc electrode containing titaniferous material and a small percentage of a lithium compound. The electrode may contain, for example, 96 per cent. of titanium carbide, 3 of black copper oxide, and 1 of lithium fluoride. The lithium compound makes the arc steady without imparting any undesirable colour thereto.—A. S.

Light and other radiations; Production of ——. S. O. Hoffman, San Francisco, U.S.A. Eng. Pat. 22,972, Oct. 8, 1912.

The invention consists essentially in allowing the rays of desired wave-length to radiate freely, and reflecting back to the source the other rays. As applied to incandescence lamps, the luminous rays are allowed to pass, whilst the non-luminous infra-red rays are reflected back, for example by means of an inner bulb having prismatic surfaces formed on it, or by a selective reflector, or by other suitable means.—A. S.

III.—TAR AND TAR PRODUCTS.

Phenol in crude carbolic acid and tar oils; Determination of ——. J. M. Weiss. J. Gas Lighting, 1913, 122, 820—821.

The method depends upon the determination of the sp. gr. and solidif. pt. of a distillation fraction of the separated tar acids. These characters for pure phenol (synthesised from benzene), *o*-cresol (extracted from a mixture of cresols and purified by crystallisation and fractional distillation) and a mixture of *m*- and *p*-cresol (separated by fractionation from a commercial mixture) are as follow:

	Phenol.	*o*-Cresol.	Mixture of *m*- and *p*-cresol.
Solidif. pt, °C...	40·5	27·75	below —10
Sp. gr. at 25°/25°C.	—	1·0129	1·0313
B. pt. range, °C.	1st drop at 179 1% at 180 92% at 181 100% at 182	1st drop at 189 19% at 190 93% at 191 100% at 192	1st drop at 198 6% at 200 81% at 201 100% at 202

In carrying out a determination 300 c.c. of the tar acids separated in the usual manner are distilled in a flask fitted with a Hempel tube until the vapour temperature is 170° C. Any phenol in the aqueous distillate is separated and returned to the distilling flask, and two further fractions are collected, viz., 170°—190° and 190°—202° C. The last-named is re-distilled and all coming over below 197° C. is added to the 170°—190° C. fraction, which now should contain all the phenol and no homologues higher than the cresols. The solidif. pt. and sp. gr. of this fraction are determined, whereupon the percentage of phenol may be estimated from the following data, showing the percentages of phenol corresponding to different specific gravities for mixtures of different solidifying points.

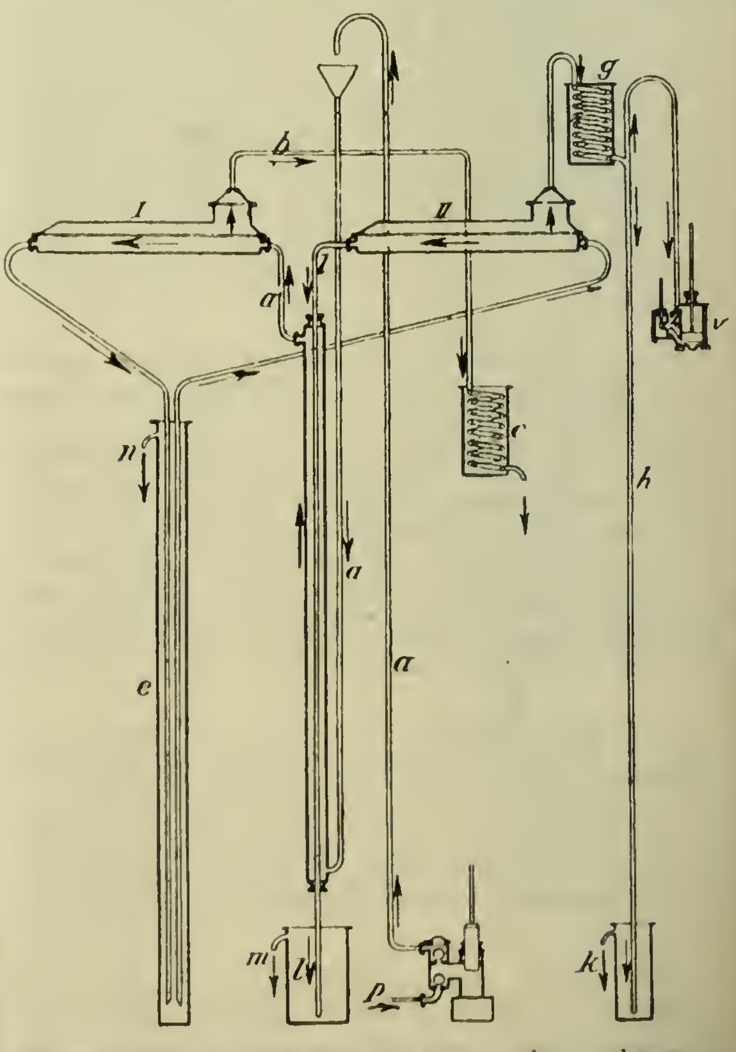
Phenol content of mixture.	Mixtures solidifying at:—				
	Below 0° C.	0°—5° C.	5°—10° C.	10°—15° C.	15°—23° C.
per cent.	sp. gr. at 25°/25° C.	sp. gr. at 25°/25° C.	sp. gr. at 25°/25° C.	sp. gr. at 25°/25° C.	sp. gr. at 25°/25° C.
0	1·032	1·038	1·039	1·040	1·041
5	1·035	1·040	1·041	1·042	1·043
10	1·040	1·042	1·043	1·044	1·045
20	1·043	1·045	1·047	1·048	1·048
30	1·047	1·048	1·050	1·051	1·052
40	1·049	1·052	1·053	1·054	1·055
50	—	—	1·055	1·057	1·058
60	—	—	—	—	1·061

For mixtures solidifying above 23° C., the phenol content may be estimated from the solidif. pt. alone, viz., 23·5° C., 70 per cent.; 29·5°, 80; 32·75°, 85; 35·5°, 90; and 37·75°, 95 per cent. of phenol. The figures given whilst not accurate for all possible mixtures of phenol and the cresols, cover satisfactorily all those likely to be obtained in practice, and the results (referred to the original material) will be accurate to within 0·2—1·5 per cent., according to the proportion of tar acids present.—A. S.

Patents.

Distillation [*of tar, etc.*]; *Process and apparatus for continuous ——.* F. Raschig. Ger. Pat. 260,060, Oct. 27, 1912.

The tar is introduced through the pump, *p*, and passes through the tubes, *a*, *a*, into a distilling apparatus, I, where the lighter constituents are removed; these are then brought through the tube, *b*, to the condenser, *c*. The residual tar is allowed to run into the vessel, *e*, which is 10 metres high, and thence it is drawn into the



second distilling vessel, II, by means of a vacuum pump, *v*. The naphthalene, carbolic oil, and creosote oil are here distilled off and condensed in *g*, whence they run off through a tube, *h*, 11 metres long, into a collecting vessel, *k*. The tar remaining in the second distilling vessel passes through the tube, *l*, into the vessel, *m*; during its passage it warms the crude tar on its way to the first distilling vessel, and is itself cooled. More than two distilling vessels may be used, if desired, the pressure in each one being lower than that in the preceding vessel. —T. F. B.

meso-Halogen-anthracene-β-monosulphonic acids ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 260,562, May 4, 1912.

A *meso*-halogen-anthracene is treated with sulphuric acid chlorhydrin, SO_3HCl, preferably in presence of an indifferent diluent. Sulphonation of *meso*-dichloroanthracene by this process yields the *β*-monosulphonic acid, whereas treatment with sulphuric acid in the ordinary manner yields two isomeric dichloroanthracenesulphonic acids.—T. F. B.

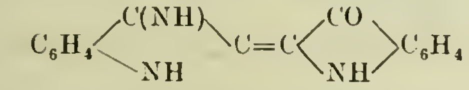
Chlorobenzenedisulphonic acid ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 260,563, May 24, 1912.

p-Chlorobenzenesulphochloride is converted quantitatively into a chlorobenzenedisulphonic acid by heating with sulphuric acid monohydrate.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo-mono-imine. A. Binz and K. R. Lange. Ber., 1913, **46**, 1691—1695.

The authors consider that indigo-mono-imine :



is formed when an ammoniacal solution of zinc hydroxide is allowed to act upon an indigo-alkali addition product. The reaction is carried out by shaking the green addition product of indigo and sodium alcoholate with a solution of zinc hydroxide in ammonia and with saturated alcoholic ammonia. The blue reaction mixture is filtered and the sparingly soluble hydrochloride of the mono-imine precipitated by means of hydrochloric acid. The hydrochloride dyes wool and tannined cotton in indigo shades. It also dyes from a borax bath like Alkali Blue, but with partial decomposition, the shade produced being greenish. With alkaline hydrosulphite the salts give leuco-compounds, which on oxidation with air give the free base together with decomposition products. The pure base is obtained by dissolving out the red-coloured impurities with alcohol. It is a dark blue substance, soluble in alcohol, alkalis and acids with a blue colour. The indigo-mono-imine has acid as well as basic properties. The above described reaction is not a simple one and a mixture of products is probably formed. The halogen-indigos, Indigo Red and thioindigo can also be converted into imines. Thioindigo-imine gives a deep red hydrochloride and a blue alkali salt. The use of methylamine instead of ammonia yields methylimino-compounds.—J. B.

Developable dyestuffs ; An innovation in ——. O. N. Witt. Chem.-Zeit., 1913, **37**, 697.

A new stable *p*-nitrobenzenediazonium double salt having the formula, $NO_2.C_6H_4.N : N.SO_3.C_{10}H_7 + NaSO_3.C_{10}H_7 + H_2O$ is obtained when *β*-naphthalenesulphonic acid is added to a solution of diazotised *p*-nitraniline. The sodium supplied by the sodium nitrite serves to form the double salt, which crystallises out from the solution, thereby differing from the *α*-naphthalenesulphonic acid salts (see Ger. Pats. 81,039, 83,367 and 89,998) which cannot be salted out. The new product is not likely to be used for Para Red on account of the curious fact that it gives yellower shades than ordinary diazo-*p*-nitraniline. Its chief use is as a developer for a certain class of coupling dyestuffs (Paranil colours) for which it is sold under the name Paranil A.—J. B.

Malachite Green ; Synthesis of alkoxy derivatives of —— *by means of aryl-magnesium halides.* E. Votocek and J. Matejka. Ber., 1913, **46**, 1755—1759.

Michler's ketone reacts easily with the Grignard reagent prepared from an alkoxy-halogen-benzene, giving an alkoxy-derivative of Malachite Green :

$$\left[(CH_3)_2N{\cdot}C_6H_4\right]_2CO + XMg{\cdot}C_6H_4{\cdot}OR \rightarrow$$

$$\left[(CH_3)_2N{\cdot}C_6H_4\right]_2C(OMgX)C_6H_4{\cdot}OR \rightarrow$$

$$\left[(CH_3)_2N{\cdot}C_6H_4\right]_2C(OH)C_6H_4{\cdot}OR$$

The same products are obtained by the interaction of the magnesium compound of *p*-bromo-dimethylaniline and the methyl ester of anisic acid :

$$CH_3O{\cdot}C_6H_4{\cdot}COOCH_3 + 2BrMg{\cdot}C_6H_4{\cdot}N(CH_3)_2 \rightarrow$$

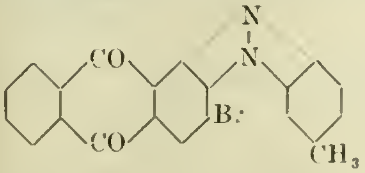
$$CH_3O{\cdot}C_6H_4{\cdot}C(OMgBr)\left[C_6H_4{\cdot}N(CH_3)_2\right]_2 \rightarrow$$

$$CH_3O{\cdot}C_6H_4{\cdot}C(OH)\left[C_6H_4{\cdot}N(CH_3)_2\right]_2.$$

The products were reduced to their leuco bases and proved to be identical with the corresponding compounds obtained from alkoxybenzaldehydes and dimethylaniline. *p*-Methoxy-, *p*-ethoxy-, *m*-methoxy- and *o*-methoxy-derivatives of Malachite Green are described.—J. B.

2-*Aminoanthraquinone.* F. Ullmann and R. Medenwald. Ber., 1913, **46**, 1798—1809.

2.2′-Dianthraquinonylethylenediamine, prepared from toluenesulphonyl-2-aminoanthraquinone by condensing with ethylene bromide and subsequently splitting off the toluenesulpho group by hydrolysis, dyes cotton in weak orange tones. Direct sulphonation of 2-aminoanthraquinone gives the 3-monosulphonic acid, which on bromination gives 1.3-dibromo-2-amino-anthraquinone. The latter condenses with *p*-toluidine to give 1-toluidino-2-amino-3-bromoanthraquinone, which on oxidation with lead peroxide in nitrobenzene solution gives 3-bromoanthraquinone-1.2.1′.2′.4′-methylphenazine (formula 1), a blue vat dyestuff, the dyeings of which however soon oxidise in the air to a yellow. Direct nitration of 2-amino-anthraquinone gives nitro-amines (Scholl, this J., 1905, 23) which on denitration give 1·3-dinitro and 3-mononitro-2-aminoanthraquinone. The latter is also obtained, together with the 1-nitro-2-aminoanthraquinone, by nitrating 2-amino-anthraquinoneurethane and saponifying, which furnishes an easy method of obtaining it in a pure state as the nitro-urethanes are easily separated. Nitration of 2-acetylaminoanthraquinone gives the 1-nitro-2-acetylamino compound as chief product. Reduction of 1-nitro-2-amino-anthraquinone yields the 1.2-diamine, but if the 1-nitro-2-acetylamino-anthraquinone itself be reduced an imidazole (formula 2) is formed. The *α*-anthraquinonyl-2-methylimidazole is a yellow substance forming a colourless hydrochloride and an orange-red sodium salt.



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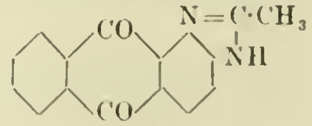

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—J. B

Colour-lakes ; Theory of ——. *II.* P. Pfeiffer. Annalen, 1913, **398**, 137—196.

A fuller and more comprehensive account of the theory of colour lakes (see this J., 1911, 1204), together with a detailed description of the experimental work on which the theory is based, including sections on the tin compounds of derivatives of acetophenone, benzoic acid, benzophenone, xanthone, chalkone, and anthraquinone, and of the hydroxyanthraquinones, resacetophenone, resobenzophenone, and euxanthone. For the production of the complex salts, from which the colour lakes are formed by hydrolysis, the presence of a hydroxyl group ortho to the carbonyl group is essential (stannic chloride may, indeed, be used as a reagent for the detection of such hydroxyl groups in hydroxy-ketones and hydroxy-quinones). For the formation of normal salts, the *m*-hydroxyl groups come primarily into consideration, and the author suggests that one of the important functions of the *m*-hydroxyl groups present in certain mordant dyestuffs of the anthraquinone series is to enable the ordinary heavy metal lake to combine with an alkaline-earth to form a mixed lake (compare Möhlau, this J., 1913, 355). An ammoniacal solution of the tin-alizarin lake described previously (*loc. cit.*), when treated with ammonium chloride, dyes wool and silk (not cotton) in orange-red shades tolerably resistant to cold soap solution, but destroyed by hot soap solutions and dilute mineral acids.—A. S.

Patents.

Halogenated Rosanilines; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 14,742, June 24, 1912.

Compounds of the Rosaniline group halogenated in the *o*-position to the amino group, may be obtained by treating an *o*-halogen substituted aniline or homologue thereof with *p*-aminobenzaldehyde or its homologues or halogen derivatives, and arsenic acid, with or without addition of zinc chloride. The compounds are valuable as dyestuffs by reason of their fastness to alkalis, and in medicine owing to their action on trypanosomes. The preparation of dichloropararosaniline, dibromopararosaniline, and a violet dyestuff from *o*-chloromonomethylaniline and *p*-aminobenzaldehyde, is described in detail.—T. F. B.

Anthraquinone-thiazoles; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 21,615, Sept. 23, 1912.

Thiazole derivatives of anthraquinone can be readily obtained by treating 2-aminoanthraquinone, or a derivative thereof which contains an unsubstituted *o*-position to the amino group or groups, with benzotrichloride or a derivative thereof in presence of sulphur and also, if desired, of a suitable solvent or diluent. Hydrogen sulphide, a metallic sulphide, or other compound which gives rise to sulphur may be used in place of the sulphur. Some of the products are applicable as colouring matters. For example, the thiazole obtained from 2.6-diaminoanthraquinone by this method dyes cotton from the vat fast lemon yellow shades.—T. F. B.

Chloro- and bromo-substitution products of indophenols and indophenolic compounds or their leuco compounds; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pats. 260,328 and 260,329, Feb. 6 and May 29, 1912.

Indophenols or indophenolic compounds or their leuco derivatives can be converted into chloro- or bromo-substitution products by treatment with chlorine or bromine or substances which give rise to these halogens.—T. F. B.

Disazo dyestuffs and pigment colours; Manufacture of yellow ——. A. Mond, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 3329, Feb. 8, 1913.

See Fr. Pat. 451,973 of 1912; this J., 1912, 650: 1-aryl-3-methyl-5-pyrazolone or other halogen derivative thereof may be used in place of the chloro derivatives mentioned.—T. F. B.

Azo dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,555, June 21, 1912.

See Ger. Pat. 253,933 of 1911; this J., 1913, 79.—T. F. B.

Aziminoanthraquinones; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,829, Aug. 1, 1912.

See Ger. Pat. 254,745 of 1912; this J., 1913, 190.—T. F. B.

Vat [anthracene] dye. A. Hamburger, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,059,607, April 22, 1913.

See Ger. Pat. 252,530 of 1911; this J., 1912, 1117.—T.F.B.

Indigo; Manufacture of finely subdivided colloid-like ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 16,850, July 19, 1912. Under Int. Conv., July 19, 1911.

See Fr. Pat. 445,803 of 1912; this J., 1912, 1174.—T. F. B.

Azo dyes; Manufacture of ——. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy, Basle, Switzerland. Eng. Pat. 25,866, Nov. 11, 1912. Under Int. Conv., Feb. 1, 1912.

See Fr. Pat. 450,866 of 1912; this J., 1913, 593.—T. F. B.

Disazo dyestuffs: Manufacture of ——. Farbwerke vorm. L. Durand, Huguenin und Co., Basle, Switzerland. Eng. Pat. 27,730, Dec. 2, 1912. Under Int. Conv., Aug. 20, 1912..

See Fr. Pat. 451,169 of 1912; this J., 1913, 593.—T. F. B.

Conversion of vat dyes into a form suitable for use as pigments. Ger. Pat. 260,428. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton from the German Colonies. C. Piest. Chem.-Zeit., 1913, 37, 753—754.

The results of the examination of some samples of raw cotton from German Colonies, and also of two American raw cottons, for comparison, are given in the following table:—

Sample.	Appearance.	Ash.	Chlorine.	Wood gum.	Ether extract.	Alcohol extract (cotton wax).	Copper number.
		per cent.	per cent.	per cent.	per cent.	per cent.	
Togo cotton	White, contaminated by seed husks and woody particles	1·95	0	0·77	0·32	0·09	1·87
Togo cotton	White, contaminated in lesser degree by seed husks	1·84	0	0·99	0·40	0·89	1·90
German E. African linters ...	Grey, contaminated by seed husks	5·63	traces	1·77	1·45	1·45	2·68
American linters	ditto	2·44	0	1·32	0·74	1·23	3·57
American linters	ditto	1·32	0	0·86	0·42	0·67	1·63

—A. S.

Cellulose; The action of ozone on ——. Part IV. Cellulose peroxide. C. Dorée. Chem. Soc. Proc., 1913, **29**, 222—223.

Ozone acting on purified cotton-cellulose was stated to furnish a peroxide, recognised by its oxidising action on potassium iodide solution (this J., 1912, 278). Doubts having been cast on the existence of this product, the question has been reinvestigated. In the absence of water, a small amount of peroxide alone is produced, but in air-dry material the quantity of peroxide formed is very much greater, and at the same time solid insoluble acid and oxycellulose are formed (*loc. cit.*). The amount of "active oxygen" fixed by air-dry cotton, mercerised cotton, and lustra-cellulose after eighteen hours' exposure to ozone was 0·0056, 0·0106, and 0·0248 per cent. respectively. The peroxide is slowly decomposed on treatment with water, hydrogen peroxide being produced. It is decomposed to the extent of 25 per cent., after heating for two hours at 37° C., and almost entirely after two hours at 95° C. The activity soon disappears if the material is kept in the air, but persists for some weeks in a dry atmosphere. The peroxide acts strongly on a photographic plate, sharp negative images of the fibres being obtained in twenty days at 14°C., or in six hours at 37°C. These properties recall the "photographic" action of the natural woods described by Russell (this J., 1904, 998, and Phil. Trans., 1904, **197**, 281), and were shown to be due probably to a similar cause, namely, the gradual production of hydrogen peroxide.

Amyl acetate and collodion; Analysis of ——. N. Chercheffsky. Caoutchouc et Gutta-percha, 1913, **10**, 7375—7387. Les Matières Grasses, 1913, **6**, 3103—3110.

Commercial amyl acetate from fusel oil contains, as its principal impurities, ethyl acetate, (normal) propyl acetate; and (iso) butyl acetate, with their respective alcohols. When "pure" amyl acetate (consisting exclusively of amyl acetate and amyl alcohol) is distilled into ten fractions each of these will show an oleorefractometer reading (at 15° C.) of about 0 to +2 or +3 (amyl alcohol = +29, amyl acetate = 0), and with the exception of the first fraction the b.pt. will not be below 128° C. In the presence of appreciable quantities of the lower esters and alcohols the b. pt. will be materially lower, and the lower fractions will show lævo-deviation in the oleorefractometer. Ethyl acetate is detected by saponifying 5 grms. of the sample for 30 minutes with 25 c.c. of a 15 per cent. solution of potassium hydroxide in amyl alcohol, then distilling 1 to 1·5 c.c. of the liquid, and applying the iodoform test to an aqueous extract of the distillate. For the determination of ethyl acetate 50 grms. of the product are saponified with 25 to 30 grms. of potassium hydroxide in about 50 grms. of amyl alcohol, and about 50 grms. of the liquid distilled. The distillate is shaken three times in succession with 100 c.c. of calcium chloride solution (sp. gr. 1·250) and 30 c.c. of pure cymene, the united aqueous layers are distilled, and the proportion of ethyl alcohol calculated from the sp. gr. of the distillate. The method gives good results in the absence of large amounts of propyl or butyl acetates. Acetone is detected and determined by exactly neutralising 10 c.c. of the sample with dilute sodium hydroxide solution in a Dewar's vacuum tube and then adding 5 c.c. of a solution of sodium bisulphite of sp. gr. 1·320. The rise of temperature affords a measure of the proportion of acetone, and gives satisfactory results for amounts between 5 and 20 per cent. Cyclic and acyclic hydrocarbons are detected by the sp. gr., oleorefractometer reading (especially of the distillation fractions), and the saponification value. As a further test, from 2 to 3 c.c. of the amyl acetate are shaken with an equal volume of sulphuric acid of 66° Bé. (sp. gr. 1·842) in a stoppered tube. In the presence of benzene (10 per cent.) a characteristic turbidity appears after 5 to 10 minutes, whilst with toluene and xylene the solution remains clear. Acyclic hydrocarbons (10 per cent. and more) form a supernatant layer, the volume of which may be measured. In analysing collodion solutions the nitrocellulose is precipitated by petroleum spirit boiling below 70° C., and dried on a weighed filter at 90° C. A second portion of the sample is evaporated and the residue dried and weighed, the amount of collodion thus determined being usually greater than that of the nitrocellulose. For the examination of the solvent 50 grms. of the sample are distilled in a current of steam and the distillate collected in a receiver containing sodium chloride to prevent solution of ethyl acetate in the water.—C. A. M.

Beech wood pulp. E. Heuser. Woch. Papierfabr., 1913, **44**, 2209—2219.

Preliminary experiments with solutions of sodium hydroxide and carbonate indicated that a satisfactory pulp could be obtained from beech wood by alkaline digestion and small scale tests were made by the sulphate process in a wrought iron boiler, using 1850 grms. of air-dry wood and 12 litres of lye. The particulars of the two tests which may be regarded as furnishing data for technical application are as follow. In the first the fresh lye contained: Na_2S 2·14, NaOH 2·82, Na_2CO_3 0·99, and Na_2SO_4 0·25 per cent., and the wood was boiled for 5 hours at a temperature rising to 170° C. under a pressure of about 7 atmospheres. The loss of caustic soda during the digestion was 63·6 per cent. and that of sodium sulphide 7·14 per cent., referred to the quantities originally present. The yield of pulp was 39·17 per cent. In the second test the wood was first steamed for 1 hour and then boiled for 1 hour with a lye containing Na_2S 2·81. NaOH 2·8, $Na_2CO_3$0·424 per cent., under approximately the same conditions of temperature and pressure as before. In this case the loss of caustic soda was 85 per cent. and that of sodium sulphide 18·5 per cent., and the yield of pulp was 40·60 per cent. The characters of the pulps are tabulated.

Paper made with beech pulp alone is not very strong, but a very strong paper of a light grey colour can be made with a mixture of 70 per cent. of unbleached beech wood pulp and 30 per cent. of unbleached coniferous wood pulp. A mixture of bleached pulps gives a very white paper with a fine surface lustre.—A. S.

Reed-pulp; Recognition of —— in presence of straw- or esparto-pulp in mixtures. E. Meienhofer. Papierfabr., 1913, **11**, Fest- u. Ausland-Heft, 71—75.

Reed-pulp, known commercially as delta-cellulose, is now manufactured on the large scale, chiefly at Braila, Roumania, as a raw material for paper-making. Its chief microscopic characteristic is the presence of tubular vessels having slit-like pores arranged in rows over almost their entire surface. The epidermal cells are thinner and have more uniform crenatures, the parenchyma cells are usually longer and less numerous, and the libriform cells are smaller and shorter than those of straw pulp. Esparto-pulp is distinguished by the regular cylindrical form of the fibres and the almost complete absence of parenchyma cells. The characteristic epidermal cells of reed pulp are to a large extent lost if the paper be boiled with caustic soda in the usual way, and in doubtful cases, a specimen should be prepared for microscopic examination simply by boiling with water and shaking with garnets. The paper is accompanied by seven photomicrographs.—A. S.

Paper; Distinguishing sulphite- and sulphate-pulp in ——. C. G. Schwalbe. Woch. Papierfabr., 1913, **44**, 2196—2198.

The paper is finely divided by a rasp or grater and freed from resin by extraction with alcohol and ether. In the case of very hard soda pulp papers, which yield much dust on rasping, the paper may be extracted with alcohol and ether and finely divided by boiling for ¼ hour with water and then shaking with glass beads. The dried pulp is treated with $N/20$ ferric chloride solution and heated at 60°—80° C. until the pulp settles to the bottom of the vessel. After carefully removing and rejecting any pulp adhering to the sides of the vessel, the mixture is filtered and the pulp washed with warm water, and treated first with 1 per cent. sulphuric acid and then with 4—8 drops of a 2 per cent. solution of potassium ferrocyanide and heated for 5—10 mins. at 60°—80° C. The treatment with sulphuric acid and ferrocyanide may be repeated, if necessary, in order to develop a more pronounced blue colour. The pulp is now separated (any adhering to the sides of the vessel being carefully removed and rejected as before), washed, and examined under the microscope. The fibres of sulphite-pulp are coloured deep blue, whilst those of unbleached sulphate-pulp acquire a faint yellowish, greenish or brownish colour, and those of bleached sulphate-pulp either remain uncoloured or are coloured a faint blue. The relative proportions of sulphite- and sulphate-pulp may be determined by counting the differently coloured fibres.—A. S.

Determination of "crude fibre" and cellulose [*in barks, etc.*]. Matthes and König. *See* XX.

Patents.

Acetyl cellulose; Treatment of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin, and A. Loose, Hermsdorf. Eng. Pat. 27,227 Nov. 26, 1912.

See Fr. Pat. 452,374 of 1912; this J., 1913, 652.—T. F. B.

Cellulose solutions; Process for the manufacture of ——. W. Traube, Berlin. U.S. Pat. 1,064,260, June 10, 1913.

See Ger. Pat. 245,575 of 1911; this J., 1912, 532.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Mordants; The preparation and constitution of alkaline aluminium, chromium and iron ——. F. Erban. Chem. Zeit., 1913, 37, 709—710.

In the preparation of alkaline solutions of aluminium, chromium and iron sesquioxides it is desirable to add the solution of the salt to the alkali, thus avoiding actual precipitation of any hydroxide. Of the various organic substances which assist the solution of metallic hydroxides in alkalis, only glycerin comes into consideration, and it should be present at the moment of mixing the solutions. The author has obtained complete solution of aluminium sulphate in four molecular proportions of caustic soda, the presence of glycerin being unnecessary. In the case of the chrome mordant only 2 mols. each of NaOH and glycerin were found necessary. Alkaline iron mordant requires glycerin. It is usually prepared from "nitrate of iron" and the author works with a solution containing 4·6 mols. NaOH and 93 mols. of glycerin. Attempts to prepare an aluminium mordant which would fix metal oxide on the fibre without the necessity of drying proved unsuccessful, but a solution containing only 3 mols. NaOH was obtained by the use of 3 mols. of glycerin. In the case of chromium mordants 1 mol. NaOH proved sufficient in the presence of 2 mols. of glycerin. Without glycerin, solutions containing 4 and even 6 mols. NaOH are unstable. By dyeing trials it was found that cloth mordanted and allowed to stand without drying gave up on washing more chrome than cloth dried after mordanting. The Alizarin dyeings in the case of the dried mordant showed lighter, bluer shades having lower fastness to washing with increasing proportion of glycerin and decreasing proportion of alkali, whereas in the case of the wet mordant, brighter and fuller tones having increased fastness to washing were obtained. In the case of iron-ammonium alum, stable solutions were obtained with 4—6 mols. of glycerin and 13 mols. NaOH. As before, wet-mordanted cloth takes up less iron with increasing proportion of glycerin and loses more in washing than does the cloth dried after mordanting. Ammoniacal aluminium mordants could not be obtained. In the case of ammoniacal chromium mordants less was lost on washing when the material was dried after mordanting, just as in the case of the caustic soda chromium mordants; the same is true of ammoniacal iron mordants, but in spite of the greater loss on washing, the wet mordant gave, on dyeing with Alizarin, fuller, bluer tones, faster to soap than those obtained on the material dried after mordanting.—J. B.

Dyeing animal fibres; The mechanism of ——. W. Suida. Z. physiol. Chem., 1913, 85, 308—323.

Some new observations in support of the chemical theory of dyeing. A study of the progressive hydrolysis of wool by water and by dilute acid enforces the view that it acts in dyeing as an amino-acid. Prolonged boiling with dilute acid renders the wool, after treatment with stannous chloride and acetic acid, completely soluble in sodium carbonate solution, while wool similarly treated but with water in place of dilute sulphuric acid, remains insoluble. In each case, however, the wool gives up part of its basic constituents and therefore becomes of a weakly acid nature. The possibility of condensation between the wool substance and phenolic hydroxy groups taking place in dyeing is shown by the behaviour of wool with phenols. In a large number of cases the phenol is taken up by the wool and, on the fibre, ceases to give its characteristic ferric chloride reaction, thus proving the hydroxyl group to have disappeared. Phenolcarboxylic acids behave in the same way. The absorption of dyestuffs suggests itself as being analogous, but the above reactions are reversible, whereas dyeing is not usually so. Salt formation, however, plays a part in dyeing, further factors coming into play to produce a fast dyeing. Some light is thrown on the actual chemical fixation of dyestuffs by the behaviour of wool—and various other protein substances and α-amino-acids—with quinones (compare this J., 1913, 594). The wool becomes strongly coloured and the reaction appears to be the same as that between quinones and aniline. Other quinonoid substances behave similarly, *e.g.*, quinhydrone, quinonechlorimide, nitrosophenol and the homologues of quinone. Certain carbon atoms in the quinone nucleus must remain unsubstituted, however, and the presence of the group CO.CH : CH.CO seems to be the criterion, thus, while xyloquinone ($CH_3 : CH_3 : O : O$, 1 : 2 : 3 : 6) dyes wool, the 1·4·2·5- and 1·3·2·5-xyloquinones do not. Many dyestuffs possess the above group, and in fact all dyestuffs have been regarded as quinonoid, but in view of the above limitations the author is against any general conclusion on these grounds as an explanation of the dyeing of animal fibres. A large number of protein substances give the quinone reaction, but the constitution of the protein in question is not without influence, as is shown by the fact that silk is less strongly dyed than wool.—J. B.

Metallic powders; Printing ——. J. Heilmann et Cie., H. Wagner and M. Battegay. Sealed note No. 2213, Nov. 26, 1912. Report thereon by A. Brand. Bull. Soc. Ind. Mulhouse, 1913, 83, 234—237.

The viscous medium is obtained by warming together on the water bath for some hours a mixture of sericose (acetylcellulose in acetic acid solution), phenol, formaldehyde and sodium acetate. The metallic powder—copper or aluminium—is then added and the mixture printed. The print is fixed by steaming, which causes a condensation of the "Bakelite" type to take place. The report states that remarkably fast and clear prints are obtained. (Compare this J., 1913, 422).—J. B.

Indigo dyed stuff; Discharges on —— *by means of nitrates and nitrites.* Report on the sealed notes of M. Freiberger, deposited July 31, 1906, to Sept. 26, 1908, by F. Binder. Bull. Soc. Ind. Mulhouse, 1913, 83, 225—234.

This process depends for its action on the instantaneous liberation of nitric acid which takes place when cloth, printed over indigo with a nitrate, is passed very rapidly through hot dilute sulphuric acid. (See Eng. Pat., 13,876 of 1908; this J., 1909, 472). No oxycellulose is produced and either sodium nitrate, zinc nitrate or lead nitrate may be used. In the latter case a coloured discharge can be obtained by afterwards converting to chrome yellow. A red discharge is obtained by means of Para Red, the lead nitrate and diazonium nitrate being printed together on cloth previously prepared with β-naphthol. In printing a nitrate and a diazo compound simultaneously, boric acid is added to the discharge paste, as it has a remarkable effect in decomposing the sodium naphtholate prepare; without it a dirty white is produced. Other suitable additions are aluminium acetate and formic acid. Lead acetate is preferably used in place of sodium acetate for the purpose of neutralising the acid of the diazo-solution, or zinc borate may be used. Starch is the best thickening agent, and it is recommended to make up the naphthol prepare with castor oil soap in order to avoid the occurrence of halos. Hydrosulphites may be mixed with the nitrates used for discharging and in this way, by the use of a direct dyestuff, a white reserve can be obtained on a coloured discharge of the indigo. A coloured discharge may also be obtained when the nitrate is printed together with Flavanthrene and an alkaline dextrine-gum arabic thickening. Steam-Indanthrene Blue and Prussian Blue are also applicable to the process.—J. B.

Theory of colour-lakes. II. Pfeiffer. *See* IV.

Sulphur olive oil and Marseilles soap. Schwarz. *See* XII.

Patents.

Bleaching vegetable fibre and fabrics; Process of ——. R. Grüter, Charlottenburg, Germany, Assignor to R. H. Comey Co., Camden, N.J. U.S. Pat. 1,063,678, June 3, 1913.

See Ger. Pat. 256,997 of 1909; this J., 1913, 422. A small quantity of a tin salt may be added to the hydrogen peroxide.—T. F. B.

Vat dyeings on animal fibres, especially silk, fast to light and washing; Production of ——. M. Maxim. Ger. Pat. 260,058, Oct. 18, 1912.

Silk or other animal fibre is immersed in an ammoniacal solution of a copper salt before passing through the dye-vat. The intensity and the shade of the resulting dyeings, and also their fastness to light and washing, is much improved by this process, *e.g.*, in the case of Indanthrene dyestuffs, Algol Violet, Ciba Blue, etc.—T. F. B.

Gluten or natural or artificial mixtures of gluten with starch or meal; Process for rendering soluble ——. R. Worms. Ger. Pat. 260,414, March 4, 1910.

The materials are heated or boiled with water in presence of a per-salt, such as a persulphate or percarbonate, especially the alkali salts. The resulting solutions may be used for dressing textiles. A dry mixture of the gluten material with the per-salt is also claimed, for use in preparing solutions for dressing.—T. F. B.

Dyeing with natural dyes; Processes for ——. J. A. Dominguez, Buenos Aires. Eng. Pat. 4248, Feb. 20, 1912.

See Fr. Pat. 437,020 of 1911; this J., 1912, 426.—T. F. B.

Gray to black shades or printings on vegetable fibres; Production of fast ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,272, July 24, 1912.

See Ger. Pat. 258,293 of 1912; this J., 1913, 484.—T. F. B.

Printing carpet-yarns; Machine for ——. V. Fussgänger, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,063,252, June 3, 1913.

See Eng. Pat. 11,420 of 1911 this J., 1911, 952.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphurous acid; Reaction between water and ——, *at different temperatures. Formation of hydrosulphurous acid.* E. Jungfleisch and L. Brunel. Comptes rend., 1913, **156**, 1719—1724.

It is known that aqueous solutions of sulphur dioxide in sealed tubes decompose above 160° C., and the authors now show that the same happens at lower temperatures, and even (though with extreme slowness) at the ordinary temperature. The ultimate products are sulphur and sulphuric acid; but hydrosulphurous acid is first produced, the successive reactions being as follow:—
$3SO_2+2H_2O=H_2S_2O_4+H_2SO_4$, and $H_2S_2O_4=S+H_2SO_4$.
—J. T. D.

Nitric oxide and oxygen; Gas-analytical determination of —— *based on the formation of nitrous anhydride.* G. Klinger. Ber., 1913, **46**, 1744—1748.

In the method described previously (this J., 1912, 1178) the essential feature is the use of dry materials; in absence of moisture nitrous anhydride is formed quantitatively without any production of nitrogen peroxide. The nitric oxide is preferably dried by means of concentrated sulphuric acid. Koehler and Marqueyrol (this J., 1913, 140) have stated that the method is inapplicable to a mixture of nitric oxide, nitrous oxide, nitrogen, and carbon dioxide and monoxide, but this is not so if carbon dioxide be absorbed first in the same apparatus before oxidising the nitric oxide. Koehler and Marqueyrol's proposal to absorb the carbon dioxide by 50 per cent. potassium hydroxide solution is not good, because part of the nitrous oxide would also be absorbed.—A. S.

Nitric oxide; Action of —— *on a neutral solution of potassium permanganate.* B. C. Dutt, B. Chatterji, and H. Banerji. Chem. Soc. Proc. 1913, **29**, 235.

When nitric oxide is passed through a solution of potassium permanganate in an atmosphere of hydrogen, the reaction which takes place is represented by the equation: $KMnO_4+NO=KNO_3+MnO_2$. There is no intermediate formation of nitrous acid.

Chlorate solutions; Activation of —— *by osmium. II.* K. A. Hofmann, O. Ehrhart, and O. Schneider. Ber., 1913, **46**, 1657—1668.

Hofmann (Ber., 1912, **45**, 3329) has shown previously that neutral solutions of alkali chlorates, to which a trace of osmium tetroxide has been added, yield oxygen smoothly and rapidly to oxidisable inorganic and organic substances, without any intermediate formation of lower oxides of chlorine. Evidence is cited in favour of the view that the oxidation is due to the formation of an addition compound of the chlorate and osmium tetroxide, which combines with the oxidisable substance by its residual affinity or by adsorption, and yields oxygen thereto. Compounds with olefinic double linkages are oxidised in the same way but not so vigorously as by permanganate. The strongly adsorbent amorphous carbon is vigorously oxidised, but amorphous silicon which has only slight adsorptive power, though much more active chemically, is not attacked. The osmium-chlorate solution liberates iodine from potassium iodide, but not bromine from potassium bromide in carbonic acid or acetic acid solution. Among other examples of the action of the activated chlorate solution are mentioned the slow but complete oxidation of the sulphides of lead, copper, bismuth, tin, antimony, and arsenic to oxides, and the oxidation of metallic iron, copper, lead, zinc, aluminium, tin, and manganese. The higher oxide is precipitated from solutions of manganese acetate, but not from those of cobalt and nickel acetates. Lampblack is oxidised to carbon dioxide and mellitic acid, and sugar charcoal, retort carbon, and graphite are also oxidised though more slowly. Ethylene is oxidised to ethyleneglycol and allyl alcohol to glycerol. Benzene toluene, and naphthalene are scarcely attacked, but anthracene is oxidised to anthraquinone and aniline is oxidised to a green substance.—A. S.

Perborates and detergents containing perborates; Determination of active oxygen in ——. F. M. Litterscheid and P. B. Guggiari. Chem.-Zeit., 1913, **37**, 677—679; 690—691.

THE use of chloroform in the permanganate method may be avoided and the influence of fatty acids prevented by shaking the sample with water at 50° to 60° C. for about 5 minutes, then adding a sufficient excess of 10 per cent. sulphuric acid and about 1 grm. of ignited kieselguhr, making the liquid up to definite volume, and titrating an aliquot part of the filtrate with standard permanganate solution. Good results may also be obtained in the same way in the iodometric method. For the gas-volumetric method a combination of Schulze and Tiemann's nitric acid apparatus and Schiff's measuring burette may be employed, the sodium perborate being decomposed by manganese dioxide and sulphuric acid, and the liberated oxgyen measured. For a gravimetric determination based upon the loss of weight in this reaction about 2 grms. of the perborate are decomposed with a weighed quantity of finely-powdered manganese dioxide (which has previously been boiled with 10 per cent. sulphuric acid) and 25 per cent. sulphuric acid in a Geissler, Frühling and Schulz's carbon dioxide apparatus. Half of the loss of weight is due to the oxygen derived from the manganese dioxide. A comparison of the results obtained by these different methods shows that all are accurate.—C. A. M.

Polythionate in the presence of thiosulphate and free sulphur dioxide; Determination of ——. W. Feld. Z. angew. Chem., 1913, **26**, 286—288.

THE method previously described by the author for the simultaneous determination of sulphurous acid, thiosulphate, and polythionate (this J., 1911, 357) is liable to give inaccurate results when the proportion of free sulphurous acid is not very small, on account of losses during heating. The following process, based on the fact that manganese sulphide reacts with sulphur dioxide rapidly and completely, in the cold, in accordance with the equation, $3SO_2+2MnS=2MnS_2O_3+S$, is of more general application. In one portion of the solution, sulphur dioxide and thiosulphate are determined by successive titration with iodine and sodium hydroxide (*loc. cit.*), and another portion is treated for half-an-hour, in the cold, with an excess of precipitated manganese sulphide, being repeatedly shaken; the mixture is then made up to a definite volume, filtered through a dry filter, and a measured volume mixed with an excess of mercuric chloride solution, boiled, ammonium chloride added, and the resulting acid titrated with sodium hydroxide and methyl orange (see Z. angew. Chem., 1912, 25, 1161); the proportion of free acid corresponding to the polythionate present (this J., *loc. cit.*) is found by subtracting from the total quantity, the amounts due to the sulphur dioxide and thiosulphate, allowance being made for the fact that the acid produced by the action of mercuric chloride on manganese thiosulphate is only one-third in quantity of that formed by the direct oxidation of the corresponding amount of sulphurous acid by iodine. The manganese sulphide is prepared by warming 600 c.c. of a solution of manganese sulphate (containing about 1 grm.-mol.) to about 60° C., treating with hydrogen sulphide, and when no further change is observed, adding a few drops of potassium hydroxide solution and continuing the treatment with hydrogen sulphide for a few minutes; the mixture is filtered and the solution (which should remain clear on again passing in hydrogen sulphide) treated, at about 60° C., with a vigorous current of hydrogen sulphide, whilst a concentrated solution containing 56 grms. of potassium hydroxide is introduced drop by drop. A red precipitate containing 80—85 per cent. of the manganese present, as sulphide, is thus obtained, and the mixture is then heated to 80° C. on the water-bath and stirred until hydrogen sulphide can no longer be detected (the clear solution should not react with iodine solution), after which the volume is made up to 1 litre with boiled water. Such a mixture, containing a small proportion of manganous sulphate, may be kept unchanged for months. —F. SODN.

Molybdenum and tungsten carbides; Simple preparation of ——. S. Hilpert and M. Ornstein. Ber., 1913, **46**, 1669—1675.

CARBIDES of molybdenum and tungsten can be obtained by heating the finely powdered metals (or their trioxides) in a current of carbon monoxide or of a mixture of methane and hydrogen (1 : 1 by vol.). By the action of carbon monoxide on molybdenum at 600° and 1000° C., Mo_2C is obtained; at 800° C., products of composition ranging from MoC to Mo_2C_3 are obtained. Tungsten yields W_3C_4 by the action of carbon monoxide at 1000° C. and WC by the action of methane and hydrogen at 800° C. —A. S.

Calcium boride. E. Wedekind. Ber., 1913, **46**, 1885—1889.

CALCIUM boride is readily obtained by heating calcium metaborate with calcium in an iron vessel from which the air has been pumped out. The product is treated with dilute acetic acid and then with dilute hydrochloric acid, leaving a brown residue of calcium boride, free from carbon and containing only a little iron and silicon as impurities. The sp. gr. of the boride is 2·11 at 18° C. It is a good conductor of electricity and can be sintered electrically to an extremely hard mass. It is not decomposed by water, but is attacked by nitric acid and by fused alkalis. A mixture of calcium and barium borides may be obtained by reducing barium borate with calcium in the same way. —W. H. P.

Azides; Sensitiveness to light of silver, mercurous, lead, and cuprous ——*, and basic lead and cupric azides.* L. Wöhler and W. Krupko. Ber., 1913, **46**, 2045—2057.

SILVER, mercurous, lead and cuprous azides are decomposed by the action of light, and in all cases nitrogen is evolved and the presence of the metal, partly at least in the colloidal condition, can be detected in the coloured decomposition product. Determinations of the sensitiveness to shock and to rise of temperature of the products, after exposure, in conjunction with their other properties, show that they do not consist of sub-azides but of mixtures of the unaltered normal azide and finely-divided metal of a colloidal nature. These results may be held to confirm the view that the latent photographic image is not a subhalide but an adsorption compound of colloidal silver and unaltered silver halide. The cuprous azide was prepared, for the first time, by adding a concentrated solution of potassium sulphite to excess of a concentrated solution of copper sulphate, just dissolving the copper sulphite by addition of acetic acid, and then adding sodium azide solution, drop by drop, with agitation. The precipitated cuprous azide was washed with alcohol and ether and dried in an exsiccator. The preparation and properties of basic lead and cupric azides are also described.—A. S.

PATENTS.

Sulphuric acid; Process for the manufacture of ——. A. Burkhardt. Fr. Pat. 452,682, Dec. 24, 1912.

SULPHUROUS gases are saturated with aqueous vapour before being brought into contact with nitrous vitriol. The process is carried out in a tower, which the hot gases from the burners enter at the bottom, passing through a reservoir of dilute sulphuric acid, up the sides of the tower over a series of superimposed cup-like trays, also containing sulphuric acid, the gases in their passage concentrating the acid and being cooled at the same time. The gases, saturated with aqueous vapour, then pass over a series of trays, containing nitrous vitriol, and the sulphuric acid, which is formed, overflows into a distributor, which supplies acid to the first-mentioned system of trays, the residual gases passing up into a Gay-Lussac tower or similar appliance.—O. R.

Nitric acid (comprising refrigeration, condensation, transport, and other operations); Process for the treatment of [use of aluminium for] ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 451,812, Dec. 12, 1912. Under Int. Conv., Dec. 21, 1911.

Aluminium is unattacked by liquors containing not less than 65 per cent. of nitric acid and not more than 5 per cent. of nitrogen peroxide, and its use for apparatus dealing with such liquids is claimed.—O. R.

Carbonitride; Process for the production of a composition of matter believed to be a ——. S. Peacock, Philadelphia, U.S.A. Eng. Pat. 11,390, May 13, 1912.

To produce a substance believed to be a carbonitride, $Ca_3C_3N_6$, lime and carbon are heated in a current of nitrogen to about 1500° C. in an electric furnace, the partial pressures of the gaseous products being maintained below atmospheric pressure, preferably below 350 mm. of mercury. The carbon, in the form of finely divided coke or charcoal, should be from 25 to 30 per cent. in excess of the amount required by the equation: $3CaO+6C+3N_2=Ca_3C_3N_6+3CO$.—O. R.

Potash alum; Process of making ——. E. Hart, Easton, Pa. U.S. Pat. 1,062,278, May 20, 1913.

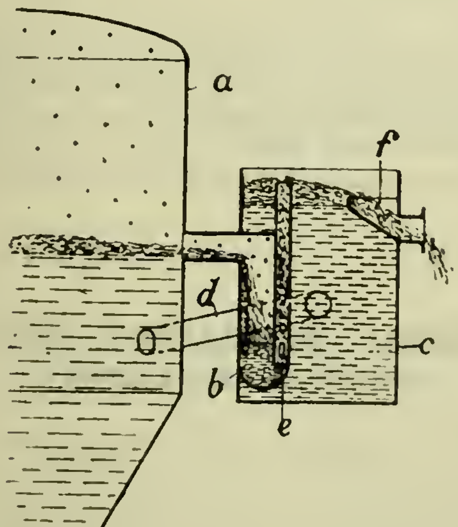
Felspar is heated with sodium sulphate and carbon, and the product is treated with sulphuric acid.—O. R.

Ammonium compounds; Production of ——. C. P. Steinmetz, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,062,805, May 27, 1913.

Air and aqueous vapour are passed through an electric arc and the products of the reaction are withdrawn into a space maintained below their temperature of dissociation.—O. R.

Ammonium sulphate Process for removing the scum produced from impurities in the acid in the manufacture of ——. H. Koppers. Ger. Pat. 260,317, Feb. 24, 1912.

The saturator, *a*, (see Fig.) is provided with an overflow leading to a U-shaped tube, *b*, disposed in a chamber, *c*, which is connected by a pipe, *d*, with the saturator, below the level of the liquid. The gas pressure in *a* produces a difference of level of the liquids in *a* and *c*. One limb of the U-tube opens above the level of liquid in *c*, and compressed air is forced in at the lower end of this limb, through the nozzle, *e*, so as to cause the liquid and supernatant scum to overflow from the upper end. The scum flows into the pocket, *f*, whence it is discharged, whilst the liquid returns to the saturator through the pipe, *d*.—A. S.



Silicon and by-products; Process of producing elementary ——. F. Machalske, Assignor to C. Offenhauser, Philadelphia, Pa. U.S. Pat. 1,062,982, May 27, 1913.

Silicious compounds are decomposed by electro-thermic fusion and the fused mass is subjected to centrifugal action, the voltage of the current being simultaneously slightly reduced. The silicon is separated from the molten metallic oxides by virtue of differences in specific gravity.—O. R.

Copper acetate; Process of manufacturing ——. J. B. Morel. Fr. Pat. 452,571, March 8, 1912.

Hydrated oxide of copper obtained by electrolytic action on metallic copper, is treated with acetic acid at the ordinary temperature.—O. R.

Chlorates and perchlorates; Electrolytic process of manufacturing ——. G. Coutagne. Fr. Pat. 452,694, March 14, 1912.

In the manufacture of chlorates or perchlorates by the electrolysis of solutions of chlorides or chlorates without diaphragms, the addition of small quantities of chromates or bichromates gives greatly increased yields. To compensate the loss of chlorine, which takes place in the course of electrolysis, a slight excess of chlorine, prepared independently by the electrolysis of a chloride with a diaphragm, is continuously introduced into the solution, preferably by circulating the electrolyte through the two cells, in one of which chlorates and perchlorates are produced without a diaphragm, and in the other chlorine only to the extent which is required.—O. R.

Oxygen and nitrogen from air; Process for the separation of ——. H. Barschall. Ger. Pat. 259,877, Nov. 9, 1911.

Two superposed rectifying columns are used, oxygen being led off from the lower end of the lower one and nitrogen from the upper end of the upper one. Cooled and compressed air is led in through a coil disposed below the lower column and then passes upwards through an external pipe to an expansion valve, the liquid air produced being sprayed on to a distributing plate at the top of the lower column, down which a portion flows, whilst another portion flows through a pipe to a cooling coil disposed in the upper part of the upper column and connected with a vacuum pump. The evaporation of the liquid air under diminished pressure, produces under suitable conditions, cooling to the boiling point of nitrogen.—A. S.

Formaldehyde compounds containing sulphur and alkali; Process for preparing ——. G. Lewit. Ger. Pat. 260,011, March 31, 1912. Addition to Ger. Pat. 251,935 (see Fr. Pat. 434,914: this J., 1912, 282).

The process described in the principal patent may be carried out more economically by allowing an alkali sulphide to react with a formaldehyde-alkali bisulphite compound.—T. F. B.

Magnesium chloride present in potash salts; Process for removing the ——. E. Krüger geb. Köwing. Ger. Pat. 260,141, Aug. 7, 1912.

Three continuous counter-current apparatus are used. In the first the potash salt is treated with cold or warm alcohol (methyl, ethyl, propyl, butyl, or amyl alcohol or homologues) in order to dissolve out the magnesium chloride. In the second the residue from the first is freed from adhering alcohol by treatment with a solution of magnesium chloride of such concentration that it does not dissolve potassium or sodium chloride or kieserite, yet contains so much water that the whole of the alcohol can be recovered by distillation without the formation of magnesium chloride containing alcohol of crystallisation. In the third apparatus the residue from the second is treated with a suitable liquor for the extraction of the potassium chloride.—A. S.

Ammonia from sulphocyanide compounds; Process for producing —— and for the purification of compounds containing sulphocyanide compounds. K. Burkheiser, Hamburg, Germany. Eng. Pat. 15,742, July 5, 1912. Under Int. Conv., Sept. 12, 1911.

See Fr. Pat. 445,556 of 1912: this J., 1913, 23.—T. F. B.

Potash recovery processes. J. M. Neil, New York. Eng. Pat. 22,557, Oct. 3, 1912. Under Int. Conv., Oct. 17, 1911.

See U.S. Pat. 1,034,281 of 1912; this J., 1912, 816.—T.F.B.

Nitrates; Process for the dehalogenisation of halogeniferous ——. C. Uebel, Heidelberg, and E. Wikander, Nienburg on Saale, Germany. Eng. Pat. 28,844, Dec. 14, 1912. Under Int. Conv., Dec. 15, 1911.

See Fr. Pat. 451,069 of 1912; this J., 1913, 602.—T. F. B.

Sulphide of zinc; Manufacture of ——. J. Koetschet and J. C. A. Meyer, Lyons, France. U.S. Pat. 1,063,356, June 3, 1913.

See Fr. Pat. 396,541 of 1908; this J., 1909, 600.—T. F. B.

Hydrogen peroxide; Art of making ——. A. Pietzsch and G. Adolph, Munich, Germany. U.S. Pat. 1,063,383, June 3, 1913.

See Eng. Pat. 23,660 of 1910; this J., 1911, 620.—T. F. B.

VIII.—GLASS; CERAMICS.

Organic matter in clay; Determination of ——. P. Ehrenberg, C. Diebel, and H. Veekenstedt. Z. anal. Chem., 1913, **52**, 408—418.

A comparison of the results obtained by combustion with those given by oxidation with chromic acid and with alkaline permanganate have shown that the combustion method alone is reliable. A maximum of 0·67 per cent. of organic matter, reckoned as humus (C × 1·7241), was obtained in a series of determinations on a variety of clays.—F. Sodn.

[*Majolica and faience glazes.*] *Ceramic school; Report from the laboratory of the Royal Bunzlau ——.* II. A. Berge. Sprechsaal, 1913, **46**, 383—385. (See also this J., 1913, 289.)

The lead and tin constituents of a number of majolica and faience glazes of the usual types were introduced in the form of "lead-ashes," without detrimental effect on the colours produced by various customary stains.
—H. H. S.

Patents.

Ceramic bodies for indicating temperature in furnaces; Process of treatment of fusible ——. E. Cramer, Berlin. U.S. Pat. 1,063,012, May 27, 1913.

A Seger cone is covered with a protective, metallic coating adapted to fuse at a temperature lower than the melting point of the cone.—O. R.

Glass, enamels, glazings, ceramic colours, and the like; Manufacture of dulled ——. H. Kretzer, Wallersheim, Germany. Eng. Pat. 12,749, May 30, 1912.

See Fr. Pat. 444,440 of 1912; this J., 1912, 1129.—T. F. B.

Ceramic refractory material; Manufacture of articles of ——. G. B. Schwerin, Frankfort, Germany. Eng. Pat. 14,235, June 18, 1912. Addition to Eng. Pat. 2626, Feb. 1, 1911.

See Addition of June 22, 1912, to Fr. Pat. 426,072 of 1911; this J., 1912; 1180.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Concrete and the like; Apparatus for testing ——. R. Färber, Assignor to Buchheim und Heister, Frankfort-on-the-Maine, Germany. U.S. Pat. 1,061,996, May 20, 1913.

A lever is adapted to engage with and bend a test-piece of concrete, held in position by two members having hooked ends, and a scale beam is so fixed on the lever that the latter is actuated by the weight of the beam. Means are provided for progressively loading one arm of the scale beam and for maintaining the latter in equilibrium during the process of loading, which is recorded by an indicator; a locking device is connected with the scale beam for locking the indicator when the fracture of the test-piece takes place.—O. R.

Wood; Apparatus for treating ——. F. A. Palen, New York. U.S. Pat. 1,062,184, May 20, 1913.

A closed, cylindrical container consists of two concentric shells; the interior of the container and the space between the shells both communicate by means of valve-controlled connections with an exhausting apparatus, and the space between the shells also communicates by means of valve-controlled connections with a refrigerating apparatus.—O. R.

Wood; Process of preserving —— from decay and fire. H. J. Livingston, Baltimore, Md. U.S. Pat. 1,062,286, May 20, 1913.

Wood is impregnated with common salt, then coated with an inflammable material, which is ignited until partial combustion of the surface of the wood has taken place, and finally treated with a mixture of waste lime, fine ashes, and coal tar.—O. R.

Wood; Methods of preserving and fireproofing —— and compositions of matter or solutions therefor. A. P. Jones, London. From Grubenholz-Imprägnierung Ges. m. b. H., Berlin. Eng. Pats. 17,042 and 17,058, July 22, 1912.

See Ger. Pats. 247,694 and 248,065 of 1911; this J., 1912, 985.—T. F. B.

Viscous, stringy, adhesive substance [for use in the asphalt industry]; Process for making a ——. J. Göpper and O. Geiger, Oberturkheim, Germany. U.S. Pat. 1,063,870, June 3, 1913.

See Fr. Pat. 434,065 of 1911; this J., 1912, 232.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Semi-steel. M. Riddell. Brit. Foundrymen's Assoc., June, 1913, 1—18. [Advance proof.]

The "hard spots" not uncommon in semi-steel (prepared by melting steel scrap with cast iron in a cupola) are considered to be due to imperfect mixing of the mass after melting. The addition of ferrosilicon to the molten metal is recommended as serving the double function of regulating the carbon content and preventing blow-holes. As semi-steel castings shrink more, and, owing to the reduction of phosphorus, set more quickly than cast iron, the heads and risers, and gates and runners, must be increased in size. The difficulties of making satisfactory semi-steel are mainly overcome by running the metal hot from the cupola, and thoroughly mixing. Semi-steel castings have a close-grained structure, the graphite existing in small curly flakes, and the pearlite in the sorbitic form.—T. St.

Mild steel; Influence of heat treatment on the properties of cold worked ——. P. Goerens. Ferrum, 1913, **10**, 226—233, 260—270.

The results of a large number of experiments on the effects of heat treatment on the mechanical properties, specific gravity, the electrical, mechanical, and thermoelectrical properties, solubility in dilute sulphuric acid, potential of solution, and structure of cold worked mild steel, are tabulated and graphically illustrated. It is concluded that (1) By annealing mechanically hardened steel the original properties may be reproduced. (2) The properties produced by cold working are not altered if the reheating temperature does not exceed 520° C., but the original condition may be restored by heating for a few minutes to above 520° C. (3) The influence of time is usually so small that in order to obtain the annealing effect a short heating at a high temperature cannot be replaced by long heating at a low temperature.—A. H. C.

Nickel-chrome steels; Transformation-points and structure of ——. L. Guillet. Comptes rend., 1913, **156**, 1774—1776.

The transformation-temperatures of a number of steels with varying proportions of carbon, nickel and chromium, are tabulated. The characters of these quaternary alloys cannot be calculated from those of ternary nickel and chromium steels. The tendency to assume a eutectoid structure increases with the nickel percentage added to a pearlitic chromium steel. The effect of the addition of chromium to a nickel steel depends on the content of chromium and nickel: whilst 0·6 per cent. Cr produces no change in the transformation-points of steels with 0·08 to 0·25 per cent. C and 2·5 to 3·4 Ni, 1·2 per cent. Cr produces very marked effects in steels with 4 to 6·25 per cent. Ni, greatly augmenting the hysteresis.—J. T. D.

Rusting of iron; A new chemical cause of ——. W. Vaubel. Chem.-Zeit., 1913, **37**, 693—694.

Ammonium nitrate attacks iron energetically, ferrous and ferric hydroxides being formed. The author has not observed the intermediate formation of nitrite (see this J., 1913, 655). A part of the iron dissolves as a complex ion which cannot be detected by the ordinary reagents. Alkalinity hinders the reaction. These facts explain the variations in the amounts of iron, ammonia, nitrous acid and nitric acid found in water which has been standing for different lengths of time in iron pipes. Calcium carbonate in water may have a restraining influence on the action of nitric acid or ammonium nitrate. A source of ammonium nitrate is nitrous acid observed by Bonnema (Chem.-Zeit., 1903, 148 and 825) to be formed by the action of air on ferrous and ferric hydroxides, now confirmed by the author. (See also Valentin's Pract. Chem., 10th edit., Iron, pp. 156—166.)—J. B.

Copper in steel—the influence on corrosion. D. M. Buck. J. Ind. Eng. Chem., 1913, **5**, 447—452.

Starting with three different kinds of steel, viz., a basic open-hearth steel (C 0·10, Mn 0·34, S 0·034, P 0·019 per cent.), a de-phosphorised basic open-hearth steel (C 0·13, Mn 0·45, S 0·036, P 0·042 per cent.), and a Bessemer steel (C 0·08, Mn 0·46, S 0·070, P 0·096 per cent.), a small quantity of copper was added to a portion of each heat on pouring. The resulting ingots, with and without copper, were then subjected to exactly the same treatment, small pieces of sheet metal being prepared for the laboratory test and larger pieces for the atmospheric corrosion tests. For these latter the corrugated test-sheets were placed on the sloping roofs of skeleton buildings, open on all sides, erected in three different localities, (1) where the air was contaminated with fumes from coke ovens, (2) where the air carried sodium chloride, and (3) where the air was pure. The results are described in detail and tabulated. They show that the addition of about 0·2 per cent. Cu materially increases the resistance to corrosion of steel. It is noted that a dark brown, closely adhering coating formed on the steel containing copper, quite different from the bright red, loosely adherent rust on ordinary steel.—A. S.

Gold extraction; Volatilisation process for ——. B. Howe. J. Chamber of Mines, W. Australia. Mining World, Chicago, May 31, 1913.

The dry crushed ore is roasted with a small quantity of sodium chloride and the fumes condensed by a water spray. The gold chloride in solution is immediately precipitated by the sulphur dioxide in the gases and is recovered by filtering, drying, and melting. The process is particularly adapted to the treatment of sulphide, telluride and antimonial ores and in some cases it is advisable to give the ore a preliminary roast without salt, after which the amount of salt required is from 1 to 2 per cent. of the weight of the ore. A temperature of about 1000° C. is usually employed.—A. H. C.

Silver; Structural forms of ——. *III. Silver separated from its solid compounds.* V. Kohlschütter and E. Eydmann. Annalen, 1913, **398**, 1—48.

Some dozen specimens of silver, differing very considerably in external appearance, were obtained by heating such compounds as the oxide, carbonate, oxalate, nitrite, etc., or by treatment with a gaseous or dissolved reducing agent. The product from the silver nitrite, and that from the reduction of silver nitrate solution with sulphurous acid were crystalline and had a metallic appearance; the former owes its crystalline structure to the secondary change resulting from its contact during preparation with fused silver nitrate. The other products are all amorphous, and vary considerably in colour and in size of granule. No appreciable differences in energy or in specific gravity between the various forms of silver obtained were observed, but considerable differences especially in the early stages in the catalytic action on hydrogen peroxide. Those forms obtained at low temperatures acted most powerfully, and silver filings least powerfully. The effect of the more active forms is much diminished by heating, while that of the others is practically unchanged. The structure of the granules differs greatly in the different specimens, *i.e.*, some are much more porous than others. When colloidal silver which has been prepared at a low temperature (<100° C.) is heated to 350° C. a considerable diminution in volume takes place, although the silver does not become definitely crystalline. The course of this agglutinating is characteristic of the source of the metal. The powders obtained in the wet way begin to contract at about 200° C. while those obtained by reducing silver oxide with hydrogen and carbon monoxide require at least 300° C. before any effect is observed. The structural differences are attributed to the special characteristics of the reaction, to the medium in which the silver is formed, and to the velocity of its formation, the products being regarded as disperse systems of different degrees of dispersion, subject in their formation to influences similar to those which the authors have studied in the formation of other structural modifications of silver. (See this J., 1912, 188, 389, 645 and 777.)—W. H. P.

Copper ore; Semi-pyritic smelting of —— *in Mexico.* R. S. Pratt. Eng. and Min. J., 1913, **95**, 1191—1192.

A complex ore consisting mostly of pyrite and pyrrhotite with intermingled chalcopyrite, tetrahedrite, and enargite and containing Cu 10. Fe 25, S 30 to 35, $SiO_2$14, $Al_2O_3$4, Zn 1·5, As 4, and Sb 0·5 per cent., with Au 0·25, and Ag 3·5 oz. per ton, when smelted in a 48 in.-diam., 8-tuyère, circular furnace using 15 per cent. of coke, yielded a matte containing Cu 25 per cent. Semi-pyritic smelting was then employed, the charge burden was lowered and using 10 per cent. of coke the furnace became too hot and it was necessary to reduce the coke to 4 per cent., when a matte containing Cu 35 per cent. was obtained.—A. H. C.

Copper-aluminium alloys with 84 *to* 90 *per cent. of copper.* H. Hanemann and P. Merica. Int. Zeits. Metallog., 1913, **4**, 209—227.

When these alloys are slowly cooled, the α- and γ- constituents crystallise in large plates, and the eutectoid of α and γ is lamellar. On cooling in air, γ crystallises in star-shaped forms, and α and the eutectoid in needles, When alloys containing 84 to 86·5 per cent. Cu are quenched, only γ can crystallise. The groundmass is unresolved β. On quenching alloys with 86·5 to 88 per cent. Cu, γ first crystallises and then needles of α. With alloys containing more than 88 per cent. Cu, needles are obtained which can be considered either as proving the segregation of α and γ, or a degree of dissociation preceding such a separation (solid solution of α and γ). A close analogy is observed between the structure of these Cu-Al alloys and the structure of steels, wherein the α-constituent corresponds to ferrite, the γ-constituent to cementite, the β-constituent to pearlite, and unresolved β to austenite.—T. ST.

Aluminium bronzes; The β-constituent of ——. A. Portevin. Int. Zeits. Metallog., 1913, 4, 257—260.

THE β-constituent contained in unquenched Cu-rich Cu-Al alloys is a eutectoid of $\alpha + \delta$. It can occur in two different forms:—(1), as a cellular or spongelike network, and (2), in a much finer lamellar form, analogous to pearlite in steel. Both forms can coexist in neighbouring zones in the same alloy, in which case the cellular form predominates in those parts which touch the pro-eutectoid α-segregate. The lamellar eutectoid is to be seen only in slowly cooled alloys under high magnification, while the netlike eutectoid can be seen in similar alloys under lower magnification.—T. ST.

Aluminium; Alloying of ——. C. H. Ivinson. Brit. Foundrymen's Assoc., June 21, 1913, 1—6. [Advance proof.]

IT is stated to be important that Al-alloys should be melted without the use of fluxes, because these by wetting the sides of the crucible facilitate the taking up of silicon which in course of time renders the alloy liable to disintegrate. Since aluminium also readily absorbs sulphur at a red heat the alloys should always be melted in crucibles having well-fitting lids to protect them from the furnace gases. Aluminium when strongly heated also absorbs nitrogen and hydrocarbons and the addition of from 2 to 3 grms. of potassium nitrate to every 100 lb. of metal is stated to be effective in removing these gases. Zinc phosphide containing twenty-five per cent. P added to the extent of 0·05 per cent. was found to be the best fluxing and cleansing agent for all aluminium alloys. The properties of Al-Mn, Al-Ti, Al-Cr, Al-Mo, and Al-W alloys and alloys with the rare metals and the method of their production are described.—A. H. C.

Aluminium; Explosion of —— when granulating. M. Bamberger and H. v. Jüptner. Z. angew. Chem., 1913, **26**, 353—355.

TEN kilos. of aluminium melted in a graphite crucible were granulated by pouring through a sieve into a tank containing 250 litres of water, when an explosion took place. The most likely causes of the explosion are discussed, and from a calculation of the amount of heat in the melted aluminium it is suggested that the explosion was due to the insufficient quantity of water employed, a portion of which assumed the spheroidal condition and then produced a sudden outburst of steam.—A. H. C.

Nickel-cobalt alloys; Specific resistance and hardness of ——. R. Ruer and K. Kaneko. Ferrum, 1913, **10**, 257—260.

A SERIES of fourteen Ni-Co alloys varying from 0 to 100 per cent. Co were prepared and the specific resistance and hardness were determined, the results being tabulated and graphically illustrated. The specific resistance increases to a maximum at from 15 to 20 per cent. Co, and then steadily falls to that of pure cobalt, when it is slightly lower than that of pure nickel. The hardness however remains nearly constant up to 70 per cent. Co when it suddenly increases to that of 80 per cent. Co, thence remaining nearly constant up to pure cobalt.
—A. H. C.

Pitchblende; Concentration of ——. H. E. Wood. Eng. and Min. J., 1913, **95**, 1164.

NUMEROUS commercial tests have shown that the usual process of concentrating pitchblende ores to remove silica results in a loss of upwards of 50 per cent. of the pitchblende. In the following process about 90 per cent. of the pitchblende is recovered, and the concentrate will contain from 45 to 56 per cent. U_3O_8:—The ore is crushed to 20-mesh size, roasted, the iron oxide separated magnetically, and then the uranium oxide by a wet or dry gravitation process. In the case of carnotite ores the vanadium oxide may be removed by shaking the crushed ore with water and collecting the slime for further concentration. By this means an ore containing from 1 to 2 per cent. of uranium and vanadium oxides will yield a concentrate containing from 75 to 85 per cent. of the oxides. After removal of the uranium and vanadium the ore can be used in the preparation of radium.—C. A. M.

Arsenic and cadmium; Compounds of ——. S. F. Zemczuzny. Int. Zeits. Metallog., 1913, **4**, 228—247.

ALLOYS containing up to 72 atoms per cent. As were prepared by melting cadmium under a mixture of lithium and potassium chlorides, and adding arsenic gradually in small lumps. The equilibrium diagram of the alloys shows two temperature maxima, corresponding to Cd_3As_2 (m.pt. 721° C.) and $CdAs_2$ (m.pt. 621° C.), and two eutectic points at 0·3 per cent. (atomic) As, and 319° C., and at 55·5 per cent. (atomic) As, and 610° C. Cd_3As_2 is dimorphous, its transformation point lying at 578° C. The existence of Cd_3As_2 and $Cd\,As_2$ is confirmed by the miscroscopical examination and also by the specific gravity and atomic volume curves. $Cd\,As_2$ is harder than either arsenic or cadmium.—T. ST.

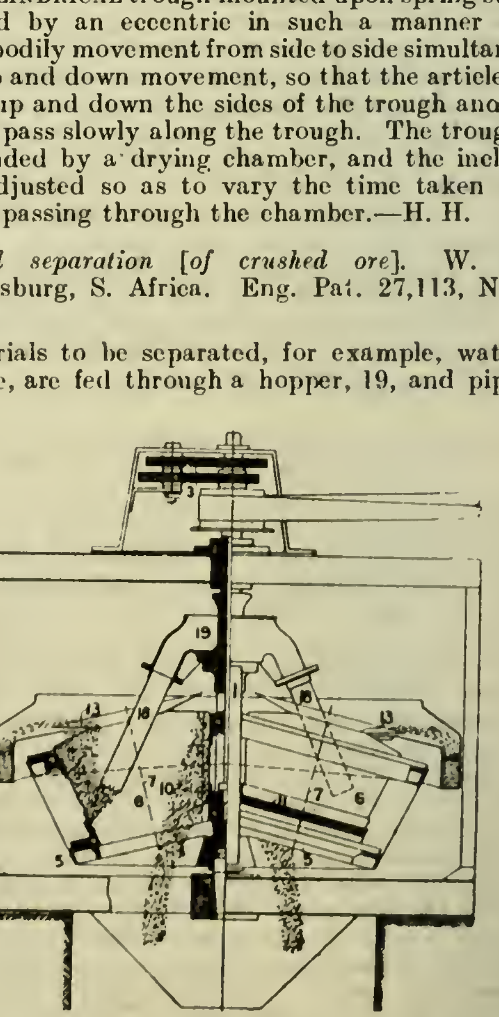
PATENTS.

Drying machine [for small metal articles]. O. Stott, Birmingham. Eng. Pat. 9765, Apr. 25, 1912.

A SEMI-CYLINDRICAL trough mounted upon spring supports is operated by an eccentric in such a manner that it receives a bodily movement from side to side simultaneously with an up and down movement, so that the articles to be dried roll up and down the sides of the trough and at the same time pass slowly along the trough. The trough may be surrounded by a drying chamber, and the inclination may be adjusted so as to vary the time taken by the articles in passing through the chamber.—H. H.

Centrifugal separation [of crushed ore]. W. Mauss, Johannesburg, S. Africa. Eng. Pat. 27,113, Nov. 25, 1912.

THE materials to be separated, for example, water and crushed ore, are fed through a hopper, 19, and pipes, 18, to two or more drums, 6, carried by a cradle, 5, the whole being mounted upon a shaft, 1, which is rotated rapidly.



In addition to the bodily rotation of the drums, 6, about the axis, 1, the drums are slowly rotated about their own axes, 7, by the spur gears, 10, 11, and reducing gear, 3, so that the outer surface of each drum is constantly changed and the heavier separated material adhering thereto is carried round towards the axis, 1, where it drops off and falls through the open bottom of the drum. The water or lighter ingredients collect at the outer angles of the drums and are discharged over the lips, 13.—H. H.

[*Zinc.*] *Method of stripping sheets.* J. McFetridge, Vandergrift, Assignor to American Sheet and Tin Plate Co., Pittsburgh, Pa. U.S. Pat. 1,063,054, May 27, 1913.

Galvanised material is placed in a bath of zinc chloride containing 2—3 per cent. of free acid, and when partly stripped, is transferred to a similar but less acid bath in which the process is completed. When the acidity of the first bath becomes reduced to $\frac{1}{2}$—1 per cent., a portion of the liquid is used to replenish the second bath, the remainder being re-acidified to the original degree. —W. E. F. P.

Zinc and volatile metals ; Vertical furnace for obtaining ——. A. Zavelberg. Ger. Pat. 259,886, June 20, 1912. Addition to Ger. Pat. 226,257 (this J., 1910, 1460).

The walls of the furnace are provided with layers of heat-insulating material, and the charge is introduced in separate portions through several inclined channels leading from the central outlet pipe of the feed-hopper ; this central pipe may be fitted with a partition to ensure uniform distribution of the ore.—A. S.

Linings, etc., of metallurgical furnaces ; Material for use in making up, repairing and replacing ——, *and process of preparing the same.* J. E. Baker, York, Pa. U.S. Pats. 1,063,102 and 1,063,103, May 27, 1913.

Raw dolomite is "burned" in a cupola furnace, the product being converted into a granular mass by crushing and subsequently re-burned at a high temperature. —W. E. F. P.

Copper-plated or copper articles ; Process for colouring —— *red.* C. Dittrich. Ger. Pat. 260,092, May 1, 1912.

The articles are coated electrolytically with lead or lead peroxide and are then immersed in a fused nitrate or nitrite or mixtures of these with other salts.—A. S.

Ores and their mixtures containing principally sulphides, sulphates, oxides and carbonates of metals and alkaline earth carbonates ; Preparation of —— *by an acid flotation process.* Bergbau-A.-G. Friedrichssegen. Ger. Pat. 260,229, Sept. 17, 1912.

Insoluble metallic sulphides are first separated in the known manner by a flotation process, the bath being acid and heated to a temperature not above 55° C., and then the acid concentration of the bath is increased and magnesium chloride added thereto. At 55° C. no separation of hydrated calcium sulphate from the solution takes place. On addition of magnesium chloride, a double calcium-magnesium salt is formed which crystallises out only on cooling to about 0° C., whereas zinc sulphate, for example, can be recovered by crystallisation at 20°—30° C.—A. S.

Colloidal metals ; Production of —— *by disintegration with the aid of electric sparks.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 260,470, July 21, 1912.

Stable colloidal metal solutions are obtained if disintegration be effected in a hydrocarbon or other rubber solvent in which a small quantity of rubber or a rubber-like substance has been dissolved.—A. S.

Air for use in blast furnaces and other like furnaces ; Obtainment of dry ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 13,050, June 3, 1912.

See Fr. Pat. 444,365 of 1912 ; this J., 1912, 1134.—T. F. B.

Blast furnace. C. Hicks, Hellertown, Pa., U.S.A. Eng. Pat. 15,685, July 4, 1912.

See U.S. Pat. 1,039,282 of 1912, this J., 1912, 994.—T. F. B.

Furnaces ; Charging and cooling apparatus for [*annealing*] ——. H. Hillebrand, Werdohl, Germany. Eng. Pat. 13,650, June 11, 1912. Under Int. Conv., June 23, 1911.

See Ger. Pat. 257,716 of 1911 ; this J., 1913, 540.—T. F. B.

Iron and steel ; Process of extracting ——. A. Hiorth, Kristiania. Eng. Pat. 16,275, July 11, 1912. Under Int. Conv., Oct. 5, 1911.

See Fr. Pat. 449,212 of 1912 ; this J., 1913, 492.—T. F. B.

Armour-plate ; Method of treating ——. S. S. Wales, Munhall, Assignor to Carnegie Steel Co., Pittsburgh. U.S. Pat. 1,064,034, June 10, 1913.

See Eng. Pat. 9380 of 1908 ; this J., 1908, 1068.—T. F. B.

Steel and iron surfaces ; Treatment of ——. W. S. Simpson, London. U.S. Pat. 1,064,671, June 10, 1913.

See Eng. Pat. 20,917 of 1911 ; this J., 1913, 146.—T. F. B.

Roasting ores and the like ; Process of and apparatus for ——. E. Bracq, Lens, France. Eng. Pat. 20,108, Sept. 3, 1912. Under Int. Conv., Sept. 22, 1911.

See Fr. Pat. 434,494 of 1911 ; this J., 1912, 343.—T. F. B.

Metallic [*iron or nickel*] *catalysts ; Production of* ——. C. und G. Müller Speisefettfabrik Akt.-Ges., Berlin. Eng. Pats. 22,092, Sept. 28, 1912, and 23,643, Oct. 16, 1912. Under Int. Conv., April 23 and May 24, 1912.

See Fr. Pat. 450,703 of 1912 ; this J., 1913, 610.—T. F. B.

Precipitating and recovering materials [*metals*] *from solutions ; Process of* ——. C. W. Merrill, Berkeley, Cal. U.S. Pat. 1,063,567, June 3, 1913.

See Eng. Pat. 7602 of 1911 ; this J., 1912, 591.—T. F. B.

Purification of vapours and gases, particularly blast-furnace gas, in the dry way. Fr. Pat. 451,815. *See* I.

XI.—ELECTRO-CHEMISTRY.

Patents.

Electrolysis ; Process of ——, *and apparatus therefor.* K. S. Guiterman, New York. U.S. Pat. 1,062,966, May 27, 1913.

The electrodes are arranged in pairs in a rectangular vessel having a trough-shaped bottom. The slime, as formed, is washed from the electrodes by means of currents of electrolyte, the latter causing the slime to remain in suspension beneath the electrodes and to accumulate at a predetermined point whence it is continuously discharged.—W. E. F. P.

Galvanic cell. A. Heil, Frankfort, Germany, Assignor to C. H. and S. Stern, New York. U.S. Pat. 1,064,211, June 10, 1913.

See Eng. Pat. 10,541 of 1912 ; this J., 1913, 610.—T. F. B.

Electrolytic process of manufacturing chlorates and perchlorates. Fr. Pat. 452,694. *See* VII.

XII.—FATS ; OILS ; WAXES.

Fat of the seeds of " Oncoba echinata " ; Occurrence of chaulmoogric acid. E. Goulding and N. C. Akers. Chem. Soc. Proc., 1913, **29**, 197—198.

Samples of the seeds of the " Gorli " plant (*Oncoba echinata*, Oliver) have been received at the Imperial Institute from Sierra Leone, and have been examined with the following results. The seeds contained 5·8 per cent. of moisture, and, on extraction with light petroleum, yielded about 47 per cent. of a hard, opaque, white fat of a crystalline appearance, and possessing a peculiar, characteristic odour. The fat furnished the following constants : sp.gr. at 100°/15·5°C. 0·898, $[\alpha]_D^{17} = +48·8°$; acid value, 4·5 ; saponification value, 192·4 ; iodine value, 99·7 ; Hehner value, 96·5 ; Reichert-Meissl value, nil ; unsaponifiable matter, 1·5 per cent. It had no definite melting point, but gradually liquefied above 35°, and was completely melted at 45° C. The fatty acids obtained by hydrolysing the fat had an iodine value of 105·1, $[\alpha]_D^{18} = +52·5°$, and consisted of a mixture of a crystalline solid and a liquid. By pressing the mixture between folds of filter-paper, a large proportion of the solid substance could be separated, and on recrystallisation from warm alcohol it was obtained in thin, lustrous plates, melting at 69° C. This acid gave an iodine value of 90·5, and $[\alpha]_D^{17} = +60·0°$; it was identified as chaulmoogric acid, $C_{17}H_{31}·CO_2H$ (Power and Gornall, this J., 1904, 669), by the analysis of the silver salt and the preparation of the methyl ester, which melted at 22° C., and had $[\alpha]_D^{21} = +55·8°$. The liquid portion of the fatty acids, although saturated with chaulmoogric acid, gave an iodine value of 122, showing that the liquid acids are highly unsaturated ; it darkened rapidly on exposure to the air. The investigation showed that the fatty acids consisted approximately of chaulmoogric acid, 87·5 per cent., and liquid acids, 12·5 per cent.

Oils from Manihot ceara and Funtumia elastica, and comparison of their properties with those of linseed and Hevea oils. S. Rideal and L. H. D. Acland. Analyst, 1913, **38**, 259—264.

Ceara rubber seeds yielded 15·75 per cent. of a light yellow oil with a pleasant nutty odour and taste. It was a good drying oil, and when boiled behaved like freshly-extracted linseed oil, but did not darken very much. With sulphur chloride, 5 grms. yielded 6·16 grms. of a transparent gelatinous mass, which when heated became darker, harder, and fairly elastic. *Funtumia elastica seeds* yielded 31 to 33 per cent. of a very dark oil with a strong bitter odour and taste. It could be decolourised by treatment with fullers' earth and animal charcoal, and on standing for some days gave a deposit of " stearine " melting at 47° C. It did not dry very well, and yielded a " tacky " film. When boiled it became very viscous and when heated with sulphur chloride gave a brown gelatinous mass (6·6 grms. from 5 grms. of oil). It is suitable for the manufacture of rubber substitutes. It was dextrorotatory (+0·7), this property being due to the presence of a bitter alkaloid (0·11 per cent.). A cyanogenetic glucoside was also present. Both of these oils resemble *Hevea* oils in their properties, but, unlike that oil, do not contain any appreciable quantity of lipolytic enzymes. The following analytical values were obtained :—

Oil.	Sp. gr.	Refractive index at 15° C.	Iodine value.	Acid value.	Saponif. value.	Hehner value.	Reichert-Meissl value.	Liquid fatty acids.	Iodine value of liquid fatty acids.
								per cent.	
Ceara	0·9238	1·475	135—137	0·62	189·1	95·1	0·44	88·9	162·5
Funtumia	0·9230	1·4788	138	2·65	185·0	94·0	0·66	79·8	175·5
Hevea	0·9258	—	138·7	5·26	191·2	—	2·7	86·0	—

The fat free residue of the Ceara seeds contained 2·19 per cent. and that from the Funtumia seeds, 4·34 per cent. N.—C. A. M.

Cocoanut and palm-kernel oil ; Proportionate determination of —— in mixtures. H. R. Burnett and C. Revis. Analyst, 1913, **38**, 255—258.

In mixtures containing no other fats the proportions of cocoanut and palm-kernel oils may be found by determining the Polenske value. When other fats are present the Reichert-Meissl-Polenske method is used, the determination being made in the standard apparatus and by the standard process, and the Polenske value obtained by means of *N*/10 barium hydroxide solution. The insoluble barium salts are separated with the aid of suction and washed with 3 c.c. of 93 per cent. (by vol.) alcohol, the funnel being covered during the filtration and washing. After removal of as much alcohol as possible, the filter and precipitate are treated with ten times the quantity in c.c. of the Polenske value of 93 per cent. alcohol and boiled beneath a reflux condenser until solution is complete. About 5 c.c. of the hot solution are poured into a test-tube (6 in. by ½ in.), which is then closed with a stopper through which pass a thermometer and a stirrer of aluminium wire. The turbidity temperature is taken, the tube then warmed, and the turbidity point again determined. Cocoanut oil gives a second turbidity temperature of 72·5° C. and palm-kernel oil 68·5° C., whilst mixtures of the two give proportionate readings. The turbidity temperatures do not depend upon the amounts of the two fats in the original mixture, but indicate their relative proportions. Insoluble barium salts derived from volatile insoluble acids are separated by heating the liquid in a closed test-tube in water at 70° to 71° C. and then decanting the clear solution before applying the test. The turbidity temperature should be determined within a few hours after the Polenske titration, since otherwise the barium salts become partially insoluble. Palm-kernel " oleine " gave a turbidity temperature of 59·5, whilst palm-kernel " stearine " yielded barium salts which were only partially soluble in 93 per cent. alcohol, so that the liquid had to be diluted to make the determination. The turbidity temperature calculated for palm-kernel " stearine " was 72·5° C., for cocoanut " oleine," 53° C., and for cocoanut " stearine," 63° C.

—C. A. M.

Sulphur olive oil and Marseilles soap. R. Schwarz. Chem.-Zeit., 1913, **37**, 752—753.

The Marseilles soap used in the degumming of silk is mostly prepared from so-called sulphur olive oil, although a soap is known in France as " *savon de Marseille*," which is made from cocoanut and arachis oils. The author mentions a case where faults in dyeing led to the discovery that the Marseilles soap used in the works contained about 7 per cent. of resin, and subsequent systematic tests showed that sulphur olive oils frequently contain resin (from 3·1 to 15·6 per cent. by Twitchell's method in the samples examined), probably owing to oxidation of the fat present in the olive marc when this is stored for a considerable time before the oil is extracted.—A. S.

Fat-determination method ; Examination of the Kumagawa-Suto —— with regard to oxidation of the fatty acids and unsaponifiable matter during the process. M. Tamura. Biochem. Zeits., 1913, **51**, 463—483.

It has been suggested that in order to prevent erroneous results owing to oxidation of the fatty acids and unsaponifiable matter in using the Kumagawa-Suto method (this J., 1908, 455), the whole of the process must be carried out either *in vacuo* or in an atmosphere of carbon dioxide. The author investigated the different phases of the process and found that there is no appreciable alteration of the fatty acids or unsaponifiable matter during the saponification and the evaporation of the petroleum ether solution, the vapour of the solvent in the latter operation preventing oxidation. In the final drying operation, however, both suffer more or less oxidation. In the case of the fatty acids the change in weight is so small as to be negligible if the drying (at 50° C.) is not continued for more than 1—2 hours, but in the case of the unsaponifiable matter, considerable errors may be caused.—A. S.

Determination of active oxygen in perborates and detergents containing perborates. Litterscheid and Guggiari. *See* VII.

Patents.

Catalytic operations; The carrying out of —— and more particularly the conversion of unsaturated fatty acids and their glycerides into saturated bodies. T. Boberg, Clapham Park, and Techno-Chemical Laboratories, Ltd., London. Eng. Pat. 4702, Feb. 24, 1912.

A metallic compound, such as nickel carbonate, is reduced by hydrogen under such conditions that the metal in the resulting catalysts, exists in the form of one or more suboxides as far as possible. The product of reduction of nickel carbonate is more active as a catalyst, the lower the temperature of reduction; a range of temperature between 230° and 270° C. appears to be the most suitable. The product may be collected for immediate use in the substance in which it is to be ultimately used, *e.g.*, oil, but if not required at once, it may be collected in water, filtered, and dried in air, and then prepared for use by heating in an atmosphere of hydrogen for one to two hours at about 180° C. When the catalyst is to be used for hardening fats or oils, this final treatment is not necessary, as it acquires its full activity at the beginning of the process. The suboxide catalyst may also be prepared by reducing an oxide of nickel as completely as possible to nickel, and then oxidising the product with air or with oxygen diluted with carbon dioxide at a temperature between 300° and 600° C. —T. F. B.

Dissolving agents; Method for the recovery of —— from the residues from extraction [of oils] and the like. S. Zipser, Stettin, Germany. Eng. Pat. 12,321, May 24, 1912.

See Fr. Pat. 444,194 of 1912; this J., 1912, 1137.—T. F. B.

Soap. T. Anyon, Fallowfield. U.S. Pat. 1,064,591, June 10, 1913.

See Eng. Pat. 24,304 of 1911; this J., 1912, 936.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Theory of colour-lakes. II. Pfeiffer. *See* IV.

Analysis of amyl acetate and collodion. Chercheffsky. *See* V.

Patents.

Vat dyestuffs of the anthracene series; Conversion of —— into a form suitable for use as pigments. Badische Anilin und Soda Fabrik. Ger. Pat. 260,428, April 16, 1912.

The hydro-compounds of vat dyestuffs of the anthracene series are oxidised very gradually by air in presence of water; the products obtained are very suitable for use as pigments, and are quite different in physical condition from the products obtained by passing air rapidly into hot solutions of the hydro-compounds.—T. F. B.

Rubber gum or rubber rosin; Process for keeping —— in solutions of drying or other fat oils. F. Boehm, Ltd., and C. A. Reihl, London. Eng. Pat. 10,947, May 8, 1912.

Rubber gum or mariola gum (a by-product of the refining of crude rubber) is used as a basis for linoleum cement, varnishes, and paint oils. To prevent crystallisation the mixture of rubber gum and oil is blown with air or oxygen at 400° F. (205° C.), or the gum is so treated and the oil added subsequently, or the rubber gum is melted with 15 per cent. or more of its weight of resinate, and the oil added afterwards.—E. W. L.

Pigments from [anthracene dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,271, July 24, 1912.

See Ger. Pat. 260,428 of 1912; preceding.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Mengwere juice [rubber coagulant]. F. Frank and E. Marckwald. Gummi-Zeit., 1913, 27, 1493—1494.

In German E. Africa the aborigines employ the juice of the Mengwere plant for coagulating rubber latex (Manihot). A sample of this juice was found to contain plant fibres, a little acid, alcohol and tannic acid, to which the coagulating action is ascribed, and other constituents. The analysis shows that rubber coagulated in this way will be contaminated with plant fibre and other impurities, and the use of this coagulant is therefore deprecated.—H. E. P.

Wild lettuce rubber. C. P. Fox. J. Ind. Eng. Chem., 1913, **5**, 477—478.

Two species of wild lettuce growing abundantly in the Central United States are suggested as possible sources of rubber. The first, *Lactuca canadensis*, is a biennial known as fireweed and trumpet weed. and all portions of it when bruised yield a thick latex. The second, *L. scariola*, an annual, yields less latex than *L. canadensis*, and the latex contains less rubber (1·58 per cent.) than that of the latter (2·19 per cent.). The rubber is stated to be firm and strong. The resin extracted by acetone (11·42 per cent. in *L. canadensis* latex, 12·85 per cent. in *L. scariola* latex) is a light brown, brittle, waxy substance, soluble in alcohol, glacial acetic acid. and benzene. The latex also contains an intensely bitter substance of weakly acid character, and hence treatment of the rubber with alcoholic potash is necessary. According to Maisch (Amer. J. Pharm., 1869, 145), *L. canadensis* contains a bitter principle equal in value to the drug lactucarium ("lettuce opium"), and it is suggested that the combined production of lactucarium and rubber might prove profitable in the north temperate zone.—A. S.

Oils from Manihot ceara and Funtumia elastica seeds. Rideal and Acland. *See* XII.

Patents.

India-rubber; Extraction or coagulation of —— from the latex. S. C. Davidson, Belfast. Eng. Pats. 11,274, May 11, and 28,555, Dec. 11, 1912.

India-rubber, after coagulation by means of acid and a preliminary rolling into the form of thin sheets, is freed from all traces of acid by immersion in a solution of a soluble alkaline salt or sulphur compound such as the polysulphides of sodium or of potassium, whereby "nascent" sulphur is simultaneously precipitated in the rubber in a very active form. The rubber is subsequently further rolled, washed, and dried.—E. W. L.

Caoutchouc or caoutchouc-like substances; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss, London. Eng. Pat. 12,773, May 30, 1912.

The raw caoutchouc-like products obtained according to Eng. Pat. 24,790 of 1910 (see this J., 1911, 1398) or by other means from hydrocarbons having six or less carbon atoms and containing conjugated double linkages, are somewhat liable to atmospheric oxidation, possibly on account of their high purity. To overcome this, and to produce compound caoutchoucs, these raw products may be mixed with natural caoutchouc or with a gum, resin, or extractive therefrom, or with a similar gum or resin, or with a rubber derived from a hydrocarbon having more than six carbon atoms. Non-oxidised vulcanised rubber (synthetic or natural) may be mixed with erythrene or a derivative thereof, or with a mixture of these, and the mixture is polymerised. Another method consists in polymerising by means of light, sodium, etc., a mixture of erythrene or a derivative with rubber latex or an extract therefrom.—T. F. B.

India-rubber; Reforming, vulcanising and similarly treating ——. T. Gare, Birmingham. Eng. Pat. 8554, April 11, 1912.

The heat necessary for re-forming ground rubber waste, or for vulcanising moulded rubber articles or rubber sheet is applied by placing the two surfaces of the mould in complete surface contact with electrical heaters, consisting of resistance wire wound on mica strips. A direct or alternating current of about 220 volts is employed, and the mould is heated to 260°—290° F. (127°—143° C.). —E. W. L.

Rubber; Process for the utilisation of waste ——. O. A. Wheeler and E. D. and B. Loewenthal. Fr. Pat. 452,482, Dec. 28, 1912.

Waste rubber containing cotton fabric is disintegrated and pulverised and allowed to remain in contact with a 20 per cent. solution of caustic soda for 5 hours. The mass is then agitated in an autoclave (Papin's digester) for from 1 to 5 hours with carbon bisulphide (about 1 part for every 10 parts of waste rubber). By this means the cellulose is converted into sulpho-carbonate. Water is then added, in quantity about equal to the weight of dry rubber, the mass well mixed, and the whole heated until a pressure of 7 kilos. per sq. cm. is reached in the autoclave, this pressure being maintained for 15—20 hours. The product may be improved by the addition of sulphur and of low-grade rubbers, such as Pontianac, Accra flake, Guayule, etc.—E. W. L.

Caoutchouc; Process of producing a substance similar to ——. Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 24,637, Oct. 28, 1912. Under Int. Conv., Oct. 31, 1911. Addition to Eng. Pat. 2313 of 1912, dated Aug. 7, 1911.

See Fr Pat. 441,655 of 1912; this J., 1912, 888.—T. F. B.

Process for keeping rubber gum or rubber rosin in solutions of drying or other fat oils. Eng. Pat. 10,947. *See* XIII.

Manufacture of butadiene and its homologues. Eng. Pat. 12,771 *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Chestnut extract. L. Pollak. Collegium, 1913, 6, 291—299. (See also this J., 1913, 373.)

The raw material for the manufacture of chestnut extract contains from 7 to 9 per cent. of tannin according to its origin. The extracts from various sources differ in character according to the quantity, kind and composition of the non-tannins and insoluble matter. All pure blood decolourised commercial extracts gave a negative result when tested for sulphite cellulose by the Procter-Hirst aniline hydrochloride test, but a sample of extract made in the laboratory without pressure and not decolourised gave a positive reaction. Red chestnut wood from Corsica which differs slightly in chemical properties from the white wood gave an extract yielding a positive result by the Procter-Hirst test while a negative result was obtained with white wood. The substance yielding the test is easily soluble in water and is dissolved during the whole of the extraction. White French wood extracted in the factory with soft, weakly acid water gave an extract showing no lignin by the test, but an extract made in the laboratory with hard water containing carbonates gave a positive result. Tables showing the amount of sugar found in chestnut extracts are given, the total sugar being divided into (1) glucose, (2) cane-sugar, found after 4 hours inversion, and (3) sugar found after 4 hours inversion of the extract itself. The sugar found under the last category was considerably greater in extracts which had not been decolourised, so it is evident that part of it was derived from materials in suspension in the extract. Decolourised extracts give a better yield of leather than extracts not so treated and the increase in yield of leather of an extract gives a better idea of the extent to which it has been decolourised than the figure obtained with the tintometer.—D. J. L.

Tanning materials; Weight-giving properties of ——, *as estimated in the laboratory.* R. H. Wisdom. J. Amer. Leather Chem. Assoc., 1913, 8, 232—236.

Large pieces of sheepskin were tacked out, allowed to dry in parchment form and cut up and weighed so that equal weights were approximately of equal area. The skin was then wet back and preserved as usual. Various tanning extracts of known purity were dissolved as for colour tests using 20 deg. Bkr. liquors (sp. gr. 1·020) and the weighed pieces put first in weak measured solutions for one hour and then in the strong solution for 24 hours, after which they were washed, air dried and weighed. The weight was then corrected for the weight value per unit of tan as returned by the official method of analysis. The weight value per unit of tan of a number of tanning materials is given, sulphite-cellulose extract being given an arbitrary value of 100. Unclarified quebracho gave 125·7, oak-bark 120·6, sumac 115·1, and gambier 110·5.—D. J. L.

Patents.

Leather goods; Process for cleaning ——. Karplus und Herzberger, Berlin. Eng. Pat. 14,082, June 17, 1912. Under Int. Conv., May 3, 1912.

The leather goods previously cleansed with soap and water are treated with dilute solutions of acids capable of dissolving the metallic salts and oxides deposited on the leather without damaging it. Tartaric and oxalic acids are suitable and their acid or neutral salts may be used in conjunction with a reagent, such as an alkali bisulphate or alum, capable of wholly or partly liberating the acid. Softness and body may be imparted to the leather simultaneously by incorporating with the acid solution the necessary dressing which has been withdrawn by the washing.—D. J. L.

Leather, Waterproofing of chrome-tanned ——. E. W. Terry, Upper Hawthorn, Victoria, Australia. Eng. Pat. 16,060, July 9, 1912.

Tallow is heated by steam in a vat to 160°—170° F. (71°—77° C.), mixed with resin, the temperature again raised to 160°—170° F. (71°—77° C.) and the chrome leather immersed in the mixture and the vat covered. The leather is left for 30—60 minutes according to its thickness and the flexibility required and then removed and placed on hot tables where it is scrubbed with hard brushes dipped in hot tallow to remove any superfluous material not absorbed by the leather. The excess of fat is removed by a sponge damped with kerosene. For leather for boot and shoe uppers, 10 lb. of tallow is used to 30 lb. of resin but if a harder leather is required the quantity of resin may rise to 40 lb.—D. J. L.

Belting; Composition for treating ——. A. Vacheron, Lyons, France. Eng. Pat. 20,553, Sept. 9, 1912.

Fifty parts of turpentine are heated to 40° C. and 20 parts of heavy American "black oil" previously heated to 50° C. are added and the whole well mixed. 20 parts of glycerin, 6 parts of sesamé oil and 2 parts each of colouring matter and nitrobenzene are thoroughly amalgamated with the mixture. American black oil consists of a mixture of cotton-seed oil, petroleum oil, sesamé oil, and petroleum jelly. The preparation, it is claimed, applied to leather belting imparts suppleness and good gripping qualities, and prevents rotting.—D. J. L.

XVI.—SOILS; FERTILISERS.

Determination of organic matter in clay. Ehrenberg and others. *See* VIII.

Patent.

Ammonium superphosphate fertiliser; Method of manufacturing an ——. T. L. Willson and M. M. Haff, Ottawa, Canada. U.S. Pat. 1,062,869, May 27, 1913.

A superphosphate is treated with gaseous ammonia and the product is mixed with fresh superphosphate.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Bagasse; Economical imbibition of [water by] ——. L. Pellet. Intern. Sugar J., 1913, **15**, 271—273.

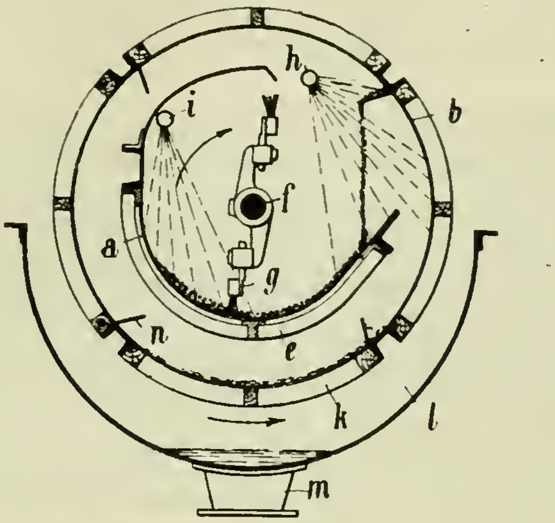
According to the author, a sufficiently complete exhaustion of the cane may be effected with, at the most, 25 per cent. of water, under suitable conditions. The water should be uniformly distributed at a sufficient number of stages. In the case, for example, of a 3-unit mill with a crusher, practising a 20 per cent. imbibition, one-third of the water should be delivered between the first and second mills, and the remainder between the second and third mills in two different places. With a 4-unit mill and crusher, effecting a 25 per cent. imbibition, there should be 4 distributors, each passing about 6 per cent., the first being placed between the first and second mills, the second and third between the second and third mills, and the fourth between the third and fourth. After each watering the surface should be renewed by turning it over, or some of the distributors should be placed beneath the surface of the material. In order to effect the best distribution of the imbibition water, special injectors atomising the water of imbibition are recommended. Only filtered water should be employed, and the piping after the filters should be of copper to prevent stoppage by particles of rust. The author considers that the distance between the mill units where the water is projected should be at least 25 ft. It is sometimes convenient instead of water to use thin-juices or wash waters, returning these between the first and second units; also the use of exhaust steam, or better the vapour from a pre-evaporator at say 110°—120° C. (230°—248° F.), may in some cases be advantageous.—J. P. O.

Patents.

Sugar juices; Process for the removal of potash and soda from ——. J. D. Riedel A.-G. Ger. Pat. 260,505, April 13, 1912. Addition to Ger. Pat. 254,883.

The process described in the chief patent (this J., 1913, 441) can be applied to thin and thick syrups in addition to raw beet juice.—A. S.

Starch or farina; Cylindrical sieves for extracting and refining ——. S. Aston. Fr. Pat. 452,395, Dec. 26, 1912. Under Int. Conv., Jan. 26, 1912.



The apparatus, which is shown in vertical section (see fig.), includes an inner, semi-cylindrical, washing sieve, *a*, and an outer, concentric, cylindrical, refining sieve, *b*, each sieve being formed of segments, *e* or *k*. The ground material is introduced into the inner sieve where it is sprayed with water from the pipes, *h* and *i*, and stirred and transported by spirally disposed brushes attached to the arms, *g*, of the rotating shaft, *f*. The starch suspension passes through the two sieves to the collecting trough, *l*, and outlet, *m*. The outer sieve rotates in a direction opposite to the motion of the brushes, and the residue left thereon is carried round by blades, *n*, and falls back into the inner sieve, being sprayed with water as it falls. The shaft, *f*, also carries scrapers (not shown) which bear on perforated rasps intercalated in the inner sieve, and help to disintegrate the material.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Diastase; Action of nitric oxide on ——. *VII.* T. Panzer. Z. physiol. Chem., 1913, **85**, 292—307.

Following previous experiments on the action of hydrochloric acid and ammonia on diastase and invertase (this J., 1913, 41, 441, 547, 620, 669), the author has now studied the action of nitric oxide on diastase. One specimen of diastase absorbed from 1·97 to 3·65 per cent., whilst another carefully purified specimen (free from lactose) absorbed from 4·85 to 11·33 per cent. The products were quite stable in the air, and gave no indications of the presence of free or merely physically absorbed nitric oxide; they responded to several of the reactions for nitroso-compounds. Only a small proportion of the absorbed nitric oxide was evolved again on subjecting the products to the action of a vacuum in presence of a mixture of ferrous sulphate and soda-lime. The treatment with nitric oxide increased the acidity of the diastase but had no effect on the content of amide-nitrogen or of nitrogen present in a form capable of yielding acid on treatment with formaldehyde. The hydrolytic activity was not affected in the case of the preparation (A) containing lactose, but that of the purified diastase (B), free from lactose, was very considerably reduced. It is probable that in the latter case (diastase B) the nitric oxide combines with an atomic group which is essential to the hydrolytic activity of the diastase, but which, in the case of diastase A, is in loose combination with the lactose, and is so protected from the action of the nitric oxide.—A. S.

Invertase ; Action of nitric oxide on ——. VIII. T. Panzer. Z. physiol. Chem., 1913, **85**, 392—398 (see also preceding abstract).

Invertase absorbs 2—6 per cent. NO, which appears to undergo subsequent oxidation very readily, thereby causing a further increase of weight, and part of which appears to be chemically combined with the enzyme, for it cannot be withdrawn in a vacuum over ferrous sulphate and soda-lime. The hydrolytic activity of the enzyme is not impaired by these changes.—J. H. L

Zymase ; Action of boric acid on ——. Comparison with the action of phosphates. H. Agulhon. Comptes rend., 1913, **156**, 1855—1858 (see also this J., 1909, 668).

The fermentation of sugar by yeast maceration juice is appreciably retarded by the presence of 0·01 per cent. of boric acid in the liquid, and is completely arrested by 1 per cent. Living yeast, however, can withstand as much as 2 per cent., possibly because the cell wall protects the zymase from contact with the acid. The inhibitive influence of boric acid is not due simply to its acidity, but is a specific property of the negative radical, for alkali borates act similarly, and therein differ markedly from phosphates (cp. Rosenblatt and Rozenband, this J., 1909, 952). Of a number of enzymes studied, the only ones found sensitive to boric acid were lipase and zymase, both of which are endocellular, *i.e.*, act normally within the cell wall.—J. H. L.

Yeasts ; Mechanism of acclimatisation of —— to formaldehyde. M. E. Pozzi-Escot. Comptes rend., 1913, **156**, 1851—1852.

The fact that formaldehyde appears to some extent to lose its antiseptic power when added to fermenting liquids, has been attributed by Effront to the elaboration of an "anti-body" by the yeast, whereby the aldehyde is oxidised to formic acid. The author's experiments indicate, on the contrary, that the disappearance of the aldehyde is due to combination with complex nitrogenous substances present in the fermenting liquid. The more organic nitrogenous matter the liquid contains, the larger is the quantity of formaldehyde required to inhibit fermentation.—J. H. L.

Fermentation ; Formation of acids during ——. E. Moufang. Z. ges. Brauw., 1913, **36**, 297—299.

Pure solutions of maltose, lævulose and dextrose, of 4—7·5 per cent. concentration, were inoculated with small quantities of various yeasts, and the acidity of the fermented solutions was determined after 5—8 days. The total acidity produced, calculated as lactic acid, ranged from 1·8 to 3·3 grms. per 100 grms. of sugar fermented, and was found to depend on the kind of yeast employed but also to a much greater extent on the temperature of fermentation, *e.g.*, solutions of maltose fermented at 25° C. were more than twice as acid as those fermented at 10° C., other conditions being the same. Volatile acids constituted 8—10 per cent. of the total acids formed from maltose, 10—15·4 per cent. of those from lævulose and 16—24·6 per cent. of those from dextrose.—J. H. L.

Beer yeasts and cask-sediments : Crystals in ——. H Will. Z. ges. Brauw., 1913, **36**, 253—258, 269—273, 285—289.

In 1890 the author observed in certain beer yeasts and cask-sediments, besides the ordinary crystals of calcium oxalate, some flat prisms frequently in the form of crossed twins, soluble in potassium hydroxide solution and in concentrated acetic acid. The present investigation shows that : (1) these crystals consist of calcium oxalate, (2) they are of fairly general occurrence in beer yeasts and cask-sediments, (3) in general the number of crystals present in yeast or sediments is greater, the higher the original gravity of the beer wort, (4) all the crystalline forms of calcium oxalate are soluble in 10 per cent. (and still more readily in 20 per cent.) potassium hydroxide, (5) from such solutions thin hexagonal tablets separate, (6) crystals of calcium oxalate, tested microchemically with concentrated acetic acid, dissolve more or less readily according to their form and the conditions under which they were produced, and (7) calcium oxalate crystals present in yeasts and cask-sediments dissolve in distilled water, probably owing to the influence of other substances present.—J. H. L.

Distilleries ; Application of taka-koji in ——. N. C. Ortved. Eighth Int. Cong. Appl. Chem., 1912, Sect. VIb., Orig. Comm., **26**, 69—76.

Taka-koji, prepared by growing *Aspergillus oryzæ* on wheat bran, is recommended as a less expensive substitute for malt, for the saccharification of distillery mashes (cp. Takamine, this J., 1913, 444). A mash consisting of corn and rye, with 4 per cent. of this koji, is saccharified completely in 15—20 mins. at 50°—55° C. The subsequent fermentation (by *S. cerevisiæ*) is very rapid and complete and a high yield of alcohol is obtained. Fermentation is accompanied by a strong odour, and the alcohol obtained by a single distillation possesses a somewhat musty flavour which may however be completely removed by re-distillation in a column still without filtration through charcoal.—J. H. L.

PATENT.

Impregnating liquids with carbonic acid ; Apparatus for ——. A. A. Pindstoffe, Copenhagen. U.S. Pat. 1,064,535, June 10, 1913.

See Eng. Pat. 22,826 of 1911 ; this J., 1912, 508.—T. F. B.

XIXA.—FOODS.

Milk sugar ; Determination of —— in milk after precipitation with ammonium sulphate. E. Kretschmer. Z. physiol. Chem., 1913, **85**, 286—291.

The author recommends Salkowski's method for the polarimetric estimation of sugar in milk after precipitation of the albumin (see this J., 1912, 507) on the grounds of of rapidity, ease and lack of difficulty in getting an absolutely clear filtrate. The ammonium sulphate in solution does not materially affect the rotation (compare Jahnson-Blohm, this J., 1913, 304). The results of a large number of control experiments in comparison with the standard methods of analysis, using ordinary milk and also human milk and yoghurt, are given.—J. B.

Chemical investigation of cacao beans. Reutter. *See* XX.

PATENTS.

Edible lard from "hog-middles" ; Process for producing ——. E. F. Bloss, Cleveland, Ohio. U.S. Pat. 1,063,107, May 27, 1913.

"Hog-middles" are ripped, soaked in brine of about 70 per cent. strength for 3—12 hours, and immersed in boiling water for 5—20 minutes.—O. R.

Flour and bread ; Manufacture of ——. C. W. Chitty, Dover, and W. Jago, London. U.S. Pat. 1,063,414, June 3, 1913.

See Fr. Pat. 432,606 of 1911 ; this J., 1912, 148.—T. F. B.

XIXB.—WATER PURIFICATION ; SANITATION.

PATENTS.

Filtration [of water] ; Apparatus for multiplex —— under pressure. J. H. Missong. Ger. Pat. 260,096, Oct 5, 1912.

The water is pumped into an elevated reservoir whence it flows through the first filter into a receptacle. It is then pumped up into a second elevated reservoir, wherein it may be treated with chemicals, and whence, after settling, it passes through one or more other filters. Connections are provided so that the water may be passed first through any one of the filters.—A. S.

Waste water and the like; Treatment of ——. Richter und Richter, Frankfort on Maine, Germany. Eng. Pat. 11,614, May 15, 1912. Under Int. Conv., June 6, 1911.

See Fr. Pat. 443,789 of 1912; this J., 1912, 1005.—T.F.B.

Device for detecting suspended matter in gases. Eng. Pat. 21,199. *See* XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

"*Crude fibre*" *and cellulose; Determination of* —— [*in barks, etc.*] H. Matthes and F. König. Arch. Pharm., 1913, **251**, 223—240, 241—245.

A comparison of different methods with filter paper and cinchona bark showed that the best results are obtained by Cross and Bevan's chlorination process.—W. P. S.

Cinchona alkaloids; Synthetic bases closely allied to the ——. A. Kauffmann. Ber., 1913, **46**, 1823—1837.

When cinchonine is boiled for a long time with 0·1 per cent. hydrochloric acid a small amount of cinchotoxine is produced. This may be detected by means of its phenylhydrazone picrate which is produced by allowing phenylhydrazine to act in the presence of a slight excess of picric acid. It crystallises from glacial acetic acid in fine red crystals and melts with decomposition at 200° C. Cinchene was hydrolysed by heating to 180° C. with 25 per cent. phosphoric acid. *p*-Methoxylepidine was separated from the products of the reaction as the sparingly soluble phosphate, m.pt. 208°—210° C. The mother liquors from the phosphate contain meroquinine, m.pt. 222° C. The hydrochloride of the ethyl ester melts at 165° C. This ester can be readily reduced by means of hydrogen in the presence of palladium with the production of the saturated cincholoipone ester, which gives a hydrochloride crystallising from alcohol in fine white needles, m.pt. 158° C., and having $[\alpha]_D = +5{\cdot}71^\circ$ in water. The free basic ester boils at 140° C. at 14 mm. N-methylcincholoipone ethyl ester boils at 139° C. at 21 mm. Methyl-(6-ethoxyquinolyl-4)-ketone was dissolved in warm hydrobromic acid and treated with an excess of bromine. The hydrobromide of a bromomethyl derivative was formed, which melted at 207° C. The corresponding bromo-base $C_{13}H_{12}O_2NBr$, melts at 104°—105° C. when slowly heated. The salts of this bromo-ketone readily react with amines dissolved in benzene or ether, the bromine being replaced by the amino group. [Piperidinomethyl]-(6-ethoxyquinolyl-4)-ketone, $C_{18}H_{22}O_2N_2$, crystallises from alcohol in bright yellow leaflets, m.pt. 158° C., and forms a hydrobromide, m.pt. 189°—190° C. [Diethylaminomethyl]-(6-ethoxyquinolyl-4)-ketone, $C_{17}H_{22}O_2N_2$, melts at 131° C. after crystallising from alcohol, and forms a hydrobromide melting at 193°—194° C. [Dimethylaminomethyl]-(6-ethoxyquinolyl-4)-ketone, $C_{15}H_{18}O_2N_2$, crystallises from alcohol in yellow prismatic needles, m.pt. 132° C. These amino-ketones can be reduced by hydrogen in the presence of colloidal palladium to the amino-alcohols. β-Piperidino-α-hydroxy-(6-ethoxyquinolyl-4)-ethane, $C_{18}H_{24}O_2N_2$, crystallises from light petroleum in white needles and leaflets, m.pt. 85° C. The solution in sulphuric acid shows a bright blue fluorescence on dilution and gives an emerald green colouration when treated with chlorine water and ammonia. It has a considerable pharmacological resemblance to quinine. β-Diethylamino-α-hydroxy-(6-ethoxyquinolyl-4)-ethane, $C_{17}H_{24}O_2N_2$, has similar properties to the above base and gives a hydrochloride, m.pt. 171° C.
—F. Shdn.

Cacao beans; Chemical investigation of ——. L. Reutter. Comptes rend., 1913, **156**, 1842—1844.

Cacao beans, steamed at 110° C. for 10 mins. and freed from oils, were extracted with hot dilute methyl alcohol. The violet-red extract deposited microscopic white crystals of a new substance, "*cacaorine*," $C_{16}H_{20}O_6N_8$, m.pt. 184°—185° C. "*Cacaorine*" dissolves in water, forming neutral, optically inactive solutions which darken slightly in the air and yield precipitates with various reagents. When aqueous solutions are hydrolysed, theobromine and small quantities of a brownish-red precipitate are formed. A colouring matter, "cacao red," $C_{40}H_{60}O_{27}N$, was obtained, in the form of violet-red spangles, by concentrating *in vacuo* the mother liquor from which the "*cacaorine*" had crystallised. It is soluble in alcohol and water. Its aqueous solutions are coloured brownish yellow by dilute alkalis, bright red by dilute acids, blood-red by picric acid, green by copper acetate, and violet by ammoniacal zinc acetate, which also produces a slight greyish deposit. Although its solutions are optically inactive they become slightly dextrorotatory after hydrolysis with acids. and at the same time a small quantity of brownish precipitate, "cacao-brown" ($C_{76}H_{78}O_{34}N$) is formed.—J. H. L.

Rhamnoxanthin from Rhamnus cathartica and frangulin from R. frangula. N. Krassowski. J. Russ. Phys.-Chem. Ges., 1913, **45**, 188—193. Chem. Zentr., 1913, **1**, 2037.

Rhamnoxanthin (see this J., 1909, 326) and frangulin are shown to be identical. Frangulin when specially purified melts at 239°—241° C. in the air-dry condition and at 242°—243° C. after careful drying. It is usually contaminated by a small quantity of a substance of m.pt. 72° C. It crystallises with 1 mol. H_2O, not ½ mol. as previously reported, and on boiling with 12 per cent. hydrochloric acid yields 1 mol. each of rhamnose and emodin: $C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5$.—A. S.

β-Salicyl glucoside by the biochemical method; Synthesis of ——. E. Bourquelot and H. Hérissey. Comptes rend., 1913, **156**, 1790.

When emulsin acts upon glucose and saligenin in presence of a medium composed of pure acetone with a small amount of water β-salicyl glucoside is produced. It forms acicular crystals, is odourless, has a bitter taste, and is fairly soluble in water. When cautiously warmed, it begins to soften and agglomerate at 50°—60° C., then melts to a glassy, viscous mass, which loses weight slightly. Even after being kept for some hours at 120° C. it recrystallises on adding a few drops of water. It appears to contain four molecules of water of crystallisation. It is lævo-rotatory $\alpha_D = -37^\circ\,5'$. The glucoside reduces alkaline cupric tartrate reagent; its reducing equivalent is one-third that of glucose. The aqueous solution is rapidly hydrolysed by emulsin into saligenin and glucose. With ferric chloride it gives a bright violet colour, not removed by agitation with ether.

Essential oils; Constituents of ——. *Constitution of zingiberene. Conversion of the monocyclic zingiberene into the bicyclic isozingiberene.* F. W. Semmler and A. Becker. Ber., 1913, **46**, 1814—1822.

The naturally occurring zingiberene is a monocyclic butadiene with three double linkages. One of the latter is in the nucleus, the two others in the side chains. Zingiberene can be reduced by means of sodium and alcohol to the monocyclic dihydrozingiberene, $C_{15}H_{26}$, b. pt. 122°—125° C. at 7 mm., sp. gr. 0·8557 at 20° C. $n_D = 1{\cdot}4837$, and $[\alpha]_D = -37^\circ$. A monocyclic hexahydrozingiberene, obtained by reducing the crude zingiberene with platinum and hydrogen, boils at 128°—130° C. at 11 mm., has the sp. gr. 0·8264 at 20° C., $n_D = 1{\cdot}4560$, and $[\alpha]_D = -10^\circ\,12'$. The original hydrocarbon can be inverted by warming with a mixture of acetic and dilute sulphuric acids. Bicyclic isozingiberene is thereby produced, b. pt. 118°—122° C. at 7 mm., sp. gr. 0·9118, $n_D = 1{\cdot}5062$, and $[\alpha]_D = -51^\circ\,36'$. When treated with hydrogen chloride in ether, zingiberene and isozingiberene both yield the same dihydrochloride, m. pt. 169°—170° C. The dihydrobromide of the latter melts at 175° C., and yields isozingiberene when boiled with an alcoholic solution of potassium hydroxide. Isozingiberene was reduced by means of hydrogen in the presence of platinum when bicyclic tetrahydroisozingiberene was formed, b. pt. 123°—123·5° C. at 10 mm., sp. gr. 0·8822 at 20° C., $n_D = 1{\cdot}4791$, and $[\alpha]_D = +4°\ 36'$. Inversion and polymerisation take place when zingiberene is heated to 215° C.—F. Shdn.

Eucalypts of Tasmania and their essential oils. R. T. Baker and H. G. Smith. Papers and Proc. Roy. Soc. Tasmania, 1912. 139—209.

A comprehensive account, botanical and chemical, of the Eucalyptus species of Tasmania. The yields and characters of the different oils, with the exception of the well-known *E. globulus* oil, are summarised in the following table. The yields refer to the green leaves and branchlets, such as would be used for commercial distillation, and may in most cases be regarded as minimum yields.

Species.	Yield.	Sp. gr. at 15° C.	Opt. rotation, α_D.	Saponif. value.	Refractive index.	Solubility in alcohol.	Eucalyptol.	Chief constituents.
	per cent.						per cent.	
E. acervula ...	0·16	0·8956	— 1·1°	32·8	1·4756 at 18°	1 vol. 80% *	21	*d*-Pinene, phellandrene, eucalyptol, geraniol, geranyl acetate, solid and liquid paraffins, sesquiterpene.
E. amygdalina	1·90	0·8668—0·8148	— 59·1° to —75·1°	2·9—3·2	1·4761—1·4790 at 18°	7 vols. 70%—1 vol. 80%	12—24	Phellandrene, eucalyptol, piperitone, sesquiterpene.
E. coccifera	0·61	0·8810	—35·8°	4·9	1·4831 at 24°	insoluble in 10 vols. 80%	under 5	Phellandrene, eucalyptol, piperitone, eudesmol.
E. cordata....	2·32	0·9138	+ 9·3°	14·8	1·4695 at 16°	1¼ vol. 70%	62	Eucalyptol, *d*-pinene, esters.
E. Delegatensis	1·52	0·8664	—48·4°	3·1	1·4828 at 24°	insoluble in 10 vols. 80%	traces	Phellandrene, piperitone, sesquiterpene.
E. Gunnii....	0·39	0·9014	+ 1·5°	6·7	1·4752 at 18°	4 vols. 80%	41	*d*-Pinene, phellandrene, eucalyptol, esters, sesquiterpene.
E. linearis ...	1·45	0·9096	—10·2°	5·8	1·4659 at 24°	6 vols. 70%	52	Eucalyptol, phellandrene, piperitone, sesquiterpene.
E. Muelleri ..	1·28	0·9096	+10·4°	15·3	1·4629 at 24°	4 vols. 70%	60	Eucalyptol, *d*-pinene, esters.
E. obliqua....	0·7	0·8836—0·8845	—24·2° to —28·8°	7·2—8·1	1·4839 at 19°—1·4852 at 24°	3—4 vols. 70%	under 5	Phellandrene, eucalyptol, aromadendral.
E. Perriniana	1·01	0·9119	+ 8·9°	10·3	1·4651 at 15°	2 vols. 70%	68	Eucalyptol, *d*-pinene, esters, sesquiterpene.
E. phlebophylla	1·01	0·8925	—22·4°	3·2	1·4761 at 18°	insol. 10 vols. 80%	9	*l*-Pinene, phellandrene, eucalyptol, eudesmol.
E. regnans ...	0·80	0·8802—0·8879	—28·4° to —31·1°	13·2—15·4	1·4882 to 1·4901 at 20°	5 vols. 80%	traces	Phellandrene, eudesmol, piperitone, esters, sesquiterpene.
E. Risdoni ..	1·38	0·9045—0·9145	—0·3° to —14·6°	21·3—27	1·4660 at 19° to 1·4733 at 16°	1¼—5 vols. 70%	56—58	Eucalyptol, phellandrene, piperitone, esters.
E. Rodwayi ..	0·48	0·9075	+10·6°	3·9	1·4653 at 24°	6 vols. 70%	64	Eucalyptol, *d*-pinene, sesquiterpene.
E. tæniola ..	0·66	0·8864	—27·6°	3·2	1·4872 at 17°	5 vols. 80%	7	Phellandrene, eucalyptol, piperitone, eudesmol, sesquiterpene.
E. urnigera ..	1·13	0·9088	+11·8°	18·3	1·4638 at 23°	5 vols. 70%	63	Eucalyptol, *d*-pinene, esters.
E. unialata...	0·9	0·9179	+ 3·1°	11·1	1·4690 at 18°	1¾ vol. 70%	62	Eucalyptol, *d*-pinene, esters, sesquiterpene.
E. vernicosa .	0·76	0·9038	+11·3°	5·9	1·4651 at 18°	1 vol. 80%	59	Eucalyptol, *d*-pinene.
E. viminalis .	0·54	0·9154	+ 4·2°	9·5	1·4711 at 19°	1 vol. 80%	50	Eucalyptol, *d*-pinene, phellandrene, esters, sesquiterpene.
E. virgata ...	0·79	0·8883	—20·9°	3·3	1·4819 at 18°	3 vols. 80%	21	Phellandrene, eucalyptol, piperitone, eudesmol, sesquiterpene.

* The alcohol percentage is by weight.

Besides *E. globulus*, the following species yield oils containing over 50 per cent. of eucalyptol, and are free from phellandrene and piperitone, the principal terpene being pinene:—*E. cordata*, *E. Muelleri*, *E. Perriniana*, *E. Rodwayi*, *E. unialata*, *E. urnigera*, *E. vernicosa*. It is suggested that the disfavour with which the presence of phellandrene is regarded in oils destined for pharmaceutical purposes, is scarcely warranted. If the presence of phellandrene were not condemned, *E. Risdoni* and, to a lesser degree, *E. linearis*, would be very suitable as sources of commercial eucalyptus oil, though the official standard for sp. gr. would have to be reduced to 0·905 at 15° C. Several of the species yield phellandrene oils for which there is a good demand in connection with mineral separation (flotation) processes. For example *E. Delegatensis* is used somewhat extensively as a timber-producing tree, and it would probably prove profitable to utilise the leaves (wasted at present) for oil extraction. The *E. amygdalina* of Tasmania is a different species from the tree known by that name in Australia (*E. amygdalina*, var. *Australiana* is proposed as name for the latter); its oil contains much less eucalyptol, more phellandrene, and is much less soluble in alcohol than the Australian oil, and it also has a very high lævo-rotation.—A. S.

Hydroxylamine; Determination of——. E. Rupp and H. Mäder, Arch. Pharm., 1913, **251**, 295—300.

Twenty-five c.c. of a bromate-bromide solution (3·35 grms. $KBrO_3$ and 15 grms. KBr per litre, standardised by $N/10$ thiosulphate) are treated successively with 100 c.c. of water, a quantity of hydroxylamine solution containing not more than 0·01 grm. of the base, and 10 c.c. of dilute sulphuric acid. After 30 mins., 1 grm. of potassium iodide is added and the liberated iodine is titrated with $N/10$ thiosulphate solution. The quantity of bromine consumed, expressed in c.c. of $N/10$ thiosulphate, is multiplied by 0·001158 to give the amount of hydroxylamine hydrochloride present.—W. P. S.

Farnesol; The aliphatic sesquiterpene alcohol ——. M. Kerschbaum. Ber., 1913, **46**, 1732—1737.

The seeds of musk (*Hibiscus Abelmoschus L.*) contain about 0·12 per cent. of the aliphatic sesquiterpene alcohol farnesol,

$(CH_3)_2C : CH{\cdot}CH_2{\cdot}CH_2{\cdot}C(CH_3) : CH{\cdot}CH_2{\cdot}CH_2{\cdot}C(CH_3) : CH{\cdot}CH_2{\cdot}OH.$

After saponifying the ethereal extract of the seeds, the alkaline liquors are extracted with ether, and the farnesol then isolated by means of its phthalic acid ester, and subsequent fractionation. Its characters are: b. pt. 160° C. at 10 mm.; sp. gr. 0·885 at 18° C., $n_D = 1{\cdot}48809$, $a_D = \pm 0°$. The acetate boils at 169°—170° C. at 10 mm. When oxidised by means of chromic acid in dilute sulphuric acid an aldehyde, farnesal, $C_{15}H_{24}O$, is produced. This boils at 172°—174° C. at 14 mm., has the sp. gr. 0·893 at 18° C., $n_D = 1{\cdot}49951$, and is optically inactive. The semicarbazone crystallises from ethyl acetate in soft leaflets melting at 133°—135° C. Farnesal oxime was converted into the nitrile and hydrolysed with an alcoholic solution of sodium hydroxide with the formation of farnesenic acid (b. pt. 202°—206° C. at 16 mm.), acetic acid and dihydropseudoionone, $C_{13}H_{22}O$. The semicarbazone of the latter crystallises from a mixture of ethyl acetate and light petroleum in leaflets melting at 95°—96° C.—F. Shdn.

Farnesol. C. Harries and R. Haarmann. Ber., 1913, **46**, 1737—1741.

The constitution assigned to farnesol (see preceding abstract) is borne out by the results of oxidation with ozone. When boiled with water, the trïozonide yields acetone, lævulinic aldehyde, lævulinic acid, and formic and acetic acids.—F. Shdn.

Ketones and aldehydes; Reduction of —— to the corresponding hydrocarbons by means of amalgamated zinc and hydrochloric acid. E. Clemmensen. Ber., 1913, **46**, 1837—1843.

A considerable excess of granulated zinc is digested for about an hour with 5 per cent. mercuric chloride solution. The liquid is poured away, and the aldehyde or ketone to be reduced is added without washing or drying the metal. Hydrochloric acid (1 : 1) is then added to cover the zinc and the whole is warmed under a reflux condenser for some hours. Fresh hydrochloric acid is added as required to maintain a brisk evolution of hydrogen. In this way numerous fatty-aromatic ketones have been satisfactorily reduced (*e.g.*, acetophenone to ethyl benzene, methyl benzyl ketone to *n*-propylbenzene, methyl-α-naphthyl ketone to α-ethylnaphthalene) as well as aromatic aldehydes (benzaldehyde to toluene), and aliphatic aldehydes and ketones (*e.g.*, methyl-*n*-heptadecyl ketone to *n*-nonadecane, stearone to pentatriacortane, œnanthaldehyde to *n*-heptane).—W. H. P.

Acetone; Purification of —— by means of sodium iodide. K. Shipsey and E. A. Werner. Chem. Soc. Proc., 1913, 29, 194.

It has been shown that sodium iodide can unite with acetone to form a crystalline compound having the composition $NaI,3C_3H_6O$. Experiments have now been made which show that acetone in a high degree of purity can be prepared from the commercial article in a very simple manner by the aid of sodium iodide. The hydrated salt $NaI,2H_2O$ may be used with advantage on account of its ready solubility in acetone; the solution when cooled to about —8° C. gives a very good yield of the above compound, and it is possible to obtain 70 per cent. of the acetone in a pure state in a single operation. The purified acetone was found to be quite equal to that prepared by the rather tedious bisulphite process.

Catalytic oxidations at high temperatures. [*Formaldehyde from methyl alcohol.*] S. Fokin. J. Russ. Phys.-Chem. Ges., 1913, **45**, 286—288. Chem. Zentr., 1913, **1**, 2016.

When methyl alcohol vapour mixed with air was passed over different metals capable of acting as oxidation catalysts, the order of activity was found to be as follows: Co 2·8 per cent., Ni 1·08, Al 1·5, Mn 2·01, Pt 5·2, Cu 43—47, Ag 64—66, Au 71, and Cu+Ag 84 per cent. of formaldehyde. In other comparative experiments the order of efficiency was $Au < Cu < Ag$.—A. S.

Patents.

Butadiene and its homologues; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss, London. Eng. Pat. 12,771, May 30, 1912.

The anhydride (oxide) of the corresponding glycol is halogenated directly by means of a halogen acid, a phosphorus halide, etc., and two mols. of the hydrohalogen acid are subsequently removed from the dichlorohydrocarbon to produce butadiene or a homologue. The glycol anhydrides may be dehydrated directly to form the unsaturated hydrocarbon, *e.g.*, by the process described in Eng. Pat. 3873 of 1912 (this J., 1913, 449). Again, the corresponding chlorhydrin may be dehydrated to form the unsaturated chloride, from which the halogen acid is finally removed. This may be effected by heating with an alkali, a formate, a carbonate, lime, or quinoline.
—T. F. B.

Tetrodotoxin and process of extracting the same. Y. Tahara, Tokyo. U.S. Pat. 1,058,643, April 8, 1913.

The viscera of *Tetrodon* is repeatedly extracted with dilute solutions of formaldehyde, the albuminous substances are separated from the combined extracts by heating, and lead acetate or baryta is added to the liquid to precipitate other impurities. The tetrodotoxin is then precipitated by means of a heavy metal salt in presence of alkali, and subsequently separated from the heavy metal salt. The solution is now evaporated to a syrup and precipitated by alcohol and ether; the inositol is removed by fractional crystallisation and the basic organic impurities by addition of mercuric chloride, after which the pure toxin is precipitated by alcohol and ether.—T.F.B.

Nitrohydroxystibinic acids; Process for preparing aromatic ——. Chem. Fabr. von. Heyden. Ger. Pat. 259,875, Dec. 24, 1911.

Nitro compounds of aromatic aminostibinic acids are heated with caustic alkali lyes until no more ammonia is evolved, nitrohydroxyarylstibinic acids being produced (see also Eng. Pat. 16,350 of 1912; this J., 1913, 109).
—T. F. B.

Thiourea from cyanamide; Process for preparing ——. H. Kappen. Ger. Pat. 260,061. Nov. 1, 1911.

Thiourea may be obtained by treating dilute aqueous solutions of cyanamide with hydrogen sulphide at high temperatures. The addition of acid or alkaline agents, and of soluble sulphur compounds of arsenic, antimony, or tin, increases the efficiency of the process. The reaction may be effected in closed vessels under pressure, the hydrogen sulphide being introduced through a number of orifices.—T. F. B.

Alkaloids of the morphine group; Process for preparing hydrogenated ——. H. and B. Oldenberg. Ger. Pat. 260,233, June 22, 1911.

Alkaloids of the morphine group are converted into hydro-compounds by the action of molecular hydrogen in presence of colloidal palladium as catalyst. The medicinal properties of the products differ considerably in some respects from those of the original alkaloids; for instance, the physiological effects of hydromorphine are more lasting than those of morphine itself.—T. F. B.

Isovalerylglycollic acid thymol ester; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 260,471, Nov. 25, 1911. Addition to Ger., Pat. 252,157 (see this J. 1912, 1201).

ISOVALERYLGLYCOLLIC acid thymol ester, prepared in the ordinary manner from thymol and isovaleric acid, possesses physiological properties similar to those of the esters described in the chief patent. It is an almost odourless, yellowish liquid, of sp. gr. 1·037 and b. pt. 207°—209° C. at 19 mm.—T. F. B.

Orange leaves; Production of a solid preparation, suitable for use as a soporific agent, from ——. F. Hoffmann-La Roche und Co. Ger. Pat. 260,481, Feb. 1, 1912.

AN aqueous extract of orange leaves is evaporated at a low temperature to a syrupy consistency, and the residue is treated with alcohol. A greyish-yellow powder is precipitated, which contains the soporific principle in the form of a glucoside.—T. F. B.

Bean shells; Process for preparing "tea" from ——. M. Lorenz und Co. Ger. Pat. 260,528, Aug. 30, 1912.

DRIED bean shells are cut into fragments which are provided with a coating of equal parts of agar-agar and tragacanth: they are then roasted for four or five hours in a roasting-drum at 100°—110° C., and the gelatinous coating is separated by mechanical means. The gelatinous coating serves to prevent loss of active constituents during roasting. "Tea" prepared from the product may be used as a diuretic.—T. F. B.

Ester sulphuric acids from oxy-acid esters of the alkamines and their alkylammonium salts; Process for the manufacture of ——. R. C. Ade, and The Hoffmann-La Roche Chemical Works, Ltd., London. Eng. Pat. 12,237, May 23, 1912.

SEE Ger. Pats. 247,455, 247,456, and 247,457 of 1911; this J., 1912, 796.—T. F. B.

Cholic acid; Manufacture of a [strontium] salt of ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 27,695, Dec. 2, 1912. Under Int. Conv., Dec. 1, 1911.

SEE Ger. Pat. 254,530 of 1911; this J., 1913, 110.—T.F.B.

Hydrogen peroxide compounds [with hexamethylenetetramine]; Process of producing stable ——. M. Hartmann and E. Jacoby, Munich, Germany. U.S. Pat. 1,063,679, June 3. 1913.

SEE Eng. Pat. 29,373 of 1912; this J., 1913, 672.—T. F. B.

Unsaturated compounds; Process of preparing hydrogenised products from ——. A. Skita, Karlsruhe, Assignor to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 1,063,716, June 3, 1913.

SEE Fr. Pat. 447,420 of 1912; this J., 1913, 253.—T.F.B.

Hexamethylenetetramine; [Camphoric acid] salt of —— *and process of making same.* A. Kircher, Sindlingen, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,064,227, June 10, 1913.

SEE Eng. Pat. 21,728 of 1912; this J., 1912, 1147.—T.F.B.

Manufacture of halogenated rosanilines. Eng. Pat. 14,742. *See* IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Sensitiveness to light of silver, mercuric, lead, and cuprous azides; basic lead and cupric azides. Wöhler and Krupko. *See* VII.

PATENT.

Toning-bath for photographic silver prints. P. Rehländer, Charlottenburg, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,064,379, June 10, 1913.

A SALT of an acid containing selenium, *e.g.*, selenosulphuric acid, is used as a constituent of the toning bath.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

[*Coal dust explosions.*] *Explosions in Coal Mines Committee.* Fourth Report. *See* IIA.

PATENTS.

Explosives; Manufacture of ——. D. D. Robertson, London, and M. Wollenweber, Hayle, Cornwall. Eng. Pat. 10,062, April 27, 1912.

NITROCELLULOSE (65 to 95 parts), nitroglycerin (5 to 35 parts), and diphenylamine (0·1 to 1 part) are incorporated with ether-alcohol, and pressed into strips or cords, or cut into grains. The powder is waterproofed with a solution of camphor, and, after drying, is dipped into a 20 per cent. solution of potassium tartrate. After re-drying, the powder is polished with graphite. Camphor may be employed up to 2 per cent., and potassium tartrate from 0·2 to 2 per cent. The treatment is intended to render the powder flameless and smokeless. Nitroglycerin may, if necessary, be omitted from the powder.—G. W. McD

Explosives from glycols or their oxides; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss, London. Eng. Pat. 12,770, May 30, 1912.

EXPLOSIVES are produced by nitrating glycols having the hydroxyl groups attached to neighbouring carbon atoms, or the corresponding oxides. The nitrated glycols may be mixed with equal weights of nitroglycerin and nitrocotton to form explosives.—G. W. McD.

Black powder or other blasting charges; Composition for coating pellets of ——. Curtis's and Harvey, Ltd., London, and C. L. Watson-Smith, Faversham, Kent. Eng. Pat. 16,111, July 10, 1912.

THE pellet, or blasting charge, is coated with a mixture of paraffin wax (13 parts) and aluminium (1 part). This coating gives the pellet a colour and lustre which renders its detection in coal quite easy, and thus diminishes the danger arising from the unrecognised presence of unexploded blasting charges in coal.—G. W. McD.

Safety explosives; Manufacture of ——. Ver. Köln-Rottweiler Pulverfabriken. Ger. Pats. 260,311, Oct. 29, 1910, 260,312, Dec. 13, 1910, and 260,313, Dec. 9, 1911.

(1) ALKALI salts of nitrocresolsulphonic acids, especially the ammonium salt, are mixed with alkali nitrates, with or without addition of trinitrotoluene or other suitable substances. (2) Salts of sulphonated mononitro-phenols are intimately mixed with oxygen-carriers. (3) Explosives which can be detonated by a fuse, without a detonator, are prepared by mixing ammonium nitrate with salts of mono-, di-, and trinitrophenols, or mono-, di-, and trinitrocresols (with the exception of the ammonium salts of trinitrophenol and trinitrocresol) or of their sulphonic acids.—A. S.

Explosive compositions for use in detonators. E. Herz, Vienna. Eng. Pat. 27,198, Nov. 26, 1912.

See Fr. Pat. 450,897 of 1912; this J., 1913, 627.—T. F. B.

Nitrocellulose-nitroglycerin powder; Smokeless —— and method of making the same. F. A. Ritschke, Geesthacht, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,063,469, June 3, 1913.

See Fr. Pat. 434,112 of 1911; this J., 1912, 258.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Cadmium from zinc; Separation of ——. W. D. Treadwell and K. S. Guiterman. Z. anal. Chem., 1913, **52**, 459—470.

The separation of cadmium from zinc by hydrogen sulphide is best carried out in hot (4—5 *N*) sulphuric acid solution, the gas being passed until the solution has cooled. The quantity of zinc precipitated is less than in hydrochloric acid solution, but if more zinc than cadmium be present, the sulphide precipitate must be re-dissolved in warm dilute hydrochloric acid (1 : 1), the solution evaporated and heated with a slight excess of sulphuric acid, and the precipitation repeated. Separation by electrolysis is more rapid and convenient than the sulphide method. With not more than 1 grm. of cadmium plus zinc, this may be carried out in oxalate solution at 70°—80° C., with a gauze electrode. 8 grms. of potassium oxalate, 6 grms. of ammonium oxalate, and 0·3—0·5 grm. of oxalic acid are added to the sulphate, or chloride, solution, which is then electrolysed for 4—5 hours (with 0·1 grm. of cadmium), the current being 0·03 amp. and the E.M.F. at the terminals 1·4—1·6 volt; a condenser is arranged to prevent evaporation of the electrolyte. From cold sulphuric acid solution, 0·04—0·2 grm. of cadmium may be separated electrolytically in the presence of 50 times the quantity of zinc, the neutral sulphate solution acidified by adding 5 grms. of sodium bisulphate, and electrolysis being effected with a rapidly rotating electrode; a smooth cathode is employed and the cathode current density made as nearly uniform as possible. The deposition of 0·2 grm. of cadmium requires 30—60 minutes.—F. Sodn.

Chromium in the presence of iron; Volumetric determination of ——. A. Kurtenacker. Z. anal. Chem., 1913, **52**, 401—407.

The solution is treated with an excess of bromine water, then made strongly alkaline with potassium hydroxide, heated, with frequent agitation, for half-an-hour on the water-bath, cooled, made up to 250 c.c., and filtered through a dry filter. 100 c.c. of the filtrate are neutralised by adding dilute sulphuric acid until the colour of bromine becomes permanent, 20 c.c. of 30 per cent. potassium bisulphate solution are added, and the mixture is boiled vigorously for 5 minutes. Chromate is determined iodometrically in the cooled liquid, but should any odour of bromine be observed after boiling (thus indicating undecomposed bromate), a further 10 c.c. of bisulphate solution must be added and the boiling repeated before titration. The residual ferric hydroxide is dissolved and titrated in the usual way.—F. Sodn.

Iron from chromium; Separation of ——. F. Bourion and A. Deshayes. Comptes rend., 1913, **156**, 1769—1771. (See also this J., 1912, 559.)

The ignited oxides are gradually heated from 200° C. to 650° C., and then maintained at the higher temperature for 3—4 hours in a very slow stream of chlorine carrying sulphur chloride vapour from the liquid kept at 30°—40° C. If the chromium is likely to be more than 40 per cent. of the total metal, the oxides are first mixed with their own weight of ammonium sulphate, and the mixture is gradually heated in a stream of chlorine only till all the sulphate is decomposed and volatilised; the porous mass remaining is then exposed to the mixed chlorine and sulphur chloride. The boat, and the portions of the tube containing any volatilised chlorides, are then treated with cold water, which dissolves the ferric chloride completely, and leaves the chromic chloride undissolved. From the weight of chloride that of the chromium sesquioxide is calculated, whilst the iron is precipitated by ammonia from the solution of ferric chloride.—J. T. D.

Determination of sulphur in illuminating gas. McBride and Weaver. *See* IIa.

Determination of phenol in crude carbolic acid and tar oils. Weiss. *See* III.

Analysis of amyl acetate and collodion. Chercheffsky. *See* V.

Distinguishing sulphite- and sulphate-pulp in paper. Schwalbe. *See* V.

Gas-analytical determination of nitric oxide and oxygen based on the formation of nitrous anhydride. Klinger. *See* VII.

Determination of active oxygen in perborates and detergents containing perborates. Litterscheid and Guggiari. *See* VII.

Determination of polythionate in presence of thiosulphate and free sulphur dioxide. Feld. *See* VII.

Determination of organic matter in clay. Ehrenberg and others. *See* VIII.

Proportionate determination of cocoanut and palm-kernel oil in mixtures. Burnett and Revis. *See* XII.

Examination of the Kumagawa-Suto fat-determination method with regard to oxidation of the fatty acids and unsaponifiable matter during the process. Tamura *See* XII.

Weight-giving properties of tanning materials as estimated in the laboratory. Wisdom. *See* XV.

Determination of milk sugar in milk after precipitation with ammonium sulphate. Kretschmer. *See* XIXa.

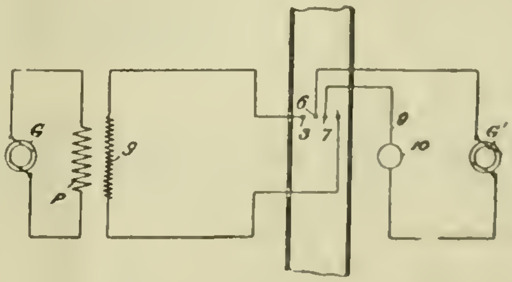
Determination of "crude fibre" and cellulose [in barks, etc.] Matthes and König. *See* XX.

Determination of hydroxylamine. Rupp and Mäder. *See* XX.

Patents.

Gases; Device for detecting suspended matter in ——. W. W. Strong, Mechanicsburg, Pa., U.S.A. Eng. Pat. 21,199, Sept. 17, 1912.

The generator, G (see Fig.), is connected with the primary, P, of a transformer, in which the current is converted,



by a secondary, S, to about 30,000 to 40,000 volts. Between the terminals, 3, and 4, respectively, placed inside the chimney stack, are the terminals, 6, and 7, the former being connected with a low-tension generator, G, and the latter with a bell, 10, which in turn is connected with G′. The terminals, 3, and 4, are so far apart that under ordinary conditions there will be no sparking between them. When the space surrounding the terminals contains a sufficient quantity of suspended matter, as, for instance, air containing smoke or other products of combustion, a conductive bridge will be formed between the terminals and sparks will pass between 3 and 4. The air insulation between the terminals, 6 and 7, will be broken down during the time of the passage of the sparks between 3 and 4, and the resulting short circuit causes the current to flow through and ring the bell, 10.—G. W. McD.

Testing air or other gases ; Apparatus for ——. M. Arndt, Aix-la-Chapelle, Germany. U.S. Pat. 1,063,946, June 10, 1913.

SEE Eng. Pat. 462 of 1910 ; this J., 1910, 724.—T. F. B.

Books Received.

REPORT ON THE PROGRESS OF AGRICULTURE IN INDIA FOR 1911-12. By BERNARD COVENTRY. Agricultural Adviser to the Govt. of India. Superintendent Government Printing, Calcutta, India, 1913. Price 7d. Volume (9¾ × 7 ins.), containing 65 pages subject matter, with two maps and tables.

DISINFECTION AND DISINFECTANTS. By M. CHRISTIAN. Physician in Chief, Royal Institute for Infectious Diseases, Berlin. Translated by Charles Salter. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 1913. Price 5s. net.

VOLUME (7½ × 5 ins.) containing 112 pages of subject matter with 18 illustrations, and an alphabetical index. The text is classified as follows :—I. Introductory. II. Physical disinfection. (i) Heat. (ii) Light and other rays. (iii) Electric currents, and mechanical influences. III. Chemical disinfection. (i) Liquid disinfectants. (ii) Gaseous disinfectants. IV. Combined systems of disinfection. (i) Gärtner's method of disinfecting books. (ii) Formalin vapour method.

FARBSTOFFTABELLEN. Von Dr. GUSTAV SCHULTZ. Professor der Chemischen Technologie an der K. Technischen Hochschule zu München. (Fünfte Auflage der tabellarischen Uebersicht der künstlichen organischen Farbstoffe von G. Schultz und Paul Julius). Lieferungen 8 und 9. Weidmannsche Buchhandlung. Berlin. 1913. Price of each number M. 3.

PARTS 8 and 9 of this work are now issued. Part 8, commences with page 281, and dyestuff No. 811 (Argolgelb), and ends on page 320, with a series of inorganic or mineral colours, the first being No. 940 (Blanc fixe). Part 9 begins on page 321, with a continuation of the mineral colours and ends on page 360, with No. 1001 (Rotholzlack).

DIE ELECTROLYTISCHE ALKALICHLORIDZERLEGUNG MIT FESTEN KATHODENMETALLEN. Herausgegeben von Dr. JEAN BILLITER. II. Teil. Beschreibung ausgeführter Anlagen usw. Wilhelm Knapp's Verlag. Halle (Saale). 1913. Price M. 9.60.

FOR the notice of Part I, see this J., 1912, 610. Part II forms a volume (9¾ × 6¾ ins.) containing 180 pages of subject matter with 52 illustrations, and an alphabetical index of names. The subject matter receives the following classification :—I. Arrangement of the different types of cells. II. The Griesheim-Elektron process. III. Vertical diaphragm cells, in which the electrolyte is moved from the anode to the cathode. IV. Cells with horizontal diaphragms, etc. V. Cells without diaphragms, in which the cathodes are arranged under the anodes. VI. Cells without diaphragms with cathodes arranged below the anodes, and having hoods for leading away the gas.

TABLES ANNUELLES DE CONSTANTES ET DONNÉES NUMÉRIQUES DE CHIMIE, DE PHYSIQUE ET DE TECHNOLOGIE. Publiées sous le Patronage de l'Association internationale des Académies, par le Comité international nommé par le VIIe Congrès de Chimie Appliquée (Londres, 2 Juin, 1909). Volume II. Année 1913. Gauthier-Villars. Paris. Akademische Verlagsgesellschaft, m.b.H., Leipzig. J. and A. Churchill, 7, Great Marlborough Street, London, W. 1913. University of Chicago Press, Chicago. Price 25s. 6d. net (paper), 28s. 6d. net (cloth).

QUARTO volume similar to Vol. I (this J., 1912, 562), and measuring 11 × 9½ in. It contains 758 pages of subject matter and 1 page of errata. The heads under which the tabulated matter, constants, and other data are arranged, have already been given in considering Vol. I. (this J., 1912, 562).

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1912. [Cd. 6852.] Wyman and Son, Fetter Lane, London, E.C. Price 2s. 5d.

VOLUME containing 274 foolscap pages, 13 × 8½ ins.

ANNUAL REPORT ON THE MINERAL PRODUCTION OF CANADA IN 1911. By JOHN MCLEISH. Report No. 201. Canada Dept. of Mines, Mines Branch, Ottawa.

CONTAINS 316 pages, 9¾ × 6½ ins., giving detailed reports of the production of various minerals and metals during 1911.

THE MAGNETIC IRON SANDS OF NATASHKWAN, COUNTY OF SAGUENAY, PROVINCE OF QUEBEC. By GEORGE C. MACKENZIE. Report No. 145, Canada Dept. of Mines, Mines Branch, Ottawa.

CONTAINS 48 pages, 9¾ × 6½ ins., together with 31 drawings and photographs, and three maps.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

I. *Thoren*, J. : Apparate zur Verbesserung der Dampfökonomie. Speisewasserreiniger, Vorwärmer, Dampfentöler, Wassermesser etc. Eigene geschützte Konstruktion. Probelieferung. (12 S. m. 14 Taf.) 8°. Leipzig, G. Schlemminger. 1913. In portfol. M. 4.50.

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IIA. *Engelbach*, H. : Notes et observations sur l'industrie houillère aux Etats-Unis, 91 fig., 5 pl., in-8°. Paris. Dunod et Pinat. 1913. 8 fr.

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VIII. *Jahrbuch* der österreichischen Bau- u. keramischen Industrie. (Industrie der Steine u. Erden, Glas u. Porzellan.) [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1913. (XVI, 268, 31 S., S. 284—332 u. 2377—2986.) 8°. Wien, Compassverlag. 1913. Cloth M. 4.60.

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PROCEEDINGS

OF THE

THIRTY-SECOND ANNUAL MEETING.

LIVERPOOL,

WEDNESDAY, JULY 16TH, 1913.

The Thirty-Second Annual General Meeting of the Society was held in the Victoria Buildings, Liverpool University, on Wednesday, July 16th, 1913, the President, Prof. Marston T. Bogert, being in the chair.

Sir J. S. Harmood Banner, M.P., Lord Mayor of Liverpool, said it was his proud position to welcome the Society of Chemical Industry to Liverpool, a city which was very actively engaged in chemical industries. They were proud of the men who had done so much to further those industries, and they were very glad to have the privilege of welcoming all those who were attending the meeting, and especially those from the United States and the Colonies.

Professor Bogert, on behalf of the Society, thanked the Lord Mayor for the graceful and warm welcome he had given them to that city. Chemistry, of course, was so intimately interwoven throughout their present-day civilisation, that practically all of their industries and branches of social life were connected with it and interested in it. In the winning of metals, in the production of coal, in devising new and useful specifics, or in the using of new and valuable products, chemistry always led the way, and yet it was surprising that the public were so ignorant of the accomplishments of chemistry. They were very grateful to the Lord Mayor for the kind words he had spoken to them.

The Secretary then read the Minutes of the Annual Meeting at New York, in 1912, which were adopted.

ELECTION OF SCRUTATORS.

On the motion of Professor W. R. Lang seconded by Mr. Julius Hübner, Dr. J. T. Barker and Mr. E. V. Evans were appointed scrutators for the ballot for members of the Council.

REPORT OF THE COUNCIL.

The Report of the Council was then read by the Secretary, as follows:—

The number of members on the register is now 4244 as compared with 4285 at the last Annual Meeting. During the year 200 new members have been elected as compared with 237 last year; and the losses have been 257 as compared with 253 last year.

The losses by death amount to 31 as compared with 49 last year, viz.:—J. Baur, J. Carter Bell, B. Biggs, E. F. Billings, G. R. Brydone, G. Burdekin, A. C. Claudet, A. J. Clayton, W. Colbert, M. H. Coupe, G. W. Davies, D. Cecil Gibbs, John Heron, Horton Johnson, T. Tolley Jones, Dr. W. F. Laycock, T. D. Lichtenstein, Dr. Morris Loeb, John McArthur, Dr. W. McMurtrie, H. de Mosenthal, Dr. G. B. Neave, E. J. Pritchard, Sir Robert Pullar, Dr. L. Schaefer, Dr. F. Schniewind, M. A. Scovell, E. C. Spurge, F. W. Keating Stock, J. H. Thwaites, F. Vorster.

Four Ordinary Members retire from the Council and to fill the vacancies thus created, six nominations have been received. A Ballot is therefore requisite.

The following Chairmen of Local Sections retire: viz., Mr. E. C. Rossiter (Birmingham), Prof. Wallace P. Cohoe (Canada), Prof. F. G. Donnan (Liverpool), Dr. G. J. Fowler (Manchester), Mr. C. L. Gagnebin (New England), Prof. M. C. Whitaker (New York) and Mr. S. R. Trotman (Nottingham). The following have been elected to succeed them:—Mr. H. T. Pinnock, Prof. R. F. Ruttan, Prof. E. C. C. Baly, Mr. Julius Hübner, Mr. S. W. Wilder, Mr. G. W. Thompson, and Sir John Turney. The Council desires to express its thanks to the retiring Chairmen for their services to the Society. The only change among the Hon. Local Secretaries is the election of Dr. G. S. Cruikshanks by the Scottish Section, to succeed the late Dr. G. B. Neave.

The Journal in 1912 contained 1204 pages of text besides Patent Lists, Supplements and Advertisements as compared with 1478 pages in 1911.

The Balance Sheet and Annual Statement of Account, which has already appeared in the June 30th number of the Journal, will be laid before the meeting.

After the Annual General Meeting in New York and the conclusion of the Eighth International Congress of Applied Chemistry, Dr. Messel in his capacity as President of the Society, accompanied by the Secretary, visited the Sections of the Society in New England and Canada, and everywhere met with a most cordial reception.

Later in the year the President, Prof. Bogert, also visited these Sections before coming to England, and was again most cordially received. The Council feels that it is a great advantage to the Society that both Dr. Messel and Prof. Bogert should have been able to visit these distant Sections.

At the meeting of the Council of the International Association of Chemical Societies at its meeting in April, 1912, resolutions were passed recommending unification in the sizes of scientific journals and the exclusive use of the metric system in chemical literature, and deprecating the introduction of fresh nomenclature until the question should have been formulated by the Association. Upon the advice of a Committee specially appointed to consider and report on these resolutions, the Council felt itself unable to recommend any alteration in the size of the Society's Journal, or the exclusive use of the decimal system therein so long as that system is not obligatory in this country, but agreed in deprecating the indiscriminate use of fresh nomenclature.

At a conference of Chemical Societies concerned with the publication of abstracts information was requested from this Society with the object of devising a scheme for the publication of abstracts in such a way as to avoid the present practice of multiple abstracting and printing. On furnishing the desired particulars, the Council stated that it was still of opinion that this Society should take no part in any scheme of joint abstracts, on the ground that abstracts of a special character were necessary in Applied Chemistry.

Dr. Messel has been appointed as the representative of the Society on the Board of Governors of the Imperial College of Science and Technology for a further term of four years.

The second volume of International Annual Tables of Constants has now appeared. As the undertaking is of value to science but not as yet self-supporting, the Council has made a further grant towards the cost.

The Council has accepted an invitation from the City of Nottingham to hold the Annual General Meeting in that city in 1914.

On the motion of Mr. T. W. Stuart, seconded by Mr. J. F. Stark, the Report was adopted.

REPORT OF HON. TREASURER.

Mr. Thomas Tyrer, Hon. Treasurer, presented the financial statement of the Society for the year ending December 31st, 1912. As already stated, the balance-sheet and the statement of revenue and expenditure for the year ending December 31st, 1912, had appeared in the Journal. Practically there was little difference between the state of affairs in 1911 and 1912. He thought it showed the Society to be going on much as usual. In 1912, there were expenses connected with the Annual Meeting which were unusual, but on the other hand, owing to the smaller number of pages in the Journal, the expenditure under that heading was somewhat less. Another notable item of expenditure was the cost of moving into the new offices; he believed that all who had visited those offices had found that they were lofty and immensely superior to those in Palace Chambers. The Society was to be congratulated that it had found such quarters. Referring to the Society's investments, the nominal value as shown in the balance-sheet in December, 1912, was £18,297 14s. 6d., but the market value at December 31st, 1912, was £16.900 6s. 9d. Dividends were unaltered, and he thought that, except in one particular, there would be a resuscitation in the values of those investments. He had pleasure in saying that the excess of income over expenditure was £778 8s. 9d. That was not all profit, for out of it had to come the life-composition and entrance fees, which had to be treated as capital under the by-laws, and invested.

Prof. P. Phillips Bedson moved the adoption of the report. They all appreciated the work done by the Treasurer in the past, and he had much pleasure in moving that the report be adopted, and also that a vote of thanks be given to Mr. Tyrer for his services in the past, and in the future.

Dr. J. T. Conroy seconded.

The President: I am very glad to accept that motion coupled with the name of one who has so long and efficiently served the Society.

The vote was carried with acclamation.

PRESIDENT'S ADDRESS.

The President then delivered his address, as follows :—

The Chemical Industries and the Universities.

Before this audience it is wholly unnecessary to dwell upon the tremendous importance of chemistry to the material growth and prosperity of the nation, or its vital bearing upon the health and happiness of the individual. Suffice it to point out that the amount of a country's appreciation of the value of chemistry in its development and the extent to which it fosters the manifold applications of this science in its everyday life is generally a measure not only of the industrial progress and supremacy of that country, but also of its real civilisation.

Two of the most important factors in the advancement of chemistry are the universities and the chemical industries, and it is consequently a matter of concern to all of us whether they are working together at present to the best advantage or not. My own observation leads me to believe that they are not, and this address is intended primarily to indicate some of the lines along which it seems to me there might be much closer co-operation.

As the majority of my fellow-members are themselves manufacturers, or are connected in one way or another with our chemical industries, I shall endeavour to present the case principally from the university side, and I trust that what I shall have to say will be judged from this point of view.

Robinson has defined education as "the process of fitting the individual to take his place and do his part in the life of his age and nation," and no educational institution at the present day can discharge its responsibilities faithfully unless it accords, in its equipment and in its curricula, adequate recognition to so comprehensive a science as chemistry, which in its wide sweep, in one way or another, touches almost every phase of human life and endeavour. That our universities are realising this more clearly every day seems evidenced by the frequent construction of new laboratories and the steadily increasing size of the chemical staff. It is worth noting that, almost without exception, additional laboratory accommodations are immediately taken up by an increased number of students. As indicative of the extent to which chemistry enters into our modern university curricula, I may be permitted to refer to my own Alma Mater, Columbia University, where this subject is taught under seven of the eleven constituent faculties; and, as proof of the demand for higher education in this same field, I would call attention to the doctorates conferred in 1911 (the latest compilation I have seen; "Science" N.S., 36, 129; Aug. 2/12) by the leading universities of the United States, when more than twice as many were awarded in chemistry as in any other subject (78 out of a total of 492), the nearest competitor being English (with 34).

The universities are active in everything which concerns the life and welfare of the nation, and it can be truly said of them, in the words of Terence, "humani nil a me alienum puto." So far as the chemical industries are concerned, it should not be overlooked that the universities, in addition to training chemists, also educate men for the non-chemical positions, whether clerical, financial, or commercial; and that everything which they accomplish to increase the security of the rights of the individual or of property, or which ministers to the general prosperity, comfort and happiness of the nation, is obviously of direct advantage to the chemical manufacturer as well, and in all such matters therefore the universities have the right to expect cordial and active co-operation on the part of our chemical industries.

In the training of men for the chemical profession we are all immediately interested, and in this direction the universities are doing the best they can with staff and equipment available and with the raw material represented by the student body. Equipment and staff are increased as funds are provided and entrance and graduation requirements steadily advance.

The chemical industries can and do co-operate by giving employment to properly trained and qualified graduates; and higher training, as represented for example by a higher degree should, other things being at all approximately equal, secure for a man a higher initial salary. It goes without saying that the salary should in any event be a fair one, commensurate with the service the man is expected to render, and with good chance of promotion for demonstrated efficiency and ability. In many cases, chemists employed by manufacturing concerns are required to execute iron-clad contracts by which they definitely waive all patent rights to anything they may discover while in the employ of the Company. These discoveries then become the property of the employer, who is under no legal obligation to remunerate his chemist therefor. Employers, however, who are really desirous of assisting the Universities in their work of training chemists, will see to it that their chemists are well rewarded for all discoveries of value.

Many of our leading chemical manufacturers have co-operated with the universities very helpfully with advice and suggestions in arranging the most effective curriculum for the training of the industrial or engineering chemist. But the curriculum is not everything, and even with the best one possible it is not an easy matter to turn out men who, in addition to adequate scientific training, are clear-headed and masterful, honourable and dependable, sober and of high moral tone, of broad and creative scholarship and conspicuous inventive ability, of unwearying energy, and with the necessary health and physique to stand plenty of hard work. Of course, such paragons are scarce and much sought for in all lines of human activity. Nor is it ordinarily feasible for a university to turn out men who are experts in the manufacturing details of the various lines of chemical industry. The best they can do is to give their men the necessary broad theoretical and practical foundation upon which all lines of chemical manufacturing rest. Minutiae can be learned only in special schools or, preferably, in the plant itself, and manufacturers can help here by giving a good man a chance to learn these details. Many a high class university graduate has lost his first position because of his employer's impatience in this respect. And yet, if the manufacturer but knew it, he is often throwing away gold and accepting dross in exchange. The properly trained chemical graduate is, in the vast majority of cases, a far more valuable man to a chemical concern than the employee who knows only mechanical details and has not had the benefit of any real scientific education. At first the latter may appear to greater advantage because of his familiarity with the processes involved, but he will be very speedily outstripped by the university man given at all a similar initial endowment. One is likely to be a mere rule-of-thumb man, whose actions are determined wholly by previous experience and who is completely lost when anything new and totally unexpected occurs. The other is the more resourceful, and will seek the underlying cause of the difficulty and independently endeavour to work out a remedy. Each has his place in our industrial life, but the scientifically trained man has surely the brighter and more promising future before him, and will rise to higher levels of usefulness.

On the other hand, university teachers often appear insufficiently posted on the type of men needed in chemical industry, and ignorant of the fact that a man admirably suited for the research laboratory is not necessarily equally well fitted for the career of an engineering chemist or works manager. To my mind, no greater unkindness can be done to a student than to secure for him a position for which he is not properly qualified, only to see him struggle along through the best years of his life and awaken finally, perhaps too late to begin another career, to a keenly painful realisation of the fact that he is but a square peg in a round hole. It is a heavy burden of responsibility, and one not to be shirked or avoided, this advising of students about to embark upon the uncertain sea of life's work for which port to steer, but it is also a splendid opportunity for high personal and public service and should be so esteemed. Few talents are more valuable to the teacher than the ability to gauge accurately a student's character and capabilities, and this genius is likewise potent in the business world, for I have heard more than one great captain of industry say that he owed his success to his knowledge of men more than to any other one thing. Employers are entitled to a perfectly frank and accurate statement concerning an applicant's qualifications—a statement which sets forth the candidate's weak points as well as his strong ones, and it does not take them very long to find out from whom they may expect such statements.

But I would not have you overlook, nor do I intend to dismiss quite so briefly, the importance of manual training, for it is a subject very much to the fore with us in the United States just now and of vital concern to all manufacturers. Every factory, in addition to capable management, up-to-date mechanical equipment and suitable research laboratories, must have in its employees technical skill equal to that of its competitors, domestic and foreign, or it cannot hope to win in the struggle. To obtain in our workmen this high degree of manual dexterity and industrial efficiency, there is need for active co-operation between our educational institutions, our factories and our labour unions. It is far better to market the results of high grade labour than merely to realise on raw material. To illustrate the point, let me quote from a recent report of a special committee of the National Manufacturers' Association of the United States, citing conditions now obtaining there :—

"We sell our cotton to Switzerland at 14 cents a pound, with scarce any labour in it. We buy it back in the form of fine handkerchiefs at $40 a pound, all labour. We export bar iron and import razor blades ; export hides and import gloves ; export copper and import art bronzes." In the year 1911, 56 per cent. of the total exports of manufactured articles from the United States carried only from 3 to 15 per cent. of factory labour.

Perhaps the greatest opportunity of all for co-operation between the universities and the chemical industries, and the one where in many countries such co-operation is conspicuously lacking, is in extending the boundaries of human knowledge by original investigation and research. Here, too, the universities and technical schools are doing what they can, with insufficient funds and equipment, and with an overburdened staff, to serve the community and the chemical industries, both by conducting original research themselves, and by throwing open their great libraries and occasionally certain of their laboratories for the solution of problems of financial value to the manufacturer. The latter, in return, can assist by supplying raw material, additional funds, and knowledge gained in the laboratories of the plant.

When a chemical industry has problems to be solved, these problems can be attacked either inside or outside of the plant. If the policy of the management is that all chemical problems are to be studied only within the establishment, a research laboratory or at least a research chemist must be provided for the plant or for the Company. At present, in the United States, probably not more than 75 or 100 manufacturing establishments have research laboratories or employ research chemists. In Germany, and perhaps also here in England, such research laboratories in association with chemical industries are much more common. The great laboratories of the Badische Anilin und Soda Fabrik and of the Elberfeld Company are good examples of the importance attached to such research work in Germany, and it would be difficult to adduce any stronger argument in support of its value than the marvellous achievements of these huge concerns.

A frequent difficulty encountered in the employment of research chemists or the establishment of a research laboratory is that many a manufacturer does not appear to grasp the need or importance of such work, or know how to treat the men in charge so as to secure the best results. The owner may not even fully understand just what is the cause of his manufacturing losses or to whom to turn for aid. If he finally engages a chemist he is apt to look upon him as a sort of necromancer who should be able to accomplish wonders, and if he cannot see results in the course of a few months is likely to consider the investment a bad one and regard chemists as a class as a poor and useless lot. It is not unusual for the chemist to be told to stick to his laboratory and not go prowling about the works, and he must also face the natural opposition of workmen to any innovations and reckon with the jealousies of foremen and of various superior officials so that, like the policemen in the "Pirates of Penzance," often his "lot is not a happy one."

From the standpoint of the manufacturer, one weighty advantage of the policy of having all problems worked out within the plant is that the results secured are not divulged, but are stored away in the laboratory archives and become part of the assets and working capital of the corporation which has paid for them ; and it is usually not until patent applications are filed that this knowledge, generally only partially and imperfectly, is made known to the public. When it is not deemed necessary to take out patents, such knowledge remains buried.

In this matter of the dissemination of knowledge concerning industrial chemical practice, it must be evident to all that there is but little co-operation between the manufacturers and the universities. The crux of the difficulty lies just here. Chemical manufacturers, as just stated, are quite naturally averse from publishing any discoveries made in their plants, since "knowledge is power" in manufacturing as elsewhere, and new knowledge gained in the laboratories of the corporation may often very properly be regarded as among the most valuable assets of the concern. The universities, on the other hand, exist for the spreading of knowledge, and from their standpoint the great disadvantage of the above policy is this locking up of knowledge, for it effects a serious retardation of the general growth and development of the science in its broader aspects, and renders it much more difficult for the universities to train men properly for such industries, since all textbooks and general knowledge available would in all probability be far behind the actual manufacturing practice. I believe that all familiar with the situation will admit that this is a real problem and one constituting a serious handicap to those endeavouring to give up-to-date instruction in industrial chemistry. One immediately harmful effect that the above policy has upon the universities is that it not infrequently results in some of their most capable investigators spending many of the best years of their lives and considerable sums of money in attempts to solve problems, the clues or answers to which had been discovered and filed away long before in the laboratory records of the factories.

Of course, the universities must also contend with the fact that the larger manufacturing establishments can usually offer much better salaries to skilful chemical investigators, and thus withdraw from university work some of the best men.

All who have had any experience in such matters know how difficult it is to secure papers for the programmes of our Sections, or for our Journal, from men engaged in industrial chemistry, the usual reply the manufacturer gives to such solicitations being to the effect that he is in business to make money and is not running an educational institution.

It is not to be expected that the manufacturers will promptly publish to the world, upon demand, their most cherished "trade secrets," and it would of course be useless to make any such request. But in almost all great chemical industrial establishments which have been in operation for any length of time, information has been accumulated in the course of the work which could be made known without injury to the firm concerned, and to the considerable advantage of the chemical world at large. For example, it not infrequently happens that a corporation permanently abandons one line of work, either because local conditions have made it no longer profitable or because it wishes to devote itself to other more lucrative ones. In such cases there seems no good reason why the knowledge gained in connection with the abandoned process or product should not be made public. Or, it may be, the analytical laboratory finds some convenient rapid method to take the place of a more laborious one, or devises new apparatus for old laboratory processes. Other cases might be cited were there time.

A very welcome form of co-operation, therefore, would be that of keeping the university teachers better posted on present-day manufacturing practice, so that they could point out more clearly the applications to industry of the principles they were endeavouring to inculcate, and call attention to the rapid approximate commercial analytical processes and short cuts used in the factories in addition to the longer and more accurate methods generally taught in analytical laboratories. Were the teacher more familiar with industrial wastes and by-products, he could often select problems for his advanced research students with reference thereto and thus considerably heighten their interest in the work.

It is well said in the Reports of the Twelfth Census of the United States that " probably no science has done so much as Chemistry in revealing the hidden possibilities of the wastes and by-products in manufactures. This science has been the most fruitful agent in the conversion of the refuse of manufacturing operations into products of industrial value. . . . Chemistry is the intelligence department of industry." Yet the teacher is often uninformed concerning the character and amount of the by-products going to waste in his immediate neighbourhood, a careful study of which might lead not only to financial reward for the manufacturer as well as for himself, but might also save us much of the present pollution of our streams and of the air we breathe.

It is not only now very desirable, but will soon become imperative for our manufacturers to avail themselves more freely of the assistance of the experts in our universities and technical schools. That nation will unquestionably make the longest strides in commercial development which sells goods carrying the maximum of brains and the minimum of raw material. Germany has already learned this, and is rapidly forging ahead as the natural result. England and America must follow that lead or ultimately find themselves far in the rear. Any country, like my own, thanks to a wonderful endowment of natural resources, and to protective tariff walls, may for a time appear to be holding its own in the world's trade without adopting the above policy ; but it is only because of these peculiar local conditions that we have been spared the embarrassment of close international comparisons. Our tariff walls are already tottering, and the lavish use of natural resources is but a spendthrift squandering of a priceless and irreplaceable heritage, and the end of that, too, is in sight with a continuance of present methods. The day is already at hand, for America at least, when manufacturers must scrutinise more closely the efficiency of their plants with reference to raw material consumed, for human intelligence is the one resource which increases with use, forever and immeasurably, and the cultivation of which furnishes the only substantial basis of prosperity, progress and happiness.

In the United States we have been wont to boast of our huge agricultural exports, but, as President Wallace said at a recent Conservation Congress, "the nineteenth century farmer was no farmer at all ; he was a miner, mining the fertility of the soil, and selling it for the bare cost of the mining," since every bushel of wheat exported carries with it approximately 27 cents worth of phosphorus, every bushel of corn 13 cents, every pound of cotton 3 cents, figures which equal the supposed profits of the transaction. How we are to replenish our stock of phosphorus, if once exhausted, is not yet clear, although, so far as we now know, the race itself must perish without an adequate supply of this element.

There are but four great manufacturing nations in the world—England, Germany, France, and the United States. Outside these four, and looking to them for their manufactured articles, stand the one and a half billion human beings in the rest of the world. The prizes to be won in this international trade are beyond compare. They are to be measured not only in money, but also in intellectual advancement, in closer bonds of international friendship, mutual respect and esteem, in national spirit, and in heightened civilization.

Any manufacturer who feels unable to co-operate as suggested above, should at least be willing to support generously those agencies upon whom now falls the chief burden of disseminating knowledge—notably our educational institutions and our chemical journals, such as the Journal of this Society.

Or, if he still demurs, there are other lines open. Few manufacturing concerns feel inclined or called upon to establish extensive libraries within their plants, and it would appear, therefore, to be to their own immediate interest to provide whatever funds might be needed to supply the library of the nearest university or technical school with all books likely to be of service to the various experts of the plant. This also would bring them into closer personal touch and sympathy with the officers of instruction there.

Any manufacturer having an important chemical problem to solve in connection with his business, and without the proper staff or equipment to attack it within the plant, must look outside for assistance, and he then has the choice of the private commercial or research laboratory on the one hand, or the universities and technical schools on the other.

The advantages and disadvantages of the private research laboratory, at least in so far as they relate to the availability of the new knowledge thus discovered, are much the same as those already pointed out for the factory research laboratory.

If the manufacturer elects to refer his problem to the university or technical school, such reference is most likely to take the form of an industrial fellowship and there is much to be said in favour of these fellowships. They allow the donor to keep secret for two or three years the results secured, after which they can be published. They also secure to him patent rights. They give highly specialised training to good men and often secure for them permanent employment and a share in the profits of their discoveries. It should be obvious at the outset that a fellowship of this character can be successful only when there are close confidential relations subsisting between the manufacturer and the officer in charge of the research. No co-operation can be really effective unless based upon a thorough mutual familiarity with the conditions and an abiding faith in the integrity and sincerity of purpose of each other. It is likely to prove a poor investment for a manufacturer to seek the aid of an investigator if he is unwilling to take such expert into his confidence. I have occasionally had manufacturers apply to me for the solution of a problem affecting their industry and, when I asked how they were actually carrying out the process in the factory, have had them say politely that they preferred not to answer any questions concerning the operations of their factory and that all I was asked to do was to see what I could accomplish in my own laboratory. Of course the answer to such a proposition should be a decided negative, since its acceptance would almost invariably result to the mutual dissatisfaction of both parties concerned.

It would seem manifest that no one man is competent to direct original research in all lines of industrial chemistry, and that the wisest course for a manufacturer to pursue when contemplating the establishment of a research fellowship would be to secure the aid of the particular university officer whose experience and personal achievements entitle him to be considered an expert in that special field, and who has the necessary equipment and location to attack such a problem with good chances of success, and then to arrange to provide him with such funds as may be required for assistants or for raw material.

In the case of divergent reports from chemical experts, the university laboratory is the natural court of appeal for an impartial verdict.

The most urgent need of the day is, in my judgment, the endowment of chemical research, either by the establishment of research professorships or, still better, by founding great chemical research institutes in affiliation with our chief universities for the study of problems both in pure and in applied chemistry. The splendid Kaiser Wilhelm Institute for Chemistry, recently opened in Berlin, thanks to the active and generous assistance of His Majesty the German Emperor, is the first of its kind in the world, and its advent should be hailed with delight as indicating the dawn of a new and brilliant era for our science. It is worth noting that the policy of this research institute is the man first, the equipment afterwards, and the group of distinguished investigators now gathered together there witnesses to the wisdom of this plan. If we would not be outstript by our friends across the water, we must have similar establishments here in England and that, too, speedily. The benefits which will accrue to the nation from the labours of such research institutes manned by our keenest investigators are truly inestimable, and it is to be hoped that this remarkable opportunity will appeal to the imagination and the generosity of other far-sighted benefactors of mankind. Much has been done, and worthily done, in all of our great cities for the cause of medicine, for example, whereas chemistry, except in Germany, still appeals in vain for similar recognition. Yet the dependence of medicine, and of life itself, upon chemistry is seen more clearly every day, and he who still has doubts upon the subject has but to read the recent remarkable presidential address of Dr. Schäfer before the Dundee Meeting of the British Association for the Advancement of Science (1912), in which, after calling attention to the few elements and simple inorganic compounds making up living substance, he says—"The combination of these elements into a colloidal compound represents the chemical basis of life ; and when the chemist succeeds in building up this compound, it will without doubt be found to exhibit the phenomena which we are in the habit of associating with the term 'life.'" He further suggests the possibility "that heredity also is one of the questions the eventual solution of which we must look to the chemist to provide," and, as already indicated, the maintenance of any human life whatever upon this planet of ours depends absolutely upon the labours of the chemist.

In the sphere of industrial chemistry such a research institute might well take the form of laboratories "especially equipped with the standard appliances for executing industrial operations, and provided with all the means for the prompt, proper and accurate determination of experimental data, in a way and on a scale which would make this data available for factory application," as has been suggested already by Professor Whitaker, the Chairman of our New York Section (Jour. Ind. Eng. Chem., Nov., 1911) and since, as he points out, few if any laboratories now exist where researches can be undertaken "which involve single and multiple effect distillation, evaporation, filtration, calcination, condensation, absorption, drying, controlled temperature reactions, vacuum and special atmosphere reactions," and the like.

The really important thing is to bring together the problem and the man competent to solve it. Skilful investigators are often wholly unaware of many of the important industrial problems calling for solution, and the great manufacturing concerns are often equally ignorant concerning the men in the country best qualified to solve these problems. If it were possible to establish some sort of a clearing-house Committee, composed of representatives of the universities and of the manufacturers, to bring investigator and problem together, it could render immense service to the country. If the research institutes proposed above were established, their Boards of Direction might perhaps perform such a function. In fact, the matter is so important, that there would seem ample justification for the general Government itself to take cognizance of it, since it concerns the prosperity of the whole nation, and refer it to an appropriate committee or board, in conjunction with its other activities for the benefit of our manufacturing industries.

Some of our wisest and most far-sighted manufacturers feel that there is urgent need for what might be termed an Industrial Efficiency Corporation, with a staff of experts in all lines of chemical manufacturing, to whom any manufacturer might refer for solution all problems affecting his plant. If the details of such an organisation can be satisfactorily worked out, this corporation can render much of the service indicated above, but it too will have to overcome the reluctance of many manufacturers to allow any other man, or group of men, to know what they are actually doing in their factories.

There is room also for better co-operation in the matter of patents. The university teacher is usually at a heavy disadvantage in endeavouring to obtain a fair trial of his inventions and a reasonable share in the profits. In this connection the establishment here of the Letters Patent Insurance Co., Ltd., and in the United States of the Research Corporation, are of interest.

The latter is described as "an experiment in the public administration of patent rights" (F. G. Cottrell ; Jour. Ind. Eng. Chem., 4, 864 ; Dec. 1912). It was incorporated February 26, 1912, as a stock company, under the laws of the State of New York, with offices at 63, Wall Street, New York City, its declared purposes being :—

(a) To receive by gift and to acquire by purchase or otherwise, inventions, patent rights and letters patent either of the United States or of foreign countries, and to hold, manage, use, develop, manufacture, instal, and operate the same, and to conduct commercial operations under or in connection with the development of such inventions, patent rights and letters patent, and to sell, license, or otherwise dispose of the same, and to collect royalties thereon, and to experiment with and test the validity and value thereof, and to render the same more available and effective in the useful arts and manufactures and for scientific purposes and otherwise.

(b) To provide means for the advancement and extension of technical and scientific investigation, research and experimentation, by contributing the net earnings of the corporation, over and above such sum or sums as may be reserved or retained and held as an endowment fund or working capital, and also such other moneys and property belonging to the corporation as the Board of Directors shall from time to time deem proper, to the Smithsonian Institution, and such other scientific and educational institutions and societies as the Board of Directors may from time to time select in order to enable such institutions and societies to conduct such investigation, research and experimentation.

(c) To receive, hold and manage, and dispose of such other moneys and property, including the stock of this and of any other corporation, as may, from time to time, be given to or acquired by this Corporation in the furtherance of its corporate purposes, and to apply the same, and the proceeds or income thereof, to the objects specified in the preceding paragraph."

To summarise briefly, the purposes of the Corporation are to control patents for the benefit of the public, and to aid research.

It is expected that the duties of the Corporation will be largely administrative, the actual practical work in connection with the patents being conducted either in co-operation with the manufacturing plants or with the universities and technical schools. These administrative expenses for the first year are estimated at $10,000, and have been provided for by subscriptions to the stock of the Corporation, which stock it is expressly stipulated shall pay no dividends whatever, but may be re-purchased at any time at par by the Board of Directors, and no stock can be disposed of without first giving the Board an opportunity to exercise this option. After the first year, it is expected that the undertaking will be self-supporting.

It appears to be the intention of the Corporation for the first few years to consider only such patents as may be offered as outright gifts, and Dr. Cottrell, in the article cited, says, "present indications are that the latter (the Corporation) will find itself well occupied even by these offers alone." In other cases, patentees may be willing, it is hoped, to assign to the Corporation their patent rights within certain geographical boundaries, retaining the rest for themselves ; or perhaps present to the Corporation the rights to use the patents in connection with certain lines of manufacturing and retain for themselves the rights for other lines.

The real actuating cause in the establishment of this Corporation has been the fine self-sacrificing generosity of Dr. Cottrell himself in turning over his own valuable patents on the electrostatic collection of smoke and fumes, and thus voluntarily relinquishing what promises to be large profits. Too much cannot be said in praise of such a splendid example of altruism, and it is to be hoped that many others may be found to follow this example of real patriotism. It has been urged that had such an organisation been in existence at the time the Diamond Match Company generously threw open to all its sesquisulphide patents, it might have been willing to turn them over to this Research Corporation for the benefit of chemical investigation.

The experiment is an exceedingly interesting one and surely we all wish it the greatest measure of success.

True, in the United States (Patent Act of March 3rd, 1883) and perhaps also here in England, patents may be formally issued as free to the public without royalty of any kind, and for these patents the Government collects no fees. One reason why such regulations have not accomplished as much as their advocates hoped for is that they fail to provide adequate protection to the manufacturer who invests the large sums necessary in plant, equipment and advertising, to market successfully a new article.

There is also need for co-operation in some countries in securing an efficient and equitable system of patent laws, and in obtaining fair and impartial legislation where our chemical industries are concerned ; co-operation which, on the one hand, shall protect our manufacturers from unjust laws or regulations and which, on the other hand, shall effectually safeguard the community against any inroads upon their rights by the manufacturers.

For example, a Government might propose legislation classing as adulterated any foodstuff containing x per cent. of arsenic. If the university experts knew that such a percentage of arsenic was normally present in certain perfectly wholesome and unadulterated natural foods, it would be their duty to call the attention of the law-making body to the fact, that the proposed legislation might be amended accordingly.

To take the other side ; if it appeared that any line of industry, by combinations at home and the erection of a tariff wall against imported articles, was effectually stifling all competition in order that it might continue old-fashioned, wasteful and inefficient methods of manufacture, and charge the public high prices for their goods, that public is entitled to redress and will surely obtain it sooner or later, and it would be the duty of the university officers to make clear to the community the extent to which they were being imposed upon by the offending manufacturers.

In the building up at our larger universities of museums illustrating the development and present status of industrial chemistry, there is afforded a field for co-operation not yet very extensively availed of. The exhibits themselves must in the nature of the case, be contributed chiefly by the manufacturers, and should include full sets of samples of all products—initial, intermediate and final, as well as working models of the mechanical parts of the process, so that the student may see represented before him all the various steps in the manufacture ; the university, on its part, to provide suitable housing and display cases, to look after the proper assorting, arrangement, distribution and labelling of the material, and the necessary care and upkeep of the same. What such collections mean to the teacher of chemistry, no one appreciates better than the Columbia University man, for there we have had for more than a generation the extensive Chandler Museum of Chemistry, contributed largely by our chemical manufacturers, and gathered together patiently and with tireless energy and enthusiasm by that Nestor of American chemists, the first American President of this Society, our own dear Dr. Chandler.

Such Museums are not only for the benefit of the university but are for public exhibition as well, and in addition to these university museums, or replacing them, are the great industrial museums of the world like the Deutsches Museum of Munich and the South Kensington of London, and it is a genuine inspiration to see these places thronged with young and old watching closely the operation of the working models exhibited, examining critically the various products, or listening to the explanatory remarks of an accompanying teacher or of an attendant. But we need to add to the equipment of those museums we now have and to assist in the creation of others, for they illustrate most graphically the commercial and industrial resources of the country and provide a telling object lesson of the significance of chemistry in the utilisation and development of those resources.

When the layman sees before him a barrel of coal tar, it is to him only a black, evil-smelling viscous mass ; but when he sees growing out of that barrel, a tree-like arrangement of the innumerable substances obtainable therefrom—first the primary products, then the secondary, and so on, until at the ends of the branches he surveys all the wonderful dyestuffs, drugs and perfumes manufactured from this same foul mass—it takes on for him a wholly new aspect and interest.

A block of wood is a very commonplace article, but when that block of wood stands side by side with some of the beautiful and useful products which chemistry can conjure therefrom, the observer begins to have some inkling of the magic of science and its potent influence in the progress of civilisation.

Lest I weary you, I will but touch upon one other opportunity for co-operation, and that is in the organisation of chemists' clubs, where the members of the profession may regularly foregather and the university man rub shoulders with his manufacturing brother. A chemists' club is a most excellent reagent for blending together in one homogeneous, harmonious whole all brands of chemists, and it is quite true that a happy union of theoretical and practical chemists can often be accomplished most pleasantly by clubbing them into it. Our Chemists' Club in New York has brought together, in one big contented family, all the chemists of that metropolitan district, and its influence has extended over the length and breadth of the United States. After all, friendship is the main thing between brother chemists, and I had rather have a colleague's intimate and warm-hearted friendship for me personally than merely his respect and admiration for my scientific achievements.

To recapitulate briefly, the university exists for the community, and its supreme desire is to render ever better and more efficient service. It is the servant of our chemical industries and their agent in the training of the men needed by these industries. It seeks closer co-operation from them in disseminating knowledge and in extending its boundaries, in endowing chemical research and chemical publications, in aiding our chemical libraries, in the matter of patents and legislation, in the creation of great museums of peaceful arts, in the organisation of chemists' clubs and the provision of suitable buildings therefor, and in countless other ways, and if this short and very imperfect presentation of the subject serves in any way to arouse increased interest in these matters, it will have been worth while. Efficiency is the only sure path to supremacy in any field of human endeavour, and closer co-operation between our universities and our industries will go far to assure increased efficiency to both.

Dr. E. K. **Muspratt** said he had much pleasure, as a Past-President of the Society, in moving a vote of thanks to the President for his address. One great advantage of that Society was that it was bringing together men engaged in pure science and others engaged in manufacture. He was glad their President had brought up the subject of universities and their relation to chemical industries. Fifty years ago Germany had very few industries, the United States had only two or three universities and there, as in our own universities, science was hardly taught at all. When he first went to the United States, in April, 1876, he went to visit a fellow-student of his, Professor Brush of Yale, who, with Professor Johnson, was engaged at the scientific school which had just been attached to the University. Although they had taught science at Yale, there was no strictly scientific school until that year, 1876. In England they were just as much behind as the United States. Our own universities hardly taught science at all. He remembered that Professor Dawber taught chemistry, botany, and geology. Very little original work was done, because there were no opportunities to do it. In North America, they founded a new university which should include the teaching of science. The Liverpool

University College was founded in 1878–80, and was opened first in 1882. One of the first buildings they erected was, he was glad to say, a chemical laboratory. At that time they had only one professor of chemistry; now they had four and in a few years, he had no doubt, they would have more, because development meant more and more specialising. He thought they had been able to train a certain number of chemists who would formerly have been imported from Germany. Germany was pre-eminent in the thorough teaching of chemical science. His old master, Liebig, had made chemical science popular by his wonderful lessons on chemistry, but he also drew attention to the chemist. For his first twenty-five years he devoted his attention to the purely scientific, and it was a great work; later he laid himself out to the application of science to physiology and agriculture, and the enormous advances which had been made in agriculture were due to the work in the laboratories of Baron Liebig. England and Scotland far surpassed Germany in agriculture, but we, unfortunately, did not adopt agricultural colleges where agriculture was taught as a science. After Liebig moved in Germany agricultural colleges were founded in every country, and since then, agriculture had made enormous strides. So the great advance in Germany, in agriculture as in other sciences, was really owing to the universities. It was always a delight to hear men from other countries, for their addresses were likely to be more original and of more advantage to the Society. He had much pleasure in moving a vote of thanks to the President for his Address.

Dr. R. Messel seconded. He laid very great stress on the personality of the chemists, and maintained that the right man was far better with education than without it. First of all, get the right man. The difference between scientific education and non-scientific existed and ought not to. They required scientific training. Professor Bogert had shown what could be gained by co-operative work between universities and technical manufactories. He heartily seconded the vote proposed by Mr. Muspratt.

The vote of thanks was accorded with prolonged applause.

ELECTION OF COUNCIL.

The President announced the result of the ballot for four ordinary members of the Council; 183 ballot lists had been received, and in the result Professor F. G. Donnan, Mr. D. Lloyd Howard, Mr. G. W. McDonald, and Mr. J. Miln Thomson had been elected.

PRESIDENT ELECT.

The President announced with great pleasure that Sir William Crookes had been elected President of the Society for the coming year. He wished to extend a very hearty welcome to him, on behalf of the Society, and to send to him an assurance of his warm and hearty support. That was scarcely necessary if they remembered what Sir William Crookes had achieved in science. At the present day, none stood higher than he. He was one of the noblest of gentlemen, and it was a delight and a matter of very great gratification that he had consented to accept the Presidency of the Society.

APPOINTMENT OF AUDITORS.

Mr. Arthur Carey moved that the auditors be re-appointed at a remuneration of £21.

Mr. H. Brunner seconded, and the motion was adopted.

PLACE OF NEXT ANNUAL MEETING.

Dr. H. J. S. Sand, in support of an invitation which had been received from the City of Nottingham and the Nottingham Section, proposed that the Society hold its next annual meeting at Nottingham. They in Nottingham were but a small Section, and could not hope to give such a welcome as a great city like Liverpool, but they would make up for that with the cordiality of their welcome.

Mr. F. R. O'Shaughnessy seconded.

Mr. S. J. Pentecost supported. They intended, he said, to try to maintain the high standard of the meeting that had been attained in the past, and under their chairman, Sir John Turney, and with the energy of Dr. Sand, he was sure they should have a good time if they would come next year.

The resolution was carried unanimously and with acclamation.

VOTES OF THANKS.

The President proposed a vote of thanks to the University for so kindly allowing them to meet in their buildings.

Sir William Ramsay, in seconding, said that the University of Liverpool was giving them practical proof of the way in which they were coming to a closer co-operation of science and industry. The closer it was, the better for science and industry.

The vote was passed very heartily.

Professor E. C. C. Baly, speaking on behalf of the Senate of the University, expressed their thanks for the very courteous terms of the vote to the authorities of the University, and for the way in which the vote had been received. The Senate and Council of the University took a great deal of pride in the fact that the Society was founded in the University or University College as it was then. It was with unlimited pleasure they welcomed the Society back to the neighbourhood of its birth. From the University point of view the Society occupied a very interesting and important position. A closer relationship between the two was to be welcomed, seeing that of the large number of chemical students passing each year through the University laboratories, so many desired to enter technical works. As one engaged in training chemists he would like to associate himself most cordially with all Dr. Muspratt had said. On behalf of the Senate and Council of the University he would like to express their sense of kindness and thanks.

Mr. Tyrer moved "that the warmest thanks of this Society, in general meeting assembled, be accorded to Dr. Rudolph Messel, F.R.S., for his indefatigable and generous services to the Society, for acting not only through the time of his Presidency, but during the time of the President's unavoidable absence." Those rather moderate terms were a long way behind the full expression of their feelings to their past President.

The President said he felt under a very great debt of gratitude to Dr. Messel for what he had done. Whatever success had been achieved during the year had been due to the splendid services of Dr. Messel. They knew the work which had been done, and it was done by him with the greatest pleasure. The Society had no more loyal member or servant than Dr. Messel. It was a very great pleasure to have that opportunity of saying so.

The motion was carried with loud applause.

Dr. Messel said he could only state how very much he appreciated the kindly words which had been spoken about him, and how gratified he was to have accomplished the duty. It had always been a pleasure to him to do for the Society what he could. Everybody else, if called upon, would have done the same. He thanked them very heartily for their kindness.

After the meeting the members of the Society and ladies accompanying them were entertained to luncheon by the members of the Liverpool Section, at the Midland Adelphi Hotel.

In the afternoon many members and friends proceeded by electric cars from the hotel to the overhead railway. The party were then conveyed by special train to Seaforth, and proceeded to Seaforth Hall, the residence of Dr. E. K. Muspratt. Here, a garden party was held, by the kindness of Dr. Muspratt.

RECEPTION BY THE LORD MAYOR OF LIVERPOOL

In the evening, from 8.30 until 11 o'clock, the Lord Mayor of Liverpool held a reception for members of the Society and other invited guests, at the Town Hall. An excellent programme of vocal and instrumental music was given in the large ballroom, and dancing was enjoyed in the small ballroom.

VISITS TO WORKS.

Thursday, July 17th.

Port Sunlight Works and Village.

Leader :—Dr. E. L. Peck.

These Works and Village, belonging to Messrs. Lever Brothers, Limited, are the growth of little more than a quarter of a century. The soap manufacture now carried on at Port Sunlight was begun at Warrington in January, 1886, at which date the output was 20 tons weekly. The rapid growth of the business necessitated removal to an area more favourable to development; and the present site on the Wirral Peninsula was chosen in view of its excellent import and export facilities. Building was begun in March, 1888, on the banks of Bromborough Pool, which gave easy access to the Mersey, while the lines of the L. & N.W. and G.W. Railways skirted the western boundary of the site. The first soapery built had a capacity for turning out 800 tons of soap per week; there are now four soaperies with an aggregate capacity of over 4,000 tons.

The Company holds, apart from its interest in the Bromborough Port Estate, 442 acres of freehold land, with a frontage to the River Mersey extending from New Ferry to the entrance to the Manchester Ship Canal at Eastham. The area at present covered by works' buildings, raw material storage, yards, railway sidings and wharves is about 125 acres. There are 13 miles of railway lines within the area of the Works. The average number of employees at Port Sunlight is about 5,500. The total authorised capital of the Company is £20,000,000 sterling, about half of which has been issued and is invested in the business at Port Sunlight, as well as in over 40 associated companies at home and abroad.

The Village of Port Sunlight was originally traversed by various deep ravines branching from Bromborough Pool, and these practically dictated the lines of the town-planning. All of these ravines except one—transformed into the ornamental park known as The Dell—have now been filled up. In the last three years five and a half acres have in this way been reclaimed. The houses built, or in course of construction, now number 823, spread over an area of 135 acres. It is not intended that the number of houses should ever exceed ten to the acre, calculated over the total area of land that may be developed for village purposes. The houses are let only to employees under a scheme of prosperity sharing, which allows them to occupy them at rents calculated on cost of maintenance only. These rents range from 5s. 3d. to 10s. 6d., including rates and taxes. The Company has also built and equipped clubs, halls, and institutions, which are let to various societies at nominal charges. The prosperity-sharing schemes have culminated in a system in which all employees of the parent and associated companies, at home and abroad, are eligible to become co-partners after five years' service if they are then 25 years of age. At the last distribution of profits, in January, 1913, over 1,900 employee-partners received a dividend of ten per cent. on the amounts inscribed on their co-partnership certificates, the total amount paid by the Company on Prosperity Sharing and Co-partnership Account for the year 1912 being £40,068 11s. 11d.

The visitors first assembled in the Gladstone Hall, and then proceeded to the Vestibule where they were received by three of the Directors, Mr. Gray, Mr. W. Hulme Lever, and Mr. Buchanan. Then the following route was taken: general offices, special gallery over box-making and printing rooms, across bridge to No. 1 soapery, manufacture, separation, cooling, stamping and packing, and box-making rooms, No. 3 soapery, manufacture of caustic soda by the Ferrite process, perfumery department, Monkey Brand and Vim packing room, toilet soapery No. 4, Lux packing room, printing and cardbox department, and out by subway to the village where the various institutions were open for inspection. After seeing the Hulme Hall art collection, luncheon was served in the Auditorium, and tea at Thornton Manor, the residence of Sir William H. Lever, Bart., and Lady Lever.* Music was provided by the Port Sunlight Prize Band.

The United Alkali Co., Widnes.

Leader :—Mr. S. J. Wilcox.

Another party went to Widnes to see the Sullivan and Pilkington Works of the United Alkali Co.

The party were received by Mr. Eustace Carey, Mr. Stuart, Mr. Max Muspratt, Mr. Davidson, and Mr. Arthur Carey, and the following processes were seen in operation: At the Pilkington Works were shown the manufacture of (1) Caustic soda by the Leblanc process; (2) Sulphur from blackash waste by the Chance recovery process; (3) Chlorine from gaseous hydrochloric acid by the Deacon process, and the manufacture of bleaching powder; at the Sullivan Works the manufacture of: (1) Sulphuric acid from cupreous pyrites containing arsenic by the lead chamber process, showing the method of recovery of arsenious acid; (2) Sulphate of soda or salt-cake in hand-worked plus-pressure Deacon furnaces; (3) Chlorine from liquid hydrochloric acid by the Weldon and Dunlop manganese process; (4) Calcium chloride; (5) Coke in the Semet-Solvay ovens and the recovery of by-products. The party were entertained at luncheon in the interval between the two visits. The party was shown round by Mr. Morrison, the general manager.

The Shipbuilding and Engineering Works of Messrs. Cammell, Laird and Co., Ltd., Birkenhead.

Leader :—Mr. W. Ramsay.

The nucleus of these works was formed in 1824 by Mr. William Laird, and were carried on by his descendants until 1903, when they were amalgamated with those of Chas. Cammell & Co. of Sheffield under the style of Cammell, Laird and Co., Ltd. After the amalgamation the Shipbuilding and Engineering Works were removed to Tranmere, the old Birkenhead Iron Works being retained for ship repair work. The property now covers about 100 acres with a frontage to the Mersey of over half a mile.

The slipways have accommodation for building the largest vessel yet projected, and the various workshops contain the most modern machinery. There are in all seven dry docks, the two latest being large enough to take the largest class of vessel; both docks are served with a 40-ton electric crane and a powerful pumping station. The fitting-out basin is 14 acres in extent. The engine and boiler shops are adjacent to the large basin. Special attention has been given to heating and ventilation, and in the joiners' shop the air is kept free from dust by extractors of the Cyclone type. The machinery of the power station is driven by gas engines, the gas being generated by a large Mond power gas plant.

The Mersey Brewery.

Leader :—Mr. J. Kent Smith.

Messrs. Robert Cain and Sons, Ltd., was founded in 1848 by the late Robert Cain, and was formed into a Limited Liability Company in the year 1896 with a capital of £1,000,000. Locally known as the Mersey Brewery, the building occupies a commanding square site in Stanhope Street covering a large area of ground. After leaving the offices the visitors inspected the Brewery, which, like the offices, is protected throughout by fire-extinguishing apparatus. The most scrupulous care and cleanliness is maintained both in the production and the handling of the firm's products, and the plant and machinery is of the most modern description.

The Diamond Match Works. (Messrs. Bryant and May, Ltd.)

Leader :—Mr. Frank Tate.

The greater portion of the matches manufactured in this factory are made on the fourth or top floor. There are in all 16 machines at work on this floor. They cut the matches from the block, paraffin and tip them, and when dry pack them into boxes nearly entirely automatically. Altogether the number of hands employed to work a machine and pack up the matches is 12 or 13. Such a machine turns out in 10 hours, on the average, 500 gross of boxes containing nearly 4½ millions of matches.

The roof is carried on pitch pine vertical supports. On every one of these is fixed a hydrant with 50 feet of piping, connected with the town mains and a special supply tank. In addition to these there is attached to the under side of the ceilings, every 10 feet in every direction, a Grinell sprinkler nozzle, of which there are some 1,600 in various parts of the premises. All the floors of the factory and all the offices are thus protected. All openings are fitted with doors and shutters coated with metal, which close automatically on the outbreak of fire. In all match-making rooms the rate of air supply is such that the whole of the air can be changed in from four to five minutes. This, besides being very beneficial to the health of the workpeople, is useful for drying the matches during manufacture.

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* It is with very great regret that we record the death of Lady Lever on July 24th.

On the third floor there is in the main building the box-making, etc., department, and the machine and fitting shop, but by far the greatest interest centres in the automatic machinery for making the boxes and the box covers. In the south wing of the third floor there is also the chemical department, where the "composition" for the match tips is manufactured. The machinery here consists of four mills for grinding and five "mixers." The cauldrons are fitted with removable covers with chimneys, which lead to the open air and take away any noxious fumes. On the second floor, in the south wing, the "paper" or "book" matches are manufactured. These matches are made of cardboard. In the south wing, on the first floor, is the "peeling" room, and here the thin strips of wood, from which the boxes and covers are made, are manufactured.

The first floor of the main building is the shipping floor, and here the finished goods are stored. The offices, too, form part of the main building at this level. The first floor, north wing, contains a kitchen and dining room. The employees are provided with soup, milk and rice, tea or coffee free of charge, and with hot dinners at a nominal sum.

British Insulated and Helsby Cables, Ltd.

Leader :—Mr. J. W. Towers.

The Prescot Works of the above Company were opened by the British Insulated Wire Co., Ltd., in 1891, for the manufacture of paper insulated underground cables. The name of the Company was changed in 1902 to the British Insulated and Helsby Cables, Limited.

The Company's factory at Prescot now covers an area of about 20 acres, and comprises not only the most extensive electric cable factory in this country, but also separate departments for the rolling and drawing of copper and aluminium wire, aluminium sheet, fitting of joint boxes, overhead materials for tramways, rail bonds, electric welders, meters, etc.

The Company were the first makers of paper insulated cables in this country, the first to manufacture triple concentric cables on a commercial scale and to provide a complete system of junction boxes for underground mains. They were the first manufacturers of low capacity air space telephone cables, and the first to use earthenware troughs for laying cables underground on the solid system. In 1902 they acquired the Helsby Works of the Telegraph Manufacturing Co., Ltd., where the Company's rubber and bitumen cables are now manufactured.

The works are driven throughout electrically from the Company's power station, which also supplies light and power to the neighbouring districts. The employees of the Company number about 5,000.

THE ANNUAL DINNER.

The annual dinner of the Society was held on Thursday, July 17th, 1913, at the Midland Adelphi Hotel. Professor Bogert presided, and was supported by Sir Alfred Dale, Sir Edward R. Russell, Sir Benjamin Johnson, Sir William H. Lever, Bart., and Sir William Ramsay, K.C.B.

The toast of "The Duke of Lancaster" having been honoured, the **President** submitted, in turn, the toasts of "Queen Mary, Queen Alexandra, the Prince of Wales and the Rest of the Royal Family," and "The President of the United States of America." The toasts were fitly honoured.

The **President** then read a cablegram addressed to Sir William Crookes, as follows :—"New York Section sends best wishes to retiring President, and congratulations to the new."

Dr. R. **Messel**, in proposing the toast of "The Society of Chemical Industry," said, in the course of a genial speech, that in his travels in Canada and in the United States during the time of his Presidency, he was delighted to see that they were not forgotten in America. He urged them to do right and fear no man, to which someone had added : "Don't write, and you need not fear any woman either."

Sir **William Ramsay** referred to the scope of the work the Society was doing, not only in bringing together manufacturers and scientific men, but in continuing to do it the more as the years rolled on. It occurred to him that day, in looking at the works at Widnes, that one side of history had not been written, that was, the history of chemistry. He had in his possession the letters of Joseph Black of Edinburgh, who was born about 1743–4, and died about the end of the eighteenth century. Black was an extremely methodical man, who kept every letter he received, and on the back wrote a draft of the reply. In a report on alkali he wrote that it was chiefly used by the cotton spinners of Belfast. He received a letter from Collison, dated 1782, respecting a patent according to which he allowed vitriolic acid to act on common salt, and having produced vitriolate of mineral alkali, he then mixed it with the clippings of leather or hides or hoofs and then with coal or other substance, limestone and water. [Eng. Pat. 1341 of 1782.] He evaporated the soluble portion, and testified that the alkali he got was stronger and better than the best barilla (see this J., 1910, 1053—1054). That, in fact, was the Leblanc process. It was not known what became of that process and of Collison's alkali. It disappeared out of England. Returning to his previous theme, Sir **William Ramsay** said there could be no question of the success of the Society, and he was sure they would join with him in drinking the toast of its increasing success, and coupling with it the name of Professor Bogert.

The toast was drunk very cordially.

President **Bogert** said he had looked forward to that dinner with very pleasurable anticipation. They had been so overwhelmed with kindness of every sort since they came to Liverpool, that, he confessed, he had exhausted his adjectives. They had had a very warm and hearty welcome and generous hospitality in all cities they had visited, but he could assure them they had never had a more warm and hearty welcome and warmer hospitality than they had had in Liverpool. Their feelings would be those of rejoicing and thankfulness and gratitude; of rejoicing, that the Society had been of use to the members and to the profession and to the community. Personally, he felt his own great gratitude to Dr. Messel for carrying on the work while he (the President) had been on the Continent. They also owed a debt of gratitude to Mr. Cresswell, to Mr. Tyrer, and to the members of the Council and to the Publication Committee, for doing the general work through the year, and to the local Committee, who had had the labour of making the arrangements for the present meeting, and to the indefatigable secretary, Dr. Rule. At the close of that meeting on Saturday night, he would lay down the office of President of that Society, and he had decided that many of them did not appreciate how much they owed him. He was prepared to maintain that he had been a model President, not a working model, but a model President in the dictionary sense of the term, namely, "a small and very imperfect imitation of the real thing." He would like to associate with the toast the name of their President elect, Sir William Crookes, than which they had no finer name in the domain of English science, and no nobler gentleman.

The toast of "The City of Liverpool" was proposed by Sir **Benjamin Johnson**. He was greatly honoured, he said, in being allowed to propose the toast of the City of Liverpool, and in being allowed to voice the sentiments of admiration and goodwill of the members of the Society and of the guests there that night. There was naturally a feeling in the breasts of Liverpool men of pride at their resources. It would not be to praise Liverpool unduly to say that there was no parallel to Liverpool's extraordinary activity. The chief claim of Liverpool was not its business activities, nor did it rest on the bigness of its docks, the wealth of its merchant princes, or the splendour of its buildings. Rather was it to be found, he thought, in the spirit, the temper, and the character of its leading citizens. Led by men who had given their great ability and were sacrificing their leisure and means in the pursuit of high public aims, the city grew year by year in public intelligence and in civic patriotism. There were three indications which bore out his assertion. The first was to be seen in the steady development of the communal life of the city reflected in municipal administration and enterprise. The second was the enlargement of the ideals of the people of Liverpool through the University. The third was to be seen in the acknowledgment of those deep instincts of mankind, from which no one could quite divest himself, as evidenced in the building, even in these times of unfaith, of a great religious temple. Judged by these tests it was safe to claim for Liverpool a pre-eminent place among the cities of the Empire. It was fitting to associate with the toast the names of two citizens. They all regretted the absence of the Lord Mayor, but they were glad to welcome in his place the deputy Lord Mayor, Mr. Max Muspratt, who combined the rival loves of the chemist and the politician. They would find it to be a happy combination. As a chemist, he had to admit they could not achieve the impossible; as a politician, he said "It shall be done." He was a type of the best public man, and though connected with a great public company, he found time to devote to the best interests of his fellow citizens of Liverpool.

Mr. **Max Muspratt** said that the Lord Mayor had asked him to express his regret that he could not be there. It was a proud privilege to be a citizen of Liverpool. Unfortunately, they were not all cast in the heroic mould. Liverpool was a peculiar mixture of the materialistic and philanthropic. At one time it accentuated the materialistic; at other times the philanthropic. Whether they took the materialistic or the philanthropic view, Liverpool had undoubtedly world-wide bounds of sympathy and of science. No city in the world had benefited more by the great advance of science, and no city in the world, when the right chord was struck, vibrated more harmoniously or more enthusiastically, to all that was best in mankind. It might be said metaphorically, that the channels of the Port of Liverpool had been cut by the chemical trade. The chemical trade was one of the first manufactures to help the Port of Liverpool. The great chemical industries of Widnes and St. Helens, and, in later days, of Northwich and other important places, had been large factors in the trade of the Port of Liverpool. Though, according to statistics, the chemical trade of Liverpool was not as large, as regards exports, as it used to be, the exports had nevertheless played an important part in the industry of the port, and the very industries the products of which, in their development, had to be carried out through the Port of Liverpool, had helped to bring to Liverpool its greatness and its fame. He thanked them for the way in which the toast of the City of Liverpool had been proposed and received. He trusted that for a long time the chemical industry would be associated with Liverpool. The Lord Mayor would greatly appreciate the toast, because he knew what the chemical industry meant to the world and to that great city.

Sir **Alfred Dale** said it was a great pleasure to be associated in that way, and under those conditions, with Mr. Max Muspratt. He thought it was not unreasonable that in the toast of "The City of Liverpool" the University of Liverpool should have a part of its own. Mr. Brodie and Dr. Hope had done their part, but there remained something for the University to do. The Education Committee had done its part in establishing a system of elementary schools, of which any city in the empire might be proud, and the pick of the scholars had passed on from the elementary to the secondary schools, and from the secondary schools to the University. On looking back over a period of many years he had been surprised to find the number of young men and young women who had won distinction within their walls: who had started at the bottom and had risen to the top. What they had done for literature they had done for science. The University School of Chemistry owed much to the late Professor Campbell Brown. His work had been taken up and carried on by Professor Baly with new vigour and fresh ideas. Though Professor Donnan had left them and now reigned where Sir William Ramsay reigned before, he was quite certain his successor, Professor Lewis, would continue to carry the torch. Their need was not now for more men but for larger laboratories, and they wanted to find some man to do what Mr. John Hughes had done for engineering and Sir William Lever had done for architecture. They had recognised from the first that their function was not only to make scholars and students and experts, but to make citizens and patriots as well, and they had to recognise that while education on the one hand brought larger powers, on the other hand it brought larger duties and the demand for larger and more generous service. Intellect and character was the double foundation on which they were building, and they strove as far as they could to develop those gifts together. The Mersey Mercantile Review of the previous week had challenged them to build as firmly and as strongly as their fathers had built, and it said that, unless they so strove and unless they so succeeded, the wealth, the pride, and the power which were theirs to-day, would fade, dissolve, and leave them. But if they could, in their time, teach and train a race of men, ardent in noble causes, loyal to high ideals and obedient to the vision, then the present and the past were leading them on to a still more glorious future in the years that were yet to come. He thanked them most heartily and sincerely for the way in which they had accepted the toast to which they had been good enough to ask him to respond.

Mr. **Thomas Tyrer**, in proposing the toast of "The Liverpool Section," said that the fact remained, that next to the Journal, the Sections were the most important part of the Society. The Sections were as pieces of machinery to keep the whole together. The Sections contributed to what was so beautifully represented at that meeting. The toast allotted to him was light. They had visited Liverpool in 1886, 1893, and 1902, and he had had the pleasure and gratification of proposing a similar toast to that on each of those occasions and on seventeen other occasions in various cities of the country. Never had he been more delighted to do it than at that meeting. He was tempted to say that that was the finest meeting they had ever had. As one associated with the Society in its early days and as having something to do with the secretariat, he ventured to say that that meeting had been conspicuous for organisation and hospitality of the most delightful kind. Nothing had been omitted which could contribute to the comfort, to the hilarity and peace of the meeting. Lancashire was the home of the Society. It was there that the idea was conceived, out of a notion that was popular of a Lancashire Chemical Society. Out of that idea grew the larger idea, and the men whose names in that district were household names, joined and were an inspiration to the men who were rising. The recollection of deeds of kindness done by them was a pleasure to that Society. He reminded them of Muspratt, Hurter, Mond, Carey, Gamble, Hargreaves, Campbell Brown, and Roscoe, all Lancashire men. Mond, while approving of the idea with his great authority, advised: "Whatever you do with your organisation or Society, make it on lines which can become national." Among the men who initiated the Society, they had had as their Presidents, Muspratt, Mond, Carey, and Roscoe. Davis died or he would have been one of them. He said a Society which could have such a list as they had was honoured by the men who had made it a hobby. There could not be any doubt that of the Liverpool Section, Dr. Rule had been the guiding and beneficent spirit, and he had been aided in a most hearty and efficient manner, by Prof. Donnan and Prof. Baly. He coupled with the toast the name of Prof. Donnan, and wished him success in his new sphere.

Professor **F. G. Donnan** thanked them very truly for the very kind and delightful things they had said. Undoubtedly, in Liverpool the Section of the Society had had a great advantage. As Mr. Tyrer had said, the Society was born there. Liverpool was the centre of the chemical industry of Lancashire. They had Sir William Lever there, and Sir John Brunner, and there was their own very old alkali industry. In going through Widnes, they saw what was doing there, and they in Liverpool derived very great advantage from that. It was one of the most important of their industries and he hoped it would continue to flourish and to grow. He would like to extend a very hearty welcome to all who had come there that night. He endorsed everything that had been said about Dr. Alexander Rule. All the success of the meeting and the organisation were due to Dr. Rule and the men who had worked with him.

The toast of "Our Guests" was proposed by Sir WILLIAM H. LEVER, BART. Chemistry, to him, he said, seemed very much like hope. He had always understood that hope was disappointment deferred. He did not know how long the manufacturer would be allowed to live with the discoveries which were being made. They were deeply indebted in Liverpool to Sir Edward Russell and the Press of Liverpool. The Liverpool University was represented there, and they had done right in coupling the name of Sir Alfred Dale, and they had Mr. Alsop there. He did not know whether the Liverpool University had benefited more by manufactures or science. He thought that there was a missing link between their universities and their industries. If there could be a way by which graduates from their universities would be able to express a preference for any walk of life and be led into ways in which the experienced mind would be of use, they would have attained a very great result. He believed a man with a university training was an infinitely better man of business than if he had left an elementary school in his teens. The difference in men in their business houses existed through the missing link between the university and a business career. Many a young man came to look on business as something a little lower than what he had aspired to. Instead of that, he should be trained to the view that business was the only proper sphere of activity and the only means by which he could apply that learning and experience which he had acquired at the universities. That should be the end of his training and not the wish to be a dilettante amateur. If they could face the fact that devotion to the work of supplying the wants of their fellow creatures and the luxuries of life was an end, and that to platitudinise or to pose and profess was not a higher culture than that of those engaged in the daily walks of life, that would be a true application of learning and training.

Sir EDWARD RUSSELL, in responding, said that the first distinguished man he knew in Liverpool had introduced him to that great hero of chemistry, James Muspratt. He (Sir Edward) had the pleasure of knowing his quality and enjoying his friendship at the early time of his own life, and at the latter time of Mr. Muspratt's life. That knowledge had left an indelible impression on him. He was very much struck by the remarks of Sir William Lever in proposing the toast. They fully justified the toast, by their wisdom and their pregnancy. It was, as he saw, a rather new thing for academic training to be believed in, in connection with practical life and practical business and manufacture. He agreed with Sir William that in that direction lay the routes of progress in this country, a route which would bring it into good competition with every country in the world, and that competition would be justified by its rationality and by experience. If he was at all familiar with anything, it was rather with the chemistry of affairs, than with the chemistry of physics. The President, on the previous day, had referred to the chemistry of affairs as being connected with the chemistry of physics, and stated that he looked with some degree of hope for a practical outcome of the teaching of the chemistry of affairs with the chemistry of physics through the co-operation of the universities. There were many signs in the public mind and in the public intelligence at the present moment, which promised greatly for progress in that direction. Their hopes were founded, not on the general knowledge of mankind, but on the general intelligent faith of mankind, and mankind had an increasing faith in the chemists' pursuits and in their aspirations. Their consciousness of great things would develop their science, and before them lay great ideas and possibilities of greater usefulness to the world. There was a rapidly growing belief in the science of politics, the science of economy, and the science of philanthropy, which were being received with more faith than they had received for many years. It was for them who were associated with such a great organisation to welcome this indication of a growing intelligence and faith on the part of the people, and to be assured that not only would they advance the prosperity and comfort of mankind, but that they would increasingly gather to themselves the confidence of the whole community, without which there could be no real co-operation of society. It was on that that he congratulated them, and it well deserved that when they were met for a common effort in the creation of great hopes, that there should be an increasing acceptance of scientific ideas, in preference to rule-of-thumb ideas; in which would be found the solution of many problems and great progress.

Mr. MAX MUSPRATT proposed the toast of "The President," which was drunk very cordially.

Professor BOGERT, in responding, thanked the assembly heartily for their expression of thanks. If they had only enjoyed the meeting as he had done, he was sure they would remember it for a long while. At the meeting at New York they expressed the hope that he might be able to be with them some other time. That hope had been realised that night. He wished to express his gratitude to those who had contributed to their pleasure.

FRIDAY, JULY 18TH.

EXCURSION TO CHESTER.

Leaders: Dr. Rule, Messrs. W. H. Roberts and Frank Tate.

On Friday a large party of members and ladies visited Chester. They were conducted round the Cathedral by Archdeacon Barber and Mr. F. Simpson, F.S.A., and then went to the Townhall, where the Mayor, Mr. H. B. Duddon, showed them the City Muniments and ancient silver. After luncheon at the Grosvenor Hotel, part of the company went to Eaton Hall by river, others to Bunbury Church and Beeston Castle by motor, and the remainder viewed the principal objects of interest in the City, returning to Liverpool at six o'clock.

PERFORMANCE AT THE REPERTORY THEATRE.

In the evening the Chairman of the Section, Prof. F. G. Donnan, F.R.S., received some 500 members, friends, and ladies in the foyer of the Repertory Theatre, after which performances were given of "The Twelve Pound Look," by Sir J. M. Barrie, and "A Privy Council," by Major W. P. Drury and Richard Pryce, songs by Mrs. Arthur Carey and Mr. J. A. McFarlane, and recitations by Miss Lilian Thomson. During the reception and the interval the Repertory Theatre Orchestra gave a programme of music.

The members and ladies then took supper at the University Club, Mount Pleasant.

SATURDAY, JULY 19TH.

HOME OFFICE EXPERIMENTAL STATION, ESKMEALS, CUMBERLAND.

Some fifty members went by train to Eskmeals, near Barrow, conducted by Prof. Harold B. Dixon, F.R.S., and Dr. Rule. On arrival they were received by Capt. A. P. H. Desborough, R.A., in the absence of Sir Henry Cunynghame, K.C.B., Chairman of the Executive Committee on Explosions in Mines, and by Dr. R. V. Wheeler, chemist in charge.

After the party had taken up its position at the Observation Station, an explosion of coal dust was shown in a large tube built of boiler plates about 750 ft. long by 8 ft. in diameter, along which coal dust was spread, at the rate of 1 lb. per lineal foot throughout the whole length. The inflammation was effected by 24 oz. of blasting powder fired from a cannon inside, 50 ft. from the closed end of the tube. There was no air current. In this instance, owing to the blowing out of the closed end, the flame travelled only some 200 ft., and nothing but black coal dust issued from the open end. On some occasions, flame has been observed to issue as far as 200 ft., and bolts and nuts have been thrown in all directions.

After examining the power, grinding, retort, and chronograph-houses, the party assembled at the safety lamp testing station for a demonstration of Home Office tests.

At the laboratories the following demonstrations were given by the staff:—

(1) Limits of inflammability of methane with air, effects of agitation, inflammability of different dusts.

(2) Apparatus for experimenting on the nature of coal, bomb for the explosion of gases or inflammable dusts, chronograph for measuring rates of detonation of high explosives, Cambridge Scientific Instrument Co.'s temperature recorder.

An interesting exhibit in this department was a series of photographic plates of coal sections, made by cutting and polishing slices of coal and merely laying them on sensitised plates and afterwards developing the images so formed. It has been found that if the coal be extracted with pyridine, no action takes place.

The construction of a model gallery on a large scale for the purpose of investigating coal dust explosions, after being advocated by Prof. Dixon and others, was recommended by a Committee of the Royal Commission on Mines appointed in 1906, and in consequence the Mining Association of Great Britain installed a large experimental gallery about 600 ft. long, constructed of disused boiler shells 7 ft. 6 in. diameter, and fitted with pressure gauges and other instruments, at the Altofts Colliery, Normanton, Yorkshire, in the year 1908.

Experiments were made here for three years under the auspices and at the cost of the Association, after which period the Government agreed to continue the experiments at the public cost. The site at Altofts being no longer available the apparatus and plant were ultimately installed at Eskmeals in Cumberland, which was chosen as being remote from dwellings, while near a railway and situated at fairly equal distances from English, Scotch, and Welsh Coalfields. The works are surrounded by sandhills, and adjoin the gun range of Messrs. Vickers of Barrow.

The large gallery has been removed from Altofts and is now 800 ft. in length. Branches with elbows have been erected at each end, while a smaller gallery 3 ft. in diameter and 400 ft. long has been fixed alongside, and communicating with, the larger gallery for comparative experiments.

At the extremity of the branch on the eastern end of the large gallery is a fan driven by a 25 h.p. engine. On a sand hill overlooking the galleries is a splinter-proof firing station, from which the firing apparatus and recording instruments are controlled. Adjoining is a small meteorological station, and to the north of the galleries a chronograph house and a lamp-testing station, including a gasholder of 1500 c.f. capacity.

To the south of the galleries is the electric light and power house with two 25 h.p. engines and two dynamos with switch boards and measuring and recording apparatus, with a set of accumulators in an adjoining room. Near the power house is the coal-crushing plant for producing the dust used in the experiments, and also a gas-making plant and two gas-holders. The observation stations and buildings are strongly protected, and splinter-proof shelters have been erected near the galleries for the protection of the workmen during explosion experiments. The laboratory has been placed about 350 yards from the works, and is fully equipped with apparatus for physical and chemical experiments. A dwelling-house for the Chief Chemist and other living accommodation has been provided through the generosity of the Mining Association. Provision has been made for complete investigations into the initiation and spread of coal dust explosions, whereby it is hoped that means of preventing or limiting them will be ascertained.

Manchester Section.

SOME OF THE CONDITIONS AFFECTING EXPLOSIONS OF COAL GAS AND AIR.

PART I. BY E. L. SELLARS, M.SC., AND C. CAMPBELL, M.SC.

PART II. BY E. L. SELLARS, M.SC.

The experiments described in the following memoir were suggested by Professor H. B. Dixon, and were carried out in his research laboratory.

The object of this investigation was to obtain some further knowledge of explosions in coal mines by carrying out explosions on the small scale.

The classical researches of Berthelot, Mallard and Le Chatelier and Dixon have thrown light on the behaviour of explosions in various gaseous mixtures in which the explosion "wave" is set up, but little has been done in the case of mixtures where the propagation is very slow. Mallard and Le Chatelier (Annales des Mines, 1883) partially studied the explosions in mixtures of coal gas with air, but the tubes they used were never longer than 4 m. nor wider than 30 mm. They devised several methods of measuring the rates of explosion, but none were satisfactory for practical purposes.

In the explosions studied in this work, the explosion wave is never set up, and as a rule, the flame travels at such a rate that it can be followed by the eye.

The coal gas was found to vary in composition somewhat, from day to day, but by making sufficient gas mixture for each set of comparative experiments in a large gas-holder, this variation did not affect the results.

PART I.

Apparatus. The propagation of the explosions was effected in glass tubes of lengths varying from 4 to 18 m. Such a tube was made up of shorter tubes ($1\frac{1}{2}$ m. long) all of the same diameter, joined together by rubber bands. For measuring the rate of propagation, the tube was marked at every metre. To time the flame as it passed each mark a drum (see Fig. 1), round which a piece of smoked paper was fixed, was employed. A pointer attached to a small rod of soft iron which could be attracted by a small electro magnet, was adjusted so that the point traced a fine line on the paper when the drum revolved. The electro magnet was connected with an accumulator by the wires *d*, a tapping key being interposed, so that an instantaneous "make" or "break" could be performed by pressing down or releasing the tapping knob. As the flame passed each metre mark, the key was momentarily tapped; the circuit was thus completed, the rod of soft iron attracted, and the pointer made an upward mark on the revolving drum. To insure that the drum revolved at a constant rate, the times for one revolution before and after each experiment were determined by means of a stopwatch. Unless these were the same to within a fraction of a second the experiment was rejected. Knowing the distance

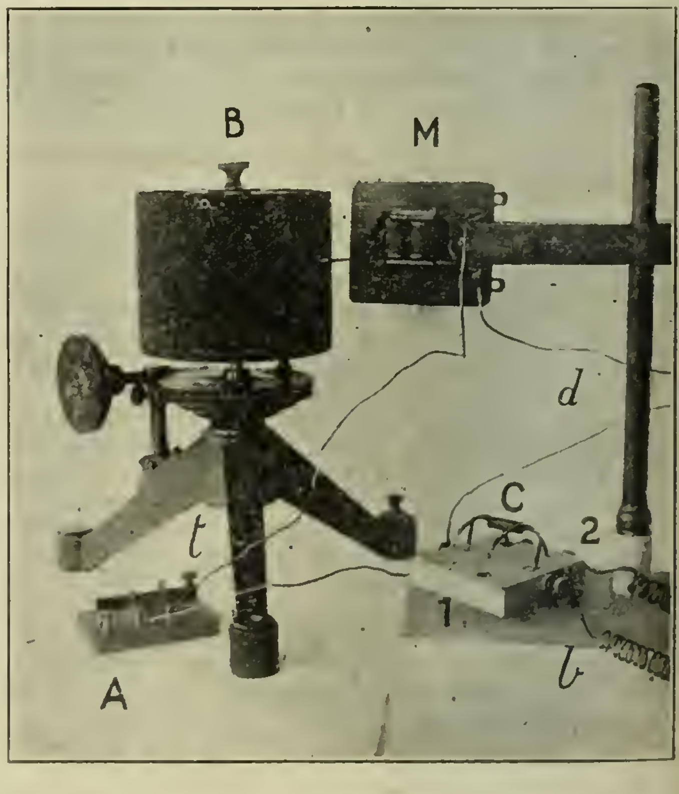


Fig. 1.

between the marks recorded by the pointer on the drum, the circumference, and the time for one complete revolution, of the drum, the time taken by the flame to travel from one metre mark to another could be calculated. In some experiments it was necessary that the instant of firing the gas mixture should be recorded on the drum, and the arrangement to accomplish this is shown in Fig. 1. B represents the drum. The sparking wires in the tube in which the propagation takes place are connected with a Rhumkorf coil. The current to produce the spark is furnished by a battery, one pole of which is connected with the coil, the other with one of the wires *b*, in the photograph. The other wire *b*, is connected with the free terminal of the coil. When the switch *e*, is in the position shown the primary current passes through the Rhumkorf coil, the hammer of which is arranged so that no sparks pass across the sparking wires in the tube. If now the knob *t*, of the tapping key A, is first depressed and the switch *e*, quickly brought over from the position 2 shown in Fig. 1 to the position 1, two things happen :—(1) the circuit through the wires *b* and the Rhumkorf coil is suddenly broken; this means that a spark passes across the wires in the firing tube; (2) the circuit through the electro magnet M is "made." This means that the pointer makes an upward mark on the drum. On releasing *t*, the circuit through the electro magnet M, is broken and the pointer falls. The time between the passage of the spark which starts the explosion and the registering of the upward mark on the drum is equal to the time taken in bringing the switch *c*, from position 2 to position 1, and may be neglected.

(*a*) *Experiments to determine the distance the flame travels under various conditions.*

The gas mixture used contained 12·3 per cent. coal gas. The conditions under which the explosions were carried out are as follows :—

1. *Sparking near an open end, the further end being closed.* Experiments were conducted in tubes of lengths 3 m. to 18 m. and of diameters 12 mm., 24 mm., and 44 mm., and in all these cases the flame travelled the whole length of the tube. In a case where the further end was closed during the experiment, as before, but the end at which the flame is started was closed immediately after ignition, the flame again travelled the whole length of the tube.

2. *Sparking near an open end, the further end of the tube being open.* It was found that unless the tube was very short (*e.g.*, 3 m., in which case the flame shot out of the further end of the tube), the flame never travelled the full length of the tube. In a set of experiments in which the length of the tube was 12 m. the flame died out at the 10th metre. The reason for this is doubtless that as the flame travels from the starting point, gas issues from, and air enters, the further end, making a certain portion of the gas mixture non-explosive. If the tube be short, the flame reaches the end before the gas has time to escape, and consequently shoots out of the end of the tube. If instead of leaving open the end near which the gas was fired, it was closed immediately after ignition, it was found that the distance the flame travelled was greatly diminished. Using a tube 12 m. long and 24 mm. wide, the flame travelled 3½ m. only, under these conditions, whereas when the end near which the mixture was fired, was left open during the experiment, the flame travelled 10 m.

3. *Sparking near a closed end, the further end being closed.* The explosions when carried out under these conditions were accompanied with some violence. The flame travelled the whole length of the tube.

4. *Sparking near a closed end, the further end being open.* The flame propagated under these conditions travelled very rapidly. It did not, except in the case of short tubes (*e.g.*, 4 m. long) travel the whole length of the tube. Using a tube 12 m. long and 24 mm. wide, the flame died out at the 7th metre.

5. *Effect of length and diameter of the tube on the distance the flame travels.* (i) *Sparking near an open end, the further end being open.* The results show that the increase in length of the tube means an increase in the distance the flame travels, although this distance does not appear to bear any proportionate relation to the length of the tube.

Length of tube.	Distance flame travels.
6 m.	5·5 m.
12.0 m.	9 m.
17·5 m.	12 m.

Experiments show that the effect of increasing the diameter of the tube is to somewhat diminish the distance the flame travels, under the above conditions.

Mixture 12 per cent. coal gas, length of tubes = 12 m.

Diameter.	Distance flame travels.
12 mm.	11 m.
24 mm.	10·5 m.
44 mm.	9 m.

(ii) *Sparking near a closed end, the further end being open.* The flame travels somewhat further in a wide tube than in a narrow one.

Mixture 10 per cent. coal gas, length of tubes = 5 m.

Diameter.	Distance flame travels.
24 mm.	3·3 m.
37 mm.	4·0 m.
44 mm.	5·5 m.

(*b*) *The manner in which the explosions are propagated under various conditions.*

The tube used was 12 m. long and 24 mm. wide.

The distance of the sparking wires from end of tube was 11 cm.

With the exception of a lead bend comprising the 7th metre, the tube consisted of lengths of glass tubes joined by rubber bands; it was set up so as to be inclined from the horizontal. The gas mixture used contained 12 per cent. coal gas.

The tube was filled with the explosive mixture and the explosion observed under each of the following conditions of the tube :—

1. Sparking near an open end, the further end being closed;

2. Sparking near an open end, the further end being open;

3. Igniting by the flame of a taper at an open end, this end being closed just after ignition, the further end being closed during the experiment. (In the case of the further end being open during the experiment, the flame did not travel a sufficient distance for its progress to be traced.)

4. Sparking near a closed end, the further end being open.

5. Sparking near a closed end, the further end being closed.

I. *Sparking near an open end, the further end being closed.* A number of experiments show that the flame starts at a uniform rate with a steady motion for about 4 m.; small oscillations then begin, and the rate appears to be slightly increased. This state continues to the 6th metre. This may be called the Initial Uniform Period. From the 6th to the 11th metre the oscillations suddenly increase in magnitude, and the propagation is accompanied with violence and a loud crackling noise. The rate of propagation, too, is simultaneously suddenly increased. This period may be called the Period of Maximum Velocity. At the 11th metre the flame assumes its original character, travelling steadily, and at a uniform rate. This continues to the end of the tube; this period may be called the Final Uniform Period.

Fig. 2 illustrates the progress of the flame propagated under the above conditions. A B represents the Initial Uniform Period, E being the point at which the oscillations begin to be apparent. B C represents the Period of Maximum Velocity, and C D the Final Uniform Period.

Illustrating the progress of the flame produced by sparking near an open end of the tube, the further end of which is closed.

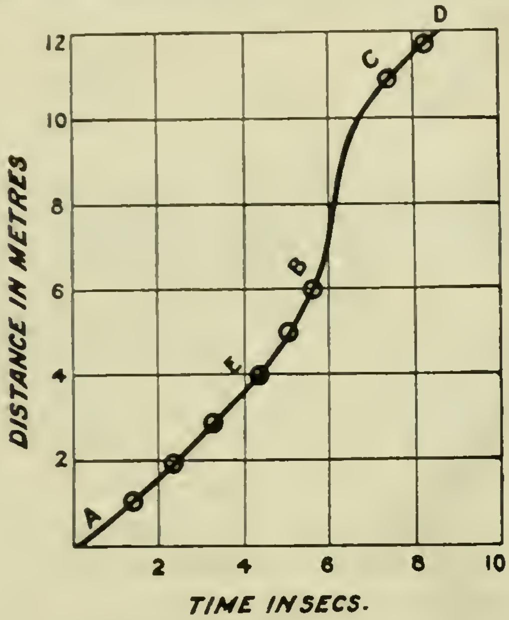


FIG. 2.

2. *Sparking near an open end, the further end being open.* Experiments show that the flame starts at a uniform rate as before, for about 4 m., small oscillations are then seen which increase in magnitude and just before the flame goes out are very violent. The period of Maximum Velocity, present in 1, is absent. The flame advances at approximately the same rate throughout. (Fig. 3.)

Illustrating the progress of the flame started by sparking near an open end of a tube, the further end of which is open.

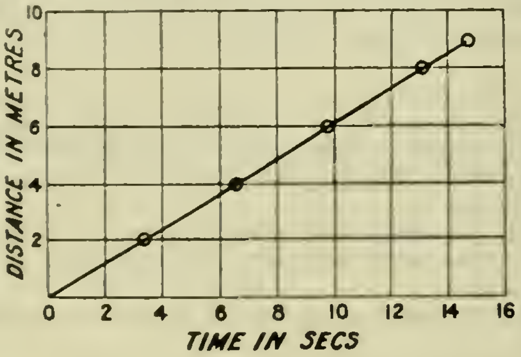


FIG. 3.

3. *Igniting by the flame of a taper at an open end, this end being closed immediately after lighting, the further end being closed during the experiment.* The flame travels in a manner very similar to that described in 1, the progress apparently being little affected by closing the end after igniting the gas mixture.

4. *Sparking near a closed end, the further end being open.* The manner in which the flame propagates itself is very different from that in previous cases. With mixtures containing about 12 per cent. coal gas the flame travelled at a very rapid rate and was accompanied with considerable violence. It was thus impossible to trace the progress of the flame metre by metre, even by using mixtures containing a less percentage of coal gas.

5. *Sparking near a closed end, the further end being closed.* Explosions which otherwise are very feeble, under these conditions become very violent, and it was only after considerable difficulty that it was shown that the flame travels at a great velocity for about 11 m. and then finishes its course to the end of the tube with suddenly diminished velocity. The progress of the flame is shown in Fig. 4.

(c) *On the "Initial Velocity" of the Flame produced in mixtures of Coal Gas and Air.*

By the initial velocity is meant the velocity with which the flame travels through that portion of the Initial Uniform Period, where oscillations have not begun. As shown by Mallard and Le Chatelier, the duration of this steady period increases with increased length of the tube to a certain limit. In a tube 12 m. long, the flame possesses this steady character for at least 3 m., but in a tube of the same diameter, and 4 m. long, this initial period only exists during the first metre of the progress of the flame.

Showing the effect of sparking near a closed end of a tube, the further end of which is closed.

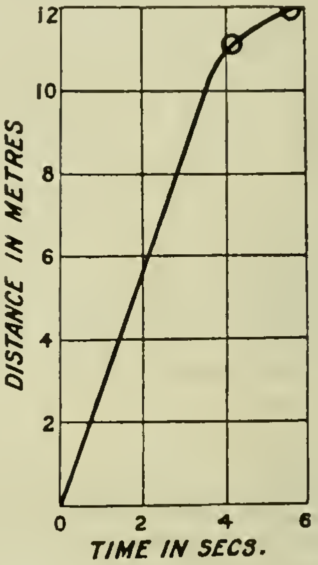


FIG. 4.

Effect of diameter of the tube on the initial velocity. The tubes used were of the following dimensions:—(1) Length—11·6 m.; diam.—44 mm. (2) Length—12·0 m.; diam.—24 mm. Gas mixture, 10 per cent. coal gas.

(I) *Sparking near an open end of the tube, the further end being closed.* The effect of the diameter of the tube on the initial velocity is apparent if the gas mixture in the two tubes is sparked at the same instant. The flame in the wider tube very soon out-distances that in the narrower tube. To determine the relative initial velocities, the flame in each tube was studied separately, and was timed at the end of every ¼ m. interval. The results show that an increase in the diameter of the tube causes an increase in the initial velocity of the flame.

The following table shows how the time taken by the flame in travelling the first two metres, is less in the wide tube than in the narrow one, and this difference in the initial velocity increases as the flame progresses.

Distance in metres.	Time in seconds.	
	Diam. 44 mm.	Diam. 24 mm.
0·25	0·52	0·57
0·50	1·08	1·23
0·75	1·53	2·02
1·00	2·05	2·70
1·25	2·58	3·40
1·50	3·21	4·14
1·75	3·78	4·80
2·00	4·33	5·86

(II) *Sparking near an open end, the further end being open.* Increase in diameter of tube means an increase in the initial velocity of a flame started under these conditions, *e.g.*:—

Distance in metres.	Time in seconds.	
	Diam. 44 mm.	Diam. 24 mm.
0·25	0·44	0·65
0·50	0·87	1·28
0·75	1·30	1·95
1·00	1·90	2·57
1·25	2·41	3·19
1·50	2·96	4·07
1·75	3·47	4·80
2·00	3·95	5·65

Effect of having the further end of the tube open, on the initial velocity of a flame produced by sparking near an open end.

Dimensions of tube :—Length—11·7 m. ; diam.—24 mm. Gas mixture, 10 per cent. coal gas.

A set of experiments was very carefully carried out, and the results show that the effect on the initial velocity of having the further end closed or open, is very slight ; it appears that if the further end is open, the initial velocity is less than if the further end were closed. This slight difference is more pronounced if the tube used is shorter (*e.g.*, 4·3 m.).

Length of tube—11·7 m.

Distance in metres.	Time in seconds.	
	Further end open.	Further end closed.
0·25	0·85	0·75
0·50	1·80	1·70
0·75	2·75	2·55
1·00	3·55	3·42
1·25	4·35	4·35
1·50	5·25	5·25
1·75	6·20	6·05
2·00	7·05	7·05

Length of tube—4·3 m.

Distance in metres.	Time in seconds.	
	Further end open.	Further end closed.
0·25	0·55	0·52
0·50	1·10	0·90
0·75	1·80	1·40
1·00	2·70	2·00

Effect of length of tube on the initial velocity.

The tubes used were of the following dimensions :—(1) Length—4·3 m. ; diam.—24 mm. (2) Length—12 m. ; diam.—24 mm. Composition of gas mixture, 10 per cent. coal gas.

(I) *Sparking near an open end, the further end being closed.* The results of several experiments show that an increase in the length of the tube causes the initial velocity to be slightly diminished, *e.g.* :—

Distance in metres.	Time in seconds.	
	Length 4·3 m.	Length 11·7 m.
0·25	0·65	0·80
0·50	1·50	1·76
0·75	2·30	2·66
1·00	3·40	3·60

(II) *Sparking near an open end, the further end being open.* Increase in length of the tube has little effect on the initial velocity under these conditions, *e.g.* :—

Distance in metres.	Time in seconds.	
	Length 4·3 m.	Length 11·7 m.
0·25	0·82	0·80
0·50	1·86	1·76
0·75	2·60	2·77
1·00	3·62	3·52

Summary of results on initial velocities.

I. Increase in diameter of tube means an increase in the initial velocity of a flame started by sparking near an open end of a tube, whether the further end be open or closed.

II. The effect of increasing the length of the tube, keeping the diameter constant, on the initial velocity of a flame produced by sparking near an open end, is, in the case of the further end being closed, to cause a slight decrease ; in the case of the further end being open the length has no effect.

III. If the flame is started by sparking near an open end, the fact of the further end being closed causes the Initial Velocity to be slightly greater than it would be, if the further end were open.

IV. The initial velocity is fairly constant.

Part II.

(a) *Effect of diameter of tube on the rate of explosion.* Three tubes, made of glass throughout, were used, of the following dimensions :—

A. Diameter—44 mm. ; Length—12·0 m.
B. Diameter—24 mm. ; Length—12·0 m.
C. Diameter—12 mm. ; Length—12·0 m.
Distance of sparking wires from end—11 cm.

Illustrating the effect of diameter of the tube on the progress of the explosion. Conditions :—Sparking near an open end the further end being closed.

Curve d, 12 mm. diam.
,, d_1, 24 mm. diam.
,, d^1, 44 mm. diam.

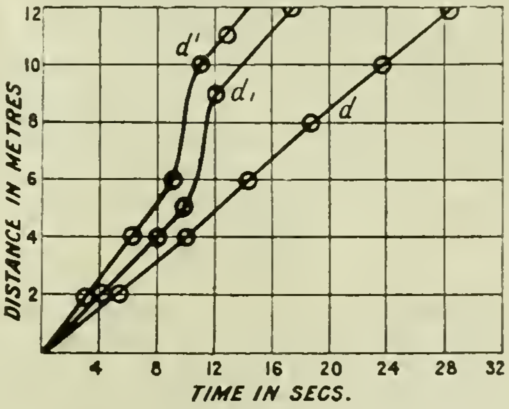


Fig. 5.

(I) *Sparking near an open end, the further end being closed.*

A consideration of the curves shown in Fig. 5 shows that :—

(i) The velocity is increased with increase in diameter in the Initial Uniform Period.

(ii) The period of Maximum Velocity can be eliminated by sufficiently diminishing the diameter of the tube.

(iii) In tubes where the period of Maximum Velocity can exist, the position of this period is slightly different in tubes of different diameter, but the duration of this period is not much affected.

A consideration of the following figures shows that the mean velocity during the Period of Maximum Velocity is slightly greater in the 44 mm. tube than in the 24 mm. tube.

Mean velocity in metres per sec. measured during the period of maximum velocity.

Experiment.	Diameter.	
	24 mm.	44 mm.
(I.)	0·82	0·97
(II.)	1·50	2·50
(III.)	0·88	0·96
(IV.)	1·82	1·89
(V.)	2·37	3·08
Average	1·47	1·89

In Fig. 6 the effect of diameter on the time for the flame to travel 11 m. is shown. The time diminishes rapidly to a certain point with increasing diameter.

Showing how the time taken by the flame in travelling 11 m. diminishes to a minimum with increase in diameter of tube. Conditions: Sparking near an open end, the further end being closed.

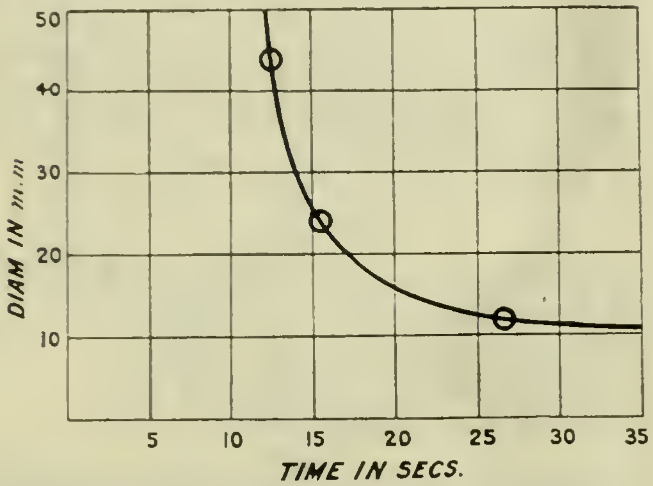


Fig. 6.

With tubes less than 10 mm. in diameter, it was found experimentally that the flame goes out as soon as started.

(II) *Sparking near an open end, the further end being open.* The tubes used were the same as in the case of the further end closed. The flame starts with a steady flame until it has travelled about one half the length of the tube. Oscillations of a small but increasing size then begin, being accompanied during the last metre of the propagation by some violence. In the 44 mm. tube these latter vibrations are accompanied by a crackling noise; in the 24 mm. tube this noise is not so great, and in the 12 mm. tube there is no noise whatever. As illustrated in Fig. 7, the diameter of the tube affects the rate with which the flame travels, very considerably, increase in diameter resulting in an increase in the rate. If as in Fig. 8, the abscissae represent times for the flame to travel 9 m., and the ordinates represent the diameter of the tube, it will be seen that above a certain limit, the diameter of the tube has little effect on the rate.

Illustrating the effect of diameter of the tube on the rate of explosion. Conditions:—Sparking near an open end of the tube, the further end being open.
oa, curve representing progress of flame in tube of 12 mm. diam.
ob, ,, ,, ,, ,, ,, 24 mm. diam.
oc, ,, ,, ,, ,, ,, 44 mm. diam.

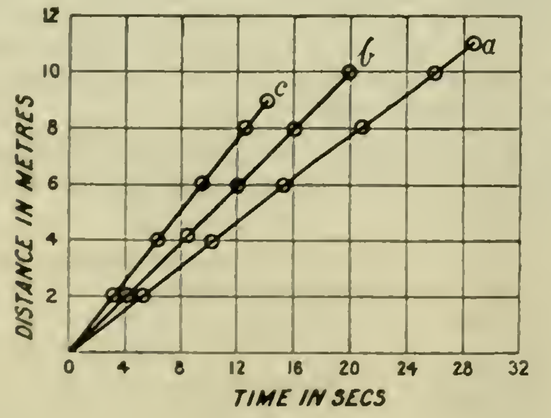


Fig. 7.

(b) *Effect on length of the tube on the rate of explosion.* The apparatus consisted of a glass tube 18 metres long, which was made up of shorter lengths joined together by rubber bands. This tube could be varied in length as required. The diameter throughout was 24 mm.

Comparative experiments were carried out under the following conditions:—

Showing how the time taken by the flame in travelling 9 m. diminishes to a minimum with increase in diameter of tube. Conditions:—Sparking near an open end of the tube, the further end being open.

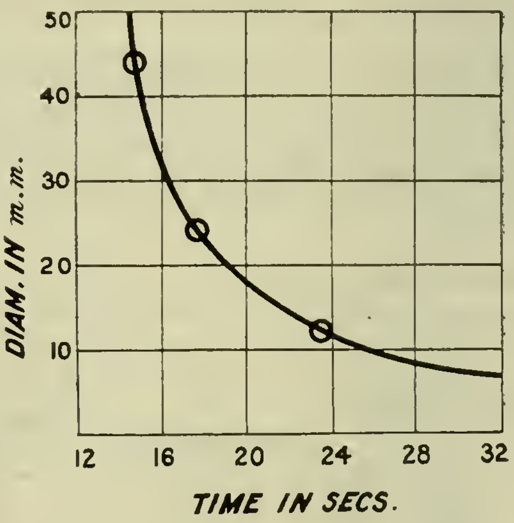


Fig. 8.

I. *Sparking near an open end, the further end being closed.* From a consideration of Fig. 9 the effects of increasing the length of the tube on the progress of the flame are as follows:—

(i) *Effect on initial uniform period.* Increase in length of the tube has practically no effect on this portion of the progress of the flame. This does not contradict the results of the effect of length on the initial velocity. (Part I. (c),) since the results there obtained were from a careful study of the initial velocities every ¼ m., whereas in this portion, the object is to observe the more pronounced differences. The differences observed in Part I. (c) are, as stated, very slight and are not apparent unless the initial velocities are slow. It will be noticed from Fig. 9 that in the case of a tube 6 m. long, the period of maximum velocity is not apparent.

Showing the effect of the length of the tube on the progress of the flame. Conditions:—Sparking near an open end, the further end being closed.
op, illustrates progress of flame in tube 6·0 in. in length.
oq, ,, ,, ,, 11·7 in. ,, ,,
or, ,, ,, ,, 16·5 in. ,, ,,

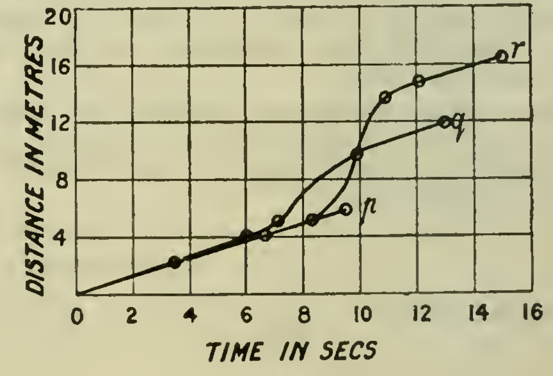


Fig. 9.

(ii) *Effect on period of maximum velocity.* The general conclusion to be drawn from a series of experiments is that (i) the period of maximum velocity is increased; (ii) the average rate during this period is increased.

Effect of length of tube on maximum velocity.

Experiment.	Velocity in metres per sec.	
	Length 12 m.	Length 18 m.
(I.)	1·1	3·3
(II.)	1·6	2·1
(III.)	1·3	1·2
(IV.)	2·0	3·0
(V.)	1·2	1·4
Average	1·4	2·2

(iii) *Effect on the mean velocity, with which the flame travels from one end of the tube to the other.* Plotting a curve with rates as abscissae and length as ordinates a curve shown in Fig. 10 is obtained. This shows that increase in length of tube, causes the mean rate to be increased to a certain limit, after which any further increase in length does not affect the rate.

Showing the effect of the length of the tube on the rate of explosion. Conditions:—Sparking near an open end of the tube, the farther end being closed.

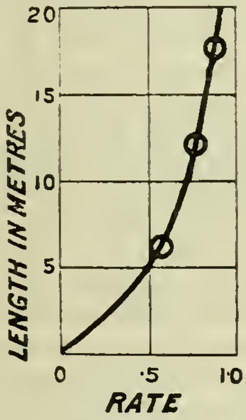


Fig. 10.

II. *Sparking near an open end, the further end being open.* Tubes of length 12·0 m. and 17·5 m. respectively, and both of diam. 24 mm. were used, and the gas mixture contained 12 per cent. coal gas.

In the shorter tube the flame travelled steadily for about 4 m., small oscillations then became apparent, these increasing in size as the flame progressed.

In the longer tube the flame behaved similarly, but a slight acceleration was observed between the 6th and 8th metres.

The following table shows how the time increases as the flame progresses in the two tubes, being greater in the shorter tube than in the longer one.

Distance in metres.	Time in seconds.	
	Tube 12 m. long.	Tube 17·5 m. long.
1	3·4	3·2
2	6·4	6·0
3	9·2	8·7
4	12·1	11·4
5	15·0	14·5
6	18·0	16·9
7	21·3	18·7
8	24·9	21·4
9	27·1	24·2

Increase in length of the tube, therefore, causes an increase in the rate of the explosion under these conditions.

(c) *Sparking near a closed end the further end being open; effect of the distance of the spark from the closed end on the rate the flame travels.*

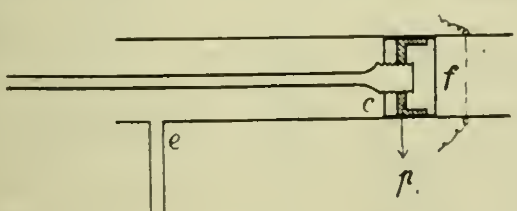


Fig. 11.

Apparatus. The glass tube used was 4·4 m. long and 37 mm. diam. At the sparking end, a brass piston (Fig. 11) was fitted, which could be moved close up to the sparking wires or any distance away up to 50 cm. The piston had a flush metal face, *f*, and was fitted with a leather bucket plunger, *p*, which was kept in position by a metal piece, *c*, screwed on as shown, and which would expand or contract with slight irregularities in the diameter of the tube, so as to be always gas tight. Before each experiment, the piston was withdrawn past the side tube *e*, in order to permit the admission of the gas mixture, and then pushed forward to the required position. The distances from the sparking wires were indicated by a scale fixed on to the tube.

When the explosive mixture was fired, the flame divided into a forward movement, and a backward movement towards the piston. This work deals only with the flame travelling in the forward direction. Two fixed points were taken in timing the flame (*a*) at the moment of firing (this was registered automatically on the drum by using the arrangement described in Part I) (*b*) as the flame passed a mark on the tube. This mark was at least 1 m. away from the place where the flame went out.

Conditions:—Sparking near a closed end of the tube, the further end of which is open. Showing the effect of the distance of the closed end from the sparking wires on the time taken by the flame in travelling 2·5 metres.
Diam. of tube = 37 mm.

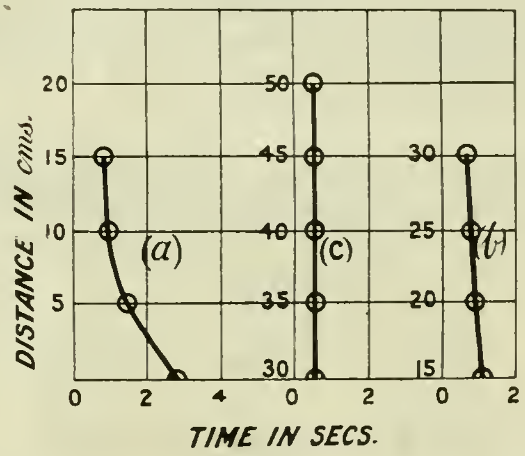


Fig. 12.

Observations were taken with the piston close up to the sparking wires, with the piston 50 cm. away, and at every intervening 2·5 cm. Fig. 12 illustrates the results obtained in a tube of length 4·6 m. and diam. 37 mm. The abscissae represent the times taken by the flame to travel a fixed distance (2·5 m.). The ordinates represent the distances in cms. of the piston from the sparking wires. The portion (*a*) shows the effect of moving the piston from a position close up to the sparking wires to a position 15 cm. away. The increase in velocity is very marked as the piston is withdrawn. The portion (*b*) shows the effect of moving the piston from a position 15 cm. from the sparking wires

Conditions:—Sparking near a closed end of the tube, the further end of which is open. Showing the effect of the distance of the closed end from the spark on the time taken by the flame in travelling 2·5 metres. Diam. of tube = 44 mm.

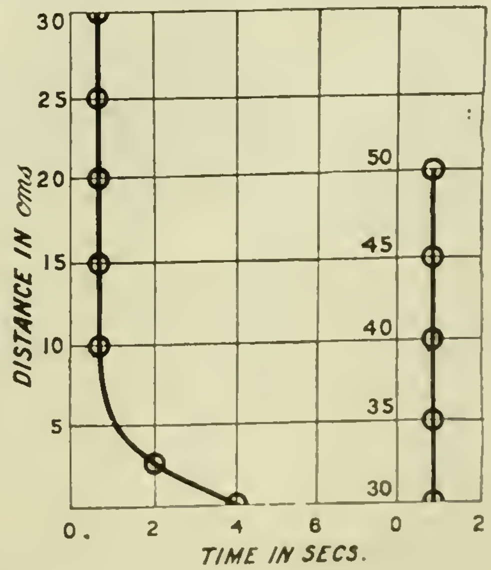


Fig. 13.

to a position 30 cm. away. The increase in velocity apparent in (*a*) continues, although not so markedly, until the piston is 25 cm. away, when the velocity appears to be unchanged with any further withdrawal of the piston. With the piston at any distance between 30 and 50 cm. away from the sparking wires the velocity is independent of the position of the piston as shown in (*c*). It is conceivable that the position of the piston may have a different effect on the velocity of the flame in tubes of different diameters, and this must be taken into consideration in studying the effect of diameter of the tube under conditions of sparking near a closed end. Experiments were therefore carried out, using two other tubes of the following dimensions :—(i) Length—4·6 m.; diam.—44 mm. (ii) Length—4·6 m.; diam.—24 mm.

Figs. 12, 13, and 14 show the curves obtained from results of experiments carried out in the three tubes. The general form of each curve is the same but, whilst the effect of moving the piston from a position close up to the wires to a position 15 cm. away, is very pronounced in the 44 mm. tube, it is not so apparent in the 37 mm. tube, and is scarcely perceptible in the 24 mm. tube. The positions of the piston which just give the maximum velocity differ, too, in the three tubes. In the 44 m. and 37 mm. tubes these positions are 15 cm. and 25 cm. respectively from the sparking wires.

Conditions:—Sparking near a closed end of the tube, the further end of which is open. Showing the effect of the distance of the closed end from the spark on the time taken by the flame in travelling 2·5 metres. Diam. of tube = 24 mm.

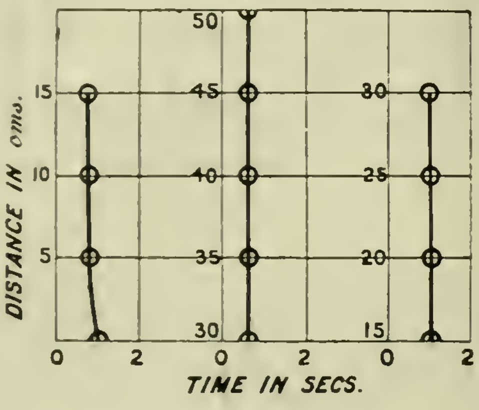


Fig. 14.

Effect of the material of the tube on the rate of explosion. Experiments were carried out in tubes of glass and of lead, each being 25 mm. in diam. and 12 m. in length. In the lead tube short glass tubes (50 mm. long and 25 mm. wide) were interposed at every metre, to act as windows, the flame being timed as it passed each window. The flame, in all cases, was started by sparking near an open end of the tube, the further end of which was closed. The gas mixture contained approximately 10 per cent. coal gas.

The results point to the conclusion that the general character of the flame in the lead tube is the same as that in the glass tube, *i.e.*, the Initial Uniform Period, the Period of Maximum Velocity, and the Final Uniform Period of the flame, are apparent in both tubes. The average velocity, however, appears to be somewhat greater in the leaden tube than in the glass tube. The following are the results of various experiments :—

Time in seconds for flame to travel 10 *m.*

Experiment.	Lead tube.	Glass tube.
(I.)	8·3	9·3
(II.)	8·2	9·2
(III.)	5·5	6·7
(IV.)	5·1	7·2
Mean	6·8	8·1

Further investigation, however, on this portion of the subject, is necessary.

Summary of Parts I. and II.

1. The conditions of the tube in which the explosion takes place greatly affect the distance the flame travels.

2. The state in which the ends of the tube are put (*i.e.*, whether open or closed) may change the whole character of an explosion; *e.g.*, a flame started near an open end of a tube may be quite feeble, and the velocity slow, but if the flame were started near the same end closed before ignition, the explosion might travel with considerable violence and velocity. This shows the possible effect of a closed passage on an explosion in a mine.

3. The initial velocity of the flame started near an open end of a tube, is increased by increasing the diameter of the tube, the length of the tube and the state of the further end of the tube in some cases affect the initial velocity.

4. Increase in length of the tube increases the rate of explosion up to a certain limit; increase in diameter also increases the rate up to a certain limit; in tubes less than a minimum diameter, the flame will not propagate itself.

5. Sparking near an open end, the further end being closed, the flame travels with a somewhat greater velocity in a lead tube than in a glass tube, although the general character of the flame is unaltered.

London Section.

Meeting held at Burlington House, on Monday, June 2nd, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

AN ILLUSTRATION OF THE PARTIAL PYRITE PROCESS.

BY W. R. SCHOELLER, PH.D.

The smelting of oxidised copper ores with carbonaceous fuel in a shaft furnace is analogous to that of iron and roasted lead ores, in that an impure metal is obtained by the reduction of its oxide. Modern copper blast furnace practice which has been evolved during the past quarter of a century differs materially from the above, as the resultant product is a sulphide of copper and iron termed matte. Smelting for matte is really a concentration process by liquation, though much more perfect than that of antimony ores, as both the valuable sulphide and worthless gangue are liquefied and separated by gravity. The subsequent bessemerizing of matte and electrolytic refining of the resultant blister copper have revolutionised the metallurgy of copper and simplified it to a considerable extent.

The usual process in blast furnace work consists in smelting imperfectly roasted ores with coke and suitable fluxes, the residual sulphur uniting with copper and some of the iron to form matte while the non-metallic elements are slagged off. The amount of sulphur left in the ore determines the amount and grade of the matte. For some time past the practice has become more and more prevalent to abandon roasting, and to smelt pyritic ores by means of the heat generated by the combustion of their sulphur and iron. At Tilt Cove (Newfoundland) the ore is smelted without any fuel at all, while at Mt. Lyell (Tasmania), Ducktown (Tenessee), and Keswick (California), the amount of coke added is 2—3 per cent. of the charge; this constitutes pyritic smelting. The process is of limited applicability, being only possible where massive payable sulphides occur.

If an ore contains insufficient sulphur and iron to be self-smelting, the heat derived from the oxidation of these elements is supplemented by the addition of coke: in partial pyritic smelting the amount added forms 5—12 per cent. of the charge. It is, of course, kept down to a minimum, not only for reasons of economy in fuel, but because the presence of coke greatly modifies the reactions taking place in the furnace; whereas in true pyritic smelting the bulk of the material is sulphide of iron which must leave the furnace in the form of ferrous silicate—hence addition of acid fluxes, the partial pyrite process uses a poorer sulphide ore rich in gangue which latter is almost invariably acid. A basic flux is here required in addition to the ferrous oxide resulting from the oxidation of the sulphide. Now, if the amount of coke be increased while the charge remains otherwise unaltered, less oxygen will be available to convert iron sulphide into oxide: the slag becomes more acid and less fusible, while the unaltered sulphide increases the quantity of matte and hence lowers its quality. Therefore, with the same charge and blast, an increase in coke causes decrease in the ratio of concentration. The process generally gives a low grade matte, unsuitable for the converter; the ore must therefore contain gold or silver to make smelting profitable, the object being to concentrate the noble metals in a matte which incidentally contains copper. In remote and isolated districts where fuel is dear and the ore too poor to ship, where local conditions militate against roasting or concentration, the partial pyrite process carried out on the spot is the best means of producing an enriched sulphide which it will pay to export.

I have just mentioned that massive sulphide ores are not commonly met with; on the other hand, siliceous ores are widely distributed. Therefore, true pyritic smelting will prove commercially less important than partial pyritic smelting. I desire to illustrate an application of the latter process by the following notes evolved from observations extending over several months and taken at a smelter in the interior of South America.

In this instance the copper ore derived its chief value from the gold and silver content, while it was rich in silica and rather poor in sulphur and iron. To ship it without previous concentration was out of the question on account of heavy freight and a long land and sea journey. A mountain stream coming down the high range at the foot of which the smelter was located supplied sufficient water for cooling the jackets, and power to drive the blowing engine; but by law the water had to be returned to the stream to supply the urgent need of irrigation, which made concentration impossible. Hand-picking proved almost useless as ore rich in copper was poor in gold and silver, the noble metals being associated with finely crystallised arsenical pyrites disseminated in the non-metallic portion of the ore. The high price of coke, imported from England, made it imperative to use as little of it as would be consistent with effective working, while roasting would have entailed additional expense in coal which also would have to be procured from abroad. The most economical method of treatment was, therefore, to smelt the raw ore as it came from the mine.

This was done in a 100-ton rectangular water-jacketed furnace discharging continuously into an external fore-hearth in which the separation of slag and matte took place. The blast was supplied by a blower of the Connersville type, driven by a dynamo coupled to two Pelton wheels. A brick flue 500 feet long provided with 30 side-doors for discharging the dust led to the chimney at the top of the hill on the slope of which the smelter was erected on the gravity principle. A ropeway brought the ore from the mine, and the cars were turned out into wooden bins provided with sliding doors at the bottom through which the ore was discharged into cars on the charging-floor.

The composition of the various materials used and obtained in smelting is shown in the accompanying table.

Ore. I think it preferable to indicate the limits within which the constituents were apt to vary, as giving a better idea of their composition than one or two complete analyses. The figures for silica, alumina, sulphur, and iron, show that the ore is unsuitable for pyritic smelting. Though the maximum for copper is given as 10 per cent., the regular ore never contained much more than 5, while at times it fell below 3 per cent. Of the three valuable metals, gold was present in most payable quantity.

Coke. (6922 calories.) The amount of coke added averaged 8 per cent. of the charge, it being unsafe to go below that figure, for fear of freezing the charge. The coke ash after ignition contained magnetic oxide of iron as shown in the table.

Flux. The flux used was a highly crystalline metamorphic dolomitic limestone of very uniform composition. As will be seen from the analyses of the flux itself and the slag, the amount of magnesia is one-third of that of the lime. This high magnesia content has a prejudicial effect on the fusibility of the slag, but in this case it was the only flux obtainable in the district.

Slag. The complete analysis in the table represents the composition of a weekly sample. In addition, the following figures for silica, ferrous oxide, and lime have been calculated from more than 60 daily assays. These three constituents total 84·65, the balance being made up as follows: magnesia is one-third of the lime; the matte content is one per cent, as is also that of the RO bases (Ba, Zn, Mn): these figures are taken from the complete analysis. Alumina is found by difference which agrees well with the assay results, 8 per cent. being usually found. These datas being derived from a great number of determinations, we obtain the following figures for the

Limestone.		Ores.		Slag.		Matte.		Flue-dust.	
CO_2	42·30	Au	0·25—2 ozs. p.t	Au	0·02 oz.	Au	1·69 oz.	Au	0·26 oz.
SiO_2	3·66	Ag	3—12 ,,	Ag	0·4 ,,	Ag	31·74 ,,	Ag	9·00 ,,
Al_2O_3	0·74	per cent.:			per	cent.:			
FeO	0·68	Cu	2·7—1·02	SiO_2	46·76	Insol.	9·10	Cu	11·04
CaO	38·88	S	25—34	Al_2O_3	8·53	Fe_3O_4	7·45	Fe	18·4
MgO	13·34	Fe	18—25	FeO	20·71	S	24·14	Zn	1·1
Alk.	0·15	SiO_2	16—37	CaO	16·73	Cu	10·16	Tot. S.	15·63
	99·75	Al_2O_3	5—15	MgO	5·59	Fe	44·00	Insol.	26·3
Coke.		$BaSO_4$	0·5—5	MnO	0·10	Zn	1·80	CaO	4·1
H_2O	0·55	MnO	0·05—0·2	ZnO	0·51	Mn	0·25	Coke	1·6
C + Vol. matter	92·61	CaO	0·1—1·5	BaO	0·26	Ni	0·23	Fume.	
SiO_2	2·67	MgO	0·05—0·6	Cu	0·20	Pb	0·10	Au	0·09 oz.
Al_2O_3	1·70	As	0·4—4	Fe	0·50	As	0·05	Ag	4·40 ,,
FeO	1·62	Sb	0·2—1·2	* Ni	0·02	Sb	trace	Cu	2·11
Fe_3O_4	0·20	Pb	0·1—0·3	S	0·20	Ag + Au	0·15	Zn	2·3
MnO	0·11	Bi	0—0·05		100·11		97·43	Sb	1·76
CaO	0·25	Zn	0·5—2	* Shots of matte in slag.				As	21·11
MgO	0·20	Ni	0·02—0·1					Free S	13·00
	99·91							SO_3	14·41
			All SiO_2 =	"true silica" (by fusion).				Fe	3·1

typical slag produced in the furnace after eliminating one per cent. of matte:

Constituents.	1 Calculated as above.	2 Typical slag.	3 Deadwood, South Dakota*	Oxygen equivalent to 2.	
				Acid.	Basic.
SiO_2	47·09	47·56	48·5	25·21	
FeO	21·17	21·38	16·0		4·80
CaO	16·39	16·56	18·0		4·71
MgO	5·46	5·52	12·0		2·19
Al_2O_3 ..	7·89	7·97	3·5	(3·74)	
RO-bases	1·00	1·01	2·0		0·16
Matte ..	1·00	—	—		
Total	100·00	100·00	100·0	25·21	11·86

* Peters, The Practice of Copper Smelting, 1911.

If alumina is taken as a base the oxygen ratio will be 25·21 : 15·60 = 1·61. If we leave it out of the calculation, the result is 25·21 : 11·86 = 2·12. I feel inclined to adopt this latter figure, according to which the slag is even more acid than that produced at Deadwood (No. 3), the ratio of which is 1·9 and which is an unusual one in copper smelting. Yet the slag, which requires a high formation and flowing temperature, gave no trouble and the furnace worked smoothly without any occasional correction in the composition of the charge. Thus I saw one campaign lasting 53 days which only came to an end through a breakdown of the blowing engine.

The barium in the slag is present as silicate showing that under the conditions prevailing in the furnace barium sulphate is broken up. The amount of copper lost in the slag (0·1 to 0·2 per cent.) varied with the grade of matte produced; gold and silver were satisfactorily recovered.

Matte. The analysis reproduced here is that of a low grade matte produced while the furnace ran sluggishly, which caused bad separation. The deficiency of 2½ per cent. is due chiefly to oxides present in the slag which were not estimated. The following is a partial analysis of an average sample from 50 consecutive tappings:

Cu	16,2	S	26,0	
Fe	45,3	Insol.	7,0	Total, 94,5

This matte was produced on ores running about 4·5 per cent. copper, showing a ratio of concentration of 3·5. It is characteristic of the process, being highly ferruginous and low in copper. The presence of magnetic oxide of iron is an objectionable feature, as it increases the quantity of matte and robs the slag of a corresponding amount of iron, thus rendering it less fusible. The formation of the magnetic oxide in the blast furnace has not yet been satisfactorily explained; it may possibly be due to a high temperature and too much oxygen above the zone of fusion, when some of the iron is oxidised to ferric oxide, which shows acid properties and combines with ferrous oxide at a temperature at which silicic acid has not yet become active; once formed, magnetite resists the action of silica. If this explanation is correct there is a close analogy between this action of ferric oxide and the behaviour of alumina in basic slags, a compound of the spinel group being formed in both cases. The specific gravity of magnetite is about 5, that of a matte containing 13·6 per cent. copper, 4·8; the former will thus sink into a low grade matte.

Practically all the arsenic and antimony of the ore are volatilised, as the matte is almost free from them. This is generally the case in true and partial pyritic smelting.

Flue dust. The figures under this head give the principal constituents of the coarser dust deposited in the dust-chamber below the down-take flue. The dust is of a dark brown colour and strongly magnetic (partially roasted sulphides). It is much richer in copper than the ores from which it is derived whereas the gold and silver content is nearly the same. A fair amount of lime is also carried over through decrepitation.

Fume. This material was taken below the chimney; it is a yellowish-grey corrosive powder and consists of the very fine dust mixed with the condensation products of arsenic, sulphur, zinc, and antimony. The point where arsenic begins to condense in quantity is situated at a distance of about 110 feet from the furnace, and condensation takes place in increasing degree over four-fifths of the length of the flue. Halfway between furnace and chimney the fume assayed 10·42 As, 15·89 SO_3, 8·53 uncombined sulphur, 3·5 Zn and 2·0 Sb.

We may now summarise the smelting operation as follows: The gold and silver-bearing copper ore does not undergo any preliminary concentration, hand-picking or roasting. It is smelted with dolomitic limestone and coke, the latter forming 8 per cent. of the charge. The slag is very acid, low in iron and high in magnesia and alumina, but runs freely and the losses in values are small. Some iron escapes slagging and is found as magnetic oxide in the matte. The latter is low grade but rich in gold. Much sulphur and zinc and most of the arsenic and antimony are driven off. A concentration of about 3·5 : 1 is attained.

Notes on slag assays. The samples were always chilled by pouring into water, when they were decomposed by hydrochloric acid provided SiO_2 was below 49 per cent. The slag frequently ran 48, 49 and once or twice over 50 per cent. On one occasion a shortage in limestone occurred and the slag assayed 53·2 SiO_2, 20·1 FeO and 12·9 CaO. It ran very thick, but the copper did not exceed 0·2 per cent.

I noticed when very acid slags are decomposed with hydrochloric acid the silica separates as a sandy powder; no gelatinisation was noticed. If the silica fell below 47½ per cent. the characteristic jelly was produced.

The daily slag assay was carried out as follows:

1. Copper: 2 grms. colorimetric assay.
2. Ferrous oxide: 0·75 grm. is decomposed in a graduated 150 c.c. flask with hyrochloric acid and reduced with zinc. The volume was made up and 100 c.c. titrated.
3. Silica and lime: 0·5 grm. was decomposed in a porcelain dish and the contents of the latter evaporated to dryness. The silica was filtered off, ignited and weighed, and the lime precipitated as oxalate in the filtrate without eliminating iron and alumina. (Low, Technical Methods of ore analysis, 1911, p. 72.) The four determinations can be made in 1½ hours.

DISCUSSION.

The CHAIRMAN said it was the first time he had heard of getting a magnetic oxide in the "matte," and he did not know whether he quite agreed with Dr. Schoeller's explanation.

Dr. W. H. NICHOLS said he had never been aware of the fact that any magnetic oxide was present in the "matte," but that was no reason why it may not have been there in very large proportions.

Dr. SCHOELLER, in reply, said the fact that magnetic oxide of iron was present in mattes was very well-known and had been proved in many copper smelters in the United States, Canada, and Mexico. It had been doubted in many cases whether the magnetic oxide was formed, but it had been shown so often that there could not be any doubt of it.

The CHAIRMAN said he had never heard of it in the Swansea district.

Dr. SCHOELLER replied that probably it had not been observed in the Welsh process. The "Mineral Industry" (1900, p. 243) gave six analyses of American mattes containing magnetic oxide of iron, one of them (from the Parrot smelter, Mont.) showing as much as 12·60 per cent.

Communication.

A RAPID METHOD FOR THE DETERMINATION OF PHOSPHORUS IN STEEL.

BY HARIPADA BHATTACHARYYA, M.A.

(Ishapore Gun and Shell Factory, Bengal.)

The yellow ammonium phosphomolybdate precipitate, obtained from the steel in the usual manner, is washed with 1 per cent. nitric acid until free from iron, and the nitric acid is washed out by means of 1 per cent. potassium nitrate solution until the washings are free from acid. The filter and precipitate are then transferred bodily to a 200 c.c. flask, 20 c.c. of $N/10$ sodium hydroxide solution and 2 drops of phenolphthalein are added, and the excess of alkali is titrated with $N/10$ hydrochloric or nitric acid until the last drop completely removes the pink colour.

The following reaction takes place :—

$$(NH_4)_3PO_4.12MoO_3+24NaOH=$$
$$(NH_4)_3PO_4+12Na_2MoO_4+12H_2O.$$

Hence, 1 grm. of phosphorus is equivalent to 31 grms. of sodium hydroxide, or each c.c. of $N/10$ sodium hydroxide is equivalent to 0·000129 grm. of phosphorus. Thus, when working with 1 grm. of steel, the percentage of phosphorus is obtained by multiplying by 0·0129 the difference between 20 and the number of c.c. of acid used in titrating the excess of alkali.

The method has been found to give very accurate results, in excellent agreement with those obtained by the gravimetric method.

Obituary.

JOSEPH CARTER BELL.

Joseph Carter Bell was born in 1839. He studied chemistry under Hofmann at the Royal College of Chemistry in Oxford Street and took the Associateship of the Royal School of Mines in 1865. After some years of practical work in chemical manufacture, he established a consulting practice and became Public Analyst for Cheshire, Salford, and other places. An original member of the Society, he took great interest in the formation of the Manchester Section, and served as its Hon. Local Secretary from its foundation in 1883 to 1903, when he was elected Chairman. On vacating the chair in 1905, he was elected a Vice-President of the Society, retiring in 1908. He also served on the Publication Committee from 1900 to 1910. He contributed several papers on analytical and sanitary subjects to the Manchester Section and was a man of great practical experience. He died on July 3rd, at the age of 74.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows; Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Explosions in air compressors. Times Eng. Suppl., July 2, 1913.

Explosions in air compressors may be due to the presence of gaseous hydrocarbons evolved from a lubricating oil of relatively low flash-point and retained for example in a valve-pocket until an explosive mixture is produced. It is probable, however, that they are usually due to carbon monoxide produced by oxidation of a carbonaceous deposit. The latter may be derived from an unsuitable lubricating oil or from dust, or from both. Lubricating oils for air-compressors should be of medium flash-point and viscosity, free from suspended impurities, and should not be derived from petroleum of an asphaltic character. The ignition temperature of carbon monoxide is relatively low and may easily be attained by the heat developed from an imperfectly working valve.—A. S.

Patents.

Evaporating and concentrating in a vacuum; Apparatus for ——. A. Fernbach, Paris. Eng. Pat. 25,800 of 1911, date of appl., May 17, 1912.

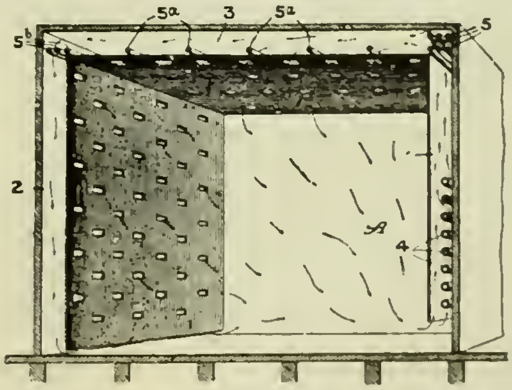
Cylindrical or corrugated evaporating tubes are disposed in a vessel connected with a vacuum pump and are provided at their upper ends with an annular trough or basin to which the liquid to be concentrated is supplied. The liquid overflows from the trough and trickles down the outer surface of the evaporating tube, which is surrounded by a jacket of wide-mesh asbestos fabric. The apparatus may be used for the desulphitation of sulphited fruit juices.
—A. S.

Heating and evaporating liquid; Apparatus for ——. J. Davie, Brookfield, Renfrewshire. Eng. Pat. 14,332, June 19, 1912.

The inlet and outlet ends of the heating coils pass out through the joint formed by the two parts of the evaporating chamber, or between the chamber and the cover. The edge of the cover or chamber is suitably recessed to allow the pipes to pass, and the joint is formed by some form of stuffing-box.—W. H. C.

Drying chambers. C. Hultgren, Chicago, U.S.A. Eng Pat. 12,224, May 23, 1912. Under Int. Conv., Oct. 30, 1911.

The drying chamber, A, has a side flue, 1, provided with a heating coil, 4, and communicating with the main chamber at the bottom. The heat causes a circulation of air as shown by the arrows up the flue, 1, and along the flues, 3, and 2. The two latter are perforated so that the air can re-enter the chamber, A. Cooling coils are arranged as desired in the positions, 5, 5a, or 5b.—W. H. C.



Kilns; Means for supplying fuel to continuous ——. F. Wattebled, Hessin-Coupigny, France. Eng. Pat. 12,372, May 24, 1912. Under Int. Conv., May 27, 1911.

In continuous kilns of the Hoffmann and other types, a fuel-feeding device is arranged over each firing hole. The fuel-feeding devices are divided into as many groups as there are transverse rows of firing holes, and are connected with a common shaft of adjustable speed in such a way that those of each group are operated at the same speed, whilst the several groups may be operated at speeds varying within wide limits by means of change speed gear interposed between the shaft and each group of fuel-distributors.—A. S.

Filters. L. Steinschneider, Brünn, and P. Porges, Vienna, Austria. Eng. Pat. 12,737, May 30, 1912. Under Int. Conv., June 7, 1911.

In chamber filter-presses the filter-plates, of the type composed of a sheet metal plate with a strainer-plate on each side, are provided with strengthening frames, so as to form an annular channel around the plate. By making the sheet metal plate project beyond the strengthening frame, the annular channel may be divided into two. The filtered liquid from each plate collects in the annular channel and hence leakage between two plates can be at once detected.—A. S.

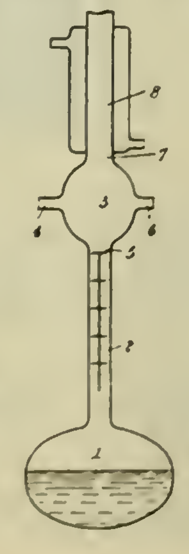
Filtering apparatus. A. G. Leigh, Chorley. Eng. Pat. 20,899, Sept. 13, 1912.

A rectangular tank with an inverted pyramidal bottom at the apex of which is a valve normally retained in a closed position by a weighted lever, is provided, in its upper part, with a filter consisting of filter-cloth or other suitable fabric folded upon a framework. The liquid to be filtered enters the centre of the vessel, the solid materials collect in the pyramidal portion and the clear liquid, passing through the filter-cloth, overflows. As soon as the weight of deposited solids is sufficient to overcome the pressure of the weighted lever, the valve opens downwards and the solids are discharged. The inflow of liquid is cut off by a valve connected with the lever, and the return flow of liquid through the filter helps to discharge the solids. —W. H. C.

Rotary filter. R. P. Akins, Assignor to Colorado Iron Works Co., Denver, Colo. U.S. Pat. 1,059,327, April 15, 1913.

A drum having a perforated or slotted face covered by suitable filtering material, is rotated half submerged in a tank containing the material to be filtered. By means of a hollow axis the surface of the drum can be subjected either to a vacuum or to pressure. As the surface of the drum rises from the tank, the deposit is washed with weak liquor, which passes through and is collected separately and when after reaching the highest point the surface commences to descend again, the deposit receives a fresh washing with water, which is also collected separately. Just before the surface re-enters the liquid in the tank, the vacuum is cut off and pressure is applied from behind and the washed and drained deposit is forced off the surface of the cloth.—W. H. C.

Chemical reactions; Apparatus for effecting ——. F. E. Matthews and E. H. Strange, London, and C. A. Pim, Rushgar, Ireland. Eng. Pat. 13,051, June 3, 1912.

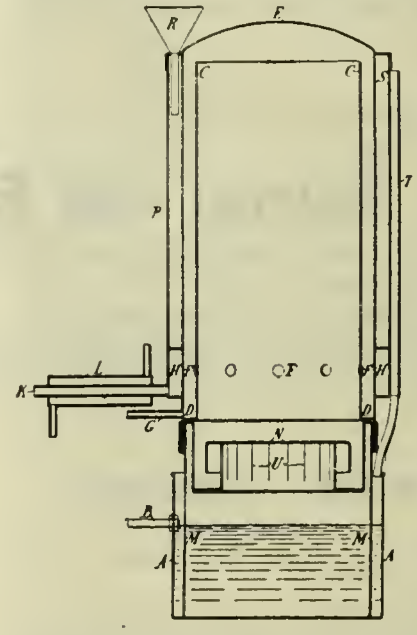


The container, 1, is connected by the fractionating column, 2, with the reaction vessel or chamber, 3, which is surmounted by a reflux condenser, 7, 8, and is provided with openings, 4, and 6, for the insertion of a thermometer and the introduction of a gaseous reagent. The material required for the reaction is placed in the vessel, 1, and is distilled, the vapours passing up the fractionating column, 2, into the reaction chamber, 3, where they react with the gas introduced through 6. The products of the reaction are condensed in the reflux condenser, 7, 8, and flow back to the vessel, 1.—W. H. C.

Heat-insulating materials and methods for manufacturing the same. S. Sokal, London. From Armstrong Cork Co., Pittsburgh, Pa., U.S.A. Eng. Pat. 13,248, June 5, 1912.

Diatomite (kieselguhr), together with not more than 30 per cent. of alkaline earth (lime) and with or without asbestos fibre, is mixed with water to form a thin paste, which is poured into moulds, caused to set by the application of live steam at about 125 lb. (8½ atmospheres) pressure, and then dried. Separate claim is made for the product, in which a portion of the alkaline-earth is combined as silicate, and which, in addition to the cellular structure of the kieselguhr, has a large number of air cells formed by evaporation of water from the mixture.—A. S.

Distillation of liquids; Apparatus for the ——. W. R. Bousfield, Hendon. Eng. Pat. 14,223, June 18, 1912.



The water or other liquid to be evaporated, is contained in the pan, A, and is heated by any convenient means. The open ended cylinder, M, stands loosely in the pan, A, and supports the double-walled condenser, C, D, E. The vapour rising from A, passes first through the tangential slots, U, in the spray arrester, N,U, and thence upwards into the condenser, and is partly condensed in the annular space between the double walls, the condensed liquid flowing away by the pipe, G. The uncondensed vapour passes through the openings, F, into the annular chamber, H, and thence to a secondary condenser, K,L. Cooling water enters the jacket, P, through the funnel, R, and overflows at S. If water is being distilled the overflow from S, enters the pipe, T, and is delivered into the pan, A, to be evaporated, any excess passing away by the overflow, B. —W. H. C.

Dissolving in liquids solid substances particularly powder, pigments, dyes and the like; Method and device for ——. E. Zappert, London. From W. Loebel, Leipzig, Germany. Eng. Pat. 20,585, Sept. 10, 1912.

The solid and the liquid are placed together in a vessel having a hemispherical bottom and curved sides and by means of steam or compressed air a portion of the mixture is withdrawn from a point near the surface and injected into the mass of the liquid near the bottom, thus setting up a vigorous agitation.—W. H. C.

Dissolving-tank. W. E. Lummus, Lynn, Mass. U.S. Pat. 1,063,707, June 3, 1913.

A sloping tray is supported near the level of the solvent in a tank and is provided with openings through which the solvent can pass upwards, and a pipe or funnel at the lowest point of the tray, through which the solution can pass to the bottom of the tank.—W. H. C.

Raising liquids, compressing air and the like purposes; Apparatus for automatically ——. A. G. Leigh, Chorley. Eng. Pat. 27,354, Nov. 28, 1912.

The apparatus consists of a series of high-level or pressure cylinders communicating with a series of low-level or air cylinders by suitable air and liquid pipes and valves. Water or other suitable liquid under an adequate head is conveyed into the first of the upper series of cylinders, and flows through the series, successively compressing the air in the lower series until the sum of the pressures in the lower cylinders is sufficient to overcome the head to which it is desired to force liquid either from the first upper cylinder, or from an auxiliary cylinder filled from another source of supply.—W. H. C.

Cooling and heating or otherwise treating fluids; Apparatus for ——. A. J. Roach-Cuming, London. Eng. Pat. 28,012, May 7, 1912.

In tubular apparatus for cooling liquids or gases, in which evaporation from the exterior causes the cooling of the interior of the apparatus, the tubes are formed of porous earthenware, or are covered with suitable fibrous material. —W. H. C.

Pickling and other tanks for holding corrosive liquids not acting strongly on wood. W. Sherratt, Toronto, Canada. Eng. Pat. 5814, March 8, 1913.

The tanks are formed of tongued and grooved planks with a packing of suitable resilient material and held together by wooden tie-rods, wooden corner pieces being fitted into the angles between the sides, and between the sides and the bottom.—W. H. C.

Centrifugal separator. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 1,062,215, May 20, 1913.

A rotatable drum is divided into a number of compartments by transverse partitions having central openings therein, the material being conveyed from the periphery of one compartment to the opening leading to the next by spiral blades mounted upon flat rotatable discs arranged parallel with and adjacent to the dividing partitions. —H. H.

Separating solids and liquids, and washing or otherwise treating the separated solids; Apparatus for ——. J. J. Berrigan, Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 1,062,216, May 20, 1913.

A centrifugal separator comprises a rotating drum divided longitudinally into a number of chambers and having a series of conveyors mounted upon a central shaft for conveying the material from one chamber to another successively. The material is supplied to the end chamber only, while washing water may be supplied from the central shaft to one or all of the chambers. The liquid is drawn off from certain of the chambers only.—H. H.

Explosive volatile liquids; Commercial package for ——. H. B. French, Assignor to Smith, Kline and French Co., Philadelphia, Pa. U.S. Pat. 1,062,565, May 20, 1913.

A container for explosive volatile liquids consists of a tubular glass receptacle having a projecting neck sealed by fusing the glass, and a covering formed of loosely woven textile fabric surrounding the body portion of the receptacle and large enough to provide a free interspace between the walls of the receptacle and the covering. —H. H.

Porous material; Process for the preparation of —— and filling for vessels for storing explosive gases. Champy Frères. Fr. Pat. 453,353, Jan. 6, 1913.

The porous material, for use in storing explosive gases, particularly acetylene, is manufactured from certain kinds of wood (preferably birch) or other organic matter which, after having been reduced to a convenient size, is carbonised by means of superheated steam. The material is claimed to possess the advantage of being free from moisture and ready for use with no further preparation or addition.—W. G. W.

Recovering volatile solvents [from fabrics]; Apparatus for ——. C. F. Hopewell, Newton, Mass. U.S. Pat. 1,063,686, June 3, 1913.

The apparatus consists of a closed vapourising chamber into and out of which a strip of fabric is passed through openings sealed by a suitable liquid to prevent access of air to the box. When starting, the air contained in the chamber is driven out by steam through a valve. The chamber is heated by a coil, or other suitable means, and the vapourised solvent is driven off and is passed through a condenser, where it is recovered.—W. H. C.

Constant and known high temperatures; Means for providing ——. W. R. Whitney, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,064,037, June 10, 1913.

The apparatus consists of a jacketed chamber, provided with suitable means for heating, the jacket being filled with some suitable material of known boiling point. The jacket is connected with a pump and a condenser so that the pressure under which the material in the jacket is vapourised, and consequently the temperature, can be controlled at will. The vapours are passed through the condenser and the condensed liquid is returned to the heating jacket.—W. H. C.

Gas-washing fan. H. E. Theisen. Fr. Pat. 451,055, Nov. 27, 1912.

The gas is introduced with a spray of water into a centrifugal fan, the periphery of which is surrounded by a volute chamber containing auxiliary washing surfaces consisting of inclined or curved plates or baffles against which the gas and liquid particles are projected by centrifugal force.—H. H.

Dehydrating or desiccating air; Process for ——. W. Loebel. Fr. Pat. 452,272, Dec. 21, 1912. Under Int. Conv., Dec. 22, 1911.

Air for use in refrigerating plant is dehydrated by passing it through a conduit across which a number of fine streams of concentrated brine or other saline solution are projected. The air may be simultaneously cooled by employing brine at a low temperature.—H. H.

Catalytic masses; Process for the manufacture of ——. Nitrogen Ges. m. b. H. Fr. Pat. 453,099, Jan. 13, 1913.

The addition of substances, refractory at the required temperature and chemically inactive towards the mixture, is claimed to increase the efficiency and the period of activity of contact masses and to avoid the possibility of a reaction between the catalyst and the constituents of the support of the contact material. For example, in the use of a mixture of copper and copper oxide as the catalyst, and clay or other material containing silicates as the support, the addition of aluminium oxide causes the mass to retain its activity for a longer period. It is claimed to have perfect porosity, the reaction between the copper oxide and the silicates is prevented and the catalyst is so finely distributed throughout the mixture that the agglomeration or fusion of copper cannot take place. —W. G. W.

Gases; Apparatus adapted to chemically convert —— by means of repeated contact at adjustable temperatures. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,470, Jan. 22, 1913. Under Int. Conv., Feb. 13, 1912.

The apparatus for the catalytic treatment of gaseous mixtures, has two or more contact and "heat-exchange" chambers, alternately superimposed and directly intercommunicating, the pipe leading the gases to the first chamber being provided with branches (which can be closed) leading to several heat transmitters, for the purpose of regulating the gas temperatures of the various chambers by exchange of heat of the gases which flow in and out.—W. G. W.

Drying materials by employing vapours other than water vapours; Process for ——. E. R. Besemfelder, Charlottenburg, Germany. Eng. Pat. 7975, April 2, 1912.

See U.S. Pat. 1,059,820 of 1913; this J., 1913, 585.—T.F.B.

Drying kilns. G. J. H. Petitpierre, Maldon, Essex. Eng. Pat. 11,569, May 15, 1912.

See Fr. Pat. 449,493 of 1912; this J., 1913, 475.—T. F. B.

Desiccation; Process of ——. W. H. Allen, Cleveland, U.S.A. Eng. Pat. 22,200, Sept. 30, 1912.

See U.S. Pat. 1,040,486 of 1912; this J., 1912, 1069.—T.F.B.

Unsaturated steam or vapours at a high temperature; Means for obtaining ——. G. J. H. Petitpierre, Maldon, Essex. Eng. Pat. 8272 of 1913, date of Appl., May 15, 1912.

See Fr. Pat. 449,493 of 1912; this J., 1913, 475.—T. F. B.

Filtering apparatus. T. Breakell, Wirksworth. U.S. Pat. 1,064,702, June 17, 1913.

See Eng. Pat. 28,945 of 1909; this J., 1911, 71.—T. F. B.

Filtration; Process of ——. The Chemical Process Co. Fr. Pat. 453,611, Jan. 25, 1913. Under Int. Conv., Jan. 26, 1912.

See U.S. Pat. 1,043,455 of 1912; this J., 1912, 1169.—T.F.B.

Separation by the action of centrifugal force; Apparatus for ——. W. J. Gee, Tulse Hill. U.S. Pat. 1,065,519, June 24, 1913.

See Eng. Pat. 24,803 of 1911; this J., 1912, 1167.—T. F. B.

Concentrating solutions; Apparatus for ——. E. Monti, Turin, Italy. U.S. Pat. 1,065,829, June 24, 1913.

See Fr. Pat. 447,379 of 1912; this J., 1913, 302.—T. F. B.

Evaporating apparatus. A. L. Webre. Fr. Pat. 452,841, Jan. 3, 1913.

ee U.S. Pats. 1,049,424, 1,049,425, and 1,049,426 of 1913; his J., 1913, 221.—T. F. B.

Evaporating apparatus. J. A. Power. Fr. Pat. 453,442, Jan. 21, 1913. Under Int. Conv., Jan. 27, 1912.

See U.S. Pat. 1,028,777 of 1912; this J., 1912, 627.—T.F.B.

Extraction of liquids or solids suspended in or combined with gases or smoke. J. Armstrong. Fr. Pat. 452,874, Jan. 4, 1913.

See Eng. Pat. 821 of 1912; this J., 1913, 184.—T. F. B.

Compound metal plates for tanks and vats. Eng. Pat. 1664. *See* X.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Natural gas; Chlorination of ——. *I. Chlorination at elevated temperatures and in presence of catalysts.* St. Tolloczko and K. Kling. *II. Chlorination under the influence of rays from a mercury (Uviol) lamp.* St. Tolloczko. Abhandl. Krakauer Akad. Wiss., 1912, A. **52**, 295—306, 307—316. Chem. Zentr., 1913, 2, 98—100.

In order to avoid explosions experiments were made with mixtures in which either the natural gas or the chlorine was in excess, at relatively low temperatures and in presence of catalysts. Experiments were also made on chlorination under the influence of ultra-violet rays. On passing a mixture of natural gas with excess of chlorine, at a velocity of 2·5 litres per hour through a tube of Jena glass, 1 m. long, filled with pumice and heated to 400° C., about 2 grms. (per litre of gaseous mixture) of chlorination products (sp. gr. 1·635 at 18° C.) were obtained, containing CCl_4 52, C_2Cl_4 9, C_2Cl_6 5, C_4Cl_6 1, and C_6Cl_6 1·5 per cent. Using a mixture containing an excess of natural gas, at a velocity of 5 litres per hour, in presence of pumice impregnated with cupric chloride, at 300° C., 0·79 grm. of liquid and 0·35 grm. of gaseous chlorination products were obtained by passing the mixture twice through the reaction tube. On using as reaction tube, the outer jacket of an Uviol lamp constructed like a Liebig's condenser, no explosions occurred even with a mixture of equal volumes of natural gas and chlorine, at 80°—100° C. With a mixture in the proportions 1·2 : 1, at a velocity of 4 litres per hour, a double passage through the tube gave a yield of 1·53 grms. of liquid and 0·38 grm. of gaseous products.—A. S.

Water-gas; Composition of ——. L. Vignon. Comptes rend., 1913, **156**, 1995—1998.

Gautier (this J., 1910, 947) has shown that very small quantities of methane are produced by the action of hydrogen on carbon monoxide at 400°—1200° C., and the author has observed that water-gas always contains a small proportion of methane, less when sugar charcoal is used as a source of carbon than when coke is used. Experiments with mixtures of coke and varying proportions of lime showed that the resulting water-gas contained more methane, the larger the quantity of lime added. In further experiments carbon monoxide, mixtures of carbon monoxide and carbon dioxide respectively with hydrogen, and a mixture of carbon monoxide and dioxide, methane and hydrogen, all in the moist condition, were led over lime at about 1000° C. The results show that the methane in water-gas is due to the reactions:

$$(1)\ 4CO+2H_2O=3CO_2+CH_4;$$
$$(2)\ 2CO+2H_2=CO_2+CH_4;$$
$$(3)\ CO_2+4H_2=CH_4+2H_2O.$$

The lime present in the coke plays an important part. At temperatures below 800° C. the formation of calcium carbonate is an important factor (see this J., 1911, 121, 488), whilst above 900° C., *i.e.*, above the temperature of dissociation of calcium carbonate, lime acts as a catalyst in regard to reactions (1), (2) and (3).—A. S.

Carbon bisulphide in coal gas; Decomposition of —— *by hot purification.* C. C. Carpenter. J. Gas Lighting, 1913, **123**, 30—33. (See also this J., 1912, 675 and Eng. Pat. 6672 of 1912; this J., 1912, 763.)

By passing the gas over reduced nickel at 430° C. carbon bisulphide is converted into hydrogen sulphide: $CS_2+2H_2=2H_2S+C$, and the hydrogen sulphide can be removed in the usual manner. The catalyser is prepared by impregnating balls of refractory material 1 in. diam., with nickel chloride, and reducing in a current of hydrogen. An installation capable of dealing with 10 million cub. ft. of gas per day has been put down by the South Metropolitan Gas. Co. The installation comprises 5 units heated by a single gas producer. The catalyser is packed in tubes in a chamber heated to 430° C., and the gas, previously heated to 410° C., is passed through these tubes. The gas passes first through regenerators, then through tubes in which it is further heated, and then through the reaction tubes. Since starting the installation, about 650 million cub. ft. of gas have been treated. The sulphur in the gas before treatment has varied from 36·6 to 141·1 grms. per 100 cub. m., and the proportion of sulphur removed has varied from 63·5 to 86·4 (average 80·7) per cent. The carbon deposited on the catalyser gradually reduces its activity, and after 30 days working it is necessary to remove the carbon by combustion. For this purpose the temperature must be reduced and the combustion spread over 4 or 5 days.—A. T. L.

Carbon bisulphide; Extraction of —— from gas by the "Athion" process. F. Kuckuk. J. Gas Lighting, 1913, **123**, 34. (See also Eng. Pat. 3043 of 1912; this J., 1912, 526.)

The alkali-cellulose used for absorbing carbon bisulphide is obtained by treating sulphite cellulose with soda lye. The material is crushed by rolling, and is spread on grids in a vessel similar to an oxide purifier. The gas is first treated for the complete removal of tar, ammonia, and hydrogen sulphide and is then washed with a solution of potassium carbonate which absorbs the carbon dioxide. The results of trials made at Heidelberg showed that with gas containing 30·75 grains of carbon bisulphide per 100 cub. ft., 75 per cent. of the carbon bisulphide was extracted. Ten tons of the "Athion" (alkali-cellulose) absorbed 1·25 tons of carbon bisulphide, corresponding to over 35 million cub. ft. of gas containing 45 grains per 100 cub. ft. The potassium carbonate scrubber removed 87 per cent. of the carbon dioxide; the remainder was extracted by a lime purifier.—A. T. L.

Petroleum benzine, petroleum, paraffin oil, and paraffin as sources of carbon and energy for micro-organisms. Söhngen. *See* XVIII.

Patents.

Coal; Process for freeing slack —— from water. C. Simon, Essen-on-the-Ruhr, Germany. U.S. Pat. 1,063,296, June 3, 1913.

The coal is moved over a draining support by a chain or belt in an evenly distributed layer having the coarse particles at the bottom. The upper stratum is continually loosened by passing against fixed rods or spikes, and air laden with dried coal is delivered to said layer and air passed through it.—A. T. L.

Fuel briquettes; Utilisation of vegetable pastes obtained by the dissociation of the constituent elements of vegetable materials for the production of —— by mixing the requisite quantity of paste with coal dust and compressing the mixture. H. de Monpezat. Fr. Pat. 452,051, Mar. 30, 1912.

A binder for making fuel briquettes is prepared by heating wood, straw, etc., in an autoclave at 15 atmospheres pressure with water containing 1 per cent. of lime, the total weight of lime used being about 25 per cent. of the weight of the wood, etc.—H. H.

Coke-ovens. Stettiner Chamotte-Fabrik Akt.-Ges., vorm. Didier, Stettin, Germany. Eng. Pat. 3147, Feb. 6, 1913. Under Int. Conv., Sept. 25, 1912.

The claim is for heating the coke-ovens with a mixture of coke-oven gas and blast-furnace or other "poor" gas. The poor gas is suitably preheated and is allowed to mix with the cool coke-oven gas only immediately before they enter the combustion flue. This is done in order to prevent the premature decomposition of the coke-oven gas by heat.—W. H. C.

Gas; Process of manufacturing ——. H. Pettibone, New Rochelle, N.Y., Assignor to The Power and Mining Machinery Co. U.S. Pat. 1,063,382, June 3, 1913.

Gas is made from bituminous fuel in a producer worked with a down-draught. In order to avoid combustion in contact with the firebrick walls, and to prevent the formation of clinker thereon, the gas outlet and the air inlet are arranged axially, and the fresh coal is fed in above the central air inlet and along the side walls. Part of the gas is compressed and stored, and at intervals the working is interrupted whilst a vent-pipe at the top of the producer is opened and the compressed gas blown upwards through the producer so as to free the fuel column from dust and ashes.—A. T. L.

Gas producer. J. A. Herrick, New York. U.S. Pat. 1,063,540, June 3, 1913.

The producer is of the up-draught type, with a centrally-arranged rotating feed-hopper resting upon the cover. A central vertical water-cooled shaft provided with stirring arms near its lower end passes through the hopper and rests at the lower end in a journal formed in the tuyère-box.—A. T. L.

Gas; Method of producing ——. O. H. Ensign, Los Angeles, Cal. U.S. Pats. 1,064,625 and 1,064,626, June 10, 1913.

(1) Oil and air are introduced continuously into a combustion chamber, the oil flowing towards the air, and combustion takes place where they meet. The proportions are so adjusted that the lighter constituents of the oil are distilled off and converted into fixed gases before reaching the zone of combustion, and the heavier constituents are consumed. The mixed gases, vapour and combustion products pass in a circuitous course through firebrick channels; the vapours are decomposed forming a deposit of carbon, which is in turn taken up by the carbon dioxide in the gases, with formation of carbon monoxide. (2) Oil is caused to fall within a vertical combustion chamber, so that the lighter constituents are removed by gravity and distillation simultaneously. The heavier fuel which reaches the bottom of the chamber is partially consumed by air admitted at the base. The fuel is progressively dissociated by the heat of combustion of the heavier constituents, and the resulting gases are kept at a high temperature whilst the gaseous products from the lighter portions are kept practically free from combustion. —A. T. L.

Gas producer. J. H. Hirt, Nashua, N.H., Assignor to Allis Chalmers Co., Milwaukee, Wis. U.S. Pats. 1,064,905 and 1,064,906, June 17, 1913.

Fuel, air and steam are admitted to an ignition chamber, and pass thence through a heating and mixing chamber to a central unobstructed gasifying chamber. The gas leaves the latter at the lower end and passes through regenerators to the outlet.—W. H. C.

Heavy hydrocarbons into lighter hydrocarbons; Process and apparatus for the conversion of ——. F. Lamplough, London. Eng. Pats. 19,702, Aug. 28, and 28,101, Dec. 5, 1912.

A mixture of heavy hydrocarbon oil with about 10 per cent. of water is pumped under pressure through a series of U-tubes, containing metallic nickel rods, and heated to dull redness in an oil-fired furnace. The escaping mixture of vapours of unaltered heavy oil, light hydrocarbons, steam and permanent gases is passed through a condenser, and subsequently separated in any convenient way. The relative proportions of oil and water and the relation of the temperature of the furnace to the amount of oil treated, are maintained constant by gearing together the oil and water pumps and the pump supplying oil to the furnace. It has been found best to pass the mixture of oil and water through the tubes at a fairly rapid rate, as this favours the production of light hydrocarbons, rather than permanent gas. After the first passage through the apparatus the unaltered heavy oil is again passed through the apparatus but at an increased temperature, and so on till the whole of the oil is converted.—W. H. C.

Fuel vapour; Method of producing a ——. A. T. Porter and H. E. Rider, New York, Assignors to Oil Utilities Co. U.S. Pat. 1,064,086, June 10, 1913.

Liquid fuel is sprayed or atomised in a chamber with a restricted supply of air, and the atomised fuel is ignited, so that the combustion of a small part vapourises the whole. The vapour is collected for use in an internal-combustion engine.—A. T. L.

Anthracite briquette. Anthraduff Smokeless Fuel Co., Ltd. Fr. Pat. 453,286, Jan. 17, 1913.

See Eng. Pat. 12,196 of 1911; this J., 1912, 481.—T. F. B.

Gas-producer. Q. Moore, Glasgow. U.S. Pat. 1,065,315, June 17, 1913.

See Eng. Pat. 5500 of 1912; this J., 1913, 353.—T. F. B.

Gas producers. Q. Moore. Fr. Pat. 453,490, Jan. 23, 1913. Under Int. Conv., March 5, 1912.

See Eng. Pat. 5500 of 1912; this J., 1913, 353.—T. F. B.

Sulphuretted hydrogen from gases; Process for removing ——. K. Burkheiser, Hamburg, Germany. Eng. Pat. 16,172, July 10, 1912. Under Int. Conv., Sept. 26, 1911.

See Fr. Pat. 448,728 of 1912; this J., 1913, 413.—T. F. B.

Illuminating and other gases; Process for purifying ——. O. Guillet. Fr. Pat. 453,385, April 2, 1912.

See Eng. Pat. 18,597 of 1912; this J., 1913, 78.—T. F. B.

Preparation of porous material and filling or vessels for storing explosive gases. Fr. Pat. 453,353. *See* I.

Method of washing coal tar, mineral or other oils, and apparatus therefor. Eng. Pat. 16,385. *See* III.

Production of coke from wood-tar. U.S. Pat. 1,064,350. *See* III.

Manufacture of ammonium salts. Eng. Pat. 14,079. *See* VII.

Testing machine for cylinder oils. Ger. Pat. 259,599. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Formation of acetic acid from wood gum on boiling with water and on destructive distillation. Bergström. *See* V.

Patents.

Distilling wood or analogous products; Process and apparatus for ——. F. Sykes. Fr. Pat. 453,328, Jan. 20, 1913. Under Int. Conv., May 23 and Sept. 7, 1912.

See Eng. Pat. 12,257 of 1912; this J., 1913, 691. An apparatus for drying wood, etc., before carbonisation is also described. It consists of a long jacketed cylinder, with a steam inlet at one end, at which the material is introduced, and an inlet for hot gas at the other end. A rotating shaft, carrying deflecting arms, runs the length of the cylinder.—T. F. B.

Electric incandescence lamps; Eliminating, by means of phosphorus, the last traces of gas in ——. N. V. Philips' Metaal-Gloeilampenfabriek. Fr. Pat. 453,375, Jan. 18, 1913. Under Int. Conv., Dec. 6, 1912.

The filament itself is made to carry the phosphorus, by plunging a reel of the material into a liquid bath containing phosphorus, or by passing it through the bath during the winding-on or winding-off process. The filament is afterwards heated to incandescence whilst in contact with the phosphorus.—B. N.

Tungsten for electric incandescence lamps; Manufacture of ductile illuminating bodies principally of ——. E. Becker. Fr. Pat. 453,568, Jan. 24, 1913. Under Int. Conv., Jan. 26, 1912.

Alloys of tungsten with alkaline-earth or rare earth metals are obtained by mixing tungsten, or its oxides or acids, with suitable quantities of the oxides or salts of earthy metals. If the compounds of tungsten are employed, they are reduced to metal by means of hydrogen, or other reducing agent. The mixture is drawn into wire, and then heated to a white heat by a continuous current. By liberation of oxygen, the earthy metals are liberated, and alloy with the tungsten; they should be present in amount not greater than 4 per cent.—B. N.

Drawing of wires, and more particularly of tungsten and other metal filaments. Eng. Pat. 12,469. *See* X.

III.—TAR AND TAR PRODUCTS.

Patents.

Washing coal tar, mineral or other oils; Method of and apparatus for ——. H. P. Hird, Norwood Green. E. V. Chambers and T. C. Hammond, Huddersfield. Eng. Pat. 16,385, July 13, 1912.

Apparatus for continuously washing a constituent or constituents from coal tar, mineral oil, etc., consists of a series of cylindrical or other vessels, each containing a chamber reaching to the bottom, in which is a pipe, with funnel-shaped top, and extending to the lower part of the chamber; the lower ends of the pipes communicate by perforations or otherwise with the chambers. Pipes are also provided to convey steam, air, etc., to the chambers for agitation, or mechanical agitators may be installed. Between each pair of vessels is a pair of troughs, one of which is connected with the upper part of one of the adjoining vessels, while the other is connected with the lower part of the other vessel; in these troughs revolve dippers which convey the liquid from the trough into the next succeeding vessel. The tar or oil to be washed is supplied to the funnel-topped tube in the vessel at one end of the system, whilst the alkali, acid, or other washing liquid is introduced at the opposite end, and thus passes through in the reverse direction. The washing liquids and washed-out constituents sink to the bottom of the vessels, and are finally run off from the vessel at which the tar or oil enters, whilst the washed tar or oil overflows at the top of the last vessel of the system.—T. F. B.

Coke from wood-tar; Process for the production of ——. F. W. Lefelmann, Aue, Germany. U.S. Pat. 1,064,350, June 10, 1913.

The tar is heated in a still until the volatile matters and heavy oils have passed over, the heat is then increased until the residue "rises by itself" from the retort into a previously heated coking chamber, where the operation of coking is completed.—W. H. C.

Carbazole and its N-alkyl derivatives; Preparation of monosulphonic acids of ——. L. Cassella und Co. Ger. Pat. 260,898, April 16, 1912.

Carbazole and its N-alkyl derivatives are converted into monosulphonic acids by treatment with chlorosulphonic acid in presence of a suitable solvent or diluent, at a low temperature. The yields are stated to be almost theoretical. Sulphonation with sulphuric acid by the usual method, at a low temperature, gives rise to mixtures of di- and trisulphonic acids.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Azomethines and azo dyestuffs. C. G. Vernet. Arch. Sc. phys. et nat. Genève, 1913, [4], **35**, 148—172. Chem. Zentr., 1913, **1**, 2130—2132.

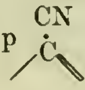
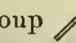
The author describes the preparation and properties of the azomethines from the diamines: diaminodiphenylamine, 3.3′-diaminocarbazole, *trans-o-* and *p*-diaminostilbene, benzidinesulphone, mononitro- and *m*-dinitrobenzidine, and the aldehydes: benzaldehyde, *p*-nitro- and *p*-dimethylamino-benzaldehyde, and *o*-vanillin. By treating cotton prepared with alkaline β-naphthol with diazo-solutions from various diamines, the following colours were obtained: benzidine, brown; thiobenzidine, red-brown; benzidinesulphone, reddish-brown; 2.2′- and 3.3′-diaminocarbazole and *p*-diaminostilbene, dark brown, almost black; 2-mononitrobenzidine and *trans-o*-diaminostilbene, bright red; *m*-dinitrobenzidine, bright orange;

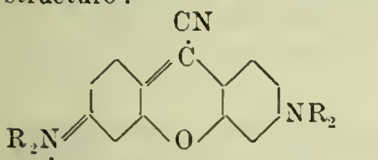
o-dinitrobenzidine, garnet-red; and diaminodiphenylamine, red-brown. Disazo dyestuffs were prepared from benzidine, 2-mononitro-, and *o*- and *m*-dinitro-benzidine, thiobenzidine, benzidinesulphone, diaminodiphenylamine, 3.3′ and 2.2′-diaminocarbazole, and *p*- and *trans*-*o*-diaminostilbene on the one hand, and aminonaphtholdisulphonic acid H, chromotrope acid, α-naphthol-4-sulphonic acid, resorcinol, and naphthionic acid on the other. With the exception of those from *o*-diaminostilbene and some of those from *o*-dinitrobenzidine, all of them dyed cotton directly, and all of them, without exception, dyed wool in an acid bath. The shade is influenced more by the sulphur atom in thiobenzidine than by the SO_2-group in benzidinesulphone or the NH-group in carbazole. The nitro group appears to reduce the dyeing power.
—A. S.

Azo dyestuffs from phenylisoxazolone. A. Meyer. Comptes rend., 1913, **156**, 1992—1995.

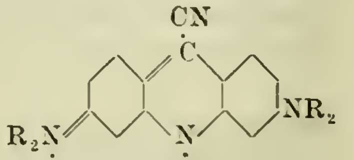
A NUMBER of acid and substantive azo dyestuffs were prepared from phenylisoxazolone. The shades produced by them differed little in colour from those obtained with the corresponding dyestuffs derived from pyrazolone (Tartrazine, Flavazine L, Dianil Yellow R, etc.), but were considerably less fast to light.—A. S.

Pyronine and acridinium dyestuffs; Action of potassium cyanide on ——. P. Ehrlich and L. Benda. Ber., 1913, **46**, 1931—1951.

PYRONINE cyanide, formed by the action of potassium cyanide on Pyronine G, passes when heated into pyronine leucocyanide, a colourless body which on re-oxidation gives a deep blue dyestuff, cyanopyronine. The change is parallel with that undergone by Acridinium Orange, which gives a deep violet dyestuff, and in both cases the shade of the new dyestuff is more suggestive of an oxazonium or azonium dyestuff than of a pyronine or an acridine colour. This suggests that in ortho-quinonoid dyestuffs the group  is the tinctorial equivalent of the group , hence the shifting of the shade towards the dark end of the spectrum. The authors, however, think the cause lies deeper than this, and that, in fact, the change is no less than one from ortho- to para-quinonoid structure:

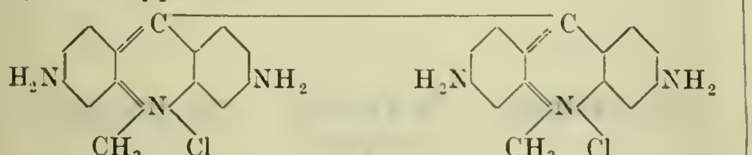


Cyanopyronine

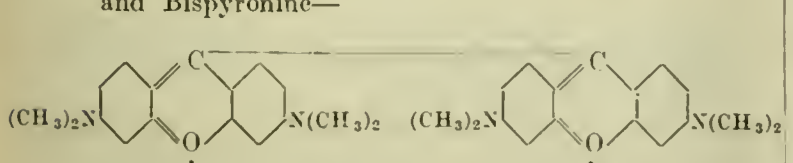


Cyanoacridinium Orange

Benda's "Trypaflavine" undergoes the same changes, giving a safranine-red dyestuff. The new dyestuffs show interesting biological properties (trypanocides), and in addition give rise to a new series of dyestuffs of practical value when reduced in acid solution. These dyestuffs belong to the bis-acridinium and bisxanthonium group, *e.g.*, Bis-trypaflavine—



and Bispyronine—



The latter is a violet dyestuff, while Bisacridinium Orange has a rose shade of Rhodamine-like purity. The new dyestuffs show great resistance to alkalis.—J. B.

Azafrin. C. Liebermann and W. Schiller. Ber., 1913, **46**, 1973—1986.

AZAFRIN (this J., 1911, 531) is not identical with Bixin as conjectured by van Hasselt. In spite of the similarity in their reactions there is a difference of one per cent. in the hydrogen content. The author has obtained further evidence of difference by a series of acid reactions, especially with the stronger organic acids. The acid reactions of Azafrin furnish a good example of halochromism. It was also noticed that with certain acids Azafrin could combine with one, two or three molecules of the acid. Methylazafrin, obtained by the action of dimethyl sulphate, gives a series of salts parallel with those of the parent substance. Oxidation and reduction derivatives and a hydrazone of Azafrin are described.—J. B.

PATENTS.

Disazo dyestuffs; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort, Germany. Eng. Pat. 14,125, June 17, 1912.

THE diazo compound of 2-amino-5-naphthol-7-sulphonic acid is combined with a suitable amino compound (*e.g.*, *m*-amino-*p*-cresol ether, α-naphthylamine, 1.6- or 1.7-naphthylaminesulphonic acid, or 2.8.6- or 2.5.7-aminonaphtholsulphonic acid), and the monoazo dyestuff is diazotised and combined in alkaline solution with one mol. of 2.5.7-aminonaphtholsulphonic acid or a derivative thereof, such as the phenyl or benzoyl derivative. If an aminonaphtholsulphonic acid is used as the middle component, the dyestuff may also be produced by diazotising this aminonaphtholsulphonic acid, combining with one mol. of 2.5.7-aminonaphtholsulphonic acid or a derivative thereof in alkaline solution, and then allowing one mol. of diazotised 2.5.7-aminonaphtholsulphonic acid to act in alkaline solution on the product thus obtained. The dyestuffs have good affinity for cotton. They produce red to blue dyeings which, when developed with *p*-nitrodiazobenzene, give considerably deeper dyeings of clear violet to blue shade, fast to washing and light and capable of yielding pure white discharge effects.—T. F. B.

Azo dyestuffs; Manufacture of —— and after treatment of fibres dyed therewith. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,989, Sept. 2, 1912.

THE tetrazo compounds obtainable from the diaminodibenzoyldiamino compounds described in Fr. Pat. 426,201 of 1911 (this J., 1911, 948) are combined with resorcinol, *m*-phenylenediamine, *m*-aminophenol, or their substitution products. Yellow to orange-red dyestuffs are thus obtained. Fibres dyed with them may be rendered very fast to washing by treatment with formaldehyde.—T. F. B.

Vat dyestuffs; Manufacture of —— and of intermediate products for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,915, Sept. 26, 1912.

HALOGEN derivatives of 2.3-naphthisatins are obtained (1) by treating with chlorine the β-hydrocyanocarbodinaphthylimine, $C_{10}H_7.NH.C(CN):N.C_{10}H_7$, condensing the product (m.pt. 201° C.) by means of aluminium chloride to the chloronaphthalide of 1-chloro-2-3-naphthisatin, and removing the chloronaphthylamine by treatment with acid; (2) by converting 1-bromo-2-naphthylamine into 1.1′-dibromo-2.2′-dinaphthylthiourea by treatment with carbon bisulphide and hydrogen peroxide, converting this into the dibromohydrocyanocarbodinaphthylimine, by means of lead carbonate and potassium cyanide, condensing the product by means of aluminium chloride, and saponifying. The 1-bromo-2.3-naphthisatin crystallises in red needles of m.pt. 256° C. Treatment with halogenating agents converts the products into higher halogen derivatives. When derivatives of these halogenated 2.3-naphthisatins (in which the oxygen of the α-keto group is replaced by easily movable substituents, such as halogen, sulphur, amino, or alkyloxy groups) are condensed with compounds such as 4-chloro-1-naphthol, a-anthrol, oxythionaphthene, dibromoindoxyl, carbazole, etc., or when the halogenated naphthisatins themselves are condensed with oxythionaphthene, indoxyl, or similar compounds containing a CH$_2$.CO group, or their derivatives, new products are obtained which dye cotton fast shades from the hydrosulphite vat. For example, the dyestuff from dichloronaphthisatin chloride and 4-chloro-1-naphthol or oxythionaphthene dyes blue shades, that from dichloronaphthisatin chloride and 4-methoxy-1-anthrol green, that from dichloronaphthisatin and oxythionaphthene red, and that from dichloronaphthisatin and indoxyl red-violet shades.—T. F. B.

Sulphide dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,026, Jan. 10, 1913. Under Int. Conv., Jan. 20 and Oct. 5, 1912.

See Ger. Pat. 253,239 of 1912 ; this J., 1913, 16. The phthaloperinones may be replaced by perimidyl-*o*-benzoic acid, obtained by condensing 1.8-naphthylenediamine with phthalic anhydride.—T. F. B.

Vegetable colouring matters fast to acids ; Process for making ——. E. Hagen. Fr. Pat. 453,310, Jan. 18, 1913.

Vegetable extracts containing soluble colouring matters (*e.g.*, those of mountain-ash berries or oak-bark) are treated with formaldehyde, and also with a reducing agent, such as zinc or magnesium powder ; it is preferable to effect the reduction in presence of a small quantity of an aluminium salt. Instead of using a reducing agent, the colouring matter may be treated with formaldehyde in presence of an aluminium salt and an alkali hydroxide or carbonate, whereby an aluminium lake of the colouring matter is formed. For example, the dyestuff extract is mixed with 5 to 10 per cent. of alum, and then boiled with 10 to 25 per cent. of zinc powder until no further development of colour occurs. During or after the heating, about 10 per cent. of formaldehyde is added. The liquid thus obtained may be concentrated or evaporated to dryness. The products are fast to acids, and may be used for colouring food products.—T. F. B.

Metallic compounds of vat dyestuffs, sparingly soluble in water, and suitable for use in dyeing and printing ; Manufacture of ——. R. Wedekind und Co. G. m. b H. Fr. Pat. 453,427, Jan. 11, 1913.

Metallic compounds of leuco-indigo are known, having been obtained by treating Indigo White with the metallic salt. It is now found that other vat dyestuffs are capable of forming leuco compounds with alkaline-earth and heavy metals, which are much less stable in air than the corresponding calcium compounds. The magnesium compounds of leuco derivatives of indigo, halogen-indigos, thioindigo dyestuffs, Hydron dyestuffs, and 1-benzoylaminoanthraquinones, are obtained by reducing the dyestuff in presence of magnesium hydroxide or a basic magnesium carbonate ; they are also obtained by treating the leuco-alkali compounds with magnesium salts. The compounds with other metals are also obtained by double decomposition of the leuco-alkali compounds. *Example :* 10 parts of tetrabromo-indigo (40 per cent.) are triturated with 8 parts of a 50 per cent. magnesium hydroxide paste, 6 parts of hydrosulphite, and 2½ parts of water, without access of air : a greenish 15 per cent. paste is obtained. The pastes may be diluted, with or without addition of hydrosulphite, and used directly for dyeing. Cotton dyes best in cold baths, wool in hot baths, and silk in tepid baths.—T. F. B.

Colouring matters of the anthracene series ; Manufacture and employment of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,361, Oct. 12, 1912.

See Fr. Pat. 451,216 of 1912 ; this J., 1913, 593.—T. F. B.

Anthracene compounds and colouring matters and process of making same. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,065,102, June 17, 1913.

See Fr. Pat. 400,787 of 1909 ; this J., 1910, 621.—T. F. B.

Benzoquinone derivatives and process of making same. R. Maag, Sindlingen, and P. Jörg, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,065,063, June 17, 1913.

See Eng. Pat. 8886 of 1912 ; this J., 1912, 766.—T. F. B.

Dyestuffs of the triphenylmethane series and process of making same. A. Stock and F. Heim, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,065,405, June 24, 1913.

See Eng. Pat. 12,378 of 1912 ; this J., 1912, 809.—T. F. B.

Dyes of the anthraquinone series. H. Friedmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,065,440, June 24, 1913.

See Ger. Pat. 254,745 of 1912 ; this J., 1913, 190.—T.F.B.

Selenocyanides of the anthraquinone series. L. Gattermann, Freiburg, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,065,441, June 24, 1913.

See Ger. Pat. 256,667 of 1912 ; this J., 1913, 417.—T. F. B.

Selenocyanides and selenophenols of the anthraquinone series ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,208, Jan. 15, 1913. Under Int. Conv., Jan. 24, 1912.

See Ger. Pat. 256,667 of 1912 ; this J., 1913, 417.—T. F. B.

Azimino-compounds of the anthraquinone series ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,313, Jan. 18, 1913. Under Int. Conv., Jan. 26, 1912.

See Ger. Pat. 254,745 of 1912 ; this J., 1913, 190.—T. F. B.

Dianthraquinonyl thio-ethers ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,514, Jan. 23, 1913. Under Int. Conv., Jan. 29, 1912.

See Ger. Pat. 254,561 of 1912 ; this J., 1913, 188.—T. F. B.

Monoazo dyestuffs ; Process for producing mordant ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,554, Jan. 24, 1913. Under Int. Conv., Feb. 1, 1912.

See Eng. Pat. 2956 of 1912 ; this J., 1912, 1073.—T. F. B.

Dissolving in liquids solid substances, particularly powder pigments, dyes and the like. Eng. Pat. 20,585. *See* I.

Manufacture of yellowish green colour lakes [*from triphenylmethane dyestuffs.*] Eng. Pat. 7757. *See* XIII.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Textile fibres ; Action of ozone on ——. C. Dorée. J. Soc. Dyers and Col., 1913, 29, 205—212. (See also this J., 1912, 278 ; 1913, 482, 695.)

The effect of treatment with ozone on the breaking strength and elongation of cotton, mercerised cotton, and viscose silk is shown in the following table. The cotton yarns were extracted successively with alcohol, alcohol-ether, ether, and water, then wetted out, pressed between a cloth, opened out and hung up in a chamber through which ozonised oxygen (1·5—2 per cent. ozone) was passed continuously. After exposure, the yarns were immersed in water, pressed, and air-dried.

Time of treatment.	Relative breaking strength (B) and elongation (E) after treatment with ozone for different periods. (Untreated material=100).									
	Egyptian cotton.				Grey cotton.		Grey cotton, 2–60, mercerised.		Viscose silk,120 deniers.	
	1/40		2/80		2/60					
hrs.	B	E	B	E	B	E	B	E	B	E
0·5	100	99	103	92	99	96	—	—	106	99
1	99	84	100	84	94	103	97	104	98	90
3	91	80	88	76	82	97	92	100	86	70
6	88	78	70	65	65	82	82	94	73	54
12	53	52	44	47	52	70	70	76	53	21

The effect of ozone (2 per cent.) on the chemical characters of cotton and viscose silk is shown in the following table. The copper number was determined by Schwalbe's method (this J., 1907, 548; 1910, 689), the Methylene Blue absorption by Vignon's method (this J., 1897, 908; 1898, 917); the loss of weight on boiling for 10 mins. with a 10 per cent. solution of potassium hydroxide was also determined.

	Cotton wool.		Mercerised cotton wool.		Mercerised yarn, 2/60, grey (tension).		Viscose silk, 120 deniers.	
	Normal.	After 24 h. ozone.	Normal.	After 24 h. ozone.	Normal.	After 24 h. ozone.	Normal.	After 24 h. ozone.
Loss in weight, %	—	12	—	7	—	—	—	4·5
C, per cent.	44·4	43·5	43·2	43·5	—	—	44·6	44·4
Methylene Blue absorption	0·3	2·1	0·4	3·1	—	2·3	1·6	1·8
Copper number ..	1·2	16·9	1·7	24·0	—	9·6	3·0	15·5
Loss in 10% KOH	—	64	—	57	—	—	—	50

Flax was very rapidly attacked by ozone, solid acids and formic acid being produced. Air-dry wool when subjected to the action of ozone in a damp atmosphere was scarcely affected after 6 hours, but on more prolonged treatment, an increase in breaking strength was observed. When the wool was kept saturated with water during the treatment, it became strongly acid and sticky, and a marked fall in breaking strength and elongation took place. Silk when slightly wetted with water was strongly attacked by ozone.—A. S.

Sulphite cellulose and edge-runner resin. E. Richter. Wochenbl. Papierfab., 1913, 44, 2486—2490.

Certain grades of sulphite cellulose give considerable trouble in the paper mill owing to the formation of lumps of pitch or resin, which is rubbed off the fibres by the action of the edge-runner. For the determination of the percentage of resin in sulphite pulp, a sample of at least 20 grms. of pulp should be extracted in a Soxhlet apparatus first with pure ether for six hours and then with alcohol for three hours. The respective values obtained are termed ether-resin and alcohol-resin, the former always predominating in quantity. The percentage of ether-resin in normal sulphite pulps generally lies between 0·7 and 1·1, whilst the percentage of alcohol-resin may range from 0·09 to 0·5, being most frequently somewhere about 0·2 per cent. On keeping samples of the pulp exposed to the air but not to the light for about six months the percentage of ether-resin decreases whilst the alcohol-resin increases but to a less extent. If the quantity of resin separated as lumps in the edge-runner be determined, it is found to be only a fraction of the total resin in the pulp. The ether-resin would appear to be the constituent which causes the trouble, but it is to be remarked that the tendency to form resin clots is not entirely dependent on the quantity of resin present. Pulps containing 1 per cent. of ether-resin may be expected to give trouble, but some pulps containing only 0·7 per cent. may also give resin clots, whilst others which contain 0·8 may be quite free from them. Some edge-runner resin was collected on filter paper and analysed; it showed ether-extract, 33·2 per cent.; alcohol-extract, 3·7; aqueous extract, 0·6; residual organic matters, 24·5 per cent., including about 5 per cent. of fibre. Two determinations of ash in the resin showed 41 and 38 per cent.; the composition of this ash was similar to that of the ash of the pulp, but it contained less silica and rather more sulphuric acid. A portion of the organic matter is in combination with the bases of the ash (mainly iron and calcium) and is not extracted by the solvents.—J. F. B.

Wood gum; Formation of acetic acid from —— on boiling with water and on destructive distillation. H. Bergström. Papierfabr., 1913, 11, 759—761. (See also this J., 1913, 358.)

Wood gum was prepared by extracting birch-wood sawdust with 5 per cent. sodium hydroxide for 24 hours, precipitating the gum with methyl alcohol and acidifying the precipitate. About 10 grms. of the air-dry gum (containing 8·9 per cent. of moisture) were boiled with 40 c.c. of water for 2 hours under a pressure of 84 lb. per sq. in., which pressure was reached in one hour. The volatile acids were distilled from the extract and treated with mercuric oxide for the separation of the formic acid. There were obtained from the wood gum 0·13—0·16 per cent. of acetic acid and 0·11—0·16 per cent. of formic acid, whereas from birch-wood itself there were obtained 3·13 per cent. of acetic and 0·16 per cent. of formic acid, calculated on the dry materials. On destructive distillation, the wood gum yielded 37·2 per cent. of charcoal, 11·1 of tar and oil, 33·6 of pyroligneous acid, 18·1 of gas, 0·29 of acetic acid and 0·17 of formic acid. Birch-wood itself yielded 33·0 per cent. of charcoal, 6·3 of tar and oil, 43·0 of pyroligneous acid, 17·3 of gas and 6·9 of acetic and formic acids: from birch cellulose were obtained 4·2 per cent. of the mixed acetic and formic acids. The pyroligneous acid from the wood gum contained about 9 per cent. of furfural. Thus it is evident that wood gum yields only inconsiderable quantities of acetic acid, contrary to previous statements to the effect that the pentoses of wood yield more acetic acid than the wood itself. Similarly only small quantities of acetic acid are obtained from the wood gum of fir-wood.—J. F. B.

Patents.

Fibrous vegetable and like substances; Process for treatment of ——. C. F. Kübler, Berlin. Eng. Pat. 25,680, Nov. 8, 1912. Under Int. Conv., Nov. 11, 1911.

Raw bast ribbons preferably stripped from the wood and freed mechanically from the coarsest adhering substances are softened by soaking in water or preferably in a soap or fat emulsion. The liquid is drained off and the bast-material is subjected to a freezing process so that the liquid retained is frozen throughout. The frozen material is then washed in hot water, preferably by boiling in water, in some cases under pressure, and if necessary, with the addition of soap, Turkey red oil or other ingredients. —J. F. B.

Flax and other fibres; Preparation of ——. O. Silberrad. Fr. Pat. 453,348, Dec. 31, 1912. Under Int. Conv., Jan. 17, 1912.

See Eng. Pat. 1372 of 1912: this J., 1913, 132. A solution of copper sulphate may be used in place of salicylic acid, and the treatment with formaldehyde may be preceded by treatment with ammonia gas.—T. F. B.

Fishing nets ; Process of treating —— for increasing their durability. A. I. van Vriesland, Aachen, Germany. Eng. Pat. 86, Jan. 1, 1913. Under Int. Conv., Jan. 2, 1912.

It is stated that the principal cause of the deterioration of fishing nets is the mechanical abrasion induced by the tightening of the knots upon one another in course of use. This is prevented by impregnating the threads, before or after netting, with a solution of viscose once or several times. This coating contracts and prevents swelling, whilst making the knots smoother and more elastic. Catechu or oil may be applied after the fixation of the viscose to increase the resistance to water. Other soluble derivatives of cellulose may be used instead of viscose. —J. F. B.

Plastic compositions ; Treatment of the seed of the phytelephas palm (vegetable ivory) and analogous tropical seeds, for the manufacture of ——. E. F. Harrison, London. Eng. Pat. 13,691, June 11, 1912.

The seeds are ground to a powder, which is rendered plastic by the addition of viscose and then moulded into the desired shape, with or without the addition of colouring matter. The articles are finally dried.—J. B.

Textile and other fibres, bands, films, etc., from viscose ; Process for preparing ——. Verein. Glanzstoff-Fabriken A.-G. Ger. Pat. 260,479, Sept. 16, 1911.

The precipitating bath is formed of a substance which precipitates cellulose directly from viscose, together with glucose or similar substance and a small quantity of a zinc salt ; for example, it may contain sulphuric acid, 8·5 parts, glucose, 9, ammonium sulphate, 4, sodium sulphate, 12, zinc sulphate, 1, and water, 65·5 parts by weight. The addition of zinc salts gives rise to fibres which are stronger than those otherwise obtained.—T. F. B.

Cellulose solutions ; Preparation of concentrated cuprammonium —— containing little ammonia. Hanauer Kunstseidefabrik G. m. b. H. Ger. Pat. 260,650, May 19, 1908.

Solutions containing only about 1 kilo. of ammonia to each kilo. of cellulose may be obtained by allowing concentrated ammonia solution and copper hydroxide or a basic copper salt to act on cellulose in presence of pieces of ice. —T. F. B.

Artificial fibres ; Process for preparing ——. L. Sarason. Ger. Pat. 260,812, June 14, 1912. Addition to Ger. Pat. 258,810 (see Fr. Pat. 448,429 ; this J., 1913, 420).

In the process described in the principal patent, a compound of a metal is added in which the metal is present as anion, *e.g.*, a salt of molybdic or tungstic acid. The products obtained are more viscous, and after drying are tougher and more elastic.—T. F. B.

Cellulose acetate solutions ; Process for preparing neutral ——. Internationale Celluloseester-Ges. m. b. H. Ger. Pat. 260,984, Feb. 14, 1912.

The acid acetylated mixtures, obtained by the usual method, are diluted with an organic liquid or mixture of liquids, which is not capable of dissolving the dry acetate which is precipitated ; on addition of a suitable base, the acid is precipitated in the form of a salt and filtered off, whilst the cellulose acetate remains in solution. These solutions are capable of being gelatinised, even when dilute. —T. F. B.

Paper, cardboard, etc. ; Process and apparatus for treating —— with waterproofing material. A. Stephen, Leytonstone. Eng. Pat. 14,246, June 18, 1912.

Cardboard boxes are immersed in molten wax, or similar material, and then caused to travel along a heated chamber in order that the cardboard may become thoroughly impregnated and that superfluous impregnating material may run away and be returned to the immersing bath. The boxes then pass into the open air where the wax, etc., sets. —J. B.

Paper [suction couch rolls] ; Manufacture of ——. R. Marx, London. Eng. Pat. 17,485, July 27, 1912.

In the construction of suction couch rolls it has hitherto been the custom to employ an effective gap, through which the suction is applied to the paper passing over the roll, which is relatively small (4—6 ins. according to the size of the roll), and to work such a roll under a relatively high vacuum (15—18 ins. of mercury). It is now claimed that greater efficiency or an economy of power is obtained by constructing the roll with a relatively wide suction gap and working under a relatively low vacuum, so that a large volume of air at a lower velocity than usual is drawn through the paper to drain it. For instance, the gap employed may exceed one-sixth of the periphery of the roll or in any size of roll may exceed 10 ins., and a relatively low vacuum, corresponding to 8—10 ins. of mercury, may be employed.—J. F. B.

Electric charges accumulating in fibrous substances during manufacture or treatment ; Process for neutralising the ——. Siemens und Halske Akt.-Ges. Fr. Pat. 453,196, Jan. 15, 1913. Under Int. Conv., Jan. 16, 1912.

See Eng. Pat. 1555 of 1912 ; this J., 1913, 18.—T. F. B.

Artificial silk from viscose ; Manufacture of ——. G. B. Ellis, London. From Chem. Fabr. von Heyden Akt.-Ges., Radebeul, Germany. Eng. Pat. 22,436, Oct. 2, 1912.

See Fr. Pat. 449,536 of 1912 ; this J., 1913, 482.—T. F. B.

Artificial silk ; Bobbins for use in connection with the manufacture of ——. F. Küttner, Pirna-on-Elbe, Germany. Eng. Pat. 28,083, Dec. 5, 1912. Under Int. Conv., Nov. 13, 1912.

See Fr. Pat. 450,818 of 1912 ; this J., 1913, 596.—T. F. B.

Paper pulp or paper ; Manufacture of ——. W. A. R. M. McRae and N. Malcolmson. Fr. Pat. 452,989, March 20, 1912.

See Eng. Pats. 14,871 and 26,043 of 1911 ; this J., 1912, 769.—T. F. B.

Apparatus for recovering volatile solvents [from fabrics]. U.S. Pat. 1,063,686. *See* I.

Process of producing tanning extracts. U.S. Pat. 1,063,428. *See* XV.

Preparing artificial gums from amylaceous materials. Fr. Pat. 452,943. *See* XVII.

Compound [combustible] for utilising waste residue or sludge from paper mills, sewerages, and the like. Eng. Pat. 2682. *See* XIXB.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Patents.

Wool ; Process of bleaching ——. A. Samuel. Fr. Pat. 453,708, Jan. 28, 1913.

Instead of the usual energetic soaping before chlorinating, the cloth is simply wetted out and then passed through a bath of sodium hypochlorite containing about 10 per cent. of sodium sulphate. The usual souring is omitted, the cloth being passed directly into a rinsing bath, then into a bisulphite bath, and finally rinsed, soured, washed, and dried as usual. The operation is carried out in a machine with adjacent baths, the cloth travelling at full width.—J. B.

Boiling cloth under pressure; Apparatus for ——. Erckens und Brix. Fr. Pat. 453,794, Jan. 30, 1913.

An autoclave of elliptical section in which the cloth is wound off one roller on to another during the boiling process.—J. B.

Weighting silk and other textile fibres; Process for ——. E. Stern. Ger. Pat. 261,142, Aug. 2, 1912.

The fibres are impregnated with solutions of the complex acids or their soluble salts, which tungstic and molybdic acids form, for example, with phosphoric acid, boric acid, or silicic acid; the acids are then precipitated on the fibre in the form of insoluble compounds by means of soluble tin, zirconium, or other suitable salts: the solutions may be used in the reverse order, if desired. The weighted fibres are stated to be unaffected by light.—T. F. B.

Mordanting fibres, leather, and analogous products; Process for ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 260,897, Jan. 27, 1911.

Fibres, leather, etc., are mordanted with the aid of compounds containing antimony and glycollic acid as auxiliary mordants. The results are as good as those produced by antimony-lactic acid mordants, without the tendency to brown stain exhibited by the latter.—T. F. B.

Dyeing and padding fabrics; Apparatus for ——. S. Barlow and Co., Ltd., and L. Taylor, Castleton. Eng. Pat. 17,529, July 29, 1912.

An improvement on the dye-jig described in Eng. Pat. 20,291 of 1911. A padding roller is adapted to swing over from one bowl to the other, according to which is being driven at the moment, by means of a lever and link arrangement through which acts also the weight which secures the "nip." The reversing gear is connected with the same mechanism so that one movement reverses the drive and at the same time shifts over the padding roller into contact with the opposite bowl.—J. B.

Dyeing; Art of ——. B. S. Summers, Assignor to Summers Linen Co., Maine. U.S. Pat. 1,064,393, June 10, 1913.

Non-sulphurised vat dyes are dissolved in a solution containing sodium sulphide and a reducing agent, such as sodium hydrosulphite, the material to be dyed being treated with the solution.—B. N.

Dyeing machine. J. C. Evenden, Assignor to Klauder-Weldon Dyeing Machine Co., Amsterdam, N.Y. U.S. Pat. 1,065,036, June 17, 1913.

The dye-liquor is caused to circulate horizontally along the tank by means of suitable circulating mechanism and a perforated end-plate, while the yarn, suspended vertically, is caused to travel along in an opposite direction. The mechanism for moving the yarn is a wheel, half immersed in the liquor, upon the periphery of which are fixed the yarn sticks, so that the yarn in its movement is alternately immersed in and withdrawn from the liquor. The yarn sticks are mounted in sets with intermeshed gear wheels adapted to secure a regular rotation of the sticks simultaneously with the movement of the whole body of yarn through the liquor.—J. B.

Yarn in hanks; Machine for dyeing and bleaching cotton, linen and jute ——. H. Vueghs. Fr. Pat. 452,902, Jan. 6, 1913.

An enclosed machine with circulating pump, etc., in which the hanks are suspended vertically between pairs of laths, to the upper of which a vertical up and down motion is given.—J. B.

Dyeing vegetable fibres. Read, Holliday and Sons, Ltd., Fr. Pat. 453,362, Jan. 10, 1913. Under Int. Conv., Dec. 2, 1912.

The shade obtained in the ordinary way by means of a sulphide dyestuff is improved by topping with an oxidation colour, obtained by treating the dyed material in a bath composed of an oxidising agent (*e.g.*, sodium bichromate) and a substance of the type of *p*-phenylenediamine, *p*-amino-*p*-hydroxydiphenylamine, *p*-aminophenol, *o*-aminophenol, or the condensation products of *p*-phenylenediamine with naphthols, phenols, *m*-diamines, etc.—J. B.

Calico-printing; Process for producing fast shades in ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 260,848, May 31, 1912. Addition to Ger. Pat. 253,293 (see Eng. Pat. 9510 of 1912; this J., 1912, 1176).

Indigoid dyestuffs in general are found to have the property, possessed by those mentioned in the principal patent, of producing fast shades in calico-printing, by applying them to the fibre with a metallic salt, with or without addition of a reducing agent. The shades produced are yellow, red, or grey, according to the dyestuff used.—T. F. B.

Red dyeings on the fibre [by means of azo dyestuffs]; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 452,910, Jan. 6, 1913. Under Int. Conv., Jan. 22, 1912.

See Eng. Pat. 2550 of 1912; this J., 1912, 918.—T. F. B.

Dyeing wool, cotton, or silk in hanks; Apparatus for ——. L. Gillet. Fr. Pat. 453,237, Jan. 16, 1913. Under Int. Conv., Jan. 16, 1912.

See Eng. Pat. 8679 of 1912; this J., 1913, 422.—T. F. B.

Grey shades in printing on fabrics; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,799, Jan. 30, 1913. Under Int. Conv., Feb. 5, 1912.

See Eng. Pat. 9510 of 1912; this J., 1912, 1176.—T. F. B.

Manufacture of azo dyestuffs and after-treatment of fibres dyed therewith. Eng. Pat. 19,989. *See* IV.

Preparing artificial gums from amylaceous materials. Fr. Pat. 452,943. *See* XVII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Thoria from monazite sand; Extraction of —— with the help of hypophosphoric acid, and the detection of cerium with an alkaline ammonium tartrate solution. F. Wirth. Chem.-Zeit., 1913, **37**, 773—774. (See this J., 1912, 814.)

Formation of sparingly soluble alkali double sulphates of cerium earth metals is avoided by generating the anion of hypophosphoric acid directly in the acid liquor resulting from the decomposition of monazite sand. This is effected by the anodic oxidation of copper phosphide in the solution, after first neutralising the free acid present, so far as to leave the phosphates just dissolved. With an E.M.F. of about 10 volts, the hypophosphate ions are at once converted into the insoluble thorium salt. Oxidisers, such as hydrogen peroxide, which give ozone on electrolysis, facilitate the process. Thorium may also be precipitated by alkali hypophosphate from feebly alkaline solution (*e.g.*, of the tartrate), and the solubility of thorium hypophosphate in a large excess of ammonium oxalate may be utilised for separating thorium, in alkaline solution, from trivalent earths, which are insoluble in ammonium oxalate. The thorium hypophosphate is treated as already described (*loc. cit.*). Cerium may be detected in neutral solution by adding 5 c.c. of 10 per cent. ammonium tartrate solution and 5 c.c. of dilute ammonia; the solution becomes yellow or yellowish-brown on boiling, or in the cold with 0·1—0·5 per cent. of cerium. Hydrogen peroxide gives a brown precipitate of cerium peroxide with concentrated alkaline solutions of ceric tartate, and a colouration may be detected with 0·0002 grm. of cerium peroxide in 100 c.c.—F. Sodn.

Thorium chloro-oxalate. A. Colani. Comptes rend., 1913, **156**, 1907—1909.

Thorium chloro-oxalate prepared by the action of concentrated hydrochloric acid on thorium oxalate (this J., 1913, 485) has the formula $3Th(C_2O_4)_2,ThCl_4,20H_2O$. When heated rapidly some thorium chloride is volatilised, but if the temperature is raised slowly the product is thoria containing practically no chlorine. The rare earth metals by similar treatment are converted into oxychlorides. If thorium oxalate is precipitated from an 18 per cent. solution in hydrochloric acid, the precipitate is almost free from chlorine. The author gives figures showing the solubility of the chloro-oxalate in concentrated hydrochloric acid, and the great diminution in this solubility produced in the presence of oxalic acid, although the chloro-oxalate is not decomposed by the oxalic acid. If treated with hydrochloric acid of less than 21 per cent., the chloro-oxalate is rapidly and completely decomposed into oxalate and chloride.—W. H. P.

Sulphides; Action of carbon dioxide on mineral——. N. D. Costeanu. Comptes rend., 1913, **156**, 1985—1987.

The author has subjected some inorganic sulphides to the action of carbon dioxide at temperatures below that at which dissociation into carbon monoxide and oxygen takes place. It was found that under these conditions the sulphides of silver, copper, cadmium, bismuth, and antimony are not affected, and carbon dioxide may be used as an inert atmosphere in the preparation of crystalline from amorphous metallic sulphides by fusion. Silicon sulphide is, however, decomposed practically quantitatively by carbon dioxide at 1100° C.:

$$2CO_2+SiS_2=2CO+2S+SiO_2.$$

The reaction takes place even as low as 450° C.—A. S.

Liquid sulphur dioxide; Photoelectric phenomonon exhibited by——. J. Carvallo. Comptes rend., 1913, **156**, 1882—1884.

The experiments previously recorded (this J., 1910, 1303) on the conductivity of liquid sulphur dioxide were carried out in the dark. If the cell is illuminated when the conductivity has reached its limiting value the illumination produces a sharp diminution in the current; extinction of the lamp is followed by a sharp increase which is greater than the preceding diminution. These changes the author calls the negative effect. There is also a positive effect which consists of a slow rise from the minimum after illumination and a slow fall from the maximum after extinction. In the author's experiments six illuminations and extinctions increased the current from $0{\cdot}37\times10^{-6}$ ampere to 60×10^{-6} ampere, and in 48 hours after the last extinction the current had again fallen to $0{\cdot}67\times10^{-6}$ ampere. Both effects are produced in the mass of the electrolyte and not at the electrodes, both are due to ultraviolet radiation, and both are produced simultaneously by the same radiations. The positive effect is caused by the reaction $3SO_2=S+2SO_3$ which proceeds in the light, giving products which increase the conductivity. In the dark these products are removed by the current and the conductivity falls. The negative effect appears to be purely physical and to depend on the prolonged passage of a continuous current.—W. H. P.

Arsenic; Total adsorption of——by ferric hydroxide. G. Lockemann and F. Lucius. Z. physik. Chem., 1913, **83**, 735—758. (See also this J., 1904, 1027; 1910, 1202 and 1911, 802.)

When ferric ammonium sulphate is precipitated with ammonia the formation of soluble basic ferric salts (iron hydroxide sols) takes place to an extent which depends largely on the nature and concentration of sodium and ammonium salts which are present. Sodium nitrate has the smallest influence, ammonium sulphate the greatest. In the presence of salts the most favourable conditions for the adsorption of arsenic are given when the quantity of ammonia necessary to precipitate the ferric salt is added in two portions of $\frac{1}{3}$ and $\frac{2}{3}$ respectively at intervals of 15 minutes. The whole is then allowed to stand 15 minutes before filtering. Adsorption proceeds less readily (*i.e.*, more ferric hydroxide is required for total adsorption) at higher temperatures, particularly for small concentrations of arsenic. The total adsorption formula $E=\beta A^p$ (where E=mgrms. $Fe(OH)_3$, A=mgrm. As in 100 c.c., β and p both varying with temperature) requires relatively more iron hydroxide for small quantities than for large quantities of arsenic. This behaviour is not however a contradiction of the general adsorption law. The total adsorption conditions are not greatly influenced by the presence of salts, so that adsorption by ferric hydroxide is applicable to the purification from arsenic of strong salt solutions as well as for the determination of small quantities of arsenic in nitrate melts and other solutions. The results obtained in this work show much less iron is required for total adsorption when simple stoichiometrical quantities of ammonia are used than with double these quantities.

—W. H. P.

Nitrogen; An active modification of——produced by the electric discharge. V. R. J. Strutt. Roy. Soc. Proc., 1913, A.**88**, 539—549.

For preparing and storing the nitrogen to be submitted to the electric discharge, two 15-litre aspirator bottles are arranged as a gas-holder in the usual way, a muslin bag containing chopped phosphorus being suspended in the gas space. The gas-holder is filled with commercial nitrogen. All traces of oxygen are removed in 2—3 hours, and when the fumes arising from the phosphorus have subsided, the gas is ready for use. On its way to the discharge tube the nitrogen is dried by passing it first through a column of phosphorus pentoxide, 30 cm. × 5 cm., and then through a tube packed with copper gauze and cooled with liquid air. As the gas is withdrawn from the holder the water rises and finally drowns the phosphorus, dissolving out the oxides and leaving it ready for further use. The gas-holder should be covered with a black cloth to protect the phosphorus from the action of light. Contrary to statements by other workers (see Tiede, this J., 1913, 232), the phenomena of active nitrogen are not due to the presence of traces of oxygen. Oxygen in fact acts unfavourably and 2 per cent. prevents the phenomena altogether. Hydrogen and carbon dioxide are less harmful than oxygen, but water vapour, even in traces, is very prejudicial. Active nitrogen combines with the vapour of mercury, cadmium, zinc, arsenic, sodium, and sulphur to form nitrides, which are decomposed by water or potassium hydroxide solution, with evolution of ammonia. Carbon bisulphide yields polymeric carbon monosulphide and a blue polymeric nitrogen sulphide. Sulphur chloride gives ordinary yellow nitrogen sulphide. All organic compounds tried, except carbon tetrachloride, yield hydrocyanic acid freely, but not cyanogen. In the case of halogen compounds cyanogen chloride is formed. Benzene appears to yield cyanobenzene.—A. S.

Draft Regulations under Section 79 *of the Factory and Workshop Act*, 1901 (1 *Edw.* 7. *c.* 22), *for the Manufacture of Chromate and Bichromate of Potassium or Sodium.*

In pursuance of Section 79 of the Factory and Workshop Act, 1901, the following Regulations have been drawn up to apply to all factories and workshops or parts thereof in which is carried on the manufacture of chromate or bichromate of potassium or sodium.

In these Regulations "*Chrome process*" means manipulation, movement or other treatment of chromate or bichromate of potassium or sodium. "*Efficient exhaust draught*" means localised ventilation effected by heat or mechanical means, for the removal of steam or dust so as to prevent them from escaping into the air of any place in which work is carried on.

1. With regard to every uncovered fixed vessel, whether pot, pan, vat or other structure, containing any corrosive liquid:—(*a*) Each such vessel shall, unless its edge is at least 3 feet above the adjoining ground or platform, be securely

fenced; (*b*) For the purposes of paragraph (*a*) of this Regulation no fencing shall be deemed to be secure unless it extends to a height of at least 3 feet above the adjoining ground or platform: provided however that Paragraph (*b*) of this Regulation shall not apply—(i) to any vessel constructed before 1st January, 1899; or (ii) where a height of 3 feet is impracticable by reason of the nature of the work to be carried on; (*c*) No plank or gangway shall be placed across any such vessel unless such plank or gangway is—(i) at least 18 inches wide; and (ii) securely fenced on both sides; either by upper and lower rails, to a height of 3 feet, or by other equally efficient means; (*d*) where such vessels adjoin, and the space between them either—(i) affords foothold, and is not fenced as in paragraph (*c*) (ii) of this Regulation, or (ii) is less than 18 inches in width, clear of any brick or other work surrounding them, a secure barrier shall be so placed as to prevent passage between them.

2. All dangerous places near to which persons are employed or near to which they have to pass, shall be efficiently lighted by day and night.

3. Grinding, unless done with slow moving edge runners, and sieving the raw materials, evaporating, and packing shall not be carried on except either—(*a*) with an efficient exhaust draught; or (*b*) in such a manner as will prevent escape of dust or fume into the air of any place at which work is carried on.

4. No person under 18 years of age and no female shall be employed in any chrome process.

5. (*a*) Every person employed in a chrome process shall be examined by the Surgeon once in every calendar month on a date, or dates, of which due notice shall be given. The Surgeon shall undertake any necessary medical treatment of lesions contracted in consequence of such employment. (*b*) A Health Register containing the names of all persons employed in any chrome process shall be kept in a form approved by the Chief Inspector of Factories. (*c*) No person after suspension shall be employed in any chrome process without written sanction from the Surgeon, entered in the Health Register.

6. Requisites (approved by the Surgeon) for treating slight wounds and ulcers shall be kept at hand and be placed in charge of a responsible person.

Regulations 7 to 11 relate to the provision of overalls, respirators, lavatory accommodation, etc., while regulations 12 to 20 refer to the duties of persons employed.

Electro-chemical and electrometallurgical industries of Lyons. Chem. Trade J., July 12, 1913. [T.R.]

The electro-chemical and electro-metallurgical industries of the consular district of Lyons continue to expand satisfactorily. The manufacture of nitrides from bauxite by the Serpek process has not yet passed out of the experimental stage, the costly experiments which have been carried on for the last two years not having been so successful as was anticipated, owing to difficulties in arriving at the necessary temperatures in the electric furnace. The production of cyanamide is being carried on at Notre Dame de Briançon (Isere), on a small scale. The output of the various branches of these industries in the Lyons district in 1912 is estimated as follows:—

Articles.	Quantity.	Value.
	Tons.	£
Aluminium	9,000	594,000
Ferro-silicon	30,000	204,000
Ferro-chrome and ferro-manganese	15,000	270,000
Calcium carbide	20,000	200,000
Silicon carbide	1,500	54,000
Total	—	1,322,000

Alum mountain in New Mexico. Chem. Trade J., June 21, 1913. [T.R.]

The alum mountain near the Gila River, in South-western New Mexico, is 900 ft. high, covering 2 square miles, and the United States Geological Survey finds it to be so pure that for many uses it can be marketed in the natural state. As a probable future source of aluminium this material has a still greater value. Enormous beds of lignite near by offer power at one-fourth to one-half of the cost of hydro-electric power.

Errata.

Graphite industry of Madagascar. (See this J., 1913, 656.)

The exports of graphite during the first quarter last year were 980,000 kilos., in 1912 474,000 kilos., and in 1911 259,000 kilos. The exports in 1916 are expected to reach 20,000 metric tons.

Arsenic for Russia. See Trade Report, p. 770.

Determination of nitrites by means of thiourea and the interaction of nitrous acid and thiourea in presence of acids of different strength. Coade and Werner. *See* XXIII.

Patents.

Sulphuric acid; Manufacture of —— and apparatus therefor. G. K. Davis, Manchester. Eng. Pat. 15,459, July 2, 1912.

A number of transverse shafts carrying fanners are mounted within chambers of the usual type, and each chamber is divided by a weir into two compartments. Rotation of the shafts causes the acid to be sprayed from one division into the other, and circulation is secured by arranging an external channel (preferably fitted with a cooling pipe) through which the acid is returned. Owing to the increased speed of reaction, the chambers are of smaller size than is customary, and with suitable modifications, such chambers may be employed for denitrating and for absorbing nitrous compounds (see Eng. Pat. 2113 of 1909; this J., 1910, 79).—F. Sodn.

Sulphuric acid; Apparatus for the concentration of ——. A. Zanner. Ger. Pat. 260,655, Aug. 31, 1912.

After a preliminary concentration, *e.g.* in quartz vessels communicating with one another by overflow tubes, the final concentration is effected in open vessels disposed in a closed muffle heated over practically the whole of its outer surface by fire-gases.—A. S.

Ammonium salts; Manufacture of ——. F. Perry, Tipton, Staffs. Eng. Pat. 14,079, June 17, 1912.

Mond or other producer, coke oven, illuminating or the like gas is treated with a solution of sulphate or chloride of iron, or waste "pickle," without subsequent purification of the resulting liquor by oxidation. A precipitate of iron sulphide, which may be roasted to sulphate or oxide, is thus produced, and a solution of an ammonium salt.—F. Sodn.

Nitrogen and carbon dioxide; Processes and apparatus for making ——. C. D. McCourt, London, and C. Ellis, Montclair, N.J., U.S.A. Eng. Pat. 25,629, Nov. 8, 1912. Under Int. Conv., Jan. 26, 1912.

A mixture of fuel and air is made to undergo surface combustion in apparatus such as is described in Eng. Pats. 25,808 of 1909 and 4362 of 1910 (this J., 1910, 1448; 1911, 406), so as to give a product containing only traces of unconsumed fuel or oxygen, and the carbon dioxide is subsequently absorbed from the gases by a suitable liquor (such as alkali carbonate) which is made to circulate through the absorption apparatus and is afterwards subjected to heat derived from the combustion process. The residual nitrogen, after purification, is fixed as calcium cyanamide, in a suitable converter.—F. Sodn.

Calcium carbide; Process of producing ——. M. W. Murray, Assignor to G. H. Rosenblatt, New York. U.S. Pat. 1,060,206, April 29, 1913.

Very high temperatures, suitable for the manufacture of calcium carbide, carborundum, and the like, are produced by superheating and carburetting explosive mixtures of gas (such as water-gas) and air, and subjecting them (preferably under pressure) to surface combustion, by forcing them, for example, through a bed of heated small pieces of magnesia, below which is a conveyor carrying the material to be heated. Aromatic and unsaturated hydrocarbons, and vapours of explosive substances, such as picric acid, may be used in carburetting the mixture.—F. Sodn.

Lead arsenate; Method of making ——. C. B. Sprague, Salt Lake City, Utah, Assignor to United States Smelting, Refining and Mining Co., Portland, Me. U.S. Pat. 1,064,023, June 10, 1913.

Material containing lead and arsenic is roasted in the presence of air, at a moderate red heat, and the lead arsenate present is then dissolved by means of a solution of caustic alkali and subsequently precipitated by neutralisation.—F. Sodn.

Bromine or bromides, Production of ——. F. I. du Pont, Wilmington, Del., Assignor to Internat. Haloid Co. U.S. Pat. 1,064,460, June 10, 1913.

An aqueous solution containing free bromine is agitated with carbon tetrachloride, or other immiscible solvent capable of extracting the bromine, and, after separating from the aqueous layer (and preferably drying), the bromine extract is shaken with antimony.—F. Sodn.

Sodium nitrate from raw material; Process of extracting ——. M. R. Lamb, Assignor to Allis-Chalmers Co., Milwaukee, Wis. U.S. Pat. 1,065,053, June 17, 1913.

The disintegrated material is mixed with water, and rock and sand are removed mechanically. The remaining fine pulp is filtered, the solution is evaporated and the residue mixed with mother liquor and heated, to induce crystallisation of sodium chloride, which is removed. Finally, sodium nitrate is separated from the remaining liquor.—F. Sodn.

Lyes containing sodium carbonate and alkali borates; Process for the treatment of ——. H. Foersterling, F. Hoyler, and A. L. Gardner. Ger. Pat. 260,993, July 9, 1912.

The process is based on the fact that borax has the power of salting-out sodium carbonate from hot solutions. The lyes are kept boiling and the sodium carbonate is separated from the mother-liquor either continuously or in stages. In applying the process to the mother liquors obtained in the process described in Ger. Pats. 193,722 and 218,569, the treatment is restricted so that a quantity of sodium carbonate is left in the mother-liquors sufficient for the decomposition of a further quantity of boron mineral.—A. S.

Alkalis; Process for obtaining —— *in the form of nitrates from alkali-bearing rocks.* Chem. Fabrik Rhenania and A. Messerschmitt. Ger. Pat. 261,099, May 24, 1911.

The rocks, especially those of recent volcanic origin, are powdered and boiled with a solution of calcium nitrate or other suitable nitrate, with or without addition of lime, and preferably under pressure. It is stated that by this method about 180 kilos. of potassium nitrate and 220 kilos. of sodium nitrate can be obtained from 1000 kilos. of phonolith.—A. S.

Potash salts and the like; Process and apparatus for the continuous decomposition, dissolving, and purification of ——. E. Thie. Ger. Pat. 261,210, Oct. 18, 1911.

The material to be decomposed, dissolved or purified is moved continuously through the apparatus in contact with the decomposing, dissolving or washing liquid. In order to allow the material to remain in contact with the liquid for a sufficient time to ensure complete decomposition, solution or purification, means are provided whereby the speed of the conveying device can be accelerated or diminished, or the conveyor can be stopped, or its action periodically reversed. In this way the material can be kept in the apparatus for the requisite time and may travel in the same or the opposite direction as the liquid, or partly in the same and partly in the opposite direction. —A. S.

Ammonia; Manufacture of ——. A. J. Boult, London. From Centralstelle f. Wissensch.-technische Untersuchungen, Neubabelsberg, Germany. Eng. Pat. 14,585, June 21, 1912.

See Ger. Pat. 252,997 of 1912; this J., 1912, 1178.—T.F.B.

Ammonia [and molybdenum-nitrogen compounds]; Process for producing ——. Badische Anilin und Soda Fabrik. Second Addition, dated Jan. 9, 1913, to Fr. Pat. 431,295, June 19, 1911. Under Int. Conv., Jan. 30, 1912.

See Ger. Pats. 259,648 and 259,649 of 1912; this J., 1913, 657.—T. F. B.

Ammonium sulphate from ammonium bisulphite; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 452,961, Jan. 8, 1913. Under Int. Conv., Jan. 27 and 29, and June 11, 1912.

See Eng. Pat. 12,845 and 14,114 of 1912; this J., 1913, 363.—T. F. B.

Salt; Method of precipitating ——. J. Hodgkinson, Manchester, Assignor to J. F. Seacombe, East Ham. U.S. Pat. 1,065,128, June 17, 1913.

See Eng. Pat. 26,068 of 1908; this J., 1910, 24.—T. F. B.

Heating gases to high temperatures; Method of and means for ——. [*Production of oxides of nitrogen.*] C. F. R. von Koch, Stockholm. U.S. Pat. 1,065,144, June 17, 1913.

See Eng. Pat. 14,528 of 1911; this J., 1912, 490.—T.F.B.

Lime cartridge for mining purposes. H. L. Storey and J. Parkinson, Lancaster. U.S. Pat. 1,065,261, June 17, 1913.

See Eng. Pat. 10,442 of 1912; this J., 1912, 922.—T.F.B.

Separating liquefied mixtures of gases [air]; Process for ——. A. C. Morrison. Fr. Pat. 452,834, Jan. 2, 1913.

See U.S. Pat. 1,056,043 of 1913; this J., 1913, 426.—T.F.B.

Chemical compounds or minerals such as phosphates; Process for decomposing —— *by superheated steam.* H. C. Woltereck and J. Moeller. Fr. Pat. 452,993, Jan. 9, 1913.

See Eng. Pat. 28,920 of 1911; this J., 1913, 85.—T. F. B.

Alkalis or alkaline compounds and hydraulic cement from minerals or rocks containing alkalis; Simultaneous manufacture of ——. E. W. Jungner. Fr. Pat. 453,461, Nov. 15, 1912. Under Int. Conv., Jan. 30, March 7, and May 7, 1912.

See Eng. Pats. 26,497 and 28,970 of 1912; this J., 1913, 534, 486.—T. F. B.

VIII.—GLASS; CERAMICS.

Fireproof porcelain. Heinecke. Chem.-Zeit., 1913, 37, 768.

The so-called "fireproof" porcelain cooking vessels upon the market can only be regarded as fire-resistant, since in technology the term "fireproof" is restricted to products melting above Seger cone 26. The basis of European hard porcelain is a mixture of 50 parts of clay, 25 of felspar and 25 of quartz. A body prepared from a mixture of 30 parts of Zettlitz kaolin, 52 of felspar and 45 of alumina (burnt at Seger cone 18, or preferably fused in an electric furnace) does not melt below Seger cone 35 to 36, but since it softens without melting at high temperatures it is advisable to replace the felspar by an intimate mixture of 1 mol. of felspar with 3 to 6 mols. of alumina. Very compact and fire-resistant masses (melting at Seger cone 37) may be prepared from a well-burnt mixture of alumina and magnesia.—C. A. M.

Patents.

Quartz masses for the manufacture of tubes of quartz; Method of fusion of ——. A. L. Billon-Daguerre. Fr. Pat. 453,219, Jan. 16, 1913. Under Int. Conv., Jan. 20, 1912.

Silicious bodies containing spar and fluorine, and having a melting-point at about 2000° C. are heated in an electric furnace to 1800° C. till soft and are fashioned into rings, the completion of fusion being achieved at 2000°—2500° C. by means of the oxyhydrogen flame. These rings are then used to build up vessels of any required shape in the oxyhydrogen flame.—H. H. S.

White enamels; Manufacture of ——. Verein. Chem. Fabr., Landau, Kreidl, Heller und Co. First Addition, dated Jan. 18, 1913, to Fr. Pat. 438,908, Jan. 11, 1912 (this J., 1912, 643). Under Int. Conv., May 4, 1912.

The power of hydrates of conferring opacity was found to be most effective when 2—7 per cent. of alkali was present. It is stated that the content of water of hydration influences the covering power of enamels, and that it is favourable to opacity to increase the alkali content at the expense of the water of hydration.—H. H. S.

Moulds of kaolin for the manufacture of ceramic objects. Brüder Mracek. Fr. Pat. 452,842, Jan. 3, 1913.

The mould is made of kaolin and fired at cone 3.—H. H. S.

Abrasive material; Process for producing —— from bauxite. Soc. Anon. des Produits Abrasifs et Alumineux de Provence. Fr. Pat. 453,138, Jan. 14, 1913. Under Int. Conv., Jan. 26, 1912.

An abrasive material of hardness 8 on Mohs' scale is produced by heating a special bauxite, containing at least 18 per cent. Fe_2O_3, without fluxes, first to 1200° C., where the mass undergoes a modification shown by a change of tint to iron-grey and then to 1800° C.—H. H. S.

[Quartz] glass and process of making same. F. Wolf-Burckhardt and W. Borchers. First Addition, dated Jan. 30, 1913, to Fr. Pat. 432,786, July 31, 1911.

See Eng. Pat. 2176 of 1913; this J., 1913, 365.—T. F. B.

Quartz articles; Process for producing transparent ——. Zirkonglas-Ges. m. b. H. Fr. Pat. 453,517, Jan. 23, 1913.

See Eng. Pat. 2150 of 1913; this J., 1913, 427.—T. F. B.

Glass; Apparatus for drawing ——. W. A. Jones. Fr. Pat. 453,098, Jan. 13, 1913.

See Eng. Pat. 628 of 1913; this J., 1913, 535.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Cement blocks; Process of forming ——. C. Westergard, Everett, Wash. U.S. Pat. 1,063,899, June 3, 1913.

Heated sand is mixed with asphaltum, cement and sulphur are added, and the mass is mixed with sufficient water to make a plastic mass which is pressed into moulds. The moulded articles are "cured" by sprinkling and submerging in water, treating with steam, increasing the pressure, and intermittently sprinkling, after which they may be rapidly submitted to a high temperature.—F. Sodn.

Waste gases of combustion from Portland cement, lime, and other kilns; Process of utilising the ——. F. Schott, Heidelberg, Germany. U.S. Pat. 1,064,550, June 10, 1913.

After separating the heavier particles of dust, the gases are cooled, and the finer dust particles and condensed potassium and ammonium salts are separated by filtration. The remaining gases may be drawn off by suction and passed into the atmosphere.—F. Sodn.

Cement; Process of manufacture of an impermeable ——. A. M. H. Hansen and M. C. J. Neve. Fr. Pat. 453,751. Jan. 29, 1913. Under Int. Conv., Jan. 30, 1912.

Forty parts of fish oil or other grease are boiled with 10 parts of hydrochloric acid, and this mixture is added, whilst hot, to 200 parts of quicklime, previously slaked with 300 parts of water. The resulting paste is allowed to harden, and is then broken into pieces and a suitable quantity added to lumps of cement clinker, and this mixture ground and sifted in the ordinary way.—W. C. H.

Basalt; Manufacture of articles of fused and reconstituted [devitrified] ——. F. Ribbe. Fr. Pat. 453,366, Jan. 13, 1913.

The process claimed in Fr. Pat. 418,624 (this J., 1911, 88) is extended so as to include the recovery of a quantity of cast iron as a by-product in the fusion of basalt, the separation of basalt and pumice-like basalt in a special crucible, by decantation, the production of objects in pumice, covered with basalt without complicating the moulding operation, and the decolourisation of articles of pumice or basalt by acting on these materials with air at a high temperature. Devitrification, without re-heating, is secured by using sets of dihedral or square metal moulds, arranged so that only a single wall separates two objects, and by superposing the sets during cooling; the sets are heated prior to the first fusion and are coated on the outside with heat non-conducting materials. In the case of the use of single moulds, these can be covered with a coat of basalt. Tiles can be made automatically by using open moulds charged with material and passed under a roller, and the objects devitrified without previous removal from the moulds.
—W. C. H.

Artificial stone, and its process of manufacture. G. Boisselier and E. Diligeon. Fr. Pat. 453,388, April 2, 1912.

Building materials of any shape or size are made from the following ingredients which give rise to the formation of a hydrated magnesium oxychloride. A mixture of the following solids, lead carbonate, 2 parts, magnesium carbonate, 87 parts, calcined alumina, 1 part, powdered felspar, 9 parts, and caustic soda, 1 part, is treated with a liquid composed of 80 to 100 litres of hydrochloric acid of 25° B. (sp. gr. 1·21), 14 to 16 litres of a solution of magnesium chloride of 22° B. (sp. gr. 1·18), 1 to 2 litres of zinc sulphate or basic lead acetate of 12° B. (sp. gr. 1·091), and 500 grms. of burnt alum. Varying quantities of such materials as broken crockery, earthenware, gravel, sand, earth, wood or stone sawdust, etc., are incorporated with the mass formed by mixing the above compositions.
—W. C. H.

Artificial stone; Process of manufacture of ——. E. Dumas. Fr. Pat. 453,417, Jan. 21, 1913.

The stone is made of a mixture of white or brown cement and river sand, together with slag or slag and tufa.
—W. C. H.

Building bricks made by agglomeration in the cold. L. Chauvot, L. Davion and E. Douzal. Fr. Pat. 453,653, April 9, 1912.

The main constituents of the bricks are slaked lime, sand and a small quantity of cement, which are moistened with water containing colloidal iron oxide. The mass is moulded into objects which are then immersed for a short time in a solution of an alkali silicate, or this may be introduced into the mass during the mixing.—W. C. H.

Wood; Process of injection [impregnation] of ——. E. Golorons. Fr. Pat. 453,435, Jan. 17, 1913.

The injection cylinder is provided with safety valves. A supplementary creosote receptacle is used to feed the receptacle arranged to supply the cylinder, and its temperature is about the same as that of the latter. A raised receptacle is used so that the sleepers may always be immersed in the creosote, although they absorb it, so that the time of contact and amount absorbed may be the same for all the sleepers. The vacuum is produced by a steam jet ejector and not by a pump. The process aims at saving 25 to 30 per cent. of the quantity of creosote required for impregnating the sleepers.—W. C. H.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; Influence of phosphorus on the properties of ——. E. d'Amico. Ferrum, 1913, 10, 289—304.

Three series of experiments were made on the natural, annealed, and chilled material of 12 samples with increasing phosphorus content (0·012—1·242 per cent.). Chemical composition, specific gravity, and metallographical characters are given. The following conclusions are submitted:—The increase in hardness is nearly proportional to the phosphorus content (about 12 Brinell units per 0·1 per cent.) increase. Elasticity is increased (about 2·7 kilos. per sq. mm. per 0·1 per cent.). Tensile strength increases until 0·5 per cent. P is reached, beyond which it decreases. Expansion and contraction decrease as the tensile strength increases with low phosphorus contents; but with high phosphorus they are practically nil. Above 0·24 per cent. P the metal is very brittle. The electric conductivity is lowered, but the magnetic properties are influenced only by a high phosphorus content, the latter counteracting the effect of the preliminary treatment of the material. Numerous tables, diagrams, and microphotographs are given.—W. R. S.

Steels; Thermo-electricity of ——. W. Broniewski. Comptes rend., 1913, **156**, 1983—1985.

The author has determined the thermo-electric power, in relation to copper, of five carbon-steels containing: Mn up to 0·09, Si up to 0·05, S up to 0·022, and P up to 0·006 per cent. The results are represented graphically and show that this method is equal or superior to the other methods usually employed for gaining information on the critical points of steels. In the steel with C 0·07 per cent., the critical point a_2 is at about 730° C., just as with electrolytic iron (see this J., 1913, 290), but a_3 is at about 850° C. as compared with 950° C. for pure iron. In the steel with C 0·24 per cent., recalescence (a_1) makes its appearance at the critical point a_2, and a_3 is shown by a slight change of direction below 800° C. In the case of the steels richer in carbon (0·44, 0·79, and 1·12 per cent. respectively), a_2 and a_3 become merged in the recalescence point (a_1), which is shown by a break in the curve corresponding to about 140 microvolts.—A. S.

Fluorine; Determination of —— in zinc ores. L. Schneider. Oesterr. Zeits. Berg- u. Hüttenw., 1913, **61**, 365—367.

Ten grms. of finely powdered blende or calamine intimately mixed with 5 grms. of quartz, and 100 c.c. of concentrated sulphuric acid are heated to 160°—170° C. in a 300—400 c.c. flask placed in an oil bath, dry air being passed through the apparatus. The gases pass a U-tube filled with small dry quartz fragments, then a flask containing not more than 100 c.c. of water. A fresh flask is substituted after one hour: the operation is interrupted when silicic acid no longer separates. The liquid is evaporated to dryness in a platinum dish after adding 2 grms. of potassium nitrate to destroy sulphurous acid. The residue is treated with water, 25 c.c. of strong ammonia added, and the solution boiled with calcium chloride, the precipitate filtered off, ignited in a platinum dish, treated with acetic acid, evaporated to dryness and extracted with hot water. The residue of calcium fluoride and silica is ignited and weighed, the latter is volatilised with hydrofluoric acid, and after again igniting the calcium fluoride is weighed. The first weighing is useful as a check, as the ratio of SiO_2 (taken by difference) and CaF_2 is 1 : 3·4. This figure is empirical. The results are stated to be low: about 3·5 per cent. of the fluorine present appears to escape estimation.—W. R. S.

Metallurgical products; The influence of "drawing" on the properties of ——. L. Guillet. Rev. Mét., 1913, 10, 769—777.

Drawing has been found to raise the elastic limit, increase the brittleness, and reduce the elongation of metals. Experiments made to ascertain the difference in behaviour of annealed and rolled plates of pure aluminium, and of aluminium alloys, in water, and solutions of sodium hydroxide (1 per cent.), sodium chloride (1, 5, and 10 per cent.), hydrochloric acid (1 per cent.), and magnesium chloride (1 per cent.), showed that while in general the rolled plates were attacked to a greater extent than the annealed plates, this result was not invariable.—T. St.

Metals; Electrical emissivity of and disintegration of hot ——. J. A. Harker and G. W. C. Kaye. Roy. Soc. Proc., 1913, A. 88, 522—538.

The metals were heated by alternating current, mostly in nitrogen at reduced pressure. Positive electricity was emitted at temperatures from about 1000° to 1400° C., and for metals which melt within this range, a sudden and marked increase in the positive current often occurred at the melting point, probably owing to the sudden release of occluded gas. The positive current appears to be increased in presence of oxygen. Negative electricity predominates at higher temperatures and increases rapidly with the temperature. With carbon in air at atmospheric pressure, a negative ionisation current of 3½ ampères was obtained. At moderate pressures the negative currents appear to be largely increased when considerable sputtering of the metal occurs; they are probably due to a chemical reaction between the metal and the surrounding gas. It is considered that the deposits obtained in these experiments are due not only to volatilisation and condensation, as ordinarily understood, but also to straight line emission of particles (compare Reboul and de Bollemont, this J., 1911, 429, 1262.) Carbon becomes soft and plastic, and readily sublimes, at about 2500° C. A metal tube cooled by water was surrounded by a carbon tube, and the latter was heated by low-voltage alternating current to about 2500° C., hydrogen being passed between the two tubes. After about ½ hour, the metal tube was coated with a deposit of carbon sufficiently hard and coherent to be removed in short lengths. It is suggested that carbon of high purity could be obtained in this way by fractional distillation.—A. S.

Electro-chemical and electrometallurgical industries of Lyons. Chem. Trade J., July 12, 1913. [T.R.]. *See* VII.

Determination of small quantities of lead. Elsden and Stansfield. *See* XXIII.

Patents.

Steel or other metals; Method of and apparatus for solidifying molten —— in casting the same into ingots. B. Gerdau, Düsseldorf, Germany. Eng. Pat. 21,738, Sept. 24, 1912.

The steel is cast in a mould composed of lengthwise sections, containing grooves in which are placed metal plates capable of bending as the mould is contracted. These plates close the joints or spaces between the parts, and hold the refractory material which is used as filling for the joints of the mould. As the metal solidifies, the mould is contracted by forcing it upwards by a hydraulic ram acting on its base, within a ring which narrows in an upward direction. Friction between the mould and ring is reduced by means of rollers or balls. Simultaneously with the contraction of the mould, a second hydraulic ram exerts pressure directly on the base of the ingot, tending to force it upwards inside the mould which tapers from the bottom. The top of the ingot is left open and is heated by a gas burner during the pressing, thus enabling slag and other lighter parts of the molten material to become eliminated.—T. St.

Ferro-alloys; Process of producing low-carbon ——. J. M. Morehead, Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 1,063,280, June 3, 1913.

A high-carbon alloy, produced by electrically smelting a compound of the alloying metal, an excess of carbon and a source of iron, is heated electrically in presence of gaseous oxygen or an oxidising gas containing combined oxygen to such a temperature that the affinity of oxygen for the contained carbon is greater than its affinity for the alloyed metal.—T. St.

Ferro-alloys [ferrochromium]; Process of producing low-carbon ——. I. R. Edmands, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 1,063,341, June 3, 1913.

A compound of the alloying metal (chromium) is smelted electrically with an excess of carbon and a source of iron, and the high-carbon product so obtained is heated electrically in presence of an oxidising gas to a temperature such that the affinity of oxygen for the contained carbon is greater than its affinity for the alloyed metal (chromium). —T. St.

Steel, iron, etc.; Treatment of ——. *Annealing process, etc.* A. W. Machlet, Elizabeth, N.J. U.S. Pats. 1,065,379 and 1,065,697, June 24, 1913.

(1) The metal is heated above redness, *e.g.*, to a temperature between 900° F. (482° C.) and its melting point, in an atmosphere of ammonia, or a slow current of ammonia is passed over the heated metal, so as to form a "shell or coating" thereon. (2) Steel articles are annealed by heating them in a closed retort charged with a mixture of ammonia and a "carbonous gas," and then allowing them to cool in the same atmosphere. The retort is agitated during the heating.—A. S.

Steel; Process for hardening —— *superficially.* Vickers Ltd. Fr. Pat. 453,235, Jan. 16, 1913.

Steel plates, etc., are superficially hardened or tempered by quickly heating and cooling the surface, using an oxy-acetylene blowpipe, or they are submerged under a thin layer of liquid which is temporarily displaced by the blast. A hardening agent (such as ferrocyanide) may be added to the liquid.—W. R. S.

Metals, ores and other substances; Concentrating apparatus for separating —— *in wet recovery processes.* W. E. Cox, Lelant, and H. McG. Morris, St. Buryan, Cornwall. Eng. Pat. 5975, Mar. 9, 1912.

The apparatus, which is particularly suitable for treating alluvial tin ores, is of the jig type. Ground ore is fed by water into open-topped vertical chambers, of square cross-section, connected at the bottom with a water supply through a hollow cylindrical rotating valve. Long narrow ports in the valve-wall allow the water to enter the chambers in an intermittent manner, whereby pulsations are set up. A screen or grid extends right across each chamber about midway of its height. A layer of the heavier particles of the ore forms on the screen, while similar particles sufficiently small pass through, and are drawn off. An opening shielded by a curved baffle, and at a suitable adjustable height, allows of the heavy particles too large to pass through the screen to be continuously discharged, whereby the layer is maintained of a uniform suitable depth. One wall of each chamber is shortened so as to form a weir over which the lighter particles pass into a common discharge launder. One rotary valve may control the pulsations of water in a number of independent separating chambers.—T. St.

Ore concentration; Apparatus for ——. J. Hebbard, Broken Hill, New South Wales, Assignor to Minerals Separation Ltd., London. U.S. Pat. 1,064,209, June 10, 1913.

The ore pulp is agitated in a series of mixing vessels by rotary agitators with blades shaped to give an upward circulation to the pulp. Connecting the mixing vessels, on the same level, is a series of spitzkasten. Each mixing vessel has a high-level outlet to the next spitzkasten, and each spitzkasten a low-level outlet to the bottom of the next mixing vessel. There is a connection between the several spitzkasten to adjust the level of the liquid therein. —T. St.

Metallic tungsten; Method of joining —— *to copper.* The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, U.S.A. Eng. Pat. 10,338, May 1, 1912.

Copper purified by melting with an oxidisable boron material, will, after casting in contact with tungsten, adhere to the latter. Or, the tungsten with the boron material and copper, may be subjected in a crucible to a temperature several hundred degrees above the melting point of copper; or the copper and tungsten may be heated together in a vacuum furnace to about 1400° C., and simply allowed to cool in contact with each other.—T. St.

Furnace for melting and alloying metals in vacuo. W. S. Simpson, London. Eng. Pat. 12,067, May 21, 1912.

A steel or iron crucible rests on and within a metal casing lined with fire-brick, the whole being mounted on trunnions. Round the upper edge of the crucible is a tongue which fits into an asbestos-packed groove in the cast-iron cover. The latter is held in position by the external air pressure, and is provided with glass eye-pieces and a socket for connection with the suction pump. A rod, to the end of which a carrier is attached, passes through a gland in the cover, and serves for the introduction of material into the molten metal in the crucible without impairing the vacuum. The crucible is heated by a gas burner, outlets for the products of combustion being provided in the upper part of the casing. (Reference is directed to Eng. Pats. 19,781 and 19,781a of 1905 and 11,832 of 1910; this J., 1906, 1049; 1911, 1020.)—T. St.

Furnace for metal heating and metallurgical purposes. J. A. Hill, Sheffield. Eng. Pat. 12,349, May 24, 1912. Addition to Eng. Pat. 1976, Jan. 26, 1907.

The grate of a furnace used for reheating, annealing, puddling, and similar operations, contains a number of conduits within which are laid transverse fire-bars provided with ribs, such that vertical spaces are formed between the fire-bars. Compressed air or steam in regulated amount is blown into the conduits. The products of combustion pass into the chamber containing the material under treatment.—T. St.

Stirring or agitating device for use in roasting furnaces and the like. M. van Marcke de Lummen, Cologne, Germany. Eng. Pat. 13,551, June 10, 1912.

The cooling medium for the agitating arms is supplied up the centre of the hollow vertical shaft carrying the arms, passes to the end of each arm, then back to the centre, and discharges through lateral passages in the hollow shaft in a direction opposite to its inlet.—T. St.

Puddling furnaces. F. J. Millard and R. J. Hadlington, West Bromwich. Eng. Pat. 22,073, Sept. 28, 1912.

The secondary air supply is preheated by passing it through transverse passages, open at the bottom, in the fire-bridge and flue-bridge respectively. These passages are open at one end to the atmosphere and are connected by a longitudinal flue in the back wall of the furnace which extends into the back wall of the fire-grate and is provided near the crown of the furnace with cross ports through which the heated air is delivered to the space over the fire-grate.—A. S.

Blast furnace. R. Kunz, Osnabrück, Germany. Eng. Pat. 26,806, Nov. 21, 1912. Under Int. Conv., Dec. 9, 1911.

In order to prevent the molten iron breaking the walls, these consist from the hearth upwards as far as desired, of a massive iron annulus, down the outer surface of which cooling water is allowed to flow. The surface of the wall is preferably made oblique, so that the shaft at its lower part increases in diameter downwards. The wall is also provided with a vertical fluting, and is surrounded at the bottom end by a water-discharge gutter.—T. St.

Metallurgical furnaces, particularly zinc muffle furnaces; Device for mechanically discharging ——. F. Méguin und Co., A.-G., and W. Müller, Dillingen-Saar, Germany. Eng. Pat. 494. Jan. 7, 1913.

Water or steam is supplied by a pipe line consisting of two concentric pipes, to a pointed bulbous steam chamber which is pushed into the furnace. Steam blows from the chamber backwards towards the mouth of the furnace and thus discharges the latter. In the case of hot zinc muffles, water is supplied along the pipe line through the annular space surrounding the centre pipe. A regulated amount passes into the steam chamber, where it becomes transformed into steam by the heat of the furnace. The excess water returns by the centre pipe and serves to keep the pipe line cool.—T. St.

Crucible furnace. H. Wade, London. From F. Hundt, Geisweid b./Siegen, Germany. Eng. Pat. 4908, Feb. 26, 1913.

In an oil-fired tilting crucible furnace, the bottom of the crucible shaft is spherical and fits closely into a concentric spherical depression in the bed-plate. The base of the shaft and the bed-plate are each provided with an opening, the two openings coinciding in the vertical position of the crucible. The fuel oil and air blast enter through one of the trunnions, and the waste gases pass through the openings at the base into a chamber situated below, whence they are led away. The chief advantage claimed for this arrangement is freedom from noise.—T. St.

Furnace: Oscillating Siemens-Martin ——. Atelier de Constructions Electriques du Nord et de l'Est. First Addition, dated Mar. 19, 1912, to Fr. Pat. 436,020, Jan. 11, 1911 (this J., 1912, 393).

The furnace is provided with an upper and lower taphole and can be tilted in opposite directions.—W. R. S.

Wires; The drawing of —— and more particularly of tungsten and other metal filaments. C. Gladitz, London. Eng. Pat. 12,469, May 25, 1912.

In order to obtain a pointed end to the wire for inserting into the draw-plate, etc., the wire is stretched between two points in a bath of a corrosive agent such as iron cyanide, and during the passage of an electric current, wherein the wire forms the anode in the bath, the wire is gradually withdrawn vertically. A projection on the rod to which the stretched wire is attached stops the upward movement at the desired point. A lamp in series with the wire indicates the end of the process, when the wire breaks.—T. St.

Smelting and brazing with compressed gases; Method and apparatus for ——. J. Knappich, Augsburg, Germany. Eng. Pat. 13,290, June 5, 1912.

The combustible gas escaping under pressure sucks in the necessary air by injector action, the gases becoming mixed before issuing at the nozzle orifice. The nozzle is removable, and the flame can be given any desired shape by varying the pressure and the shape of the nozzle orifice. (Reference is directed to Eng. Pat. 21,724 of 1907.)—T. St.

Metal plates for tanks and vats; Compound ——. L. W. Goold, Birmingham. From Hoyt Metal Co., St. Louis, Mo., U.S.A. Eng. Pat. 1664, Jan. 21, 1913.

Claim is made for a rolled metal sheet for tanks comprising a thick inner layer of commercial lead and a thin outer layer of Pb-Sb alloy containing at least 2 per cent. Sb, welded on to the inner layer.—A. S.

Alkali metals from their fused halogen compounds; Apparatus for the [electrolytic] production of ——. Electrizitätswerk Lonza A.-G., Basel, Switzerland. Eng. Pat. 3575, Feb. 11, 1913. Under Int. Conv., Feb. 15, 1912.

The apparatus comprises a furnace chamber, in which a partition wall of insulating material structurally independent of the rest of the furnace and especially of the collecting cathode, is pressed against the latter. In consequence of the deflection of the flow of current, which keeps the electrolyte fluid, a layer (which may be strengthened by cooling) of solidified salt is formed which cements the walls of the partition to the cathode. By increasing the amperage of the current, the layer can be softened to such an extent that the partition wall can be easily changed without stopping the work, and without interfering with the rest of the apparatus.—B. N.

Alkali metals; Process for the manufacture of ——. J. E. Bucher. Fr. Pat. 453,086, Jan. 13, 1913.

A process for producing alkali metals by heating their cyanides with finely divided iron, iron carbide and nitrogen being also formed. The alkali metal is obtained by distillation.—W. R. S.

Metals and alloys; Process of casting ingots of —— and apparatus therefor. P. H. G. Durville, Paris. Eng. Pat. 6027, Mar. 11, 1913. Under Int. Conv., Mar. 12, 1912.

In order to obtain ingots free from slag and blow-holes, the molten metal is not poured directly into the mould but is run into a suitable reservoir, and allowed to stand in the molten state until bubbles and slag have had ample opportunity of rising to the surface. Scum and slag are removed, the mould is gently lowered into the metal, and the whole is then allowed to stand until the metal has solidified. The reservoir is made in the form of a trough with a refractory lining and round the ingot-mould is a casing having the same configuration as the reservoir. The space between the mould and the outside of the casing is filled in with sand, pieces of pig iron, or other material to give the necessary weight to enable the whole to sink into and displace the molten metal. Several such moulds are supported in a casing and lowered simultaneously into the reservoir.—T. St.

Copper; Recovering —— from its ores. U. Wedge, Ardmore, Pa., Assignor to The Furnace Patent Co., Philadelphia, Pa. U.S. Pat. 1,063,629, June 3, 1913.

The ore is oxidised in presence of a sulphate of a metal at such a temperature that copper sulphate is formed. The ore is moved through the furnace during the process and the gases formed in the first part of the treatment are led to a point in advance of that at which they were formed and there act upon the partially sulphated ore. —A. T. L.

Copper-bearing material; Method of obtaining values from ——. H. F. Wierum, Upper Montclair, N.J. U.S. Pat. 1,063,486, June 3, 1913.

A matte having been formed by smelting the material in a blast-furnace, the molten mass is subjected to a "converting" blast charged with a silicious fluxing material.—T. St.

Cyanide solutions; Process of precipitation of material from ——. C. W. Merrill, Berkeley, Cal. U.S. Pats. 1,063,568 and 1,063,569, June 3, 1913.

(1) The partially precipitated solution is passed through a comminuting apparatus, wherein it is brought into contact with a brittle alloy, a constituent of which is a precipitant for the metals in solution. (2) The comminution brought about in the comminuting apparatus is intensified by incorporating with the metallic precipitant, an inert non-metallic abrasive substance.—T. St.

Metals; Precipitant for recovering —— from solutions. C. W. Merrill, Berkeley, Cal. U.S. Pat. 1,063,570, June 3, 1913.

A precipitant for recovering metals from cyanide solutions consists of a powder made from an alloy containing a substance capable of effecting the desired precipitation, and an abrasive substance.—T. St.

Magnetic separation of ores out of slimes. B. Schwerin, Assignor to Ges. für Elektro-Osmose m. b. H., Frankfort on the Maine, Germany. U.S. Pat. 1,063,893, June 3, 1913.

The slimes are brought into the colloidal state by addition of an electrolyte of an electrical character opposite to that of the ore to be separated, and are then subjected to magnetic separation.—B. N.

Zinc; Metallurgy of ——. A. L. J. Queneau, Assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Pa. U.S. Pat. 1,064,992, June 17, 1913.

In a rotatory electric furnace, the lining is made up of longitudinal courses consisting of equal numbers of conducting and non-conducting blocks, so as to equalise expansion, the conducting blocks of adjacent courses overlapping so as to conduct the electric current from one to the other. Midway along the furnace the conductors have a break in their electric continuity and are successively bridged at the bottom of the chamber across the break by the molten charge.—T. St.

[*Uranium, radium, and vanadium.*] *Ores; Process of extracting values from ——.* W. F. Bleecker, Canonsburg, Pa., Assignor to The Standard Chemical Co., Pittsburgh, Pa. U.S. Pat. 1,065,581, June 24, 1913.

The comminuted carnotite ore is leached with a hot solution of sodium carbonate, whereby the uranium and part of the vanadium are dissolved. After washing, the residue is leached with an acid, other than sulphuric acid, *e.g.*, hydrochloric acid, whereby the radium together with some of the remaining vanadium are dissolved. After again washing, the remainder of the vanadium is recovered by leaching with dilute sulphuric acid.—A. S.

Vanadium; Process of purifying ——. W. F. Bleecker, Canonsburg, Pa., Assignor to The Standard Chemical Co., Pittsburgh, Pa. U.S. Pat. 1,065,582, June 24, 1913.

An acid solution containing vanadium and impurities (lead, aluminium, calcium, magnesium, etc.), is treated first with a lead salt and then with sodium carbonate; the precipitated lead vanadate is separated and treated with sulphuric acid, yielding lead sulphate and an acid vanadium solution free from impurities.—A. S.

Agglomeration of fine, granular, or friable material [*ores*]; *Process for the ——.* V. A. Kroll. Fr. Pat. 452,631, Nov. 28, 1912. Under Int. Conv., Dec. 9, 1911.

Granular or powdered materials, more particularly ores, are agglomerated by heating them to incandescence and introducing air and a combustible, combustion taking place without flame within the pores or interstices of the material. Ordinary furnaces may be adapted for carrying out the process by fitting them with a conduit for leading combustible gas into the material or a spraying device for projecting a fine spray of liquid combustible thereon. —H. H.

Silvering metals and alloys. Auphelle et Cie, T. Vergnes and H. Jullien. Fr. Pat. 452,886, March 19, 1912.

The product, employed for silvering, comprises silver nitrate (1 part), or other silver compound, together with potassium cyanide (2 parts), and calcium carbonate (4 parts) or bicarbonate or magnesium sulphate, or the like. When used as a dry powder, tripoli is added approximately in the proportion 4 parts to 10 of the mixture. For a liquid preparation sugar syrup, glycerin, gum arabic or other neutral body is added. For preparing a paste, soft soap and English rouge are added.—B. N.

Steel; Manufacture of ——. F. Thuaud, Sheffield. Eng. Pat. 27,978, Dec. 4, 1912.

See Fr. Pat. 447,522 of 1912; this J., 1913, 238.—T. F. B.

Ferrochrome free from carbon; Process for increasing the yield of chromium in the aluminothermic manufacture of —— from chrome-iron ore. The Goldschmidt Akt. Ges. Fr. Pat. 453,205, Jan. 15, 1913. Under Int. Conv., July 5, 1912.

See Eng. Pat. 18,671 of 1912; this J., 1913, 430.—T. F. B.

Steel ingots; Treatment of ——. B. Talbot. Fr. Pat. 453,402, Jan. 21, 1913. Under Int. Conv., March 14, 1912.

See Eng. Pat. 6391 of 1912; this J., 1913, 238.—T. F. B.

Iron; Process for protecting —— against corrosion. S. O. Cowper-Coles. Fr. Pat. 453,605, Jan. 25, 1913.

See Eng. Pat. 26,484 of 1911; this J., 1913, 238.—T. F. B.

Metals; Process and apparatus for refining —— by heating. A. Helfenstein, Vienna. Eng. Pat. 13,577, June 10, 1912. Under Int. Conv., June 10, 1911.

See Ger. Pat. 249,032 of 1911; this J., 1912, 993. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 25,400 of 1907, 1676 and 18,523 of 1908, and 3739 of 1910.—T. F. B.

Ore concentration. G. A. Chapman, S. Tucker, and Minerals Separation, Ltd., London. Eng. Pat. 14,273, June 18, 1912.

See Fr. Pat. 452,299 of 1912; this J., 1913, 663.—T. F. B.

Ore concentration. H. H. Greenway, Melbourne, and H. Lavers, Broken Hill, N.S.W., Assignors to Minerals Separation, Ltd., London. U.S. Pat. 1,064,723, June 17, 1913.

See Eng. Pat. 21,875 of 1910; this J., 1911, 1263.—T. F. B.

Tin; Process for the purification or recovery of —— from alloys or mixtures containing smaller quantities of other metals. P. Bergsöe, Copenhagen. Eng. Pat. 21,223, Sept. 18, 1912.

See Ger. Pat. 255,748 of 1911; this J., 1913, 294. T. F. B.

Furnaces for roasting ores. Soc. Minière et Métallurgique de Peñarroya, Paris. Eng. Pat. 3142, Feb. 6, 1913. Under Int. Conv., Oct. 9, 1912.

See Fr. Pat. 449,186 of 1912; this J., 1913, 493.—T. F. B.

Cementation-furnace. F. Giolitti, Turin, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 1,064,898, June 17, 1913.

See Fr. Pat. 435,970 of 1911; this J., 1912, 393.—T. F. B.

Metallurgical furnaces, especially zinc retorts; Apparatus for mechanically discharging ——. F. Meguin und Co., A.-G., and W. Müller. Fr. Pat. 453,245, Jan. 15, 1913.

See Eng. Pat. 494 of 1913; preceding.—T. F. B.

Cupola furnace. P. Anderson. First Addition, dated Jan. 21, 1913, to Fr. Pat. 435,259, Aug. 16, 1911. Under Int. Conv., Aug. 31, 1912.

See Eng. Pat. 2289 of 1913; this J., 1913, 493.—T. F. B.

Metal; Method of plating —— [*with copper*]. W. S. Rockey and H. Eldridge, New York, Assignors to Metallurgical Research Co., Arizona. U.S. Pat. 1,065,727, June 24, 1913.

See Fr. Pat. 434,971 of 1911; this J., 1912, 342.—T. F. B.

Alloys; Process of manufacturing ——. L. Weiss, Berlin-Charlottenburg, Germany. U.S. Pat. 1,065,855, June 24, 1913.

See Fr. Pat. 424,056 of 1910; this J., 1911, 752.—T. F. B.

Metals; Process of producing ——. S. E. Sieurin, Höganäs, Sweden. U.S. Pat. 1,065,890, June 24, 1913.

See Fr. Pat. 415,894 of 1910; this J., 1910, 1316.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Patents.

Electrolyte for galvanic batteries: Alkaline gelatinous ——. *Copper oxide plate for use in electric batteries and process of producing the same.* G. S. Engle, Washington, U.S.A. Eng. Pats. 2395 and 2396, Jan. 29, 1913. Under Int. Conv., Oct. 8, 1912.

(1) A caustic alkali solution of 28° B. (sp. gr. 1·241), is mixed with vegetable starch, in the proportion of about 1 part of starch to about 90 parts of the solution by weight. The mixture is then raised to a temperature not exceeding 180° F. (82° C.), stirred, and finally allowed to cool until it attains a consistence suitable for pouring into a battery cell. (2) A bar of copper is heated and sprayed with water, thus forming blisters on the metal which are scraped off the bar in the form of flakes of cupric oxide mixed with a small amount of metallic copper, and these are then treated with boiling water to remove unctuous matter. The flakes are mixed with a binder consisting of a solution of purified sugar, the mass pressed into the desired size and shape, and subjected to the action of heat in a curing oven until the binder is reduced to a small charcoal residuum. The mass is afterwards subjected to a high temperature in a baking oven to burn out the binder residuum, and convert the metallic copper into cuprous oxide. Finally, the mass is again compressed whilst red hot, and allowed to cool in the air.—B. N.

Refractory container [*Electric furnace.*] E. Weintraub, Lynn, Mass., Assignor to General Electric Co. U.S. Pat. 1,063,483, June 3, 1913.

A small electric furnace in which material may be heated to over 1700° C. in an inert gas, is contained in an envelope consisting of compressed self-bonded boron nitride. The envelope is surrounded and supported by a metal casing. Such an envelope is stated to be inert, infusible, and a substantial non-conductor of electricity at the highest obtainable temperatures.—T. St.

Furnaces; Rotating electric ——. Leflaive et Cie. Fr. Pat. 453,107, Jan. 13, 1913.

The electrodes are pierced with canals, and are provided with entry and exit tubes for the circulating fluid for cooling purposes. The electrodes are connected with pistons, mounted in cylinders, the latter being furnished with ribs for increasing the cooling effect. Rings, forming the electric resistance within the furnace, are mounted between carbon cylinders which are attached to the electrodes, and the latter may be brought nearer to each other in an automatic manner, according to the amount of wear and tear of the resistance. This is accomplished by means of rods attached to the pistons, and subjected to continuous pressure by the action of a system of levers and springs.—B. N.

Electric arcs; Production of long stable ——. J. Zenneck, Danzig-Langfuhr, and K. Vollmer, Jena, Germany, Assignors to Norsk Hydro Elektrisk Kvaelstofaktieselskab, Christiania, Norway. U.S. Pat. 1,063,760, June 3, 1913.

The arcs, for the production of endothermic reactions, are formed in an enveloping current of gas, which possesses a whirling motion brought about by the action of magnetic fields.—B. N.

Gaseous reaction by a silent electric discharge; Apparatus for producing a ——. *Ozonator.* M. W. Franklin, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pats. 1,064,064 and 1,064,065, June 10, 1913.

(1) The apparatus comprises a pair of concentric electrodes suitably spaced apart, the inner one being composed of a series of sections, arranged to permit gas to pass throughout the electrode and between the successive sections. A gas passage is disposed adjacent to the inner electrode on the side opposite from the outer electrode, with means for deflecting the gas in the passage to the spaces between the outer electrode and the successive sections of the inner electrode. After being subjected to each discharge, the air is mixed with more of the untreated air. (2) The apparatus comprises a base, with a frame mounted thereon consisting of two similar members provided with openings. Arms extend longitudinally from the top and bottom of the frame, and plates provided with openings are mounted upon the arms. Hollow units, comprising the electrodes for producing a gaseous reaction by a static discharge, are mounted between the plates, so that the units register with the openings in the plates. The current is obtained from a transformer, the core of which is mounted in the openings in the frame.
—B. N.

Electrodes for electrolysis. Soc. D'Electro-Chimie. Fr. Pat. 453,172, Jan. 14, 1913.

For use with fused electrolytes, or in electric furnaces, the electrode is provided with a metallic coating of appropriate thickness, obtained by casting the metal around the electrode in a suitable mould.—B. N.

Insulating compound and process of making the same. G. F. Dreher, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,064,893, June 17, 1913.

See Eng. Pat. 23,225 of 1909; this J., 1910, 1018.—T.F.B.

Electrode for alkaline accumulators; Negative ——. H. P. R. L. Pörscke and J. A. E. Achenbach. Fr. Pat. 453,434, Jan. 16, 1913. Under Int. Conv., Feb. 3, 1912.

See Eng. Pat. 29,848 of 1912; this J., 1913, 664.—T. F. B.

Furnace; Electric —— *for metallurgy and chemical industry.* V. Stobie. Fr. Pat. 453,560, Jan. 24, 1913. Under Int. Conv., Jan. 26, 1912.

See Eng. Pat. 2081 of 1912; this J., 1913, 198.—T. F. B.

XII.—FATS; OILS; WAXES.

Lipase of Chelidonium seeds. K. Bournot. Biochem. Zeits., 1913, 52, 172—205.

Attempts to isolate the lipase present in *Chelidonium majus* seeds (see Fokin, this J., 1906, 994) proved unsuccessful. The enzyme is almost insoluble in alcohol, water, and glycerin, but dissolves to some extent in the oil extracted from the seeds and in a mixture of oleic acid and alcohol. The powdered seeds are most active without any addition other than water. In experiments with cottonseed oil and triolein the maximum hydrolysis attained was 92—95 per cent., and this final condition of equilibrium was not affected by variation of temperature between 18° and 39° C., though the speed of hydrolysis was increased by rise of temperature, viz., 3·6 fold by a rise from 19° to 29°, and 1·4 fold by a rise from 29° to 39° C. The enzymic activity of Chelidonium seeds is only slightly reduced by heating the seeds for ¼ hour at 100° C., but if the seeds freed from fat and suspended in oil or in an emulsion of water and oil be heated, enzymic activity is destroyed in ¼ hour at 160° or 100° C. respectively. In the synthesis of triolein the best results (47—50 per cent. of combined oleic acid) were obtained by using a large excess of glycerin in presence of not more than 20 per cent. of water. Experiments on the synthesis and hydrolysis of some alkyl esters of fatty acids by the enzyme of Chelidonium seeds are described, and a comparison of the enzymes of Chelidonium seeds and castor beans is made. (See also Jalander, this J., 1911, 1321.)—A. S.

Fats ; Influence of light on —— in the complete absence of air. H. Wagner, R. Walker, and H. Oestermann. Z. Unters. Nahr. Genussm., 1913, 25, 704—705.

Fats, such as butter, lard, tallow, margarine, sesamé oil, etc., were filtered, dried at 110° C., and filled into flasks ; after the small remaining volume of air in the flasks had been replaced by nitrogen, the flasks were sealed hermetically and exposed to light (to direct sunlight as much as possible) for a period of 2 years, the fats being melted and shaken every 2 or 3 months. The fats were analysed before and after the exposure to light and the results obtained are recorded. In certain cases the acidity of the fats increased distinctly, for instance, with margarine the acid value rose from 5·0 to 12·2, whilst in other cases the increase was small. The iodine value diminished by 1 or 2 units for every fat, but the other analytical constants remained unaltered. At the same time, the fats were bleached and had a typically rancid taste, showing that air is not essential to the development of rancidity in fats. —W. P. S.

Vegetable wax exports from Japan. Board of Trade J., July 3, 1913. [T.R.]

The exports of vegetable wax, which is obtained from the berries of a tree called *haze*, showed a slight increase in 1912 and amounted to 7,000,000 lb. worth £116,000, of which the United States took £35,000 and the United Kingdom £23,000, the balance going to France and Germany. The total production is about 20,000,000 lb., but there is a considerable consumption in Japan, largely for candle-making and also for the preparation of a compound used by Japanese women for keeping their hair glossy and straight. In making candles, the unbleached green wax is used, and these candles are particularly in favour amongst jinrikisha men for use in their paper lanterns, because of the little smoke they produce. Were it not for this special use and for certain religious purposes, the vegetable wax candle would practically have died out, for in most cases it has been driven out of the market by the paraffin wax candle. It has recently been found that by a process which entails the use of benzine an additional 10 per cent. of wax can be obtained from the berry, and several of the wax works are now adopting this system.

Patents.

Palm oil extracting machines. T. K. E. Phillips, London. From S. C. Phillips, Lagos, W. Africa. Eng. Pat. 18,370, Aug. 9, 1912.

The barrel of the mill in the machine claimed in Eng. Pat. 9733 of 1907 (this J., 1907, 881) has a smooth instead of a corrugated surface, whilst the cleaned palm nuts are removed in a strainer. The "tines" or beaters are made with a square or angular section and are arranged to allow clearance for the nuts.—C. A. M.

Soap ; Manufacture of——. F. W. Cleveland, East Sheen. Eng. Pat. 13,010, June 3, 1912.

Crushed oil seeds, etc., are treated directly with an alkali, and the resulting soap filtered or strained, while still liquid, from the insoluble husks and debris. (Reference is directed to Eng. Pats. 21,048 of 1896, 23,546 of 1905, 5620 and 20,089 of 1909, and 4262 of 1911 ; this J., 1897, 747 ; 1906, 1226 ; 1910, 889, 1214 ; 1911, 1125.)—C. A. M.

Solutions of organic compounds giving emulsions with water ; Liquid or solid——. R. Vidal. Third Addition, dated April 10, 1912, to Fr. Pat. 445,053, July 8, 1911 (see this J., 1912, 1190).

Organic compounds insoluble in water are dissolved in concentrated alkali- or sulphonated alkali compounds of castor oil, together with a hydroxy compound of the terpene series, such as terpinol or terpineol, or an aromatic alcohol, or sandalwood oil or santalol. (See also this J., 1913, 150, 498.)—T.F.B.

Vegetable oils ; Process and apparatus for the extraction of ——. I. T. Hawkins, London. Eng. Pat. 14,138, June 17, 1912.

See Fr. Pat. 450,861 of 1912 ; this J., 1913, 612.—T. F. B.

Whale oil and herring oil ; Process for the manufacture of a product especially suitable for soap-making and the like, from the fatty acids of——. S. H. Goldschmidt and C. Jörgensen, Copenhagen. Eng. Pat. 20,820, Sept. 12, 1912.

See Fr. Pat. 448,517 of 1912 ; this J., 1913, 435.—T. F. B.

Method of utilising waste products of canning industry. U.S. Pat. 1,063,297. *See* XIXa.

Testing machine for cylinder oils. Ger. Pat. 259,599. *See* XXIII.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Patents.

Paint. D. R. Cooper and E. M. Murley, New Plymouth, and J. V. Wyborn, Inaha, New Zealand. Eng. Pat. 14,137, June 17, 1912.

A durable, adherent, non-inflammable and non-toxic paint, which does not form a skin on standing, is made by mixing crude petroleum, "papa rock" (a mudstone, marl or marine clay found in New Zealand and elsewhere) or burnt clay or whiting (according to the colour desired) with linseed, soya or tung oil, turpentine and driers, to which white lead, zinc white, red lead, iron oxide, etc., may be added. An addition of common salt may also be made —C. A. M.

Printing-surfaces, matrices and the like ; Composition or material for making ——. S. A. C. Kristensen, Frederiksberg, Denmark. Eng. Pat. 24,652, Oct. 28, 1912.

The material, which is suitable for matrices or moulds and supporting surfaces for cliches and the like, is produced by melting resin in a suitable container, mixing about 5 per cent. of sulphur therewith, and adding a certain quantity of infusorial earth heated to a temperature of 100° C., so as to produce a mass of the required consistence. —B. N.

Colour lakes [from triphenylmethane dyestuffs] ; Manufacture of yellowish green ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 7757, April 2, 1913. Under Int. Conv., April 16, 1912. Addition to Eng. Pat. 27,636 of 1910, dated Dec. 11, 1909.

Instead of using *p*-chloro-brilliant green or *p*-chloro-malachite green as in the principal patent (see Fr. Pat. 422,843 of 1910 ; this J., 1911, 636), 3-nitro-4-chloro-brilliant green or 3-nitro-4-chloro-malachite green may be used. The lakes obtained are much more yellowish-green and of great purity.—T. F. B.

Plastic materials [from the protein of maize] ; Process for the manufacture of ——. J. J. Geistdörfer, Boulogne-sur-Seine, France. Eng. Pat. 17,842, Aug. 1, 1912. Under Int. Conv., Aug. 4, 1911.

See Fr. Pat. 446,840 of 1912 ; this J., 1913, 151.—T. F. B.

Coating and impregnating substances ; Process for making ——. C. Roth. Fr. Pat. 453,875, Feb. 1, 1913. Under Int. Conv., Feb. 8, 1912.

See Ger. Pat. 251,710 of 1912 ; this J., 1912, 1190.—T. F. B.

Dissolving in liquids solid substances particularly powder, pigments, dyes and the like. Eng. Pat. 20,585. *See* I.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber latices: Chemical coagulation of ——. F. Kaye. Indiarubber J., 1913, 45, 1297—1301.

Experiments are described in which the water extract of raw rubber is dialysed. After removal of the acid in this way protein is found, which leads to the conclusion that there is chemical interaction between acid and protein. This is confirmed by other observations, and especially by experiments on the residual acidity of a fresh *Plumeria* latex and *Hevea* latex preserved by ammonia, after coagulation by various coagulants. It is concluded that the action of coagulants is related to molecular quantities. —H. E. P.

Vulcanisation of rubber. A. O. Bourn. Scient. Amer. Suppl., 1913, 75, 397—398.

Experiments with a mixing composed of 12 lb. of dry fine Para rubber, 6 lb. of litharge, 6 lb. of whiting, and 6 oz. of sulphur, using the dry-heat air process, showed that in order to obtain physical vulcanising effects as nearly identical as possible, the time required is doubled for each decrease in temperature of 11° F. (6° C.) between 304° and 194° F. (151° and 90° C.). Between 400° and 304° F (204° and 151° C.) the time required is about doubled for a decrease in temperature of 25° F. (13° C.). Experiments are also described showing that vulcanisation proceeds very slowly even at the ordinary temperature in rubber mixings and even in the case of pure rubber in contact with sulphur. For example a piece of pure Para biscuit rubber embedded in flowers of sulphur at 110°—115° F. (43°—46° C.) was found to contain 0·49 per cent. of combined sulphur after six months.—A. S.

Patents.

India-rubber compositions and processes for manufacturing the same. E. Lamberty (née Kühl), Wilmersdorf, Germany. Eng. Pat. 20,261, Sept. 5, 1912.

A solution of raw rubber (about 25 per cent.) is mixed with white of egg freed from fat (72·5 per cent.) and dissolved sulphur (about 2·5 per cent.). The product can be vulcanised.—C. A. M.

Caoutchouc substances; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,556, June 21, 1912.

See Ger. Pats. 254,672 and 255,129 of 1912; this J., 1913, 372.—T. F. B.

Rubber; Process for producing a substance similar to ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Jan. 9, 1913, to Fr. Pat. 419,316, Aug. 12, 1910. Under Int. Conv., Jan. 25 and March 12, 1912.

See Ger. Pats. 254,672 and 255,129 of 1912; this J., 1913, 372.—T. F. B.

Elastic substances resembling rubber: Process for making ——. W. E. Reeser. Fr. Pat. 453,035, Jan. 11, 1913. Under Int. Conv., Jan. 19, 1912.

See Eng. Pat. 25,912 of 1912; this J., 1913, 615.—T. F. B.

Condensation products from phenol or cresol; Manufacture of substances [rubber substitutes] from ——. L. Collardon. Fr. Pat. 453,393, Jan. 20, 1913. Under Int. Conv., Jan. 20, 1912.

See Eng. Pat. 1598 of 1912; this J., 1913, 498.—T. F. B.

Rubber: Compounds with a basis of —— and their manufacture. L. Collardon. Fr. Pat. 453,394, Jan. 20, 1913. Under Int. Conv., Jan. 20, 1912.

See Eng. Pat. 1599 of 1912; this J., 1913, 498.—T. F. B.

Rubber composition. C. Marter. Fr. Pat. 453,418, Jan. 21, 1913. Under Int. Conv., Jan. 23, 1912.

See Eng. Pat. 1843 of 1912; this *J., 1912*, 446.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Gallic acid and tannin (tannic acid); A colour reaction of —— and its application. O. Schewket. Biochem. Zeits., 1913, 52, 271—274.

If 3 c.c. of a 1 per cent. solution of iodine in potassium iodide be shaken with 2 c.c. of a 1 per cent. solution of gallic or tannic acid, and then 300—500 c.c. of tap water or of a very dilute solution of alkali carbonate or other alkaline salt (sodium borate, disodium phosphate, or alkali salts of many organic acids) be added, a reddish violet colouration is produced. The colouration is prevented by even dilute mineral acids but is not affected by dilute organic acids. Caustic alkalis and alkali carbonates in high concentrations give a dirty brown colour, but the alkali salts of organic and weak inorganic acids (boric and phosphoric acids) produce the red-violet colour even in relatively high concentrations. The iodine must be in excess, as excess of tannin itself prevents the reaction. By this test gallotannic acid may be distinguished from other tannins (kino, catechu, cinchona tannins, etc.), so far as these are free from gallic acid. The reaction may also be used for detecting gallic acid or tannin in plants and pharmaceutical preparations, for testing a solution in regard to alkalinity, and for distinguishing organic from mineral acids.—A. S.

Patents.

Tanning extracts; Process of producing ——. G. Gianoli, Assignor to Lepetit, Dollfus and Gansser, Milan, Italy. U.S. Pat. 1,063,428, June 3, 1913.

Crude resinous quebracho extracts are rendered soluble by treatment at 95°—115° C. with a solution of sodium lignosulphonate, obtained for example from waste liquor from sulphite pulp making by treatment with lime water to remove sulphurous acid followed by sodium sulphate to remove excess of lime.—D. J. L.

Leather board stock; Production of ——. A. L. Clapp, Braintree, Mass., Assignor to Hide-Ite Leather Co., Boston, Mass. U.S. Pat. 1,063,958, June 10, 1913.

Stock for the manufacture of leather board is produced by treating wood flour with heated oil until a granular mass is produced and incorporating this with a mass of shredded leather.—D. J. L.

Leather or leather substitute; Composite —— and process of producing same. A. L. Clapp, Braintree, Mass., Assignor to Hide-Ite Leather Co., Brockton, Mass. U.S. Pat. 1,065,028, June 17, 1913.

Leather scrap is softened by treatment with ammonia and an oil is then added. The excess of ammonia forms a soap with the oil, and this soap is then rendered insoluble by the addition of a suitable substance.—W. P. S.

Tanning and dyeing skins; Apparatus for ——. A. Billaud. Fr. Pat. 453,763, April 11, 1912.

The apparatus consists of a rotating drum fitted with a door and divided, in the interior, into two compartments, in one of which the skins are placed. By the rotation of the drum, the skins are alternately plunged into the liquid and drawn out from it, which permits of the goods being dipped, drained or oxidised without removing from the drum. One of the sides of the partition is movable to facilitate loading and removing the goods and provision is made for heating the liquor to any required temperature. —D. J. L.

Glue or gelatin; Process of obtaining ——. G. Upton, Salem, Mass. U.S. Pat. 1,063,229, June 3, 1913.

The glue stock is placed in a digester to which steam is admitted, the stock at the same time being agitated. The glue dissolves in the condensed water and escapes immediately from the digester by gravity.—D. J. L.

Glue [*vegetable*] *and process for obtaining same.* Perkins Glue Co. First and Second Additions, dated Jan. 11, 1913, to Fr. Pat. 436,297, Nov. 11, 1911 (this J., 1912, 453).

Viscous or gelatinous solutions such as colloidal solutions of starch in alkali and water are rendered more fluid by submitting to prolonged agitation either continuous or intermittent. The process applies particularly to the manufacture of vegetable glue from cassava starch. The alkali is added slowly and in small quantities in order to avoid swelling the mass of starch and in such proportion as to obtain the required viscosity, cohesion and adhesion in the finished product. As the last quantities of alkali are added the mass passes into a semi-fluid glue which may be applied mechanically, the total quantity of water being 4 parts or less referred to the weight of dry starch.
—D. J. L.

Tanning. C. W. Nance, London. U.S. Pat. 1,065,168, June 17, 1913.

See Eng. Pat. 26,040 of 1909; this J., 1910, 1216.—T.F.B.

XVI.—SOILS; FERTILISERS.

Sterilisation of the soil; The partial —— by means of caustic lime. H. B. Hutchinson. J. Agric. Sci., 1913, **5**, 320—330. (See also this J., 1909, 1213; 1911, 471.)

The known actions of lime in improving the physical condition of a soil, neutralising acidity, and rendering plant foods available by chemical action are not sufficient to account for many of the results obtained in practice by the application of lime. It is now shown that caustic lime in sufficiently large quantities produces effects intermediate in character between those produced by volatile antiseptics and those induced by high temperatures. The larger protozoa and many bacteria are killed, and the organic nitrogenous constituents of the soil are decomposed. When all the lime has been converted into carbonate, a period of active bacterial growth ensues, with increased production of plant food. Pot experiments gave results in agreement with those of bacteriological and chemical analyses. A poor arable soil, containing a sufficiency of calcium carbonate, gave increased yields after application of 0·5 per cent. of caustic lime. A rich garden soil after the application of lime (up to 1 per cent.) gave decreased yields in the first crop, but largely increased yields in the second crop.—A. S.

XVII.—SUGARS; STARCHES; GUMS.

Cane sugar, glucose, and fructose; Influence of acids on the rotatory power of ——. F. P. Worley. Roy. Soc. Proc., 1913, A, **88**, 439—443.

Experiments on the inversion of cane sugar (sucrose) in presence of benzenesulphonic acid gave results confirming those obtained previously with sulphuric acid (this J., 1913, 101), the ratio of the final rotation of the invert sugar to the initial rotation of the sucrose becoming considerably greater as the concentration of the acid was increased. Further experiments have now shown that the acid (benzenesulphonic acid) produces changes in the specific rotatory power of all three sugars, causing a decrease in positive and increase in negative rotation. The effect is considerably greater in the case of lævulose than in that of sucrose or dextrose, but the combined effects are sufficient to explain satisfactorily and completely the observed increase in the value of the ratio of the final to the initial rotation in the hydrolysis of sucrose in presence of acid.—A. S.

Lævulosans, Hydrolysis of —— and its application to analysis. P. L. de Vilmorin and F. Levallois. Bull. Soc. Chim., 1913, **13**, 684—691.

In determining the yield of fermentable sugars from such plants as Jerusalem artichokes, which contain inulin or other substances yielding lævulose on hydrolysis, the use of mineral acids or oxalic acid for effecting inversion is precluded, because these act on the lævulose. Concordant results can be obtained with acetic acid as recommended by Jungfleisch and Grimbert (this J., 1889, 295), but hydrolysis is rather slow, unless it be used in relatively high concentrations, and then the acetate produced on neutralising is a source of inconvenience in the determination of the reducing sugars. The authors recommend the use of sulphosalicylic acid (0·72—4·3 grms. per litre), with which inversion is complete in at the most $1\frac{1}{4}$—$1\frac{1}{2}$ hours at 80° C. Concordant results are obtained and the acid does not interfere with the subsequent determination of the reducing sugars by means of Fehling's solution.—A. S.

Patents.

Sugar crystals; Process and vacuum pan for producing crystals, especially ——. O. Fromm and M. Schodly, Schwartau, Germany. Eng. Pat. 28,074, Dec. 5, 1912.

Thick juice or syrup is boiled in a vacuum pan with a conical bottom, until small crystals are formed; a further quantity of syrup is then added, and the process is repeated until the pan is full. The mass of crystals and mother liquor is then pumped from the bottom of the pan to a chamber above the pan. This chamber contains an ascending sieve-trough in which a screw-conveyor is mounted. The mass is transported along the trough, being subjected at the same time to the action of the mother liquor which it contains, and of the vapour ascending from the pan. The small crystals are returned through the sieve-trough to the pan whilst the large crystals are discharged through a descending pipe leading from the end of the trough.—L. E.

Sugar; Process of refining brown ——. U. Lundgren and G. Gierling, Brussels. U.S. Pat. 1,063,708, June 3, 1913.

Raw sugar is freed from adhering syrup, and the cold syrup, of about 20° B. (sp. gr. 1·162) is bleached with ozone or ozonised air. A further quantity of raw sugar is washed with a portion of the bleached syrup, and sugar, freed from syrup, is dissolved in another portion of the bleached syrup.—L. E.

Gums; Process of preparing artificial —— from amylaceous materials. Soc. Mabboux et Camell. Fr. Pat. 452,943, Jan. 7, 1913.

100 kilos. of starch suspended in 80—90 litres of an aqueous solution containing 9 kilos. of bromine, are treated with a solution of 4·5 kilos. of sodium hydroxide and the whole is left for 24 hours. Alternatively, the bromine is replaced by chlorine which is passed into a suspension of starch in alkali solution, or the starch may be treated with hypochlorite or hypobromite directly. The product is freed from liquid and traces of chlorine or bromine, treated with 10—20 kilos. of commercial formaldehyde, and boiled until it remains limpid and viscous when cooled; the dried product may be used in printing, finishing and paper making.—L. E.

Lignocellulose; Apparatus for treating ——. Standard Alcohol Co. Fr. Pat. 452,920, Jan. 7, 1913. Under Int. Conv., Jan. 29, 1912.

See U.S. Pat. 1,032,449 of 1912; this J., 1912, 833.—T.F.B.

Fermentable sugars; Process for producing ——. Standard Alcohol Co. Fr. Pat. 452,921, Jan. 7, 1913. Under Int. Conv., Jan. 29, 1912.

See U.S. Pats. 1,032,443, 1,032,444, and 1,032,450 of 1912; this J., 1912, 832, 833.—T. F. B.

Fermentable sugars; Process for producing ——. Standard Alcohol Co. Fr. Pat. 453,139, Jan. 14, 1913. Under Int. Conv., June 6, 1912.

See U.S. Pat. 1,033,064 of 1912; this J., 1912, 833.—T.F.B.

Sacchariferous plants ; Process for extracting juice from ——. C. Steffen. Fr. Pat. 453,322, Jan. 18, 1913. Under Int. Conv., Jan. 19, 1912.

See Eng. Pat. 1540 of 1912 ; this J., 1913, 40.—T. F. B.

Mucilaginous products ; Manufacture of ——. The Gum Tragasol Supply Co., Ltd. Fr. Pat. 453,426, Jan. 4, 1913. Under Int. Conv., Jan. 8, 1912.

See Eng. Pat. 564 of 1912 ; this J., 1913, 206.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast ; The protein substances of ——. P. Thomas. Comptes rend., 1913, **156**, 2024—2027.

Starting with partially autolysed yeast the author has isolated two different proteins. The first contains : N 16·10—16·18, P 1·75—1·83, and S 0·38 per cent., and in its properties is intermediate between casein and vitellin, but more closely resembling the former. The second, to which the name *cerevisin* is assigned, appears to be a typical albumin. It contains : N 16·3—16·4, S 0·89—0·94, and P up to 0·7 per cent. ; the phosphorus is probably present as an impurity owing to imperfect purification. Cerevisin is soluble in water and is not precipitated by acetic acid or magnesium sulphate, or by adding to its solution an equal volume of a saturated solution of ammonium sulphate. On heating the neutral or slightly acid solution it becomes turbid at about 40° C. and gives a slight coagulum at 41° C. The filtered solution remains clear up to 49° C. and yields a second coagulum at 50° C. On further heating abundant precipitation occurs between 55° and 58° C., and coagulation continues continuously up to 70° C. Cerevisin gives the usual precipitation and colour reactions ; the glyoxylic reaction (tryptophan) is particularly distinct.—A. S.

Alcoholic fermentation ; Catalysers of ——. H. Euler and H. Cassel. Z. physiol. Chem., 1913, **86**, 122—129.

Alcoholic fermentation by living yeast is considerably accelerated by salts of aliphatic and hydroxy acids (ammonium formate and acetate, sodium lactate and racemate). For example in the fermentation of 2 grms. of sucrose dissolved in 110 c.c. of water, by 0·25 grm. of yeast, the quantities of carbon dioxide evolved were 30 c.c. in 90 mins., 51 c.c. in 180 mins., 80·5 c.c. in 330 mins., and 102 c.c. in 490 mins., whilst in presence of 0·04 grm. of ammonium formate the corresponding quantities were 33·5, 65, 120·5 and 180·5 c.c. respectively. No similar effect was produced with dried yeast or expressed juice from Munich yeast. The amount of carbohydrate phosphoric ester produced as intermediate product in the fermentation of dextrose by extract of dried yeast in presence of sodium phosphate is not increased by addition of ammonium formate. Experiments in which dextrose was fermented by living yeast, and the reaction followed by determinations of both the optical rotation and the amount of carbon dioxide formed (see this J., 1912, 246, 1142) indicated that ammonium formate accelerates the reaction ; hexose→intermediate product to a greater degree that it does the reaction : intermediate product→alcohol +carbon dioxide. Within the limits tried, the accelerating effect is greater the lower the yeast concentration, and the higher the concentration of the added salt. The fermentation of mannose is accelerated only to a considerably lesser extent than that of dextrose. Similar results have been obtained with sodium lactate and racemate and ammonium acetate.—A. S.

Alcoholic fermentation ; Influence of some colloids on ——. N. L. Söhngen. Folia Microbiologica, Holländische Beiträge zur gesamt. Mikrobiol., **2**, 27 pages. Chem. Zentr., 1913, **1** 2167—2168.

The author's experiments were made at 38°—40° C., at which temperature the fermentative activity of the yeast does not decrease during 2 hours, although no growth of yeast takes place. The fermentation was not appreciably affected by colloidal hydroxides of iron, aluminium, and silicon, or by humic acid ; it was affected injuriously by alkali humate, and strongly accelerated (to the extent of 50 per cent.) by bio-colloids such as peat, filter-paper, blood charcoal, and garden soil. The growth of yeast in a culture medium containing a small quantity of yeast (3—10 per cent. of dextrose in yeast water) was also increased by about 50 per cent. The bio-colloids promote the evolution of carbon dioxide from the liquid, the minute bubbles forming on the surface of the colloids by surface tension growing to larger bubbles, which are evolved. Hence the supersaturation of the culture medium by carbon dioxide is prevented and it is to this that the favourable effect of the biocolloids is ascribed. The author's results afford an explanation of Moufang's observations on the catalytic effect of dead yeast cells on fermentation (this J., 1913, 303).—A. S.

Enzyme ; Relation between the active and inactive condition of an —— *and its surface tension.* M. J. Gramenizky. Biochem. Zeits., 1913, **52**, 142—154.

The author has shown previously (this J., 1910, 1403) that certain enzymes which become inactive on heating, slowly regain activity when the solution is allowed to stand. Experiments with purified Taka diastase are now described showing that the destruction of enzymic activity is accompanied by a pronounced reduction of surface tension, and that on standing, the surface tension gradually increases again.—A. S.

Petroleum benzine, petroleum, paraffin oil and paraffin as sources of carbon and energy for micro-organisms. N. L. Söhngen. Zentr. Bakter. u. Parasitenk., 1913, II. Abt., **37**, 595—609. Chem. Zentr., 1913, **2**, 167.

The author has succeeded in isolating from garden soil, dung, and ditch-water, a number of organisms capable of utilising petroleum products as sources of carbon and energy, oxidising them to carbon dioxide and water, probably with formation of fatty acids as intermediate products. The micro-organisms in question can be divided into two groups, both widely distributed : (1) fat-hydrolysing bacteria, *e.g.*, *Bac. fluoresc. liquefac.*, *Bac. pyocyaneus*, *Bac. Stutzeri*, *Bac. lipolyticum* α, β, γ, and δ, and *Micrococcus paraffinae* ; (2) a group of mycobacteria, of which six species are distinguished and described, viz., *Mycobacterium phlei*, *album*, *luteum*, *rubrum*, *lacticola*, and *hyalinum*. These mycobacteria are similar to the actinomycetes in many of their properties ; they are capable of oxidising a great variety of substances in addition to paraffins of b. pt. above 60° C., viz., salts of fatty and other organic acids, dextrose, sucrose, mannitol, glycerin, peptone, alcohol, higher alcohols, cetyl alcohol, cholesterol, phytosterol, fats, caoutchouc, cellulose, and humic substances. They slowly assimilate sugars and fats without secreting an enzyme. They vary in habit of growth according to the culture medium, forming ordinary bacteria colonies on media rich in easily assimilable substances, and mould-like colonies on poor culture media. They can be distinguished from other kinds of bacteria by their fine thread-like growth on tap water agar media. They are affected injuriously by even 0·001 per cent. of salts of heavy metals such as zinc chloride, copper sulphate, and lead acetate, and by 0·01 per cent. of manganese salts. On some media there is more or less pigment formation, this being favoured by peptones, magnesium salts, nitrates, and chemically active light rays. The mycobacteria are resistant to acid but not to acid and alcohol together. They are capable of oxidising, on the average, 15 mgrms. of petroleum and about 8 mgrms. of paraffin per 2 sq. dcm. of surface of culture medium in 24 hours at 28° C.—A. S.

Enzyme action ; Reversibility of ——. *α-Glucosidase and α-methylglucoside.* E. Bourquelot and E. Verdon. J. Pharm. Chim., 1913, **8**, 19—21. (See this J., 1913, 251 and 456.)

An aqueous extract obtained by macerating bottom fermentation yeast was added to separate solutions of α-methylglucoside and dextrose in dilute methyl alcohol, the glucoside and dextrose being in equivalent proportions. After a number of days a state of equilibrium was reached, both solutions showing the same optical rotation. Hence the action of α-glucosidase on α-methylglucoside is reversible.—F. Shdn.

Detection and determination of salicylic acid in fruit juices. Heintz and Limprich. *See* XIXa.

Reversibility of enzyme action. α-Glucosidase and α-methylglucoside. Bourquelot and Verdon. *See* XX.

Patents

Beer and wine finings. E. S. Spencer, London. Eng. Pat. 84, Jan. 1, 1913.

Isinglass finings are mixed with, say, an equal quantity (calculated on the dry substances) of moist gelatinous silica or silicates, or with a larger proportion thereof if the product is to be used for fining beers of high gravity.—L. E.

Glycerin and cattle food ; Process of treatment of distillery vinasses for extracting ——. H. Gouthière et Cie. and P. Ducancel. Fr. Pat. 453,073, March 25, 1912.

This process, which is especially applicable to grain vinasse, differs from that claimed in Fr. Pat. 442,923 of 1911, and Additions thereto (this J., 1912, 1031 ; 1913, 233), in that the nitrogenous matter is recovered in a form suitable as cattle food. A mixture of the concentrated vinasse and spent grains or other residues, is distilled in a current of dry steam under reduced pressure, the glycerin being recovered from the distillate. Part of the residue is mixed with further portions of vinasse and the remainder is utilised as fodder.—L. E.

Digestive ferment ; Process of producing ——. H. Yenjo, Nihonbashi-ku, Japan. U.S. Pat. 1,065,575, June 24, 1913.

See Eng. Pat. 25,879 of 1911 ; this J., 1913, 42.—T. F. B.

XIXa.—FOODS.

Storage butter ; Factors influencing the change in flavour in ——. L. A. Rogers, W. N. Berg, C. R. Potteiger, and B. J. Davis. U.S. Dept. Agric., Bureau of Animal Ind., Bull. 162, April 8, 1913, 69 pages.

Although proteins are hydrolysed in cold storage and in strong salt solutions provided that very large amounts of active proteolytic enzymes are present, there is no evidence of an increase of soluble nitrogen in butter when kept for a long time at 0° F. (—18° C.). Butter-milk from sweet unpasteurised cream and from sweet pasteurised cream when preserved with 18 per cent. of sodium chloride showed no proteolysis during a long period in cold storage. Bacterial enzymes kept in milk containing 18 per cent. of sodium chloride gave some evidence of proteolysis during cold storage; the action of pepsin and trypsin under similar conditions was not entirely inhibited. Butter made from sweet pasteurised cream keeps much better than butter from similar cream without pasteurisation, but the changes in the unpasteurised cream cannot be reproduced by re-inoculating the pasteurised cream with the bacteria of the cream before pasteurisation. Analyses were made of the gases contained in butter; fresh butter contains about 10 per cent. by volume of gas consisting of N_2 (by diff.) 33 and O_2 20 per cent., the remainder being gases absorbed by sodium hydroxide solution. The proportion of oxygen is materially less after storage. The addition of iron to cream, even in as small quantity as 1 or 2 parts per million, has an influence on the flavour of the butter; there is no evidence that the nature of the flavour developed on storage is changed, but the rate of development is accelerated. The action of copper is similar but perhaps more intense, and ferrous salts are more active than ferric salts. Aldehydic or ketonic substances appear to be formed by the action of ferrous salts on milk as the distillate from such milk yields a strong iodoform reaction. —W. P. S.

Salicylic acid in fruit juices ; Detection and determination of ——. W. Heintz and R. Limprich. Z. Unters. Nahr. Genussm., 1913, 25, 706—717.

Petroleum spirit extracts a definite proportion of salicylic acid from aqueous solutions containing varying amounts of the acid, and on shaking a solution of salicylic acid in petroleum spirit with dilute solution of ferric chloride, the salicylic acid is obtained quantitatively in the aqueous solution in the form of its violet iron compound. Twenty-five grms. of the juice or syrup are diluted to 50 c.c. in a 250 c.c. cylinder, a few drops of concentrated sulphuric acid are added, and the mixture is then shaken with 100 c.c. of petroleum spirit; 50 c.c. of alcohol are now added, and, after again shaking, the mixture is allowed to separate into layers. Ten c.c. of the clear petroleum spirit layer are pipetted into a tube, mixed with 10 c.c. of a 0·1 per cent. solution of ferric chloride, and the colouration obtained compared with standards prepared as follows :—Fifty c.c. of a 0·1 per cent. solution of salicylic acid are acidified with sulphuric acid and shaken with petroleum spirit and alcohol in the proportions given above; quantities of 0·5, 1·0, 1·5, 2·0, etc. c.c. of the petroleum spirit layer are then placed in separate tubes and mixed with 10 c.c. of the solution of ferric chloride. The method may be applied to the determination of salicylic acid in jams, beer, and wine, provided that the alcohol present is removed previously by evaporation in the presence of an alkali. The process described by Vierhout (this J., 1911, 918) was found to be untrustworthy.—W. P. S.

Influence of light on fats in the complete absence of air. Wagner and others. *See* XII.

Determination of ammonia and trimethylamine [*e.g. from gluten*]. Budai. *See* XXIII.

Patents.

Emulsions ; Means for use in the production of ——. [*Margarine manufacture.*] S. H. Blichfeldt, Southall. Eng. Pats. 7498 and 7499, Mar. 27, 1912.

(1) The water or other medium of suspension is made to pass through a successive number of constricted passages between surfaces which are in relative motion towards each other, whilst gradual additions of fat are meanwhile made. The moving surfaces may consist of a series of discs revolving upon a shaft within a series of overlapping annular baffles, the distance of which from the discs can be adjusted. A distributing valve may be used as described below, and means may be provided for the preliminary mixing of the fat and water prior to this treatment. (2) Liquid may be gradually introduced at different stages of the emulsification (*e.g.* of margarine). A special distributing valve claimed for this purpose consists of a casing the wall of which contains a series of outlets connected by means of pipes with different parts of the apparatus, these openings being controlled by a rotating disc in which is a slot or cavity.—C. A. M.

Waste products of canning industry ; Method of utilising ——. P. A. Singer, Assignor to C. S. Miner, Chicago, Ill. U.S. Pat. 1,063,297, June 3, 1913.

A compressed oil cake containing the germ and bran of sweet corn (maize), characterised by a high content of corn sugar, is made by removing the portions of the kernels which remain on the cob after the upper portions of the kernel have been cut off for canning, and by pressing such portions of the kernels to expel the juice, drying the mass and pressing it to expel the oil.—A. T. L.

Milk ; Method of drying ——. O. Nicolai, Viersen, Germany. U.S. Pat. 1,063,581, June 3, 1913.

The milk is thickened to about 6°—9° B. (sp. gr. 1·045—1·067) by exposure to a temperature of about 65°—80° C. for half an hour to one hour, and at once exposed, in a thin layer to a temperature of about 90°—100° C. for a few seconds, whereby a wet milk skin as thin as paper is obtained. This product is cooled and exposed to a temperature of about 65°—85° C. for half an hour whereby it is freed from water excepting the water of crystallisation of the lactose. The dried milk is then cooled.—L. E.

Milk; Process for the sterilisation of ——. V. Henri, A. Helbronner, and M. von Recklinghausen. Second Addition, dated Mar. 30, 1912, to Fr. Pat. 442,807, June 28, 1911 (this J., 1912, 1004; 1913, 620).

The milk is heated for a few minutes to 55° C., then cooled to 2° C. and submitted at this temperature to the action of ultra-violet rays.—W. P. S.

Milk; Sterilised ——. A. Helbronner, V. Henri, and M. von Recklinghausen. First Addition, dated Mar. 30, 1912, and Second Addition, dated July 9, 1912, to Fr. Pat. 442,924, July 1, 1911 (this J., 1912, 1004).

(1) To prevent milk acquiring an unpleasant odour when subjected to the method described in the original patent (loc. cit.), it should be heated to 55° C., for a few minutes, then homogenised, and cooled to 2° C. before being passed through the sterilising apparatus. (2) The milk is frozen in the form of thin layers at a temperature of from —10° to —15° C., exposed in this solid state to the action of ultra-violet rays, and then heated to about 60° C.—W. P. S.

Beverage extracts. W. H. Post, Assignor to Postum Cereal Co., Ltd., Battle Creek, Mich. U.S. Pats. 1,064,767 and 1,064,768, June 17, 1913.

(1) A solid soluble extract is obtained by extracting figs which have previously been roasted or caramelised. (2) Dandelion roots are mixed with molasses, the mixture is roasted or caramelised, and then extracted with water, the extract being next concentrated so as to form a powder.—W. P. S.

Drum for treating granular materials, such as cereals, malt, seeds, etc. J. A. Topf und Söhne. Fr. Pat. 451,726, Nov. 29, 1912.

A drum more particularly for subjecting grain to the action of a current of air, is provided with a central air-admission pipe having fine perforations for the entry of air on one side. The drum has similar perforations for the escape of air on the side opposite to the perforations in the inlet pipe, so that the air has to flow in a circular path through the contents of the drum.—H. H.

Alimentary product resembling milk from soy beans or similar vegetable seeds; Process of manufacturing an ——. F. Gössel, Stockheim, Germany. Eng. Pat. 27,860, Dec. 3, 1912. Under Int. Conv., Dec. 4, 1911.

See Fr. Pat. 451,447 of 1912; this J., 1913, 621.—T. F. B.

Soja; Method of manufacturing [food] products from ——. Yu Ying Li, Vallées, France. U.S. Pat. 1,064,841, June 17, 1913.

See Eng. Pat. 30,275 of 1910; this J., 1912, 355.—T. F. B.

Phospho-protein compounds from fish; Process for making ——. Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappij. Fr. Pat. 453,729, Oct. 14, 1912. Under Int. Conv., Dec. 20, 1911.

See Eng. Pat. 8524 of 1912; this J., 1913, 446.—T. F. B.

Treatment of distillery vinasses for extracting glycerin and cattle food. Fr. Pat. 453,073. *See* XVIII.

XIXB.—WATER PURIFICATION; SANITATION.

Microbes in raw river water and in crude sewage; Search for certain pathogenic ——. A. C. Houston. Metropolitan Water Board. Ninth Research Report. April, 1913.

Continuing his researches on the feasibility of isolating pathogenic microbes from river water (see this J., 1912, 355), the author added typhoid and Gärtner bacilli in small numbers to raw river water and was able to recover them again, whereas from a duplicate sample of uninoculated river water none of these microbes could be isolated. The results showed that the tests were delicate to the extent of detecting one typhoid bacillus in about 7 c.c. of water and one Gärtner bacillus in about 25 c.c. Similar experiments were made on the feasibility of detecting the typhoid bacillus in sewage. The number of typhoid bacilli added to the sewage averaged 205 per 0·01 c.c., the quantity of sample used for the subsequent isolation, and the number of bacilli recovered was 20. From this result it is deduced that if 0·001 c.c. of sewage should contain a single bacillus, then it would be detected by examining 0·01 c.c. In the duplicate uninoculated sample of sewage no typhoid bacilli were detected in 0·01 c.c., so that they were absent from 0·001 c.c., although the sample contained 1155 excremental bacteria in that volume. It is calculated that the Thames does not contain a single typhoid bacillus in 24 c.c. as an average. As the filtered water is improved at least a thousand times, it follows that the consumer has very little chance of imbibing a dose of typhoid bacilli from this source. It is concluded also that persons breathing sewer air would have to inhale enormous volumes before being inoculated with a typhoid bacillus, and that the danger of an infection of a water is not so much from sewage contamination as from accidental contamination from an individual who is a "carrier."—J. H. J.

Factories and Workshops; Annual report of the Chief Inspector of —— *for the year* 1912. [Cd. 6852.] Price 2s. 5d.

Legislation. There are now fifteen Acts of Parliament in force under which power gas must have a distinctive and readily perceptible smell, but only under one of these has power gas actually been supplied and so far no case of carbon monoxide poisoning has been reported. In the United States a tax of 2 cents per 100 matches is to be imposed on all white phosphorus matches manufactured after July 1, 1913; the importation of such matches is prohibited from Jan. 1, 1913, and exportation from Jan. 1, 1914. The use of white phosphorus matches in Mexico is now prohibited. The special rules for the manufacture of earthenware and china and for the making of transfers for pottery have been superseded by the pottery regulations (see this J., 1913, 142), and the special rules for the manufacture of bichromates of potassium and sodium are also to be replaced by regulations (see page 750).

Dust explosions. Only seven minor cases of dust explosions were reported, viz., one of sawdust in a rubber works, two of coal dust in a steamship and a cement works respectively, one of cork dust in a linoleum factory, and three of shoddy dust in a rag carbonising works. In addition to the experiments of Wheeler on explosive dusts (this J., 1913, 447), Haydon has found that dusts such as occur in oil mills are able to produce explosions when present in quantities ranging from 2 to 25 grms. per cb. ft. of air. In the case of coal-dust as used in cement works, J. Jackson found that explosions could be produced with 7 grms. per cb. ft. of air.

Industrial poisoning. The number of cases of poisoning, together with the number of fatal cases (in brackets), in 1912 and 1911 respectively were: lead, 587 (44), 669 (37); arsenic, 5, 10 (1); mercury, 17, 12; anthrax, 47 (6), 64 (11). In regard to lead poisoning experience during the year confirms the view that control of the sources of dust is most important. One of the cases of arsenic poisoning was that of a man employed in a paper-mill in dissolving block tin, after granulation, in hydrochloric acid: the tin was found to contain 0·03 per cent. and the acid 0·2 per cent. As. The Birmingham inspector reports on the use of mercury in the manufacture of thermometers, in gilding, and in the browning of gun-barrels and steel; four cases of mercurial poisoning occurred in thermometer works and seven in connection with hat-manufacture. Attention is drawn to two publications by F. E. Tylcote of Manchester and by L. Teleky of Vienna with respect to industrial poisoning from mercury, with special reference to felt hat making. There has been a further number of cases of carbon monoxide poisoning in connection with suction gas engines.

Dangerous trades. Chemical works. A fatal case of gassing by nitrous fumes occurred during the cleaning out of the Gay-Lussac tower of a sulphuric acid plant. In Germany the following rule dealing with plant in sulphuric acid works is enforced by the Chemical Trades Association under its statutory safety regulations required by the Imperial Insurance Office. "Where it is necessary for workmen to enter closed receivers either an efficient breathing apparatus must be used, or the receiver must be connected with an efficient ventilator such as a chimney stack. The breathing apparatus must consist of either a respirator connected with a supply of fresh air from the outside, or an oxygen breathing apparatus." In the United Kingdom there are still some works where folds of flannel are used as respirators, although these cannot be satisfactory where poisonous gases are present. *Chemical manure works.* The percentage invalidity and mortality appears to be somewhat heavy for chemical manure workers, and enquiries have been made as to the need for exhaust ventilation in grinding mills and phosphate dens. Some of the mill rooms are not quite free from dust, though localised exhaust ventilation is generally installed. Reconstruction and re-arrangement of the grinding plant is necessary in some instances and also the use of conveyors in order to avoid unnecessary handling of raw materials and minimise the production of dust. The covering of open conveyors, efficient enclosing of elevators, covering of open bins, and modern installations of exhaust plant with dust-collecting chambers are also needed in some cases. In France and Germany mechanical devices are now being largely used for emptying the superphosphate dens, and these have been installed in some of the works in this country. The following are some of the rules of the German Chemical Trades Association dealing with the manufacture of artificial manures, and these rules have a statutory obligation under the Imperial Insurance Law. "The dens must be provided with appliances which prevent as completely as possible the escape of dangerous or injurious gases and vapours into the workrooms. Raw materials which generate fumes containing fluorine, chlorine or nitric acid in injurious quantities must not be discharged on the open ground. The addition of sulphuric acid must be so arranged that spilling or squirting is avoided as much as possible. Goggles must be provided for and used by the workers. During the process of manufacture care must be exercised that generation of injurious dust is prevented as much as possible. Where it is impracticable to collect such dust, the workers must be provided with respirators, mouth sponges, cloths or similar efficient means of protection, the use of which is prescribed." *Blanket bleaching.* Ill health and discomfort are caused by contact with fumes from the bleaching of blankets by sulphur dioxide, and instructions have been issued that efficient means of ventilation should be provided and maintained for all blanket stoves. *Tar-distilling.* Cases of asphyxiation during the repairing of a tar still have shown that the precautions recommended for the cleaning of tar stills (disconnection of gas pipes and wearing of lifebelts) should be observed also in repair work. A case is reported from Cardiff where the life of a man overcome by gas in a tar still was saved by playing oxygen from a cylinder on to his face until it was possible to bring him out of the still. *Chlorate of potash.* A serious explosion occurred on April 23, 1912 in the drying shed of the chlorate department of a chemical works at Widnes. A dryer consisting of a large steam-heated tray, weighing about six tons, had been raised, and whilst resting on wood packing, was being lowered back into position, when the explosion occurred. This was probably due to accidental bumping of the dryer on the wood packing, which fired or exploded a mixture of chlorate and carbonaceous matter under the packing. Since the accident the flooring has been concreted so that no material can accumulate under the dryers; and instructions have been issued that all floors in chlorate houses should consist of smooth concrete with a suitable fall to drain off water; the chlorate dryers should be raised to a height of 2 feet to allow inspection of the flooring and removal of dirt and chlorate. All workers in chlorate houses should wear boots without metal on the soles, and woollen overalls, washed daily. Wooden casks are generally used both by English and foreign chlorate manufacturers, except the Swedish makers, who use square wooden cases. It is possible for an explosion to take place if two wooden casks containing chlorate forcibly strike each other when being rolled. The Bradford Dyers' Association have adopted the following rules. "Packages of chlorate must be very carefully handled and *must on no account be dropped*, as any rough handling may result in explosion. They must be stored apart from other goods and never piled above 3 feet in height, the top and second layer to recede from the bottom one. In cases of sampling, an iron tool should not be used to open the packages, but the top should be levered off with a wooden appliance." *Diesel engines.* Several cases of explosions in connection with the use of compressed air or oxygen in Diesel engines have occurred.

Earthenware. Reference is made to new trade appliances likely to prove beneficial to the operatives. Two new tile-dipping machines are in use by which handling of glaze is reduced to a minimum, and the fettling and cleaning of the glaze from the edge of the tile is practically abolished. A new tunnel-kiln has been installed in a tile-factory, which, if successful, will be of special value, in that carrying of heavy weights is reduced, working in hot kilns is done away with, and handling of dipped tiles is diminished.

Report of Medical Inspector. The problems of poisoning by lead, anthrax, and noxious fumes, and of the injurious effects of dusts are discussed fully.—A. S.

Patents.

Compound [combustible] for utilising waste residue or sludge from paper mills, sewerages and the like. L. and L. Towler, Burnley. Eng. Pat. 2682, Aug. 1, 1912.

Sludge from paper mills or sewage works is mixed before passing to the press with combustible binding ingredients in the proportions approximately of 1 ton of sludge, 1 cwt. of lime, ¼ cwt. of powdered rosin and in some cases 2 cwts. of coal dust. The mixture is pressed into cakes, dried and dipped in a hot mixture of 1 gallon of creosote, 1 quart of paraffin or other inflammable oil and ¼ lb. of rosin. The cakes are finally broken up for use as fuel.—J. F. B.

Refuse material; Apparatus for treating ——. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,063,886, June 3, 1913.

The apparatus includes a platform on which the refuse is separated from water and sorted, and a comminutor. The comminuted refuse is introduced into a pit in which a definite level of water is maintained in order to prevent escape of offensive gases. The pit is connected with a dryer comprising an encased, endless, horizontal conveyor on which the refuse is transported to a furnace. An air-blower serves to force hot gases from the furnace through the dryer; the gases may be withdrawn from the dryer by exhausting fans, and deodourised by passage through a zone of intense heat, or they may be withdrawn through a stack fitted with an injection device. —L. E.

Filtering material and other substances; Apparatus for washing ——. J. Arnold, Swindon. Eng. Pat. 16,036, July 9, 1912.

For washing grit, etc., out of the material used for making filter-beds for sewage, the material is caused to travel down an inclined reciprocating screen, and is washed by jets of water delivered in the opposite direction. (Reference is directed to Eng. Pat. 15,789 of 1888.)—A. S.

Effluents; Method of and means for treating trade ——. E. V. Chambers and T. C. Hammond, Huddersfield. Eng. Pat. 19,303, Aug. 23, 1912.

The effluent is delivered into a small chamber provided with two outlet pipes, of which one extends to the bottom of a conical tank containing lime whilst the other enters the top of this tank. The pipes are provided with valves so that the quantities of effluent delivered to the bottom and top of the tank, respectively, may be proportionately regulated. The portion of effluent entering the bottom of the tank dissolves a quantity of the lime, and the

solution, as it rises in the tank, mixes with the main volume of the effluent entering by the upper pipe. Partial sedimentation takes place in this tank, and the clearer portion of the treated effluent then flows from the top of the tank into a series of conical settling tanks; means are provided for withdrawing the sludge from all the tanks and conducting it to a separate sludge tank.
—W. P. S.

Sterilising apparatus for use with ultra-violet rays. M. von Recklinghausen, A. Helbronner, and V. Henri. Fr. Pat. 453,191, Mar. 28, 1912.

A U-SHAPED mercury vapour lamp in which the electrodes are fitted in the ends of the tube, a current of 400 to 500 volts being employed. The electrodes are cooled by means of radiating plates or by means of the liquid to be sterilised. Devices for setting the lamp in action, and various forms of sterilising chambers are described.
—W. P. S.

Water; Radio-chemical process for sterilising ——. A. Blavinhac. Fr. Pat. 453,192, Mar. 28, 1912.

THE water is treated with a small quantity of calcium hypochlorite and then submitted to the action of ultra-violet rays.—W. P. S.

Water; Process for the removal of carbonic acid, oxygen, and other gases from ——. J. Wetter, London. From J. D. Riedel Akt.-Ges., Berlin. Eng. Pat. 6891, March 20, 1912.

SEE Fr. Pat. 441,567 of 1912; this J., 1912, 948.—T. F. B.

Slime; Process of draining and utilising ——. F. Richter, Frankfort on Maine, Germany. U.S. Pat. 1,064,773, June 17, 1913.

SEE Fr. Pat. 421,276 of 1910; this J., 1911, 479.—T. F. B.

Emulsion-products [from tar, pitch, oils, etc.], and process for producing them. K. Albert and L. Berend, Amoneburg, Germany. Eng. Pat. 13,586, June 10, 1912.

SEE Fr. Pat. 444,739 of 1912; this J., 1912, 1173.—T.F.B.

Insecticide, sheep-dip, vermifuge, etc. I. S., I., and S. McDougall, Manchester. U.S. Pat. 1,065,156, June 17, 1913.

SEE Eng. Pat. 10,215 of 1911; this J., 1912, 658.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids; Microsublimation of —— under diminished pressure. R. Eder. Schweiz. Woch. Chem. Pharm., 1913, **51**, 228—231, 241—245, 253—256. Chem. Zentr., 1913, **2**, 91—92.

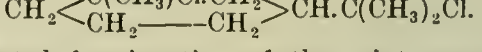
AT about 10 mm. pressure visible sublimation occurs at the following temperatures in the case of pure alkaloids: cocaine, 75°—90° C.; atropine, 93°—110° C.; codeine, 100°—130° C.; quinine, 133°—148° C.; narcotine, 146°—156° C.; brucine, 158°—175° C.; solanine, 168°—184° C. The alkaloids examined may be classified as follows according to their behaviour: A. Sublime without melting. (1) Yield a crystalline sublimate directly: caffeine, theobromine, cinchonine, solanine, and cantharidine. (2) Yield a deposit consisting of microscopic amorphous droplets, in which crystals form while sublimation is proceeding: strychnine, morphine, apomorphine hydrochloride, codeine, thebaine, narcotine, pilocarpine hydrochloride, yohimbine, cinchonidine, quinidine, quinine, coniine hydrobromide, arecoline hydrobromide, and hyoscyamine. (3) Yield a deposit in which either isolated crystals may make their appearance: cocaine, brucine, papaverine, piperine, atropine, homatropine, physostigmine, hydrastine, or which remains entirely amorphous: scopolamine hydrobromide, aconitine, delphinine. B. Sublime only after melting, yielding amorphous deposits: narceine, pilocarpine, veratrine, emetine, and colchicine. C. Do not yield sublimates: sparteine sulphate and nicotine hydrochloride. It was observed that the stability of the amorphous droplets is smaller and crystal-formation more rapid the higher the vapour pressure of the alkaloid, that is the lower the temperature (below the melting point) at which it sublimes.—A. S.

Essential oils; Constituents of ——. *Eudesmol and its derivatives; globulol.* F. W. Semmler and E. Tobias. Ber., 1913, **46**, 2026—2032.

THE oil obtained from several varieties of Eucalyptus contains the sesquiterpene alcohol eudesmol. This is bicyclic and has one double linkage. The characters are: b. pt. 156° C. at 10 mm., m. pt. 78° C., sp. gr. 0·9884 at 20° C., $n_D=1·516$ at 20° C., $[\alpha]_D=+31° 21'$ in chloroform at 20° C. The characters of the acetate, $C_{15}H_{25}OOCCH_3$, are: b. pt. 165°—170° C. at 11 mm., sp. gr. 0·9933 at 20° C., $n_D=1·49204$, $[\alpha]_D=+31°$. Dihydroeudesmol was obtained by reducing the alcohol by means of hydrogen in the presence of platinum; it boils at 155°—160° C. at 12·5 mm. and melts at 82° C. This reduced alcohol was boiled with formic acid when dihydroeudesmene was produced; this boils at 126°—130° C. at 10 mm., has the sp. gr. 0·9067 at 20° C., $n_D=1·48762$ and $[\alpha]_D=-7°$. Eudesmene, $C_{15}H_{24}$, was obtained by a similar reaction from eudesmol. The characters are: b. pt. 129°—132° C. at 10 mm., sp. gr. 0·9204 at 20° C., $n_D=1·50738$, $[\alpha]_D=+49°$ at 20° C. When eudesmol or eudesmene is treated with a solution of hydrogen chloride in glacial acetic acid, the same dihydrochloride, $C_{15}H_{24}2HCl$, is produced, which melts at 79°—80° C. after crystallising from alcohol. The dihydrobromide melts at 104°—105° C. The essential oil of *E. globulus* contains an alcohol, globulol, $C_{15}H_{26}O$, which boils at 283° C. at 755 mm. and has $[\alpha]_D=-35° 29'$ in chloroform. When the elements of water are removed, two sesquiterpenes are formed. One of these is lævorotatory and its characters are: b. pt. 102°—103° C. at 6 mm., 247°—248° C. at 748 mm., sp. gr. 0·8956 at 15° C., $n_D=1·49287$ at 20° C., and $[\alpha]_D=-55° 48'$. The characters of the other sesquiterpene are: b. pt. 265·5°—266° C. at 750 mm., sp. gr. 0·9236 at 15° C., $n_D=1·50602$ at 20° C., $[\alpha]_D=+58° 40'$.—F. SHDN.

Sylvestrene. The constitution of d-sylvestrene and its derivatives. W. N. Haworth, W. H. Perkin, jun., and O. Wallach. Chem. Soc. Trans., 1913, **103**, 1228—1241.

THE constitution of the dihydrochloride of sylvestrene (the terpene present in Swedish oil of turpentine) may be regarded as definitely established as:—



$$CH_2<\begin{matrix}C(CH_3)Cl.CH_2\\CH_2\text{———}CH_2\end{matrix}>CH.C(CH_3)_2Cl.$$

By repeated fractionation of the mixturo of terpenes obtained by the action of diethylaniline on pure sylvestrene dihydrochloride, a product was obtained boiling at 175° C. at 751 mm., $\alpha_D=+83·18°$ at 18° C., sp. gr. 0·8479 at 18° C., $n_D=1·4760$, these characters agreeing, except for the higher optical rotation, with those given by Wallach (Annalen, 1885, **230**, 241; 1887, **239**, 24; 1888, **245**, 272) for sylvestrene. Experiments on the sylveterpineols and sylveterpins which result from the action of alkalis on sylvestrene dihydrochloride are also described, and it is concluded that the sylvestrene fraction with the characters described above is still not a single substance but a mixture of the $\Delta^{1.8(9)}$- and $\Delta^{6.8(9)}$- *m*-menthadienes.
—A. S.

Aromatic substances; New method for converting —— *into iodo-derivatives.* K. Elbs and A. Jaroslawzew. J. prakt. Chem., 1913, **88**, 92—94.

IODINE can be readily introduced into aromatic hydrocarbons by the simultaneous action of iodine and a persulphate. For instance, 20 grms. of benzene and 20 grms. of iodine were dissolved in 60 c.c. of glacial acetic acid. The mixture was boiled with 80 grms. of sodium persulphate for 15 hours when the colour of the iodine had disappeared. Mono- and di-iodobenzene were formed during the reaction.—F. SHDN.

Organic acids; Regularities in the distillation of —— with steam. A. Stein. J. prakt. Chem., 1913, **88**, 83—89.

Dilute aqueous solutions of volatile organic acids were distilled with steam, the pressure and temperature being kept constant, as well as the volume of liquid in the distillation flask. The rate of distillation of the volatile acid is expressed by the equation,

$$c = \frac{1}{v} \log \frac{a}{a-x},$$

where c is a constant, v the volume of liquid in the distillation flask, a the amount of acid originally present, whilst x represents the amount that has distilled over. Increasing the volume of liquid in the distillation flask lessens the rate of volatilisation. The values of c for a number of organic acids are given.—F. Shdn.

Alcohols; Oxidation of —— by simple heating [without catalysts]. J. B. Senderens. Comptes rend., 1913, **156**, 1909—1912.

Many alcohols are readily oxidised by air at relatively low temperatures (about 400° C.). If a current of dry air (100 c.c. per minute) is passed through ethyl alcohol and then through a heated glass tube, it will be found that oxidation begins at about 405° C., and that all the oxygen is removed at 450° C. Isobutylalcohol is more easily oxidised and isoamylalcohol more easily again. The main products are carbon monoxide, carbon dioxide and water, with much smaller quantities of aldehyde and acid. In the light of this knowledge it appears that magnesium, zinc and aluminium are only very poor catalysts, and that the action which they were previously believed to promote takes place nearly as readily in their absence. Molybdic anhydride, blue tungstic oxide, thoria and silica are also only poor catalysts.—W. H. P.

Reversibility of enzyme action. α-Glucosidase and α-methylglucoside. Bourquelot and Verdon. *See* XVIII.

Patents.

Ketones; Manufacture of cyclic —— [from adipic acid, etc.]. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,409, Aug. 24, 1912.

See Ger. Pat. 256,622 of 1911; this J., 1913, 450. Sodium sulphate, sodium-ammonium phosphate, boric acid, phosphoric acid, or ammonium vanadate may also be used to accelerate the reaction.—T. F. B.

2-Phenylquinoline-4-carboxylic acid; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,844, Aug. 30, 1912.

In preparing 2-phenylquinoline-4-carboxylic acid from 2 mols. of acetophenone and 1 mol. of isatin in presence of aqueous-alcoholic potash, a yield of only 65 per cent. is obtained, considerable quantities of acetophenone being lost. It is now found that the product may be obtained in almost theoretical yield by the interaction of equimolecular proportions of acetophenone and isatin, *e.g.*, in presence of aqueous-alcoholic solutions of caustic potash.—T. F. B.

Arylated quinolinecarboxylic acids; Process for preparing esters of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 261,028, Nov. 12, 1911.

Arylated quinolinecarboxylic acids or their derivatives are esterified with salicylic acid, its derivatives or homologues. The products are quite tasteless and are easily decomposed in the organism; they possess antirheumatic properties.—T. F. B.

Acetic acid esters of amyl alcohol and its homologues; Manufacture of ——. F. Kaufler, Brückl, Austria. Eng. Pat. 2779, Feb. 3, 1913. Under Int. Conv., Feb. 23, 1912.

To obtain good yields of amyl acetate and to prevent formation of much amylene in the decomposition of chloropentane with sodium acetate, the latter should be very porous and bulky: a small quantity of water is not detrimental. To prepare such a bulky product, approximately equivalent quantities of anhydrous sodium carbonate and glacial or highly concentrated acetic acid are mixed; when the reaction is complete, the product is heated for 8 to 12 hours, without being melted, the temperature being raised to about 140° C., whereby the carbon dioxide and the greater part of the water are expelled. By heating 72 parts of this acetate with 100 parts of chloropentane and 6 parts of glacial acetic acid under pressure for 8 to 12 hours at 195°—210° C., a yield of 65 parts of pure amyl acetate is obtained. In a similar manner, increased yields of hexyl acetate or acetates of higher alcohols are obtained from the corresponding chloro-hydrocarbons.—T. F. B.

Organic compounds [olefines]; Separation of —— at low temperatures. E. I. du Pont de Nemours Powder Co. Fr. Pat. 453,164, Jan. 11, 1913.

Mixtures of organic compounds, *e.g.*, of olefines, are treated with a selective reagent, such as hydrochloric acid, at a low temperature, the portion which has entered into reaction is separated by distillation or otherwise, and the remainder is again submitted to the action of the reagent at a higher temperature. In applying this process to the mixtures of olefines obtained from pentanes, hexanes, etc., by chlorination, the first treatment with hydrochloric acid at the ordinary temperature results in the conversion of the amylene into amyl chloride, etc.; this mixture of chlorides can then be converted into the alcohols. The unconverted olefines are again treated with hydrochloric acid at a higher temperature, preferably about 130° or 140° C., for 10 to 12 hours; this converts practically the whole of the olefines into chloro-paraffins, which may be subsequently converted into the acetates by treatment with sodium or potassium acetate.—T. F. B.

Organic compounds [olefines, etc.]; Separation of ——. E. I. du Pont de Nemours Powder Co. Fr. Pat. 453,165, Jan. 11, 1913.

Mixtures of olefines or other organic compounds are separated by treating them with a reagent such as hydrochloric acid, first at a low concentration, separating the portion which has entered into reaction from the remainder by distillation, and then treating the remaining portion with the reagent at a higher concentration, with or without addition of calcium chloride; the products of this second treatment are converted into alcohols, whilst the acid used is again employed for the first treatment with dilute acid.—T. F. B.

Chlorination; Process and apparatus for ——. E. I. du Pont de Nemours Powder Co. Fr. Pat. 453,406, Jan. 21, 1913.

The hydrocarbon or other liquid to be chlorinated is run into the top of a tower made of opaque material, up which a current of chlorine passes, so that the chlorine is absorbed in the absence of light. The liquid is then drawn from the base of the tower through a system of glass tubes, in which it is subjected to the action of daylight or the light from a mercury-vapour lamp; the chlorination is thus effected in these tubes in absence of any appreciable quantity of gas, and as the action of the light can be regulated, risk of explosion is minimised. No iodine or other halogen carrier is used. The hydrochloric acid produced during the reaction, is passed through an absorption tower and condenser. The process is repeated until the desired degree of chlorination is attained.—T. F. B.

Piperacenes containing starch flour; Process for obtaining the medicinally-active constituents of the ——. H. Holzer and H. Beck. Ger. Pat. 260,713, April 2, 1912.

Parts of the plants, preferably reduced to powder, are heated with water, and the starch is converted into sugar by any suitable means; the solution is finally freed from bacteria by heating. During the saccharification the greater part of the resinous and gummy constituents are dissolved.—T. F. B.

Fluorine-glue compounds soluble in water; Process for preparing ——. S. Weissbein. Ger. Pat. 260,757, Feb. 20. 1912.

Aqueous solution of glue or glue-peptone are treated at the ordinary or somewhat higher temperatures with aqueous or alcoholic hydrofluoric acid: the products may be precipitated from the aqueous solutions by means of alcohol. Aqueous solutions of the fluorine-glue compounds may be used for subcutaneous or intravenous injection. —T. F. B.

Silver in colloidal and stable form; Production of preparations containing ——. C. Kelber and A. Schwarz. Ger. Pat. 260,849, Jan. 23. 1912.

Silver salts are reduced by means of formic acid, in organic acid solution, in presence of decomposition or degradation products of gluten, and the resulting colloidal solutions are evaporated to dryness. The products are stable towards acids, and may be applied in medicine. —T. F. B.

Lecithin; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 260,886, Oct. 12, 1910.

Dry egg yolk, or the lecith-albumin prepared therefrom, is extracted with methyl alcohol at the ordinary temperature. It is stated that the lecithin is extracted in a very pure condition by this means, since the oils contained in the egg-yolk are much less easily soluble (viz., about 1 in 700 at 15° C.) in methyl alcohol than in ethyl alcohol (about 1 in 40).—T. F. B.

Mercury compound of the pyrazolone series; Process for preparing a ——. L. Givaudan and E. Scheitlin. Ger. Pats. 261,081 and 261,082, Dec. 21, 1911, and May 12, 1912.

(1) Mercuric oxide is heated with 1-phenyl-2.3-dimethyl-4-sulphamino-5-pyrazolone in aqueous solution or suspension, until the mercuric oxide has almost entirely dissolved. (2) Salts of 1-phenyl-2.3-dimethyl-4-sulphamino-5-pyrazolone soluble in water are heated with mercuric salts. The products contain more mercury than those described in the first patent, *viz.*, from 65 to 68 per cent.—T. F. B.

Tariric acid di-iodide; Process for preparing ——. F. Hoffmann-La Roche und Co. Ger. Pat. 261,211, July 10, 1909.

Aqueous alkaline solutions of tariric acid are treated with suitable quantities of iodine-potassium iodide solution, and the product is precipitated by addition of acid, and then recrystallised, either at once or after purification by means of the alkali salt. Owing to its iodine content, the product is said to possess valuable therapeutic properties.—T. F. B.

Menthol ester; Process for preparing a ——. R. Meyer Ger. Pat. 261,228, July 14, 1911.

Menthol is converted into its aminoacetic acid ester by the usual process of esterification. The product possesses powerful anæsthetic properties, and is less toxic than the menthol ester of diethylaminoacetic acid.—T. F. B.

Divinyl and isoprene; Process for obtaining ——. I. Ostromislensky, and Obstchestvo proizvodstva & torgovli resinovymi izdeliami "Bogatyr," Moscow. Eng. Pat. 6301, March 13, 1912.

See Fr. Pat. 442,980 of 1912; this J., 1912, 1007.—T. F. B.

2.3-*Dimethylbutadiene* (1.3); *Manufacture of* ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 9471, April 22, 1913. Under Int. Conv., May 14, 1912.

See Ger. Pat. 256,717 of 1912; this J., 1913, 507.—T.F.B.

1-*Dimethylamino-2-methylbutene-3; Process of producing* ——. 1-*Dimethylaminobutene-3 and process of making same.* G. Merling, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,065,159 and 1,065,160, June 17, 1913.

See Ger. Pat. 254,529 of 1912; this J., 1913, 212.—T.F.B.

Isoprene; Producing ——. H. A. F. Staudinger, Karlsruhe, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,065,182, June 17, 1913.

See Addition of July 15, 1911, to Fr. Pat. 425,885 of 1911; this J., 1912, 151.—T. F. B.

Hydrocarbons with more than one double bond; Process of producing ——. K. Gottlob, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,065,522, June 24, 1913.

See Fr. Pat. 433,322 of 1911; this J., 1912, 151.—T. F. B.

Turpentine or turpentine oil; Process for depolymerising ——. A. Heinemann. Fr. Pat. 453,452, Jan. 22, 1913. Under Int. Conv., Jan. 24, 1912.

See Eng. Pat. 1953 of 1912; this J., 1913, 252.—T. F. B.

Butadiene and its homologues; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss. Fr. Pat. 453,748, Jan. 29, 1913. Under Int. Conv., Feb. 15, 1912.

See Eng. Pat. 3873 of 1912; this J., 1913, 449.—T. F. B.

Urethanes of tertiary alcohols; Manufacture of ——. E. Merck, Darmstadt, Germany. Eng. Pat. 159, Jan. 2, 1913. Under Int. Conv., Feb. 28, 1912.

See Ger. Pat. 254,472 of 1912; this J., 1913, 213.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Kinematographic films and waste products of the same; Process for recovering the material of the support of ——. H. Danzer, Paris. U.S. Pat. 1,065,115, June 17, 1913.

See Eng. Pat. 14,407 of 1909; this J., 1909, 1327.—T.F.B.

Photographic images; Process for obtaining ——. Neue Photographische Ges. Fr. Pat. 453,567, Jan. 24, 1913. Under Int. Conv., Feb. 6, 1912.

See Ger. Pat. 253,335 of 1912; this J., 1913, 47.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosives with liquid oxygen as a base. Soc. L'Air Liquide (Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude). First Addition, dated March 19, 1912, to Fr. Pat. 451,265, Feb. 8, 1912 (this J., 1913, 627).

In place of the aluminium used in the envelope which contains the liquid air, coal, or a hydrocarbon, may be used. The liquid air absorbed by the kieselguhr, being in close contact with the carbonaceous matter, causes complete combustion on explosion.—G. W. McD.

Nitration of cellulose; Arrangement of workroom for the ——. M. H. Kaltenbach. Fr. Pat. 453,588, Jan. 17, 1913.

In the centre of the room is a compartment containing the pots for the mixed acid, and a transferrer, attached to an endless wire, for conveying the guncotton to the centrifugal machine, which is also inside the compartment. The compartment has air vent holes at the top and bottom, the latter being connected with an exhaust fan. Small openings, provided with sliding doors, are placed opposite the various parts of the apparatus. Air is blown by a fan into the main building and passes out from the building through the holes at the top of the central compartment and the holes at the bottom.—G. W. McD.

Explosive compositions for blasting; Use of ——. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. Geo. Claude), Paris. Eng. Pat. 3102, Feb. 6, 1913. Under Int. Conv., Feb. 8, 1912.

See Fr. Pat. 451,265 of 1912; this J., 1913, 627.—T. F. B.

Lime cartridge for mining purposes. U.S. Pat. 1,065,261. *See* VII.

XXIII.—ANALYTICAL PROCESSES.

Lead; Determination of small quantites of ——. A. V. Elsden and J. F. Stansfield. Chem. Soc. Trans., 1913, **103**, 1039—1042.

The method proposed consists essentially in precipitating the lead in the presence of ferric iron by means of ammonia, dissolving the precipitate, and re-precipitating the lead as molybdate after the iron has been reduced to the ferrous condition (see also this J., 1909, 636). To the lead solution is added at least ten times as much iron (in the form of ferric chloride) as there is likely to be lead present, ammonia is added, and the mixture is boiled. The precipitate is collected, dissolved in hot concentrated hydrochloric acid, the solution neutralised with ammonia, and $N/2$ hydrochloric acid added to the extent of 2 c.c. for every 0·01 grm. of iron used, with a minimum of 10 c.c.; after the addition of not less than 1 grm. of sodium sulphite, the solution is warmed until the iron is reduced, ammonium acetate is then added, and the boiling solution is precipitated with ammonium molybdate solution. The precipitate is collected, washed with hot water, dissolved in hot hydrochloric acid, and the solution, after the addition of a small quantity of tartaric acid and dilution to 50 c.c., neutralised with ammonia. The solution is then acidified with a few drops of hydrochloric acid, ammonium acetate added, the mixture boiled for a short time, and the precipitate collected, washed with hot water, ignited with the filter paper, and weighed. When the lead solution under examination contains phosphorus, antimony, and tin, it is necessary to precipitate the two latter together with the lead by means of hydrogen sulphide; the tin and antimony are then separated from the lead in the usual way with ammonium sulphide, and the lead sulphide is dissolved in hydrochloric acid containing bromine, and determined as molybdate. The method may be applied to the determination of lead in quantity not exceeding a few mgrms. in 50—100 c.c. of solution, and also to the determination of lead in such alloys as brass, phosphor-bronze, etc., where the amount of lead does not exceed 1 per cent.—W. P. S.

Reduction of ferric salts and their titration by potassium permanganate; New method for ——. A. Leclère. Pharm. Chim., June 16, 1913, 587.

The ferric solution to be reduced is placed in an Erlenmeyer flask with a little pure granulated zinc and a piece of platinum wire, and acidified with sulphuric acid in the proportion of 1 to 2 c.c. per 100 c.c. of solution. 2 to 3 grms. of ammonium sulphate is then added, the mouth of the flask covered with a small funnel, the liquid brought to a gentle boil and kept boiling until reduction is complete. The object of adding ammonium sulphate is to form ammoniacal ferrous sulphate, which is very stable in sulphuric acid solution. The filtered ferrous solution is titrated with permanganate in the usual way. Details are given for using the method in the case of blood, thus:—Incineration is effected in presence of a few drops of sulphuric acid, which causes the mass to swell and enables it to be calcined without decrepitation. The ash is treated with a few drops of water and evaporated. If the residue adheres to the sides of the dish, 5 to 10 grms. of potassium acid sulphate is added. and gently heated to fusion, and this state is maintained until the iron oxide has disappeared. The mass is treated with water, filtered if necessary, and titrated as described.

Nickel; Application of α-benzildioxime [α-diphenylglyoxime] to the detection and determination of small quantities of ——. F. W. Atack. Chem.-Zeit., 1913, **37**, 773.

An alcoholic solution of α-benzildioxime gives with nickel compounds a bulky red precipitate which is insoluble in water, alcohol, acetone, 10 per cent. acetic acid, and ammonia; the precipitate becomes reddish-yellow on boiling. The reagent is much more sensitive than dimethylglyoxime, showing 1 part of nickel in 5 million of water, and the precipitate is readily filtered (compare Ibbotson; this J., 1911, 1317). Small quantities of nickel are determined as follows:—150 c.c. of a hot saturated alcoholic solution of the oxime are added for every 0·01 grm. of nickel, the mixture is heated for a few minutes on the water-bath, filtered, the precipitate washed with hot alcohol, and dried at 110°—112° C.; it has the formula, $C_{28}H_{22}N_4O_4Ni$, and contains 10·93 per cent. Ni. Nickel may be separated from cobalt in ammoniacal solution. α-Benzildioxime is prepared by boiling 10 grms. of benzil, dissolved in 50 c.c. of methyl alcohol, with a concentrated aqueous solution of 8 grms. of hydroxylamine hydrochloride, for 6 hours, washing the precipitate with hot water and then with a small quantity of ethyl alcohol, in which it is only slightly soluble. It may be crystallised from acetone.—F. Sodn.

Nitrites; Determination of —— *by means of thiocarbamide [thiourea], and the interaction of nitrous acid and thiocarbamide in the presence of acids of different strength.* M. E. Coade and E. A. Werner. Chem. Soc. Trans., 1913, **103**, 1221—1228.

When a nitrite is brought into contact with a solution of thiourea containing a strong acid, such as hydrochloric acid, a reaction takes place essentially according to the equation: $2CSN_2H_4+2HNO_2=C_2S_2N_4H_6+2NO+2H_2O$. The gas evolved contains a small quantity of nitrogen, but this is of no importance as far as the gasometric determination of nitrites is concerned, as the volume of the gas is the same in both cases. Results of experiments on the action of thiourea on nitrites in the presence of various acids are also recorded; as mentioned above, the gas evolved in the presence of mineral acids consists almost entirely of nitric oxide, but when organic acids are employed, more nitrogen than nitric oxide is formed; in the case of *p*-bromobenzoic acid the gas evolved consists entirely of nitrogen, but the reaction takes about 24 hours for completion.—W. P. S.

Ammonia and trimethylamine; Determination of ——. K. Budai. Z. physiol. Chem., 1913, **86**, 107—121.

The aqueous solution of the hydrochlorides of the two bases is treated with excess of formalin, previously rendered neutral to phenolphthalein, and then titrated with $N/10$ sodium hydroxide in presence of phenolphthalein (compare Blair, this J., 1911, 397): the number of c.c. used (x) corresponds to the ammonia.

$$4NH_4Cl+6CH_2O+4NaOH=(CH_2)_6N_4+10H_2O+4NaCl.$$

The solution is now diluted with a large quantity of water, made strongly acid with sulphuric acid, and concentrated to one-third of its volume over a free flame. In this way the hexamethylenetetramine produced by the action of formaldehyde on the ammonium salt is hydrolysed into ammonia and formaldehyde. The solution is now made alkaline and distilled, the vapours being collected in excess of $N/10$ acid and the excess of acid titrated. From this titration the number of c.c. (y) of N/10 alkali corresponding to the trimethylamine + ammonia is ascertained, whence that corresponding to the trimethylamine is obtained by difference ($y-x$). The method was applied to a sample of dried gluten several months old. The gluten was suspended in water, treated with alcohol and magnesia and distilled *in vacuo*, the vapours being collected in hydrochloric acid. The acid distillate was evaporated to dryness on the water-bath and then tested by the above method. The dried gluten was found to yield 0·029 per cent. NH_3 and 0·009 per cent. $N(CH_3)_3$. —A. S.

Methoxyl and ethoxyl determinations; Volumetric method for ——. A. Klemenc. Monatsh. Chem., 1913, **34**, 901—912.

The vapourised methyl iodide or ethyl iodide, produced and split off as in the ordinary Zeisel method, is passed through a heated tube, which causes decomposition with the formation of free iodine and a little hydriodic acid. The flask with the side tube in which the substance is treated with hydriodic acid is connected with a vertical condenser. A tube leads from the top of the condenser to a small wash-bottle containing water and red phosphorus. The latter is connected with a tube of hard glass or quartz, 25—28 cm. long and 1·2 cm. diam. This is packed with broken pumice. When ethoxyl groupings are present, part of the pumice must be replaced by platinised asbestos and a small plug made of fine strips of platinum foil. The tube can be heated by two flat-flame Bunsen burners, and is connected with the absorption apparatus by a ground joint. During the reaction a current of air free from carbon dioxide is passed through the apparatus, whilst the decomposition tube is strongly heated. The iodine and hydriodic acid are retained by a strong solution of potassium iodide. The contents of the absorption apparatus are washed into a flask and the free iodine titrated with standard thiosulphate solution. Excess of potassium iodate is then added and the iodine set free titrated. A blank titration is made in a separate flask using the same quantities of potassium iodide, iodate and water as in the determination. —F. Shdn.

Extraction of thorium from monazite sand with the aid of hypophosphoric acid, and detection of cerium with alkaline ammonium tartrate solution. Wirth. *See* VII.

Determination of fluorine in zinc ores. Schneider. *See* X.

A colour reaction of gallic acid and tannin (tannic acid) and its application. Schewket. *See* XV.

Hydrolysis of laevulosans and its application to analysis. Vilmorin and Levallois. *See* XVII.

Detection and determination of salicylic acid in fruit juices. Heintz and Limprich. *See* XIXa.

Patents.

Cylinder oils; Testing machine for ——. Oelwerke Stern-Sonneborn A.-G. Ger. Pat. 259,599, April 5, 1912.

The machine is of the type in which the oil is interposed between two discs, one fixed and the other rotating. In the example described, the testing machine is driven by a steam turbine. Steam is led into the closed testing chamber, being mixed either in the chamber or before it enters the chamber, with the oil to be tested. The oil is distributed over the testing discs and the steam passes on through a hollow shaft and serves to set the turbine (and hence also the testing discs) in motion. A part of the exhaust steam from the turbine is led through an oil separator. The testing discs are provided with grooves for the passage of the steam, and the quality of the oil is judged from the speed of the machine, the amount of deposit from the oil in the testing chamber, and the amount of oil in the oil separator.—A. S.

Air-pyrometer. M. Arndt, Aix-la-Chapelle, Germany. U.S. Pat. 1,065,651, June 24, 1913.

See Fr. Pat. 388,992 of 1908; this J., 1908, 970.—T. F. B.

Testing apparatus for air and other gases. M. Arndt, Aix-la-Chapelle, Germany. U.S. Pat. 1,065,652, June 24, 1913.

See Ger. Pat. 242,540 of 1911; this J., 1912, 304.—T. F. B.

Trade Report.

Arsenic for Russia. Board of Trade J., June 19, 1913.

H.M. Consul at Batoum reports that a South Russian agricultural Society requires a quantity of arsenic for agricultural purposes, and wishes to secure quotations from manufacturers in the United Kingdom. The name and address of the Society may be obtained by manufacturing chemists in the United Kingdom on application to the Commerce Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Books Received.

The Chemistry of Rubber. By B. D. Parritt, B.Sc., Chief Chemist to the North British Rubber Company, Edinburgh. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1913. Price 1s. 6d.

Volume (7½ by 5 in.), containing 87 pages of subject matter, with Bibliography of 6 pages, and an alphabetical index. The text is subdivided as follows:—I. Properties of crude rubber. II. Constitution and derivatives. III. Methods of vulcanisation. IV. Theories of vulcanisation. V. Waste rubber and its utilisation. VI. Synthetic caoutchouc.

An Introduction to the Chemistry of Plant Products. By Paul Haas, D.Sc., Ph.D., and T. G. Hill, A.R.C.S., F.L.S. Longmans, Green and Co., 39, Paternoster Row, London, New York, Bombay and Calcutta. 1913. Price 7s. 6d. net.

Volume (9⅝ by 6 in.), containing 388 pages of subject matter, with diagrams and illustrations, and an alphabetical index of subjects. The matter is treated under the following heads:—I. Fats, oils, and waxes. Phosphatides. II. Carbohydrates. III. Glucosides. IV. Tannins. V. Pigments. VI. Nitrogen bases. VII. Colloids. VIII. Proteins. IX. Enzymes.

Die Apparatfärberei der Baumwolle und Wolle unter Berücksichtigung der Wasserreinigung und der Apparatbleiche der Baumwolle. Von E. J. Heuser. Julius Springer's Verlag. Berlin. 1913. Price M. 8.

Volume (9⅜ by 6⅜ in.), containing 295 pages of subject matter and 191 illustrations, followed by a combined alphabetical index of names and subjects. The subject matter is arranged under the following heads:—I. Water used in machine dyeing. II. Machine bleaching and dyeing of cotton. (*a*), System and arrangement of machinery. (*b*), Manner of machine dyeing with the different dyestuffs. III. Machine dyeing of wool. (*a*), System and arrangement of machinery. (*b*), Manner of machine dyeing with the different dyestuffs. IV. The drying arrangements and apparatus.

Treatise on General and Industrial Organic Chemistry. By Dr. Ettore Molinari, Professor of Industrial Chemistry to the Society for the Encouragement of Arts and Manufactures, etc., at the Luigi Bocconi Commercial University, Milan. Translated from the 2nd enlarged and revised Italian edition by Thos. H. Pope, B.Sc. School of Malting and Brewing, University of Birmingham. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 24s. net.

Volume (10⅛ by 6¼ in.), containing 742 pages of subject matter and 506 illustrations, with an alphabetical index of subjects. The text is classified under the following heads, in this text there being included, with special treatment, the various technical substances and processes concerned:—I. General. II. Derivatives of methane. III. Cyclic compounds. (See also this J., 1912, 562.)

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Manchester Section.

Meeting held at Grand Hotel, Manchester, on Friday, May 2nd, 1913.

DR. G. J. FOWLER IN THE CHAIR.

A CONTRIBUTION TO THE STUDY OF THE ACTIONS OF VARIOUS WATERS UPON LEAD.

BY HARRI HEAP, M.SC., F.I.C.

Historical.

The rusting and the corroding of metals had been observed in very early times and it seemed to be generally agreed that water was the causative agent in producing these effects. Reference is made to it by Pliny in his "Natural History" where he refers to the fear which people had regarding certain waters and more particularly those that had the power of corroding iron and even copper. In this paper it is mainly to the action of certain watery solutions upon lead that I wish to draw special attention. Although Belgrand, on the authority of Varro, states that lead conduits were used in Rome to distribute the water from the Appian way, it was only during the Middle Ages that the action of certain waters upon lead began to attract special notice. This was probably due to the fact that the supplies from central sources were superseding the custom of drawing and carrying in order to meet the needs of masses of people congregating in certain areas where the amount of water from wells and springs was by no means sufficient to meet the demand upon it occasioned by the changing habits of the people. Along with the growth of the central supply systems of water distribution came the increasing use made of lead no doubt because of the ease with which it is worked and its comparative cheapness. Although the occurrence of lead poisoning as a result of the action of water on lead had not been overlooked by early observers, it was only during the nineteenth century that the scientific foundations of our present knowledge of the action of water on lead were laid.

There are, however, very important differences in the views held by chemists on this subject and of late years there has been a tendency to attribute an important rôle to acids generated in peat by certain bacteria. Since 1893 many of the water supplies of districts situated chiefly in Lancashire and in Cheshire have been studied chemically and bacteriologically in the Public Health Department of this University and on the basis of these investigations Professor Delépine has come to the conclusion that the acidity of moorland waters was rather a concomitant than a causal factor in relation to the action of these waters on lead, and the amount of saline matter and of gases present in water appeared to him to be of greater importance with regard to the action of water on lead than recent theories admitted. The question apart from its practical importance was one of very great scientific interest and for these reasons amongst others Professor Delepine advised me to investigate systematically how pure lead was affected by water containing certain substances and gases, taking the action of carefully prepared distilled water free from gases and also aerated (that is corresponding to neutral water under ordinary conditions) as standards of comparison.

(1) *Short summary of the work done and theories held by some previous workers.*

A considerable number of observations bearing upon the action of pure water and of water containing various products were made during the nineteenth century.

The most important factors influencing the action on lead had been recognised at an early date by P. Yorke (1834); T. Graham, W. A. Miller and A. W. Hofmann (1851); P. Muir (1872); J. B. Dumas (1873); M. Traube (1887); M. Muller (1887); P. F. Frankland (1889); and more recently by U. Antony (1896); S. Ruzicka (1901); F. Clowes (1902); A. C. Houston (1903); and others.

Subsequent observers have investigated very fully the share taken by some of these factors in bringing about the solution, corrosion and incrustation of the metal. It is, however, obvious that sufficient attention has not always been paid to the way in which the action of some agents is modified by the interaction of other agents, and the data given by various writers do not always allow one to discover an explanation for the divergences of opinions expressed in their writings.

In the following short review of the work done before 1905 (when our investigations were started) we have referred chiefly to the records of observations or experiments which were tolerably comparable and have laid more stress upon the points regarding which there was agreement than upon those about which there was disagreement among observers, except in those cases where the differences were of importance.

The earlier observers: Yorke, Graham, Miller, Hofmann, and Dumas, noticed that distilled water and pure water, generally speaking, had a marked action on lead when the water was aerated, and whilst they all attributed this action to the presence of oxygen in the water.

Yorke indicated clearly three kinds of action:—(1) The formation of a soluble hydrated oxide (8·3 parts of hydrated oxide of lead are soluble in 100,000 parts of water). (2) The precipitation of a less soluble product partly crystalline (oxycarbonate or a mixture of carbonate and oxide). (3) The production of lamellar and dodecahedral crystals of anhydrous oxide.

Dumas, moreover, in 1873, asserted that some forty years previously he had shown that distilled water and clean rain water, in the presence of oxygen or air had a remarkable action on lead. In the same year these remarks of Dumas were confirmed by Le Blanc, who concluded that distilled water and pure rain water would attack lead and produce crystals of the hydrated oxide when in contact with air but that river water had little effect.

The investigations of Graham, Miller and Hofmann showed that distilled water which had been boiled still attacked lead, but Muller after boiling distilled water and protecting it from the access of air while cooling, found that the water so treated had no visible effect on lead.

Muir observed that water charged with carbon dioxide at ordinary pressure and at about 6 atmospheres pressure had different solvent effects upon the lead. Under ordinary pressure there was no considerable action, but with an increase of the pressure of the carbon dioxide the solvent action was also increased. These results of Muir are probably explained somewhat by an observation made later by Muller. After boiling distilled water for some time and allowing it to cool rapidly in the presence of air, he found that the water then held 0·040 c.c. of carbon dioxide, 0·236 c.c. of oxygen, and 0·514 c.c. of nitrogen per 100 c.c. The water used by Muir may therefore have contained a fair amount of oxygen. It is, however, difficult to reconcile with the previous statement another made also by Muller to the effect that water out of contact with air reaches its maximum action on lead in three days. Again, Graham, Miller, and Hofmann asserted that by boiling water to rid it of carbon dioxide they increased its action on lead. They ascribed a protective action to carbon dioxide when present in certain quantities, but were aware that larger amounts of carbon dioxide increased the solvent action of the water. More recent observers, viz.: Carnelly and Frew, Clarke and Houston, agreed with the older observers as regards the influence which exposure to air has upon the plumbo-solvent action of water, that it somewhat increased that action.

Carnelly and Frew estimated that aerated water is four times more active than water deprived of air. According to Garrett soft water (presumably he also meant pure water) is able to take up some lead even in the absence of oxygen.

I hope it will be clear from the above statements that it is impossible to compare results of experiments in which special attention has been paid to the amount of gases dissolved in the water used, with results of experiments where no account has been taken of these gases. The same remark applies as will be shown to experiments in which the water contains saline or other matter.

Houston states with regard to pure neutral distilled water that it is usually possessed of conspicuous erosive power but that the following substances or conditions do not seemingly influence to any material extent this quality; boiling followed by aeration, exhaustion of the dissolved gases followed by aeration, aspirating air through the water, or saturation with hydrogen gas followed by aeration. He also observed that distilled waters saturated with hydrogen gas have no erosive power, and that distilled water loses its erosive power if placed under anaerobic conditions. It is obvious that his experiments dealt with visual effects only. The amount of lead in solution was not determined.

Traube observed that although pure water deprived of dissolved oxygen has no action on lead, the moment water and oxygen act simultaneously, oxidation of the lead takes place and hydrogen peroxide is produced.

Frankland further found that distilled water saturated with carbon dioxide is very much more active than that saturated with oxygen, although much less active than distilled water. Few experiments have been made with water saturated with various gases.

We have so far considered only the views held regarding the effects which aeration has upon the action of pure water on lead. Several observers have studied separately the phenomena taking place when the water contains only oxygen or carbonic acid or other gases within the limits possible or convenient in ordinary work.

Graham, Miller, and Hofmann experimenting with finely divided lead (pyrophorous lead prepared from tartrate of lead) found that when water contained no carbon dioxide it was rendered rapidly poisonous owing to the formation of the soluble oxide. Water containing 3 per cent. of carbon dioxide did not become poisonous owing to the formation of the comparatively insoluble carbonate of lead (the solubility in water of carbonate of lead is 1 in 4,000,000).

Muller after one series of experiments concluded that distilled water containing oxygen but no carbon dioxide attacked lead, and later gave the apparent contradiction that distilled water freed from carbon dioxide and containing only oxygen has scarcely any action on lead.

Clarke's observations upon the action of oxygen and carbonic acid were in general agreement with those previously mentioned, and he found that the action of distilled water was reduced to a minimum in the absence of carbonic acid and oxygen. He concluded that the action was to be mainly attributed to oxygen and carbon dioxide, and that oxygen acts more quickly than carbon dioxide. According to that observer distilled water charged with oxygen had a more violent action on lead than any natural water had. An observation of Yorke may be referred to here: Yorke noticed that lead confined in an atmosphere loaded with aqueous vapours, an "ozonic hygrometric substance" being present, became encrusted with carbonate of lead.

Reichardt also observed that water takes up lead rapidly when it comes in contact with lead which is alternately exposed to air and covered with water. Houston appears to differ from most observers when he states that saturation of water with pure oxygen gas delays or reduces the action. He makes the same remark with regard to the saturation of water with pure hydrogen gas; but he states that pure neutral distilled water strongly erodes lead and also that aeration increases the plumbo-solvent action.

The surface of lead exposed and the duration of the exposures are obviously factors of importance but the experiments bearing upon these points are more suggestive than satisfactory. Muir found that the relation between the surface of lead exposed and the amount dissolved was not a simple one. In the case of distilled water to the action of which lead was exposed for forty-two hours there did not seem to be much difference in the amount of lead dissolved when the surfaces exposed were 25 sq. cm. or 50 sq. cm. respectively, nor did contact with air affect materially the results. The case was different with exposures of greater duration. Thus after 340 hours the amount of lead dissolved showed a decrease when the surface exposed had been increased, the experiment being made in closed vessels. The reverse relation was observed, however, when air was allowed to come in contact with the fluid. Moreover, the liquid formed became cloudy on exposure to air (it is possible that in this case Muir's reference is to the phenomenon of erosion).

Muir also found that water containing carbon dioxide but no oxygen had no effect on lead. In one set of experiments Muir exposed lead to the action of water containing a constant quantity of oxygen and various proportions of carbon dioxide with the following results:—

Water containing oxygen 0·35 per cent., and carbon dioxide 0·14 per cent. attacked lead appreciably, with 0·6 per cent. more actively, and with 0·0 per cent. less distinctly. With 1·5, 2·0, 2·5, and 3·0 per cent. there was no visible action.

Garrett, whose experiments are chiefly useful as corroboration, observed like his predecessors that water containing oxygen is more active than water free from oxygen and he made some additional observations upon the action of water containing carbon dioxide after exposures of various duration. According to him, water charged with carbon dioxide took up in—

3 hours 0·94 m.mg. of lead per litre (= 9·4 in 10,000,000).
10 ,, 2·80 ,, ,, ,, (= 28·0 ,, ,,).
30 ,, 0·14 ,, ,, ,, (= 0·14 ,, ,,).

He explained these results by stating that in the first instance carbonate of lead was formed which was rapidly dissolved by the excess of carbon dioxide and that when the whole of the carbon dioxide had been used up the insoluble basic carbonate of lead was finally deposited.

Reichardt conducted a short series of experiments, and stated that the presence or absence of oxygen does not affect the action on lead of waters under pressure, but his theory was contradicted by Frankland, who found that under a pressure of 90 inches of mercury the action of lead upon water containing oxygen was diminished, whilst the action of water containing carbon dioxide was unchanged. It was especially evident that the increase in the amount of lead dissolved was associated with the increase of lead exposed when the fluid contained salts, which have the power of increasing this lead solvent action (exposures of 300 to 500 hours' duration). Although the action of salts has not yet been discussed it is convenient here to refer to the following observations, for which we are also indebted to Muir. The amount of lead taken up by water containing carbonates, sulphates or chlorides increases slightly after the first twenty-four hours of exposure, but when the water contains nitrates, the amount of lead dissolved is observed to increase with the duration of the exposures at any rate up to a period of seventy-two hours' exposure. Most observers conducted their experiments at the atmospheric temperature then prevailing, and paid little or no attention to the influence of changes of temperature on the action. Garrett, however, observed that the rate of action is much greater at 120° F. than at common temperature, and that no doubt up to that point or possibly up to a slightly higher degree, the rate of action increased with temperature but at temperature approaching the boiling point a continuation of action was prevented. The conclusions arrived at by the various experimenters can only be compared in general terms. In some cases there is no relation expressed between the volume of water and the surface of lead exposed. More than this the volume of water used in one experiment often differed from that used in another. In some cases we find commercial sheet lead or piping being used, in other cases lead shot, pure lead foil or wire. These differences must have very seriously affected the results, and yet no account was taken of them in formulating conclusions. For instance, in the case of lead shot the surface exposed is not calculated by some authors but the apparent volume is given. In almost every case the effect of the solubility in the water of the glassware used and its consequent effect upon the experiment is neglected.

A great number of observations have been made regarding the influence which the presence of various products has upon the action of water upon lead; the effects brought about by these various substances are greatly influenced by the presence of oxygen and of carbonic acid, and except when observers make special reference to the conditions under which their experiments were conducted as regards the access of air to their solutions, it may be assumed that the action of the gases of the atmosphere has not been excluded. It is owing to the difficulties introduced by this aspect of the question that the action of oxygen and carbonic acid had been discussed at the outset.

Yorke had noticed that small quantities of soluble saline substances appeared to "reduce the affinity of water for lead," and under these conditions the lead is liable to become encrusted. Muir observed that in the case of salts that have the power of increasing the plumbo-solvent action the maximum effect is produced when the surface of lead exposed to the dilute saline solution is small in proportion to the surface of solution exposed to the air.

Clarke found also that the action of various saline solutions is always less in the absence than in the presence of air. For the sake of convenience the effects which the various substances have according to some observers upon the action of water upon lead will be given here seriatim. To prevent errors of interpretation except when the observers have described clearly the kind of action (coating, erosion or solution) the general term action will be used.

Sulphuric acid when in small quantity and in the presence of air increases the action on lead (Allen), in the presence of air and of saline matter minute quantities of sulphuric acid increase the plumbo-solvent action but diminish the total action (Carleton Williams).

Silica diminishes the action of water containing sulphuric acid (Tidy). Sodium silicate dissolved in aerated distilled water reduces the action of the distilled water.

Ammonia in the absence of air increases slightly the action of distilled water. Ammonia in distilled water in the presence of air is more active than distilled water alone (Clarke). Ammonia in distilled water free from carbon dioxide attacks lead. Ammonia in distilled water with carbon dioxide does not attack lead.

Caustic soda attacks lead in the presence of oxygen and absence of carbon dioxide but when carbon dioxide is present the lead is not attacked.

Lime water through which a current of air freed from carbon dioxide is made to pass attacks lead, the maximum action being reached in thirteen hours. In the absence of oxygen or in the presence of carbon dioxide lime water does not attack lead (Muller). Slaked lime has a strong corrosive action on lead (Bamberger, also Carnelly and Frew). Calcium hydroxide in the absence of air reduces the action of distilled water to about one-fifth (Carnelly and Frew).

Calcium salts restrain to a considerable extent the plumbo-solvent action of water (Dumas and Le Blanc). Distilled water containing carbonate of calcium and in the presence of air attacks lead less actively than distilled water alone (Clarke). Calcium sulphate dissolved in distilled water and in the presence of oxygen produces a deposit (probably a basic sulphate) on lead but in the absence of oxygen the lead remains bright (Muller).

Carbonates reduce considerably the plumbo-solvent action of water (Muir). Carbonates dissolved in carbon dioxide reduce considerably the solvent action of water (Graham, Miller, and Hofmann). Sodium carbonate dissolved in distilled water produces a coating on lead which is not dissolved (Muller). Bicarbonates of sodium and of calcium act in the same way as carbonate of sodium (Muller).

Sulphates do not appear to have uniformly the protective action attributed to them (Graham, Miller and Hofmann). Sulphates diminish the plumbo-solvent action of water (Muir). Chlorides may increase the plumbo-solvent action (Graham, Miller and Hofmann). Chlorides diminish the plumbo-solvent action (Muir). Sodium chloride in the presence of air diminishes the plumbo-solvent action of water (Clarke).

Nitrates increase considerably the plumbo-solvent action of water (Graham, Miller and Hofmann). Nitrates and more especially nitrate of ammonium reach their maximum action when the surface of the saline solution exposed to the air is large as compared to the surface of lead exposed to the solution (Muir). Potassium nitrate and other nitrates do not increase the plumbo-solvent action as much in the absence of air as when the solution is exposed to the air (Carnelly and Frew). Nitrates in the absence of air increased but slightly the plumbo-solvent action of the water (Clarke).

Generally speaking, Houston's results regarding the action of various chemical substances agreed with those of previous workers. Thus he found that the following substances delayed or reduced the plumbo-solvent action of water: Ammonium carbonate, ammonium chloride, sodium carbonate, bicarbonate, phosphate and chloride, calcium bicarbonate, phosphate, sulphate, and hydroxide, magnesium sulphate, etc. Mineral acids and carbonic acid at certain dilutions. He also found that the action of water on lead was delayed when the water was saturated with pure hydrogen or pure oxygen gas, or under anaerobic conditions, and that the conditions increasing the plumbo-solvent action of water were aeration, prolonged contact and also the presence of ammonium, sodium, or potassium nitrates.

Several observers have paid special attention to the effects which the presence of organic matter had upon the action of water on lead. Graham, Miller, and Hofmann found that water containing organic matter caused rapid corrosion of lead, and Muller attributed the same power to waters containing much organic matter and carbon dioxide. On the other hand, Carnelly and Frew remarked that the action of water on lead is reduced by the addition of peaty soil, and Clarke found that organic matter added to distilled water or to a solution of nitrate of ammonium diminished the plumbo-solvent action of these fluids. In the above experiments the authors were endeavouring to find some explanation of the old idea that peat was the causal agent which made so many moorland waters conspicuous by the ability which they possessed of attacking lead to such a great extent. Quite recently Houston has again attributed the action of moorland waters to their acidity, which he associated with the growth of certain acid-producing bacteria in peat. Some of the experiments which have been made to ascertain the combined action of various substances dissolved in water may be referred to briefly. Muir noticed that the solvent action of water containing nitrates was considerably reduced when chlorides, sulphates, and carbonates were also present. Carnelly and Frew found that the corrosive action of ammonium or potassium nitrates was prevented or reduced by the addition of calcium carbonate or of calcium silicate or of a mixture of calcium carbonate and sand. They also thought that the action of slaked lime was reduced by the addition of sand. Muller observed that distilled water to which minute traces of chlorides, nitrates, ammonia, and organic matter had been added acted upon lead like ordinary natural waters. Frankland found that the carbonates of calcium and sodium, phosphates, and silicates prevented the action of waters on lead or delayed this action and ammonium nitrate certain gases and increased pressure were all factors tending towards increased activity upon lead.

Antony and Benelli experimenting with lead wire give a clear account of the action of distilled water and the same water containing chlorides and sulphates of sodium, bicarbonates and sulphates of calcium under four conditions:—1. Free from air. 2. Saturated with air by agitation. 3. Saturation with air by bubbling. 4. Saturation with a mixture of air and carbon dioxide (carbon dioxide to the extent of four parts in ten parts of air). They found that generally by aeration the action was increased and by aeration with air and carbon dioxide the action of distilled water was diminished. This is somewhat difficult to understand. In waters containing chlorides the action is increased but in other cases, with certain exceptions, it is diminished.

Ruzicka using lead foil and distilled water containing the nitrates, chlorides, sulphates, and carbonates of potassium, sodium, calcium, magnesium, and ammonium found that the influence of these salts was independent of the base and that whilst nitrates increased the action or in certain concentrations leave it unaltered, chlorides, sulphates, and carbonates diminished the action, the effect increasing in the order named. The presence of the mixed salts preserved this mode and order of action. Free carbon dioxide greatly diminishes the action of water and salt solutions on lead both when the solution is saturated with carbon dioxide before contact or when carbon dioxide is bubbled through the solution during the course of the experiment. Infusions of grass leaves and radish leaves diminishes the action, whilst peat infusion increases the action.

The experimental evidence which has been briefly summarised in the previous lines is in general agreement with observations on natural waters of which a few may now be considered.

Dumas remarked that the first rain water which fell over a town after a spell of dry weather had comparatively little action on lead, while the water which fell after the air had been washed by the first downpour acted upon lead as strongly as aerated distilled water. He attributed this difference to the presence in the dry air of calcareous dust which was removed by the first rain.

With regard to other natural waters it will be convenient to consider first those which have only a slight action upon lead. Graham, Miller, and Hofmann pointed out that well, river and lake waters do not usually attack lead which non-action they attribute more to the presence of carbon dioxide than to the presence of saline matter. Muir remarked that natural waters which in addition to nitrates contain also small quantities of carbonates, sulphates, and chlorides had little action upon lead. The comparative absence of lead solvent action which the water of the Seine, Ourcq, and Dhuis had was attributed by Dumas to the presence of lime salts. Crookes, Odling, and Tidy found that waters containing much silica dissolved lead less actively than water containing less silica. Garrett was of opinion that lead coming in contact with hard water is protected by the formation of a coat of lead carbonate. Lead exposed to alkaline water is also coated by a deposit, but this differs from that formed by lead carbonate.

The following observations refer to waters which attack lead fairly actively.

Noad paid special attention to some alkaline waters with high saline contents including nitrates, much nitrates, sulphates and chlorides, and which he found to have a powerful action on lead, he makes special allusion to alkaline waters from wells in the London basin (containing 38·6 and 30·9 grains of saline matter per gallon) and which had a corrosive action on lead.

Garrett was of opinion that the amount of lead dissolved by acid water was determined by the amount of acid, but he stated also that acid water carefully neutralised acted almost immediately. The same observer showed that when lead is exposed to the action of soft water to which air has free access a continuous process of oxidation takes place. He also stated that the presence of neutral sulphates, chlorides, nitrates and ammonium salts caused an increase in the amount of lead held in solution.

Muller has recorded some interesting experiments upon the effects of driving off by distillation the ammonia and dissolved gases contained in water, his experiment may be tabulated as follows:—Waters belonging to two types were used: A. Ocker water containing much ammonia. B. Well-water containing no ammonia. Each sample was distilled and the distillate collected in three fractions, the plumbo-solvent action of each fraction being tested with the following results:—

A. Ocker water.

	1st fraction.	2nd fraction.	3rd fraction.
Ammonia per 100,000	1·150	0·100	0·080
Gases—Total per 100 c.c.....	2·040	1·196	0·770
CO_2 ,, ...	1·159	0·178	0·025
O_2 ,, ...	0·269	0·316	0·232
N_2 (diff.)	0·612	0·702	0·513
Plumbo-solvent action (pure lead)	Slight action, slight deposit on lead. Water clear.	Considerable action, lead corroded. Water turbid.	Considerable action, lead corroded. Water turbid.

B. Well-water.

	1st fraction.	2nd fraction.	3rd fraction.
Gases—Total per 100 c.c. —	2·661	1·312	1·047
$C.O_2$,, ..	2·030	0·218	0·069
O_2 ,, ..	0·198	0·358	0·341
N_2 ,, ..	0·433	0·738	0·637
Action of lead..............	Slight	Vigorous	Vigorous

Garrett's observations regarding the action of carbon dioxide appear to be in disagreement with those of most observers, for he states that natural waters containing carbon dioxide attack lead but lose their power after the carbon dioxide has been driven out by boiling; the reverse could also be true. He obviously refers to the coating with carbonate of lead.

Houston's observations do not appear to be always in agreement with those of his predecessors and may be for the sake of convenience dealt with separately. According to this observer rain water is generally neutral, it is sometimes slightly acid. Pure rain or snow water generally erodes lead.

Neutral waters sometimes erode lead in the presence of oxygen. Neutral moorland waters are not erosive unless they have been previously in contact with lead. Acid moorland waters so called peaty waters are apt to possess erosive properties, but the action is not so rapid as that of distilled water. They may erode not only bright but also old coated lead. Rain water after stagnating in peaty, boggy or marshy places becomes acid, this acidity is greater than that which rain water may acquire before falling on the ground. During storms and when wet succeeds dry weather moorland water becomes very acid and acts strongly on lead. During dry weather the water draining from moorlands is generally neutral and does not attack lead. Water draining from formations rich in iron pyrites may be acid and act on lead; the acidity of moorland waters is seldom attributable to this cause. Acid-producing bacteria are found in peat. Neutral sterile decoctions of peat inoculated with fresh peat became acid and acquired the power of attacking lead.

Houston, without analysing so fully as had been done by Yorke and other early observers the different ways in which lead is attacked by water, distinguished the erosive from the plumbo-solvent action of pure water and of water containing various substances. With regard to plumbo-solvency he makes the following remarks:—Pure distilled water has no plumbo-solvent action. Neutral rain and snow water have no plumbo-solvent action. Slightly acid rain water collected in the neighbourhood of towns dissolved lead appreciably but nothing like peaty waters. Distilled water acidified has a plumbo-solvent action proportional to the acidity. Acid water loses its plumbo-solvency when neutralised, boiled, aerated or stored in partly filled bottles. The dangerous qualities of rain water as regards their erosive action have for long been recognised, but their manner of action in every case has not always been well understood. Rain water under ordinary conditions is neutral and therefore cannot dissolve lead to any marked extent; but its erosive action is extremely well marked. Rain water collected on moorlands situated near manufacturing cities were usually found to be slightly acid and to dissolve lead to an appreciable but slight extent. The action or the acidity in these cases could not offer any adequate explanation of the acidity or the plumbo-solvent ability observed in most cases of moorland peaty waters.

Stated in this way many of Houston's statements seem to be in disagreement with those of well-known authorities, but a consideration of the more complete experimental work of older observers such as Dumas, Yorke, Graham, Miller and Hofmann, and Muller, among others, convinces one that the differences in the way in which the various observers have stated their case are due to the fact that the early observers attached due importance to the gases dissolved in water while Houston was more impressed by the possible importance of the acidity due to peat bacteria.

Theories regarding the action of pure water and of water containing certain gases, salts and other products upon lead.

Yorke, who probably was not aware of Dumas' work with which he was in agreement, made observations which led him to formulate a theory which is in many respects more complete than any of those which have been proposed since. Yorke's theory may be formulated as follows:—The action of pure water on lead is essentially due to the presence of gases dissolved in the water. With oxygen, lead forms in the presence of water a hydrated oxide which is comparatively soluble in water. When carbonic acid is present a light crystalline mixture or compound of hydrate and carbonate of lead is produced. Anhydrous oxide of lead may also separate in the shape of lamellar or dodecahedral crystals. Lead exposed to a moist atmosphere becomes encrusted with carbonate of lead. The views held by Graham, Miller and Hofmann, by Muir, by Garrett, by Clarke and others resemble those advanced by Yorke. Muir holds that the soluble lead compound which is first produced is converted by carbonic acid into a hydrocarbonate which is soluble in an excess of carbonic acid.

Garrett develops Yorke's theory in the following manner:—The action of water on lead is primarily due to oxidation, if the supply of oxygen is limited the action is also limited, when the supply of oxygen is unlimited the oxidation is progressive. The oxygen may be derived from the air, from nitrates or from oxidised organic matter, but it does not appear to result from the electrolysis of water. The plumbo-solvent action is however increased by silver and copper, and reduced by aluminium tin and zinc couples. Houston's views have already been alluded to, this observer believes that the plumbo-solvency of moorland waters (as distinguished from erosive action) is due to acids derived from peat. The production of acids in peat is, at least in part, associated with the presence of acid-producing bacteria in peat.

(*To be continued.*)

Yorkshire Section.

Meeting held at the Queen's Hotel, Leeds, on Monday, May 5th, 1913.

MR. GEORGE WARD IN THE CHAIR.

SYNTANS—NEW ARTIFICIAL TANNING MATERIALS.

BY EDMUND STIASNY.

There are few branches of chemical industry where the development during the last decades is so striking and where the possibilities and probabilities of further changes are so hopeful as they are in leather industries.

To summarise in a few words the differences between old and present days, the old times can be characterised by handiwork, by a very few tanning materials in use, by slow and uneconomic methods, and finally by a primitive organisation of the works. To-day we see the manual work very largely displaced by machine work; we are using a much greater variety of tanning materials, our methods are quicker and more economic, and the organisation of the works is far more perfect.

As regards the number of tanning agents used in olden and modern days, the difference is most striking.

A few hundred years ago oak bark was *the* tanning material, and sumach was used for light leathers. Of mineral tannins only alum was known, and for fat tannages cod oil was the only material. To-day more than 20 vegetable tannins are used both in the form of the natural materials (bark, wood, fruit, leaves, etc.), and in the form of extracts. Of mineral tanning agents the chromium compounds had a victorious career, and chrome tannage is gaining ground every year. Iron tannage, which was the object of much experimental work done by Knapp in 1858, seems at last to have become a practical process, if one is allowed to believe in the new patents of Von Vietinghoff and Bystron, and the salts of some metals like cerium have also been proposed for tanning purposes. As a mineral tanning agent sulphur must also be mentioned, which not only contributes to the characteristic properties of a two-bath chrome leather, but is also capable of producing a commercial leather when used alone. Besides these, we have formaldehyde and quinone, tanning agents of modern days, which both produce a leather which stands boiling with water, and which both cause the tanning effect, even if very small quantities of the tanning agents are used. That no weight can be expected under such circumstances is obvious, but the white colour of the formaldehyde leather, and the beautiful appearance of some formaldehyde-tanned flesh splits shows sufficiently what practical advantages can be expected by this method.

The most important of all is still the vegetable tannage, and it is here that we meet so many unsolved problems, and so little help rendered by science, that the strongly empirical character of this industry seems justified. The three problems yet unsolved are: the chemistry of hide, the chemical constitution of vegetable tannins, and the nature of the vegetable tanning process. As to the chemistry of hide, we are entitled to assume an amphoteric character of the collagen molecule, while the great surface energies of the fibre tissue must not be forgotten, when the possible reactions between hide and tanning agents are discussed. This problem, however, is the same for all kinds of tannages, and need therefore not be specially dealt with here. As to the next problem, the discovery of the chemical constitution of vegetable tannins, we are just on the threshold of a clear understanding of these complex questions, and it is only by the latest work of Emil Fischer, Karl Freudenberg, and their collaborators, that the problem has been solved for gallotannic acid, while the two other substances of understood constitution, viz., ellagic acid and catechin, can scarcely be called tannins, but rather products derived from them. The great bulk of those tannins which are of practical importance to the leather manufacturer are quite unknown to us, as far as their chemical constitution is concerned, and even the sharp analytical distinction between the two classes of tannins (catechol- and pyrogallol-tans) cannot chemically be explained in a satisfactory way. It is obvious, therefore, that questions of practical bearing like the relation between tanning effect and chemical constitution cannot be answered at all, and it would be of great value if some light were thrown on this darkness.

The practical tanner is well aware that every tanning agent has a characteristic effect of its own on hides and skins, and that the properties of the leather obtained differ widely with the use of different materials. The chemist has only a very few explanations for such differences: he accounts for the weight-giving effect of some pyrogallol tans by the ellagic acid (bloom) which is formed and deposited on and between the fibres, he attributes to the phlobaphenes the filling effect of some catechol tans (hemlock, untreated quebracho, etc.), and he may partially explain the characteristic action of gambier and myrobalans by the presence of catechin, and of chebulinic acid respectively. But these few arguments are quite insufficient to explain the experimental facts, and the differences between the action of chestnut- and oak-wood tans, or of quebracho and mimosa and of most other tannins, cannot be explained at all scientifically, nor have we even a vague idea of those constitutional reasons which are responsible for the different degrees of astringency. It is this lack of knowledge, and the great difficulties connected with this special branch of research, which cause the empirical character of vegetable tanning. We therefore have to wait until we have got this scientific knowledge before we can proceed in the understanding of the nature of the tanning process itself. This applies to both kinds of general theories of tanning, viz., the purely chemical theory and the adsorption theory. That any conception of tanning as a chemical process (salt formation or condensation process) must start from an exact idea of the chemical constitution of both components, is obvious. But even the adsorption theory necessitates such knowledge, because adsorption is only the first phase of the process, and secondary changes have to follow, which produce insoluble products (by anhydrisation, oxidation, and polymerisation, etc.), and which cannot be understood without insight into the constitution of the tannin molecule (while the chemistry of the hide is of no importance for this theory).

Considerable time will, however, elapse before the chemical constitution of vegetable tannins will be understood so well that our knowledge of the nature of the tanning process can take advantage of it. But the question arises, is there no other shorter way of studying the problem of the theory of tanning? The following scheme seems to suggest itself. If products can be synthesised which are similar to, if not identical with, vegetable tannin, and which produce a commercial leather, and if the constitution of such synthetic tannins is varied and modified in a controllable way, then the connection between constitution and tanning effect could be studied in a convincing way, and the question could soon be answered, how far the differences in the tannin molecule are responsible for differences in the quality of the leather produced.

Such synthetic tannins may prove to be of direct technical importance, if they can be produced at a reasonable price and if the leather is of sufficiently high quality.

It is such a solution of the problem which has been found lately by the author, by the production of "Syntans" (synthetic tannins), and one of the products is placed on the market by the Badische Company, Ltd., under the name of "Neradol D," the word "Neradol" being registered as a trade mark.

Syntans are condensation products, which can be produced either by heating phenols with formaldehyde in a slightly acid solution and rendering soluble the resinous products thus obtained by means of sulphuric acid; or they can be made by first sulphonating the phenols and then condensing them with formaldehyde under such conditions that only water soluble products are formed.

Though the nature of the condensation process is not exactly studied, it seems very probable that a diphenylmethane derivative is formed which by polymerisation leads to molecules of considerable size and consequently to the amorphous character of the product. The syntans resemble in appearance vegetable tanning extracts of bright colour; their analogy with natural tans is evident by the following behaviour: the aqueous solution of syntans is of a semi-colloidal character, it only passes slowly through semi-permeable membranes and gives a precipitate with gelatin. Iron salts produce a deep bluish violet colouration, and a 10 per cent. iron alum solution can be used for the control of the course of the Neradol D tannage, by staining the flesh cut of the half tanned hides. Lead acetate and aniline hydrochloride give also precipitation with these syntans.

The most important analogy with vegetable tannins, however, lies in the fact, that Neradol D is capable of converting hide into leather; this has been proved by a great number of experiments both on a small and on a commercial scale, and it seems that there are great possibilities for the application of this tanning agent, both alone and in combination with other materials.

If Neradol D is used alone a soft leather of entirely white colour is produced, and this white colour, together with considerable toughness of the fibre, form the most characteristic features of this artificial tannage. In using Neradol D alone, one naturally cannot expect to obtain such a variety of tanning effects as one achieves by the great number of different vegetable and mineral tanning agents, and it must be left to the future to find further artificial products by which a similar variety of tanning effects can be obtained as we do now with our present products and methods. There are, however, distinct advantages in using Neradol D in combination with both vegetable and mineral tannins. As regards the heavy leather tannage such a combination may consist in suspending the hides in syntan solutions for a few days and then continuing the vegetable tannage in the ordinary way. Advantages of such combinations are that the grain is tanned gently with syntans, and that such grain is much more resistant against subsequent damages during the tannage; that lime blasts (spots of calcium carbonate which darken in contact with tannin and air) are removed, and the danger of cracking is much diminished in the finished leather. A further advantage is, that the colour of the grain remains brighter throughout the following vegetable tannage, because the syntan tannage protects the grain from being darkly coloured. If such leather is exposed to light no reddish discolouration takes place as in the case of most vegetable tanned leather, and last, but not least, the speed of the vegetable tannage is considerably increased by such a preliminary treatment with Neradol D, while the weight obtained is at least as good as in the unshortened tannage.

Similar are the advantages in the vegetable tannages of upper and light leather, and special mention may be made of the retanning of East India kips, which after stripping (partial removing of the East Indian tannage) are treated with Neradol D, whereby a leather of very good quality is obtained.

Combinations of Neradol D with chrome tannages have the advantage of bleaching the green colour of the chrome tannage, and a very white grain can be produced by a treatment of chrome sole leather before and after impregnating with suitable fats.

It is not necessary to enumerate all the possible ways of using syntans alone or in combination with other tanning materials, and the practical tanner will soon find out his own methods of using the new material.

The experience gained up to now in various leather works justifies the statement that the problem of synthetic tannins has found both a theoretical and a practical solution, and it is to be hoped that the further study of this problem will help to solve the question of the nature of the tanning process itself.

Discussion.

Mr. B. Hill asked if any experiments had been made to test the breaking stress in the heavier leathers tanned, and also if combination tannages had been tried.

Prof. A. G. Green asked if the new material used was in the form of the sodium salt or of the free acid, and also if the tanning process was carried out in acid or neutral solutions. He believed the substance tanned because it was really a "colourless dyestuff," and all dyestuffs were really tanning agents if used in large quantities. In the production of the substance phenolic sulphonic acids were coupled, and it was the hydroxyl groups which brought about combination with the leather. Acid dyestuffs must have free acid in order to react. Had the substance any affinity for or could it be used for mordanting cotton, and did it precipitate basic dyestuffs? Had Dr. Stiasny tried direct sulphonation of the dioxydiphenylmethane?

In his opinion the resinous substance obtained was a more advanced condensation product. He did not think the formation of the substance was so simple as Dr. Stiasny suggested. It was more probable that polymerisation did not take place at all, but that higher condensation products were formed. He thought *o*-hydroxybenzyl alcohols were first produced, and that these then condensed with another molecule, and afterwards the process was repeated. The proposed methane compound seemed too simple and a compound of such constitution would probably only have weak tanning properties.

Prof. H. R. **Procter** thought this was one of the most important discoveries ever made in the chemistry of tanning. It might be of far-reaching importance, not only scientifically, but also commercially. It was possible that it might compete with sumach, but a still more striking possibility was its use in modifying natural tans. Sulphite cellulose or wood pulp liquors were waste products for which chemists had long been anxious to find a use. Used in combination with syntan they gave leather of satisfactory commercial value and excellent appearance. It was difficult to say what the full commercial importance of the discovery might be. It might cause the leather trade to change to different localities. He pointed out the importance of theory to the practical side of leather manufacture. Progress was due to the gradual development of theoretical considerations. This discovery might throw an important light on the theory of the tanning process. Dealing with the extent to which chemical reactions and physical reactions took part in this process, he was in a position to prove that the action of the acids and salts in these reactions were purely chemical and absolutely subject to the same laws as any other ionic reactions.

Prof. J. W. **Cobb** referred to the action of certain substances in increasing the plasticity of clays. This was noticeable in the difference between secondary clays rich in organic matter which were plastic, and pure primary clays (kaolins) which lacked the property of plasticity. Had the power of the syntan in increasing plasticity been subjected to trial as it might be of industrial importance ?

Mr. L. A. **Ingle** asked to what extent leather produced with syntan would resist water. It seemed to him that as both tans and non-tans are necessary to make commercial leather, that the synthesis of the latter was a future problem.

Prof. **Stiasny**, in reply, said that the breaking strain of leathers tanned with syntans was found to be superior to that of leathers tanned with vegetable tannins, the toughness of the fibre being one of the valuable features of this new tannage. It was the free sulphonic acid which had the specific tanning effect, and by neutralising one diminished gradually the astringency and the tanning capacity of a syntan solution. In that respect syntans behaved analogously to vegetable tannins, but syntan leathers were more sensitive to alkalies than were vegetable tanned leathers. He agreed with Prof. Green that Neradol D was in some respects similar to colourless dyestuffs, and that many tar dyestuffs possessed some tanning capacity, although the leather produced by such materials was rather poor and not of a commercial quality. As regards the formula suggested by Prof. Green for Neradol D, he thought that the formation of phenol-alcohols was only proved when working in alkaline solutions. The ratio of formaldehyde to phenol as taken for the production of syntans is distinctly in favour of the author's conception of the condensation process, while Prof. Green's view would demand a very different ratio. The free acids of syntans gave a precipitate with basic aniline dyes, but they seemed to have no affinity for cotton. The suggestion of Prof. Cobb *re* plasticity of clay seemed to be a very valuable one, and experiments would be carried out in this direction.

Prof. **Green** asked if syntans had been tried in indigo vats in order to cause the artifical indigo blue to develop in a suitable colloidal form.

Prof. **Stiasny** said that he had not tried syntans in this direction.

Communications.

AN EXTENSION OF VIETH'S TABLE FOR CORRECTING THE SPECIFIC GRAVITIES OF MILK.

BY C. HAROLD WRIGHT, B.A. (CANTAB.), F.I.C.,

Government Laboratory, Port of Spain, Trinidad.

Vieth's table for finding the specific gravity of a milk at 60° F. from the specific gravity at some other temperature is largely used when calculating the total solids of a milk from the percentage of fat and the specific gravity. It has, however, the great disadvantage that the temperatures only extend from 40 to 75° F.; it is thus useless in a climate like that of Trinidad, where the temperature during the day is between 75 and 88° F., and milks brought in for analysis are at a temperature between these limits.

To make Vieth's table of use to analysts in the tropics I have extended it by extrapolation. The numbers in each horizontal column of Vieth's table (as given in Wynter Blyth's "Foods," 5th Edition, 1903, p. 216) were plotted on the same sheet of squared paper with degrees of lactometer as ordinates and temperatures as abscissae; in each case a smooth curve was drawn through the maximum number of points, and continued as far as 89° F. It will be noticed in Vieth's table that the difference between successive numbers in each horizontal column increase with rise in temperature; hence the curves get steeper as the temperature increases. Again, in each vertical column the differences between successive numbers increase as the degrees of lactometer increase; hence the curves when plotted on the same sheet of paper are further apart as the specific gravity increases. By reading the points where the curves intersect the ordinates at each degree from 76 to 89° F. the figures in Table I. were obtained. As the temperatures of milks in many laboratories are taken with a centigrade thermometer I give in Table II. the corresponding figures for finding the specific gravity of a milk at 15·6° C. (=60° F.) from the specific gravity determined at a temperature between 24 and 31° C.; they were obtained by converting these temperatures into their equivalents on the Fahrenheit scale, and then drawing perpendiculars at the temperatures so found, and reading the points at which these perpendiculars intersect the curves. This table is used in the same way as Vieth's; if, for example, the specific gravity of a milk is 1·028 at 28° C., its specific gravity at 15·6° C. is 1·0311.

Table II. has been tested in the case of 36 milks by comparing the total solids obtained by weighing with the total solids calculated from Hehner and Richmond's formula—

$$\text{T.S.} = 0{\cdot}25\,G + 1{\cdot}2\,F + 0{\cdot}14.$$

In each case the total solids were determined by evaporating 5 grms. of milk to dryness in a platinum dish; the fat was determined by the Leffmann-Beam method and the specific gravity with a lactometer. The milks were not in any way selected—they were the last 36 milks in which I determined the total solids, fat, and specific gravity as explained above. They were a very varied collection; some were known to be genuine; others were obviously watered; the percentage of fat varied from 5·2 to 1·95 per cent.; the observed specific gravity ranged from 1·032 to 1·019 and the temperatures at which these were taken varied from 26° to 29° C. In 21 cases the calculated total solids are greater than the total solids found by weighing, the mean difference being 0·22; in 15 cases the calculated total solids are less than the total solids found by weighing, the average difference beng 0·18. Hence the total solids calculated from the formula differ from the total solids found by weighing on the average by ±0·2.

This is the error one would expect. According to S. H. Collins (*Proceedings of the Univ. of Durham Philosophical Society*, 1909–10, 3, [4] 191) the probable error of a single determination of fat by the Gerber method is ± 0·036; the probable error of a single determination of specific gravity using a lactometer in which $1^\circ = 1$ mm. is ± 2 degrees, and using a lactometer in which $1^\circ = 3$ mms. it is ± 0·55 degree.

In calculating from the formula

$$\text{T.S.} = 0{\cdot}25\,G + 1{\cdot}2\,F + 0{\cdot}14$$

(error of T.S.)^2 = (error of 0·25 G)^2 + (error of 1·2 F)^2.

Therefore using a lactometer in which $1^\circ = 1$ mm. and determining fat by the Gerber process the error of T.S. =

$$\pm\sqrt{(0{\cdot}25 \times 2)^2 + (1{\cdot}2 \times 0{\cdot}036)^2} = \pm\,0{\cdot}5$$

Similarly, using a lactometer in which $1^\circ = 3$ mm. the error of T.S. =

$$\pm\sqrt{(0{\cdot}2 \times 0{\cdot}55)^2 + (1{\cdot}2 \times 0{\cdot}036)^2} = \pm\,0{\cdot}14$$

Assuming that the error of the Leffmann-Beam process is the same as that of the Gerber process, the above results show that the differences between the calculated total solids and those found by weighing—on the average ± 0·2—are not due to defects in Table II., but are the results of experimental error in finding the specific gravity of milk, and to a less extent in determining the fat.

TABLE I.

Degrees of Lactometer.	Temperature in degrees Fahrenheit.													
	76	77	78	79	80	81	82	83	84	85	86	87	88	89
20	21·8	21·9	22·0	22·2	22·3	22·4	22·6	22·7	22·8	23·0	23·1	23·2	23·4	23·5
21	22·8	23·0	23·1	23·2	23·4	23·5	23·6	23·8	24·0	24·1	24·2	24·4	24·5	24·7
22	23·8	23·9	24·1	24·2	24·4	24·5	24·6	24·8	25·0	25·1	25·2	25·4	25·5	25·7
23	24·8	24·9	25·1	25·2	25·3	25·5	25·6	25·8	25·9	26·1	26·2	26·4	26·5	26·7
24	25·8	26·0	26·1	26·2	26·4	26·5	26·7	26·8	27·0	27·2	27·3	27·4	27·6	27·8
25	26·9	27·0	27·2	27·3	27·4	27·6	27·7	27·9	28·0	28·2	28·3	28·5	28·6	28·8
26	27·9	28·1	28·2	28·4	28·5	28·7	28·8	29·0	29·2	29·3	29·5	29·6	29·8	30·0
27	29·0	29·2	29·3	29·4	29·6	29·8	29·9	30·1	30·2	30·4	30·5	30·7	30·9	31·1
28	30·1	30·2	30·4	30·5	30·7	30·8	31·0	31·2	31·4	31·5	31·7	31·8	32·0	32·2
29	31·1	31·3	31·4	31·6	31·8	31·9	32·1	32·3	32·4	32·6	32·8	32·9	33·1	33·3
30	32·2	32·4	32·5	32·7	32·9	33·0	33·2	33·4	33·6	33·7	33·9	34·1	34·2	34·4
31	33·3	33·4	33·6	33·7	33·9	34·1	34·3	34·5	34·7	34·8	35·0	35·2	35·4	35·6
32	34·4	34·6	34·8	35·0	35·1	35·3	35·5	35·7	35·8	36·0	36·2	36·4	36·6	36·8

TABLE II.

Degrees of Lactometer.	Temperature in degrees Centigrade.							
	24	25	26	27	28	29	30	31
20	21·7	21·9	22·1	22·4	22·6	22·8	23·1	23·3
21	22·7	23·0	23·2	23·4	23·7	24·0	24·2	24·5
22	23·7	23·9	24·2	24·4	24·7	25·0	25·2	25·5
23	24·7	24·9	25·2	25·4	25·7	26·0	26·2	26·5
24	25·7	26·0	26·2	26·5	26·8	27·0	27·3	27·6
25	26·8	27·0	27·3	27·5	27·8	28·1	28·3	28·6
26	27·8	28·1	28·4	28·6	28·9	29·2	29·5	29·8
27	28·9	29·2	29·4	29·7	30·0	30·3	30·5	30·8
28	30·0	30·2	30·5	30·8	31·1	31·4	31·7	32·0
29	31·0	31·3	31·6	31·9	32·2	32·5	32·8	33·1
30	32·1	32·4	32·7	33·0	33·3	33·6	33·9	34·2
31	33·1	33·4	33·7	34·0	34·4	34·7	35·0	35·4
32	34·3	34·6	34·9	35·2	35·6	35·9	36·2	36·6

COMPOSITION OF THE FRUIT AND SEEDS OF *ADANSONIA DIGITATA*.

BY R. G. PELLY, F.I.C.,

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The baobab tree (*Adansonia digitata*, Linn., N.O. Malvaceæ) is a large tree common in many parts of Africa and also growing in India and other tropical countries. The seeds of *Adansonia madagascariensis* and *A. Grandidieri* have been found to contain respectively about 34 and 42 per cent. of oil (*see* Lewkowitsch, "Chemistry and Technology of Oils, Fats and Waxes" (4th ed.) ii., 424), and supplies of seeds from Madagascar have appeared on the oil-seed market in Marseilles (Der Pflanzer, 1909, 5, 140). The fruit pulp of species of *Adansonia* has been stated to contain tartaric acid and tartrates, and it was considered advisable therefore to investigate fruits and seeds of the baobab tree forwarded from British East Africa to the Imperial Institute, in order to ascertain whether these were likely to be of any commercial value.

The fruits consisted of a hard, brittle woody shell, about 11 inches in length and 4 inches in diameter, and bluntly pointed at the ends; each fruit weighed about 1 lb. The interior was divided into nine compartments by fibrous septa; each compartment contained a mass of dry, buff-coloured, friable pulp surrounding and adhering to the numerous small kidney-shaped seeds.

The fruits were composed of: outer shell, 41—48 per cent.; pulp, 14—17 per cent.; seeds, 36—42.

The outer woody shell yielded 2·4 per cent. of ash containing: silica, 2·8 per cent.; potash, 47·0 per cent.; soda, 1·5 per cent.; phosphoric acid, 0·3 per cent.

The seeds were composed of a very tough husk enclosing a soft oily kernel, devoid of starch. They were examined with the following results:—*

	Per cent.
Moisture....................................	12·1
Ash	3·5
Oil	11·6
Protein (Total N x 6·25)	11·2
Fibre	22·5
Carbohydrates (by difference)	39·1

The ash of the kernels contained: potash, 31·0 per cent.; soda, 7·2 per cent.; phosphoric acid, 34·2 per cent.

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* Owing to the tough nature of the husk it was extremely difficult to grind the seeds and mix the material thoroughly; the analytical results are therefore only approximately accurate.

The oil as extracted by light petroleum gave the following results to which are added for purposes of comparison the results of examination of oil from seeds of *A. digitata* and fat from seeds of *A. Grandidieri* as quoted by Lewkowitsch (*loc. cit.*, ii., 424).

	Oil from Baobab seeds from East Africa.	Oil from seeds of *Adansonia digitata.*	Fat from seeds of *Adansonia Grandidieri.*
Specific gravity at 15/15° C.	0·920	0·915	0·918
Saponification value	193·5	190·5— 191·7	189·9— 190·9
Iodine value	82*	76·7— 77·8	53·9— 56·8

* Hübl 17 hrs.

From the above figures it is obvious that the seeds contain too small an amount of oil to render them of commercial value as a source of oil.

The seeds are free from alkaloids and cyanogenetic glucosides, but the husks are so tough that the seeds would require boiling to soften them before they could be employed as cattle food. The seeds, or the ash from them, which is rich in potash and phosphates, could be used as manure.

Fruit pulp. Specimens of the fruit pulp of species of *Adansonia* have been investigated previously. Slocum (Pharm. J. 1879—80, 10, series 3, 816) stated that the pulp of *A.* sp. (probably *A. digitata*) contained pectin, glucose, malic acid, and acid potassium malate, etc.; Heckel and Schlagdenhauffen (Pharm. J., 1888—89, **19**, series 3, 246) recorded the presence of tartaric acid (2 per cent.) and potassium hydrogen tartrate (12 per cent.)., etc.; Millard (Pharm. J., 1889—90, 20, series 3, 829) stated that traces of tartaric acid and 10 per cent. of potassium hydrogen malate were present in the pulp of a species of *Adansonia*, probably *A. madagascariensis.* In these investigations no attempt appears to have been made to isolate the acids in a state of purity sufficient for certain identification, while the species of *Adansonia* investigated is in most cases uncertain.

In the present investigation specimens of pulp taken from different fruits yielded the following results:—

	Per cent.
Moisture..............................	15—16
Ash	4·76—6·10
Matter soluble in alcohol	16·7—18·7

The ash consisted largely of alkaline carbonates and contained:—Silica, 4·74 per cent.; lime, 8·88 per cent.; potash, 48·90 per cent.; soda, 4·20 per cent.; phosphoric acid, 1·08 per cent.

The greater part of the pulp was soluble in water yielding a mucilaginous liquid and an insoluble residue of cellular tissue. The aqueous extract possessed an acid taste and reaction. The extracts of pulp from different fruits required from 40·6 to 46·7 c.c. of $N/2$ KOH per 10 grms. of pulp, for neutralisation in presence of phenolphthalein. The pulp consisted largely of pectuso matter, and considerable difficulty was experienced in separating the acids from this matter; attempts to separate the acids by precipitating the pectous matter with alcohol, as recommended by previous investigators, did not give satisfactory results. The following methods were adopted after numerous trials.

Isolation of free acid. The air-dry pulp on extraction with hot alcohol (95 per cent. by volume) yielded an acid extract. When this was evaporated to dryness and the residue treated with warm water, a brown resinous, insoluble residue remained, amounting to about 1·8 per cent. in the air-dry pulp. The aqueous extract was strongly acid, and on titration with standard alkali and phenolphthalein the extract from 10 grms. of different samples of the pulp required from 9·5 to 12·7 c.c. of $N/2$ KOH. Excess of lead acetate was added and the acids recovered from the precipitate by means of hydrogen sulphide. In this way a crystalline residue was obtained, which was found to consist principally of citric acid. The latter was identified by means of the calcium salt and by the preparation of the methyl ester, m.pt. 77° C. No indications of the presence of tartaric acid were obtained, but small amounts of malic acid may be present. From the acidity of the alcoholic extract not more than 4·4 per cent. of citric acid ($C_6H_8O_7,H_2O$), can be present in the pulp. The large amount of pectous matter would render commercial extraction of the citric acid unremunerative.

Acids soluble in alcohol. The pulp after removal of free acids by alcohol was still acid. It was extracted with water, the aqueous liquid neutralised and an excess of lead acetate added. In this way the acids and pectous matter were precipitated together as lead compounds. The latter were collected, washed, suspended in alcohol, and treated with hydrogen sulphide; no acids soluble in alcohol were obtained, and therefore such acids as tartaric, malic, or citric acids cannot be present as acid salts in the fruit pulp. Parallel experiments in which these acids were added proved that they could be recovered by this process. The acidity must consequently be due to some substance insoluble in alcohol. The lead precipitate was therefore suspended in water, containing sodium chloride or hydrochloric acid to prevent the formation of colloidal lead sulphide, and treated with hydrogen sulphide.* The resulting lead sulphide was filtered off and on pouring the filtrate into alcohol the acid was obtained as a flocculent, gelatinous precipitate. This yielded furfuraldehyde on distillation with hydrochloric acid, and mucic acid, m.pt. 216° uncorr. on oxidation with nitric acid; it is consequently an acid of the pectic type, but owing to lack of material it is at present impossible to study it further.

The acidity of the pulp is due therefore to (1) free citric acid with possibly a small amount of malic acid, (2) an acid or acids of the pectic type, possibly present as acid potassium salts. It appears that the presence of considerable quantities of acids of the pectic type in plant products is a point that may be overlooked in the examination of such products.

An aqueous extract of the pulp is used to some extent in East Africa for coagulating Ceara rubber latex; it seems unlikely that it can be of use for any other purpose.

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* The addition of hydrochloric acid or sodium chloride was necessary as the lead precipitate suspended in water alone gave on treatment with hydrogen sulphide a thick black liquid which resisted all attempts at filtration.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Drying machine; Rotary ——. A. S. Quick, London. Eng. Pat. 10,789, Nov. 7, 1912.

A horizontal cylinder provided with lifting shelves and open at both ends is mounted upon rollers supported on a frame and rotated by suitable gearing. Within the cylinder an annular series of heating pipes is arranged, fixed at each end to a ring-shaped steam-chest. The heating pipes are fixed and the cylinder is rotated around them. The whole apparatus is mounted on a frame, so that it can be tilted, and the material to be dried, which is fed into one end of the cylinder, is lifted by the shelves and dropped between the heating pipes. Brushes

are fixed on the inside of the cylinder, which as they rotate serve to keep the heating pipes free from deposit.
—W. H. C.

Drying; Process of —— with circulation of hot air. F Haas Ges. m. b. H. Fr. Pat. 453,278, Jan. 17, 1913. Under Int. Conv., Jan. 18, 1912.

The invention relates to drying processes in which the drying is effected in two stages by a current of hot air. The air leaving the final drying chamber, and charged with dust of the material being dried, is forced by a fan through the moist material in a feed-chamber discharging into the preliminary drying chamber. If the material being dried produces little or no dust, some of the dried material is introduced mechanically into the air current before this comes in contact with the moist material. This preliminary drying of the moist material by dust-laden air prevents it from adhering to the heating surfaces when it enters the drying apparatus.—A. S.

Drying and mixing heterogeneous materials; Machine for ——. U. Ammann. Fr. Pat. 453,614, Jan. 27, 1913. Under Int. Conv., Jan. 29, 1912.

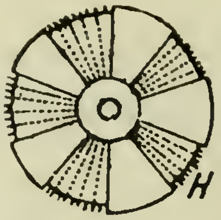
The material to be dried may be of fine or large grain while the substance to be mixed with it, after drying, may be the same or may be in a liquid or semi-liquid state. The material to be dried is fed into a revolving cylindrical dryer through which it travels and in which it comes into contact with the heating gases passing in a contrary direction. The wet material first passes through a hopper on to an oscillating table-conveyor below, whence it falls into the buckets of a chain conveyor which raise it to the cylindrical dryer by way of a charging hopper furnished with a trap valve which closes after each charge, thus avoiding as far as possible the escape of dust. The interior of the cylindrical dryer contains a cylindrical basket which revolves with it and occupies approximately its whole length. The basket is formed of a number of ribs carried by rings; the material, falling from battens attached to the dryer on to this basket, becomes spread about and broken up. The far extremity of the dryer has a central opening for the exit of the material and openings for the entrance of the heating gases, and projecting into the interior of the heating apparatus where it is joined to the end of a cylinder which traverses the heating apparatus and serves to transport the dried material to a mixer. The latter consists of a rotating cylinder furnished inside with means to lift the material. The apparatus may be used for the preparation of tar-macadam.—W. G. W.

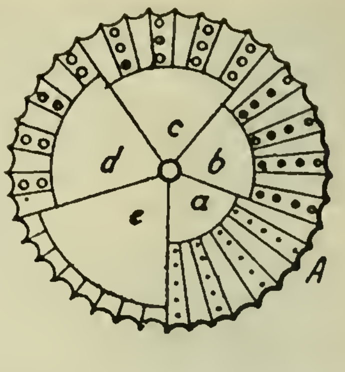
Absorber or separator for gase or vapours. J. Smith, H. L. Mitchell, and W. H. Askham, Ravensthorpe, and H. Hey, Dewsbury. Eng. Pat. 14,652, June 22, 1912.

The absorber is packed with corrugated plates so arranged that the depression in one plate enters some way into the depression immediately below, so as to form a liquid seal. The absorbing or washing liquid enters the chamber at the top and passes downwards over the plates. The gas passes upwards, the plates being either perforated alternately at the highest and lowest parts of the corrugations, or being attached at alternate ends to the outer casing and a rotating central shaft.—W. H. C.

Absorbing gases by liquids; Apparatus for ——. J. A. Dejeanne. Fr. Pat. 453,793, Jan. 30, 1913.

The apparatus consists of a vertical cylinder having conical ends. The cylindrical part is provided with a number of superposed conical discs of the form shown at A, and the upper conical part with inverted conical discs of the form shown at H. The gas enters by a pipe passing down the axis of the apparatus to a point below the lowest disc and is discharged from the top of the upper cone. The washing liquid enters at the top and is discharged from the apex of the lower cone. The conical discs, A, have scolloped edges and are divided into five sectors, *a*, *b*, *c*, *d*, *e*, which are perforated as shown. The upper discs, H, are divided into sectors, which are alternately perforated and plain.—W. H. C.



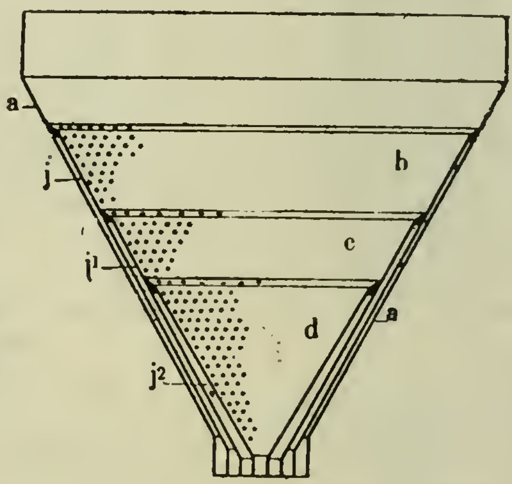


Absorption machine. E. Altenkirch and B. Tenckhoff. Fr. Pat. 453,183, Aug. 10, 1912. Under Int. Conv., Aug. 11, 1911.

A system of evaporators and absorbers are so arranged that the greater part of the heat is utilised by means of counter-current heat-exchangers.—W. H. C.

Filtering apparatus. A. C. Fioroni, Paris. Eng. Pat. 14,764, June 24, 1912.

Filter paper is placed in a number of concentric perforated funnels, *a*, *b*, *c*, *d*. As all parts of the filter have separate run-off channels, j, j^1, j^2, the whole of the surface of the paper is utilised for filtration.—W. H. C.



Impregnation of porous materials by liquid products to render them fireproof or impermeable, or to dye or tan them; Process of compression for the ——. A. B. Brunel. Fr. Pat. 453,730, Jan. 29, 1913.

The materials are placed in a strong closed vessel which is completely filled with the treating liquid. Any desired pressure is obtained by means of a ram. The vessel, which may be of any convenient shape, is provided with a cylindrical branch into which the ram is forced by a screw.
—W. H. C.

Gases; Apparatus for the chemical transformation of —— by multiple contact action at regulatable temperatures. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1994, Jan. 24, 1913. Under Int. Conv., Feb. 13, 1912.

See Fr. Pat. 453,470 of 1913; this J., 1913, 741.—T. F. B.

Gases; Producer of inert ——. H. von Eicken, Freidenau, Germany. U.S. Pat. 1,066,391, July 1, 1913.

See Fr. Pat. 432,912 of 1911; this J., 1912, 117.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Producer-gas power plant in the United States; The commercial trend of the ——. R. H. Fernald. Dept. of the Interior, Bureau of Mines, U.S.A. Bull. 55, 1913. 92 pages.

This report, including extensive tables, comprises sections on: opinions of manufacturers of producer-gas plants; present status of producer-gas plant; views of owners and operators; number and distribution of producer-gas plants in the United States; blast-furnace and coke-oven gas-power plants. It is stated that in the United States gas-engines with an aggregate rating of about 200,000 horse-power derive their power from producer gas, and engines with an aggregate rating of 350,000 horse-power or more derive their power from blast-furnace and coke-oven gas. Accompanying the report are, a map showing the geographical distribution of producer-gas plants in the United States and a list of publications on fuel technology issued by the U.S. Bureau of Mines.—A. S.

Petroleum oil; Nitro-derivatives of fractions of high boiling point of ——. K. Charitschkoff. Chem.-Zeit., 1913, 37, 869.

Machine oils, spindle oils, etc., can be readily nitrated by warm nitric acid (sp. gr. 1·50), yielding syrupy nitro-derivatives readily soluble in ether, alcohol and benzene, but sparingly in petroleum spirit. By fractional precipitation with water from alcoholic solution different fractions can be separated. One of these solidified at 52° to 54° C. and had a sp. gr. of 1·103 at 20° C. and the following mean composition:—C 60·43, H 7·13, N 6·66, and O 25·78 per cent. Mol. weight, 290—300. These nitro-derivatives are soluble in ammonia, sodium carbonate and caustic alkali solutions. They have a slight acid reaction and with heavy metals and metals of the alkaline earths form insoluble salts, which are insoluble in ammonia solution and are closely related to the nitro-compounds obtained by nitrating polynaphthenic acids and used in the preparation of dyestuffs. (See Eng. Pat. 9416 of 1902, this J. 1905, 621; also this J., 1912, 577.)—C. A. M.

Acid "asphaltum" obtained in the refining of petroleum oil. F. C. Thiele. Chem.-Zeit., 1913, 37, 841—842.

In refining crude Oklahoma petroleum oil with sulphuric acid, from 13 to 16 per cent. of "asphaltum" is obtained, consisting on the average of 66·5 per cent. of tar products and 33·5 per cent. of free sulphuric acid. The latter is removed by washing with cold water, and the residue is treated with sodium carbonate, washed with hot water until neutral and dried at 100° C. It is a black solid mass closely resembling the better qualities of asphaltum. On distillation a sample yielded 50 per cent. of oil with b. pt. 105°—302° C., and sp. gr. at 15°/15° C., 0·865, and 50 per cent. of hard bitumen melting at 149° C. The oil when chilled to 0° C. yielded about 3 per cent. of paraffin wax (m. pt. 51° C.). It reduced permanganate and ammoniacal silver nitrate solutions, and on treatment with mercuric chloride and hydrochloric acid gave a resinous deposit (about 5 per cent.). This resinous substance was insoluble in petroleum spirit, but dissolved in chloroform, benzene, carbon bisulphide, etc. The bitumen consisted of 6·3 per cent. of light yellow resin (soluble in hot acetic anhydride), 63 per cent. of yellow resin (soluble in cold acetic anhydride), 4·5 per cent. of dark brown resin (soluble in cold benzene), and 26·2 per cent. of undetermined substances.—C. A. M.

Influence of nitrous compounds in the sulphuric acid on the colour of ammonium sulphate from gas-liquor. Ceruti. *See* VII.

Patents.

Coke-oven; Regenerative ——. E. Coppée. Fr. Pat. 452,845, Jan. 3, 1913. Under Int. Conv., Feb. 13, 1912.

A tapered flue is arranged beneath the sole of the oven on each side of the centre line, and is so proportioned that the suction on each of the vertical flues acting as down-draught flues, is the same. Dampers are provided in the tapered flue to admit of readjustment of draught. —W. H. C.

Gas-producers; Method of regulating generation in —— and apparatus therefor. L. C. Chowning, Assignor to A. B. and A. A. Houghton, Corning, N.Y. U.S. Pat. 1,066,252, July 1, 1913.

A mixture of air and steam is supplied to the producer by a steam-actuated injector. The supply of steam is regulated by a valve actuated by a diaphragm, one side of which is exposed to the pressure in the main through which the gas from the producer passes. The diaphragm and the gas main are connected by a pipe into which clean air is forced, so that only clean air acts on the diaphragm. —W. H. C.

Power and heating gas; Process and apparatus for the production of —— with discharge of ash as molten slag. E. Servais. Fr. Pat. 453,409, Jan. 21, 1913.

In order to avoid the trouble due to partial solidification of the fused slag, or premature fusion, the producer is provided with two sets of tuyères. One set is arranged just above the fire zone and is supplied with steam or gas, which by its decomposition reduces the temperature. A second set of tuyères is arranged just below, through which the air blast is forced into the producer. The jets of this second set of tuyères are set in an eccentric ring, in order that a whirling movement may be given to the air. This agitates the molten slag in the crucible of the producer, and rapidly melts down any solid lumps. A combustion chamber is formed beneath the crucible, in which a mixture of gas and air is burned to help maintain the temperature of the crucible above the fusing point of the slag. In order to obtain an easily fusible slag the fuel is sprayed with lime water or mixed with a suitable amount of blast-furnace slag containing an excess of lime.—W. H. C.

Liquefied lighting gas; Process and plant for the manufacture of —— freed from poisonous compounds and of high value and capable of transport. A. V. Lipinski. Fr. Pat. 453,370, Jan. 15, 1913. Under Int. Conv., Jan. 17, 1912.

Coal gas is first purified, then compressed to get rid of the last traces of naphthalene, and the carbon dioxide and hydrogen sulphide are absorbed by water and calcium hydroxide. The gas is then liquefied and the carbon monoxide and hydrogen remaining are converted into methane and paraffins by the Sabatier and Senderens reaction. The gas is then again liquefied. Liquefied coal gas is used as the refrigerating agent.—W. H. C.

Mineral oil and other hydrocarbons; Conversion of —— into products of lower boiling point. H. Zerning. Fr. Pat. 452,919, Jan. 6, 1913 (under Int. Conv., Dec. 13, 1912), and First Addition thereto, dated Jan. 14, 1913 (under Int. Conv., Jan. 6, 1913).

(1). The mineral oil is saturated with natural gas or with gases and vapours obtained by treating petroleum or other hydrocarbons at a high temperature in the presence of suitable catalytic agents. The catalytic agent preferred is water, which is injected, together with the hydrocarbon into tubes heated to 300°—400° C. The oils after treatment may be distilled and the heavier residues re-treated with gas. (2). Gases obtained from organic substances, for example by destructive distillation, may be used in the place of natural gas; and instead of petroleum or other hydrocarbons, mixtures of oils and fats with hydrocarbons or alcohols or mixtures of hydrocarbons and alcohols may be used.—W. H. C.

Bitumen ; Process for working-up brown-coal ——. Montanwachsfabrik Ges. m. b. H. Ger. Pat. 260,697, March 29, 1911.

The crude bitumen is freed from its resinous constituents in the usual manner, and is then distilled in a vacuum, by aid of superheated steam, at a temperature of 200°—500° C. In this way, from each 100 kilos. of crude bitumen are obtained about 65—75 kilos. of distillate, which by further refining furnishes a white, tasteless, odourless wax of m. pt. 80°—85° C., and also 5—10 kilos. of pitch. The resinous portion also furnishes 13 to 25 kilos. of resin and 2—7 kilos. of soft residue containing paraffin, which may be further worked up.—T. F. B.

Oils for lubricating and for protecting metals ; Process for preparing electrically conductive ——. L. Ubbelohde. Ger. Pat. 261,070, March 16, 1913.

The alkaline earth or heavy metal salts of the naphthenic acids are dissolved in heavy mineral oils. The calcium salts, for example, furnish products which may be used as lubricants or as rustproof coatings for metals, whilst the copper salts may be used in electrical work where oils which conduct electricity are required.—T. F. B.

Gas producers. R. V. Farnham, Skelmorlie. Eng. Pat. 19,635, Aug. 28, 1912.

See Fr. Pat. 448,454 of 1912 ; this J., 1913, 413.—T. F. B.

Hydrocarbons ; Process for the purification of liquid ——. Richter und Richter, Frankfort, Germany. Eng. Pat. 18,527, Aug. 12, 1912. Under Int. Conv., Dec. 5, 1911. Addition to Eng. Pat. 23,467, May 12, 1910.

See Addition of Aug. 10, 1912, to Fr. Pat. 421,277 of 1910 ; this J., 1913, 224.—T. F. B.

Process of obtaining purified ammonia from coal gas. U.S. Pat. 1,065,566. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Pyroligneous acid, crude and rectified. Frerichs. *See* VII.

Patents.

Heating by gaseous combustion and the like. W. A. Bone, Leeds, and C. D. McCourt, London. Eng. Pat. 6732, March 19, 1912.

The gaseous fuel and the supporter of combustion, or both, are preheated either before or after mixing, by being passed through a pipe embedded in the refractory material (see Eng. Pats. 25,808 and 29,430 of 1909 ; this J., 1910, 1448).
—W. H. C.

Heating process and apparatus. G. T. Voorhees, Boston, Mass. U.S. Pat. 1,066,348, July 1, 1913.

Waste steam is compressed by high-pressure steam so that its liquefying point is above the temperature of a liquid (ammonia solution) to be vapourised. The compressed waste steam and the liquid to be evaporated are brought into contact in a suitable heat-exchanging apparatus, so that the former is liquefied and the latter evaporated.
—W. H. C.

Sodium flame with oil lamps or gas burners ; Producing a lasting ——. L. Ladewig, Berlin. Eng. Pat. 3474, Feb. 11, 1913. Under Int. Conv., Feb. 26, 1912.

A porous cone formed of a mixture of sodium oxalate and/or bicarbonate with asbestos, clay and a little potassium carbonate is placed within the flame of the oil lamp or gas jet and causes the latter to give a yellow light capable of penetrating fog.—W. H. C.

Incandescence gas mantles ; Preparation of —— *from artificial threads.* W. Bertelsmann. Ger. Pat. 260,993, April 19, 1911.

The woven fabric impregnated with the nitrates of the luminescent earths and without having been subjected to any after-treatment, is burnt off by a flame, and then shaped and hardened in the usual way.—A. S.

Carbon ; Active —— *and process of making the same.* F. Richter, Frankfort on Maine, Germany. U.S. Pat. 1,066,322, July 1, 1913.

See Fr. Pat. 428,540 of 1911 ; this J., 1911, 1183.—T. F. B.

Production of a boron-tungsten compound [for incandescence filaments]. Eng. Pat. 3525. *See* VII.

III.—TAR AND TAR PRODUCTS.

Patents.

Tar and other fluids ; Apparatus for heating ——. W. und J. Scheid. Ger. Pat. 261,422, Nov. 17, 1912.

The tar or other liquid to be heated is contained in an upright cylindrical vessel, through the lower part of which pass a number of horizontal steam pipes. The vessel is only partially surrounded by the heating jacket, but the upper, exposed part is heated by vertical tubes which are fed by a horizontal steam pipe within the jacket. The tar is introduced into the lower part of the heating vessel, and the hot tar is drawn off from a higher point.—T. F. B.

β-Bromo-aminoanthraquinones in which a bromine atom is adjacent to an amino group ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pats. 261,270 and 261,271, Aug. 29, 1911.

(1.) When a bromo-α- or -β-aminoanthraquinone, in which an amino group is in the same benzenoid nucleus as at least two bromine atoms, is heated with an unbrominated aminoanthraquinone, the bromine in the α-position passes into the other anthraquinone nucleus, and takes up a position *ortho* to the amino-group. Thus, a mixture of 1 mol. of 1·3-dibromo-2-aminoanthraquinone and 1 mol. of 2-aminoanthraquinone furnishes pure 3-bromo-2-aminoanthraquinone. (2.) A β-aminoanthraquinone is treated with one mol. of bromine for each amino group, preferably in presence of a solvent or diluent, first at the ordinary or slightly higher temperature, and finally at a high temperature. The bromine always enters a β-position adjacent to an amino group.—T. F. B.

Benzoic acid from toluene ; Process for preparing ——. Chem. Fabr. Buckau. Ger. Pat. 261,775, Nov. 18, 1911.

When toluene is heated with chromic acid mixture under a reflux condenser, only traces of benzoic acid are produced, nearly all the toluene being oxidised to carbon dioxide. It is now found that yields of benzoic acid amounting to 70 to 90 per cent. of the toluene used, can be obtained by treating toluene in the form of vapour with a chromic acid-sulphuric acid mixture ; the reaction may be effected in presence of liquid toluene.—T. F. B.

Nitro-amino derivatives of the anthraquinone series ; Process of making ——. A. Zitscher and E. J. Rath, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 1,066,777, July 8, 1913.

See Fr. Pat. 450,171 of 1912 ; this J., 1913, 479.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

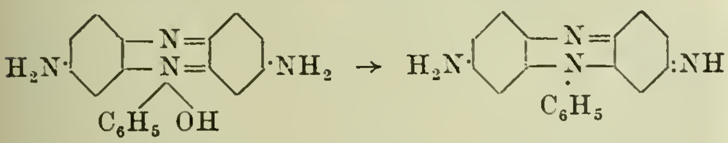
Indigo-imines. W. Madelung. Ber., 1913, 46, 2259—2264. (See also this J., 1913, 693.)

Indigo-mono- and di-imines can be obtained by fusion of indigo with zinc chloride-ammonia. For the monoimine 5 grms. of indigo are added, in portions, to a melt of

200 grms. of zinc chloride-ammonia heated to 200° C., and the temperature is maintained at 200° C. for ½ hour. For the di-imine a temperature of 260° C. is used and is maintained for 2½ hours. The melt is treated with water and a little acetic acid, and after draining off the solution, the residual zinc compound of the imine is dissolved in dilute acetic acid, and the imine precipitated by ammonia. The mono-imine forms a soluble and the di-imine an insoluble leuco-compound with hydrosulphite. The imines can be converted into indigo by hydrolysis, *e.g.*, by boiling with dilute acetic acid. The leuco-compounds can also be hydrolysed. If the mono-imine vat be warmed, for example, indigo is produced in addition to the mono-imine. Both imines in dilute acetic acid solution dye wool and tannin-mordanted cotton, and if, as is probable, the imines can be hydrolysed on the fibre, after dyeing, this would afford a method of dyeing indigo without previous reduction and without free alkali in the dye-bath.—A. S.

Colour-bases of the quinone-imide dyestuffs. F. Kehrmann, E. Havas and E. Grandmougin. Ber., 1913, **46**, 2131—2138.

EXPERIMENTS with dyestuffs of the safranine and thiazine series have shown that colour bases of quinone-imide dyestuffs behave, in many respects, in an analogous manner to those of the triphenylmethane dyestuffs (see this J., 1912, 1073; 1913, 16, 479). The quinone-imide dyestuffs possess an orthoquinonoid structure, but are readily converted into para-quinonoid imine-bases soluble in ether, on adding alkali to their aqueous solutions, *e.g.*,



The imine-base is readily hydrated by shaking its ethereal solution with water, or by addition of acid, yielding again the ortho-quinonoid azonium or thiazonium base or salt. Peralkylated derivatives of safranine and thiazine derivatives behave differently, the azonium or thiazonium form being much more stable; transformation into the imine base occurs only if an alkyl group is split off, so that the imine-base of a dyestuff with one alkyl group less than the original dyestuff results.—A. S.

Aceanthrenequinone and 1·9-*anthracene-derivatives; Some* ——. M. Kardos. Ber., 1913, **46**, 2086—2091.

ACEANTHRENEQUINONE (Ber., 1911, **44**, 209) when heated on the water-bath with hydroxylamine hydrochloride and sodium carbonate is converted into the corresponding oxime, which dyes wool in bright lemon-yellow shades in an acid bath. When subjected to the Beckmann transformation by treatment with hydrochloric acid gas in presence of glacial acetic acid and acetic anhydride, and then heating, the oxime yields the imide of anthracene-1·9-dicarboxylic acid, which dissolves to a yellow solution with alkaline reducing agents; the solution dyes cotton in clear yellow shades. The imide can also be obtained by heating aceanthrenequinone-oxime with concentrated sulphuric acid. When subjected to the potash fusion process it yields a green vat dyestuff (Aceanthrene Green), which gives a cherry red vat with hydrosulphite; cotton is dyed reddish-violet, changing to a fine, full green shade on exposure to air. Similar dyestuffs can be obtained from halogen-substituted aceanthrenequinones.—A. S.

Dyestuffs; Absorption of ultra-violet rays by some organic —— in aqueous solution. Massol and Faucon. Comptes rend., 1913, **157**, 206—209.

THE authors have studied the absorption of ultra-violet rays (wave-length from 5000 to 2200 Angström units) by the 21 dyestuffs authorised by the French Order of June 28, 1912, for use in the colouring of confectionery. The numerical results and the absorption spectra observed are given in detail in the Bull. Soc. Chim. France (1913, **13**, 217, 513, 700). The dyestuffs may be divided into two groups: (1) those which absorb only the rays of very short wave-length, viz., Eosine, Erythrosine, Rose Bengale, Bordeaux B, Crystal Ponceau, Bordeaux S, New Coccine, Solid Red, Ponceau RR, Scarlet R, Acid Fuchsin, Water Blue 6B, Paris Violet, and Acid Violet 6B; (2) those which absorb the rays at both ends of the portion of the spectrum studied and allow the intermediate rays to pass, viz., Orange I, Naphthol Yellow S, Chrysoïne, Auramine O, Malachite Green, Acid Green J, and Patent Blue. Certain of the dyestuffs show characteristic absorption bands which may be utilised as a means of identification.—A. S.

Colloidal constituents of clays. [*Adsorption of dyestuffs.*] Rohland. *See* VIII.

PATENTS.

Dye [*solutions*]; *Process of making* [*stable*] ——. A. Moffatt, Assignor to W. N. Gates, Indianapolis. U.S. Pat. 1,066,641, July 8, 1913.

STABLE solutions of aniline dyestuffs are obtained by dissolving the dyestuff (one part) in an aqueous solution of agar-agar (six parts): the solution may be subsequently gelatinised.—T. F. B.

Condensation products of the anthracene series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 260,662, Nov. 30, 1911.

VAT dyestuffs of the anthracene group are obtained by treating with alkali iodides an ω-dihalogenmethylanthraquinone or a derivative containing one or more ω-dihalogenmethyl groups, *e.g.*, a derivative of dianthraquinonyl. The products are not iodo-derivatives but condensation products; thus, ω-dibromo-2-methylanthraquinone gives *bis*-2-anthraquinonylethylene.—T. F. B.

Arylidoquinones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,180, Dec. 1, 1911.

ARYLIDOQUINONES are obtained by treating quinol or quinone with an arylamine and oxygen in presence of an oxygen-carrier. The products are applicable as vat dyestuffs.—T. F. B.

Dyestuff containing selenium; Process for preparing a ——. A. von Wassermann and E. Wassermann. Ger. Pat. 261,793, Dec. 24, 1911.

NITROSODIMETHYLANILINE or its reduction product is treated with hydrogen selenide, and the resulting compound is submitted to a mild oxidation process, *e.g.*, with ferric chloride or mercuric nitrate. The dyestuff obtained thus is analogous to Methylene Blue.—T. F. B.

Selenocyanides and selenophenols of the anthraquinone series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,164, Oct. 10, 1912.

SEE Ger. Pat. 256,667 of 1912; this J., 1913, 417.—T. F. B.

Gallocyanine dyestuff and its leuco derivative; Manufacture of a violet ——. G. B. Ellis, London. From Chemical Works, formerly Sandoz, Basle. Eng. Pat. 7161, March 25, 1913.

SEE Ger. Pat. 257,833 of 1912; this J., 1913, 481.—T.F.B.

Azo dyestuffs; Red —— *and process of making same.* A. Luther, Nied, and C. O. Müller, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,065,950, July 1, 1913.

SEE Addition of June 29, 1912, to Fr. Pat. 376,888 of 1907; this J., 1913, 131.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Calotropis procera; The fibre of ——. Bull. Imp. Inst., 1913, **11**, 204—206.

Calotropis procera, R.Br., is a shrubby plant which occurs abundantly in parts of India, the Malay Archipelago and

S. China. It also occurs in Persia and is widespread over practically the whole of tropical Africa. The stems contain latex (compare this J., 1910, 34) and yield a valuable bast fibre known in India as "Madar" fibre; the seeds have fine silky hairs which constitute a useful floss. A sample of the fibre from the Sudan, where it is known as "Ushar" fibre has been examined, with the following results: moisture, 7·1; ash, 2·5; α-hydrolysis, loss, 5·9; β-hydrolysis, loss, 16·2; acid purification, loss, 4·0; cellulose, 84·3; increase in weight on nitration, 61·1 per cent. The fibre varied in length from 3 to 5 ft. It is considered to be equal in value to Mexican sisal hemp.—A. S.

Sulphite cellulose process; Notes on the ——. C. G. Schwalbe. Wochenbl. Papierfab., 1913, **44**, 2786—2788.

In preparing bisulphite lye for laboratory digestion experiments, if milk of lime be poured gradually into an aqueous solution of sulphurous acid, previously titrated, a clear solution of known composition is obtained almost instantaneously. By operating always in presence of excess of acid, none of the insoluble calcium monosulphite is formed. On an industrial scale this principle may be turned to account for dissolving muddy deposits of lime and monosulphite found at the bottom of the lye tanks, provided these are comparatively fresh and not coarsely crystalline. Also monosulphite may be recovered from spent digestion lyes by neutralising with lime, and the sulphite so recovered may be utilised by dissolving it in aqueous sulphurous acid in which it is freely soluble. In practice gas is blown off from the charged digester when the temperature reaches about 110° C., the object being to release the air expelled from the pores of the wood, in order to avoid the possible formation of calcium sulphate. Analysis of these gases showed that, in quantity, they barely amounted to half the quantity of air originally present in the charge and, moreover, were entirely free from oxygen. Further, since the quantity of calcium sulphate did not appreciably increase, it is to be inferred that the oxygen so disappearing is entirely absorbed by the organic matters of the wood. Incidentally it is noted that the calcium sulphate becomes unequally distributed between the lye and the wood, so that for its determination, both constituents of the charge must be extracted together by digesting with dilute hydrochloric acid. Although the removal of the air has no effect in preventing the formation of sulphate, it is nevertheless extremely advantageous from the point of view of penetration of the chips. By blowing off the gas, the product is far more evenly digested and freer from splinters. The expulsion of the air at 110° C., however, causes loss of sulphur dioxide and, since calcium bisulphite is relatively stable up to a temperature of 70° C., the author considers that blowing-off the gas at this temperature would be just as effective and more economical than at 110° C.—J. F. B.

Cellulose; Hydrolysis and acetolysis of ——. H. Ost. Annalen, 1913, **398**, 313—343.

By the action of dilute sulphuric acid upon cellulose, hydrocellulose is very readily formed, but not more than about one-half of the cellulose can be made to undergo total hydrolysis to dextrose by this means. Moreover, there appear to be no intermediate products (dextrins) between hydrocellulose and dextrose when cellulose is hydrolysed by dilute acids. According to the author's experiments, neither cellulose nor hydrocellulose become perfectly anhydrous when dried at 100°—105° C.; the sample should be heated slowly up to that temperature and finally dehydrated at 120°—125° C. Between that temperature and 130° C. or even 140° C., purified cotton cellulose remains white and suffers no further loss of weight, but certain samples of hydrocellulose are slightly decomposed by heating at 125°—130° C. Hydrocellulose is less hygroscopic than cellulose. When both substances are corrected for the hygroscopic moisture expelled at 120° C., elementary analysis fails to show any difference between cellulose and hydrocellulose. The quantity of water combining with the cellulose in this first stage of hydrolysis falls within the limits of analytical error. When cellulose is hydrolysed by means of strong sulphuric acid, it forms the acid esters of a series of cellulose dextrins, which by heating at 120° C., after dilution, may be almost quantitatively resolved into dextrose. Any "amyloid" precipitated by dilution must again be treated with strong sulphuric acid before it can be completely hydrolysed. Sulphuric acid of 70 per cent. strength is a better reagent for the "sulpholysis" of cellulose than the more concentrated acid. When cellulose is acetylated by a mixture containing sulphuric acid as a catalyst, the solution, on further standing, loses its viscosity and a range of dextrin acetates is produced, terminating in cellobiose octacetate and dextrose pentacetate. These hydrolysed products contain more combined acetic acid than cellulose triacetate. The author has investigated the most favourable conditions for the total acetolysis of cellulose to dextrose acetates. The best results are obtained with a mixture of equal parts of acetic anhydride and glacial acetic acid containing 10 grms. of sulphuric acid per 100 c.c. Cellulose is digested with about 11 times its weight of such a mixture at 18°—20° C. for 4—6 months. From the reaction-product a certain amount of cellobiose acetate crystallises out; the liquid is poured into water and the dried precipitate is extracted with ether; the insoluble matter contains cellobiose acetate and the acetates of intermediate dextrins. The former separates on crystallisation from 70 per cent. alcohol, while the dextrin acetates are precipitated from the mother liquors by water. The ethereal extract of the precipitate and the ethereal extract of the portion of the reaction product soluble in water contain the dextrose acetate; a portion of this crystallises out as pentacetate and further quantities of pentacetate may be prepared by subsequent acetylation of the residual syrups with mixtures containing only traces of sulphuric acid. Of crystallised products, cellobiose and dextrose acetates, 60·6 per cent. of the theoretical quantity have been obtained from cellulose, but the residual syrups, containing acetates soluble in ether but not crystallisable, bring the total yield of simple products to over 92 per cent of the theoretical. These residual syrups are identical with those obtained in the acetylation of dextrose, and the author concludes that the cellulose molecule is entirely composed of dextrose residues.—J. F. B.

Patents.

Linen fibres; Process of rendering —— *absorbent* (*hydrophile*). A. F. G. Marin. Fr. Pat. 453,500, April 4, 1912.

Flax fibres are de-gummed and bleached in the usual way. The bleached material is treated first in a bath of an alkali sulphite and then successively in two acid baths, the combined action of which produces an absorbent fibre similar to absorbent cotton-wool and suitable for the same purposes. The fibres are immersed for about 10 minutes in a solution of 10 parts of sodium bisulphite in 100 of water. They are drained, washed, and steeped for 15—20 minutes in a 2 per cent. solution of sulphuric acid at 40° C. After again washing, the material is treated for about 30 minutes in a 1·5 per cent. solution of oxalic acid at 60° C.—J. F. B.

Cellulose acetates; Process for modifying the solubility of ——. Chem. Fabr. auf Actien (vorm. E. Schering) and A. Loose. First Addition, dated Jan. 16, 1913, to Fr. Pat. 452,374, Nov. 16, 1912 (this J., 1913, 652). Under Int. Conv., Nov. 2, 1912.

The solubility of cellulose acetates may be modified through a series of changes by heating them with aromatic amines, either in presence of salts soluble in the aromatic amines or capable of combining with them to form salts, or in presence of compounds which react with the aromatic amines to form amino-salts. The reaction may be carried out under pressure with or without diluting agents. Example: 10 parts of cellulose acetate are boiled under a reflux condenser with 100 parts of aniline with the addition of 0·2 part of diethylamine hydrochloride or quinoline sulphate, or 0·1 part of ethylenediamine hydrochloride or 0·3 part of zinc chloride, the time of boiling ranging from 2 to 3 hours. The cellulose acetate may be digested in the autoclave with aniline and benzene or alcohol under a high pressure.—J. F. B.

Cellulose esters of organic acids; Manufacture of——. Knoll und Co. Fr. Pat. 453,835, Jan. 31, 1913. Under Int. Conv., Feb. 1, 21, and 28, April 1 and Aug. 1, 1912.

Cellulose acetate, prepared by a process which yields a product insoluble in acetone, may be converted into a modification soluble in that medium by heating either the finished substance, preferably dissolved in acetic acid, or else the direct product of the reaction, with catalysers, such as neutral or acid salts of sulphuric acid, chlorides, nitrates, etc., in presence of not more than one part of water to one part of cellulose acetate. When the direct product of the acetylising reaction is employed, the excess of acetic anhydride should be destroyed by the addition of water, alcohol or glycerin. In such cases the catalyser which has served for the acetylation serves also, after the removal of the anhydride, for the modification of the solubility of the product. Examples are given illustrating the use of methylamine sulphate or bisulphate, zinc chloride, etc. The temperature of the reaction of modification may be about 70° C.—J. F. B.

Cellulose; Process for the electrical treatment [preservation] of——. A. L. C. Nodon. Fr. Pat. 453,111, March 26, 1912.

Cellulose materials, *e.g.*, fabrics, railway sleepers, wood pavement blocks, etc., are impregnated superficially with water or a saline solution containing sodium sulphate or chloride or zinc chloride and packed uniformly in concrete vats having floors covered with sheet lead or flexible metallic fabric. The material is covered with another sheet-lead electrode, layers of damp coarse cloth being interposed between the electrodes and the material to be treated. When a sufficient pile of alternate layers of material and electrodes has been built up, an electric current is passed through the whole, preferably a low-phase, alternating current, to avoid electrolysis. The time of treatment varies from 10 to 20 hours according to the nature of the material and the degree of humidity. The treated product is stated to be resistant to micro-organisms.—J. F. B.

Cellulose or paper pulp from fibrous plants; Method of isolation or extraction of—— and apparatus therefor. G. H. Rayner. Fr. Pat. 453,307, Nov. 29, 1912. Under Int. Conv., July 5, 1912.

Cellulose is prepared from fibrous materials, *e.g.*, bamboo, by means of fractional digestion. The material is first digested with water alone at 90°—100° C. in order to extract the starch and other soluble matters. The water is run off and may be evaporated for the preparation of a cattle food. The material is next treated with a solution equivalent to 7 per cent. of its weight of caustic soda, in order to dissolve the pectose constituents. The temperature of this digestion also is only 90°—100° C., or even the ordinary temperature, if the time of digestion be prolonged. Lastly the residue is digested at about 162° C. with about 11 per cent. of caustic soda, in order to decompose and dissolve the lignin. Alternatively, 18 per cent. of caustic soda may be employed for the decomposition of the lignin, and the resulting partially spent lye employed for digesting the pectose in a succeeding charge. Two digesters are employed, the one in which the first two operations are performed being of such a capacity that its charge after reduction will fill the second digester. The first digester is provided with perforated plates both at the top and the bottom, so that the liquid may be discharged in either direction.—J. F. B.

Artificial silk from viscose; Manufacture of threads of——. F. Küttner. Fr. Pat. 453,569, Jan. 24, 1913. Under Int. Conv., Dec. 14, 1912.

The bobbins containing threads of viscose coagulated by a bath of ammonium sulphate are rotated in an acid saline solution, preferably sodium bisulphate, or else such a solution is dropped or sprayed on the threads so as to impregnate them. Any acid, mineral or organic, may be employed.—J. F. B.

Artificial silks from viscose and nitrocellulose; Manufacture of——. C. Shrager and R. D. Lance. Fr. Pat. 453,652, April 9, 1912.

The resinates of zinc or magnesium are combined with solutions of viscose or nitrocellulose for the spinning of artificial fibres, but the proportion added should preferably not exceed 20 per cent. The threads are thereby rendered more resistant, both in the dry and wet condition, but their flexibility tends to be diminished. In order to overcome this, there may be added, together with the resinates, highly oxidised siccative oils, stearin or elaïdin or a mixture of these bodies. For the preparation of the resinates, resin is dissolved either in carbon bisulphide or in ether, according to whether it is to be incorporated with viscose or nitrocellulose. The solution of resin is shaken with the oxide or hydroxide of zinc or magnesium until the latter is dissolved. For the preparation of viscose, the carbon bisulphide containing the resinate is allowed to act upon alkali-cellulose preferably prepared with alcoholic instead of aqueous sodium hydroxide. For the preparation of collodion, the ethereal solution is mixed with the solvent employed for the nitrocellulose. If a large proportion of metallic resinates be incorporated with viscose or nitrocellulose, hard substances resembling celluloid may be obtained.—J. F. B.

Artificial-silk threads from cellulose; Manufacture of——. E. Bechtel, Hanau, Assignor to Hanauer Kunstseidefabrik A.-G., Gross-Auheim, Germany. U.S. Pat. 1,066,785, July 8, 1913.

See Ger. Pat. 255,549 of 1911; this J., 1913, 420.—T. F. B.

Cellulose or paper pulp from fibrous materials; Method of isolating or extracting—— and apparatus therefor. G. H. Rayner, London. From W. Raitt, Dehra Dun, India. Eng. Pat. 15,779, July 5, 1912.

See Fr. Pat. 453,307 of 1913; preceding.—T. F. B.

Producing lustrous effects on paper, fabrics, leather or the like. Eng. Pat. 16,156. *See* VI.

Preparation of sugar cane, a new product resulting therefrom, and its applications. Eng. Pat. 5145. *See* XVII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Printing vat and sulphur dyestuffs on wool. H. Grosheintz fils and Scheurer, Lauth et Cie. Sealed note No. 1970, Jan. 26, 1910. Report thereon by M. Battegay. Bull. Soc. Ind. Mulhouse, 1913, 83, 285—287.

The dyestuff is printed together with ammonia, potassium sulphite, sodium hydrosulphite and British gum thickening, and fixed by a four minutes passage at 100° C. through the small Mather and Platt, followed by oxidation, in the case of sulphur colours, by treatment in water at 65° C. for ten minutes. (See also this J., 1912, 1120, and Färber-Zeit, 1911, 314.)—J. B.

Patents.

Yarn bleaching, dyeing and washing machines. C. McFarlane, Heywood. Eng. Pat. 15,396, July 2, 1912.

A form of hank dyeing machine in which the hanks are suspended from revolving reels is improved by: (1) driving the reels at a speed sufficiently high to cause the hanks automatically to spread themselves along the reels; (2) making the tank movable so that a succession of operations can be carried out in a series of tanks without removing the yarn from the reels.—J. B.

Black to blue shades on cotton; Process for producing ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 7676, April 1, 1913. Addition to Eng. Pat. 13,766, June 12, 1912.

This process differs from the earlier one (this J., 1912, 915) in that the goods, after padding with an arylamide of 2·3-hydroxynaphthoic acid, are not dried, but are treated directly with a tetrazo compound of a para-diamine. A subsequent treatment with a hot copper sulphate solution reddens the shade and improves the fastness to rubbing. In the examples given cupric chloride and chromic acid are used along with the tetrazo compound in the developing bath. Tetrazodianisyl gives a blue and tetrazodiphenyl a black with the anilide of 2·3-hydroxynaphthoic acid.—J. B.

Lustrous effects on paper, fabrics, leather or the like, and compositions therefor; Producing ——. D. M. Sutherland, Sunbury Common, Middlesex. Eng. Pat. 16,156, July 10, 1912.

Gum tragasol, which readily absorbs water, is employed as a binder, and is mixed with a lustrous powder, such as powdered mica, and, if necessary, water, the mixture being applied to the material. Suitable softening agents, such as glycerin, may also be added. The material, coated with the composition, may be made waterproof by treating with aluminium acetate, or by mixing this with the composition.—B. N.

Dyeing wool and the like; Apparatus for ——. A. Murray, Geelong West, Victoria. Eng. Pat. 14,740, June 24, 1912. Under Int. Conv., July 28, 1911.

See Fr. Pat. 445,580 of 1912; this J., 1912, 1176.—T. F. B.

Grey to black shades on vegetable fibre and process of producing them. R. Bohn and P. Nawiasky, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,066,987, July 8, 1913.

See Ger. Pat. 258,293 of 1912; this J., 1913, 484.—T. F. B.

Washing fibrous substances; Apparatus for ——. W. R. Kay, Cottingley. U.S. Pat. 1,065,947, July 1, 1913.

See Eng. Pat. 28,192 of 1910; this J., 1911, 1307.—T.F.B.

Textile fabrics; Finishing or dressing —— *with soapy preparations.* R. Weiss, Kingersheim, Germany. Eng. Pat. 27,959, Dec. 4, 1912. Under Int. Conv., Aug. 7, 1912. Addition to Eng. Pat. 26,303 of 1912, dated Nov. 27, 1911.

See Fr. Pat. 448,490 of 1911; this J., 1913, 435.—T. F. B.

Drying machines for coated webs of material. H. S. Hopkins, Brooklyn, U.S.A. Eng. Pat. 15,308, July 1, 1912.

See Fr. Pat. 445,847 of 1912; this J., 1913, 192.—T. F. B.

Process of compression for the impregnation of porous materials by liquid products to render them fireproof or impermeable, or to dye or tan them. Fr. Pat. 453,730. *See* I.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali, etc., works; Forty-ninth annual report on —— *by the Chief Inspector. Proceedings during the year* 1912, etc., pp. 131. Price 8½d.

The number of works registered in England, Ireland, and Wales was 1305 (including 73 "alkali" works), and in Scotland 166; this makes a net increase of 8 for the United Kingdom. An advance is noted in the utilisation of by-products, sulphate of ammonia works having increased by 11, and tar works by 16, whilst nitric acid works have increased by 12, owing mainly to the recovery of nitrous fumes resulting from other manufacturing operations. The acidity of gases of "all chimneys" was equivalent to 1·218 grain SO_3 per cb. ft., as compared with 1·192 grain during 1911, but the adoption of hoods and the extended use of mechanical furnaces has effected further improvement in the escape of fume incidental to the withdrawal of heated material from furnaces. Proceedings have been instituted in two instances in consequence of the undue escape of noxious gases, and it is pointed out, *à propos* of a plea of breakdown in one of the cases, that even in case of unavoidable dislocation of plant, it is still incumbent on the owner of a works to employ the "best practicable means" for preventing the escape of noxious gases into the atmosphere.

Although operations at the alkali and copper (wet process) works were seriously interfered with in the spring, statistics for the whole year compare not unfavourably with those of the preceding year. The use of continuous mechanical furnaces for the calcining of burned cupreous pyrites and common salt has continued successfully, and the number of such furnaces has increased.

A further amalgamation of interests has taken place in the cement industry, a considerable number of works, both in the south-eastern district and in other parts of the country, having been formed into one organisation, and great activity is reported during the latter part of the year. The rotary kiln continues to increase in dimensions, and kilns of a continuous type are responsible for an increasing proportion of the total output, with a corresponding diminished production of fume and black smoke.

At smelting works much improvement has resulted from the use of water sprays to assist in the deposition of the finely divided solid particles carried away from the furnaces along with the smoke, but the diminution of the amount of acid gases sent into the air from many works of this class is regarded as a problem still awaiting a satisfactory solution. Experience suggests that it would be advantageous to bring works in which zinc blende is calcined under the same regulations as now apply to arsenic works treating ores containing a considerable proportion of sulphur. Objections have been raised to the use of water spray in large flues or chambers for the removal of fume, etc., on the ground of the reduction of temperature involved, but it is pointed out, as not generally known, that the weight of gas or air removed by a chimney is almost at its maximum at a temperature of 350° F. (175° C.) above the atmospheric temperature, and observation of the temperature of the chimney gases is recommended as an easy way of controlling the amount of water spray to be used. Water spray jets should be in such a position that the spray is at once directed into the full current of the gases and carried along with them.

Operations at sulphuric acid works were carried on actively for the greater part of the year and were less interfered with than some others by the coal strike. A slow but steady reduction in the number of works is recorded, but an increased aggregate production, the works closed being generally of small capacity. The different forms of mechanical burner, as also fans, came into more extended operation during the year, and there is a general tendency to appreciate the advantage of increased Gay Lussac tower space. In the Widnes District large fans, running at low speed, are said to be more in favour, and are generally placed between two Gay Lussac towers. As a striking instance of the advantage of reduced chamber space, mention is made of a works where two chamber sets were formerly worked without towers, the chamber space of 24—25 cb. ft. per lb. of sulphur charged per day, whereas after denuding one set and increasing the height of the first and second chambers of the other (3-chamber) set from 18 to 25 ft. introducing towers of liberal size, fan draught, and water spray in lieu of steam, 28 per cent. more acid has been produced with 67·7 per cent. of the original chamber space and 11·4 cb. ft. of space per lb. of sulphur charged per 24 hours. A novel method of introducing nitrous gases by spraying nitre solution into the first chamber is reported to have given satisfactory results at another works and appears likely to extend. The "Opl" system referred to in the last Report (this

J., 1912, 716) has continued in constant use, and a second installation has been put into successful operation. A fatality caused by the inhalation of nitrous vapours is recorded; this occurred during the removal of coke packing from a Gay Lussac tower, although previously well washed out. Means recommended for reducing to a minimum the dangers associated with the operation in question are (1) washing the tower with strong sulphuric acid prior to washing with water and steam, (2) the maintenance of a downward draught, and (3) the use of a "safety pipe," fitting with a pneumatic pad against the face of the operator, as required by the Special Rules of the United Alkali Co. The use of fans in place of the steam jet form of draught inducer in Kessler plant for concentrating sulphuric acid is on the increase. The "cascade" system of concentrating continues to gain in favour and is now in widely extended operation, silica and "tantiron" evaporating vessels being used.

Chemical manure works were kept actively in operation during the year, and, as with sulphuric acid manufacture, the production has expanded in spite of a steady falling off in the number of works. The use of mechanical methods for dealing with the solidified, freshly prepared product has further extended. The quantities of manure materials, expressed in tons, imported into the United Kingdom during the years 1910–12 were :—

	1912.	1911.	1910.
Guano	14,115	34,124	7,000
Mineral phosphates	520,270	493,413	450,000
Sodium nitrate	123,580	128,487	120,600

The exports of ammonium sulphate in 1912 amounted to 287,000 tons, as compared with an estimated home consumption (for all purposes, including manure manufacture) of 90,000 tons. The corresponding figures for 1911 were 292,000 and 85,500 tons. The anticipated increase in "Sulphate and Muriate of Ammonia, and Gas Liquor Works" was only partially realised in consequence of the coal strike, but a further increase is recorded in the amount of ammonia recovered, this (expressed as tons of sulphate) for the United Kingdom being :—

	1912.	1911.	1910.
Gas works	172,094	168,783	167,820
Iron works	17,026	20,121	20,139
Shale works	62,207	60,765	59,113
Coke oven works	104,932	105,343	92,665
Producer-gas and carbonising works (bone and coal)	32,049	29,964	27,850
Total	388,308	384,976	367,587

The decided increase in the production in gas works is attributed to the demand for gaseous fuel at a time when solid fuel was scarce. The "direct" method of producing ammonium sulphate (see this J., 1911, 890; 1910, 1364) is being more extensively adopted, and attention is again drawn to its advantages for small gas undertakings making as little as five million cb. ft. per annum. The loss of ammonia whilst handling and storing ammoniacal liquor is once more emphasised. No further progress has been made in the production of sulphate from gases containing ammonia and hydrogen sulphide, without the use of sulphuric acid, the working of the plant mentioned in the Report for 1911 (*loc. cit.*) having been stopped. The oxide of iron purifier is most widely adopted for dealing with the noxious gases evolved during the distillation of gas liquor, and the heap purifier is gradually replacing the older forms. As a rule it is desirable to have two or more interchangeable purifiers, and frequent change is of advantage in avoiding the formation of too large a quantity of sulphided oxide, with consequent tendency to undue rise of temperature during revivification; when comparatively small quantities of fouled oxide have to be dealt with, revivification is facilitated and danger of firing is reduced. Further inquiry has been made during 1912 into the behaviour of oxide of iron during fouling and revivification (see Report for 1911, *loc. cit.*). The effect of treating various samples of hydrated oxide with excess of hydrogen sulphide in a closed vessel has been studied, under conditions which permitted the rate of absorption and total absorption to be measured. A "sulphuretted hydrogen burette" for determining the exact absorptive power of an oxide for hydrogen sulphide is described; it consists of a vessel in which a weighed quantity (about 1 grm.) of oxide, contained in a small glass cup floating on mercury, is exposed to the action of hydrogen sulphide, a burette for measuring the gas over mercury (on which hydrogen sulphide has no action at the ordinary temperature, in absence of oxygen), and generators for hydrogen sulphide and hydrogen (the latter for rinsing purposes). In the event of carbon dioxide being evolved during the reaction, the burette is so arranged that the whole of the gas may be passed through a solution of sodium hydroxide and the hydrogen sulphide determined iodometrically, the proportion of carbon dioxide being obtained by difference, and, when extraction of the sulphided material with carbon bisulphide is desired, ether may be admitted to the cup by a side tube, prior to transferring the cup to a "hydrogen filter" (also described), in which treatment with carbon bisulphide or water may proceed in absence of air. Experiments were made on pure hydrated oxide, Fe_2O_3,H_2O, prepared by precipitating ferric chloride with ammonia and drying at 100° C., on mixtures of this oxide with sodium or calcium carbonate, and on natural and artificial oxides. The results, which are given in tables, show that the rate of sulphiding is rather less in the case of natural and spent oxides than with pure oxide, but that an approximate measure of the sulphiding value of an oxide may be obtained by a 4 hours' test. The "efficiency" of an oxide, which is defined as the maximum volume of hydrogen sulphide, measured at 0° C. and 760 mm., that a given weight of oxide (dried at 100° C.) is capable of absorbing, calculated per 100 volumes of hydrogen sulphide absorbed by an equal weight of Fe_2O_3,H_2O under similar conditions, can be accurately determined by a 5-days' test and approximately in a shorter time. The theoretical maximum efficiency of an oxide expresses the amount of Fe_2O_3,H_2O present per 100 pts. of oxide, dried at 100° C., but the actual efficiency as found by experiment is generally much below this theoretical maximum deduced from the percentage of iron present. Sodium or calcium carbonate, if present, tends to react forming double sulphides, with the evolution of carbon dioxide; in the case of natural oxides, the amount of carbon dioxide is small and can be neglected in an approximate test, but with artificial oxides where carbonates are present, the amount is large and must be allowed for. The series of temperature experiments at oxide purifiers begun in 1911 (*loc. cit.*), have been continued (at one English and two Scotch works); in no case did the temperature of the oxide exceed 55° C. As regards cure for "sourness," alternate treatment of the moist material with alkali or alkaline earth and exposure to air is found effective.

Chlorine works are reported as having been active during the greater part of the year, although production was restricted for a time owing to scarcity of fuel affecting the alkali works where the bulk of the chlorine is produced. The use of mechanical arrangements for the production of bleaching powder has further extended, and improves alike the conditions affecting employees and those influencing the environment of the works.

A further increase is noted in the number of Tin Plate Flux works in South Wales, but, after opening with great activity, the year closed with restricted output consequent on a lessened demand for tin plates. The methods introduced for minimising the escape of hydrogen chloride have proved satisfactory, the general average escape falling from "0·219 grain per cb. ft. in 1911 to 0·170 in 1912," but it is considered that many operations carried out in tin plate works would well repay scientific investigation. In connection with scruff washing, it is pointed out that the masses of scruff must not be excessively large, and washing must be continued for several days, the water being kept as near boiling point as possible by the admission of steam; furthermore, there must be a continuous supply of running water, for the removal of soluble chlorides, etc., from the washing tank. A sufficiency of subsequent settling space is also necessary. A new method of scruff treatment, due to S. V. Bowen of Swansea, is in use at one works and has been found satisfactory; the main bulk of the metal is liquated, the scruff being heated in a closed retort; oily material and tin chloride are distilled off and condensed; the distillate separates on standing into two layers, an upper layer of oil and a lower one containing much tin chloride in solution, from which metallic tin can be separated as a spongy mass by means of scrap zinc, the resulting zinc chloride solution being used to replace part of the flux in the tinning pot. The residue from the retort is washed with water and is then calcined at a low temperature.

The number of sulphide works under inspection increased from 69 in 1911 to 78 in 1912, and attention is called to the fact that the use of hydrogen sulphide in a works for subsidiary operations, such as the removal of metallic impurities from a crude product, necessitates registration under the Act. During the year, 4 works in which sulphide colours were manufactured were found to require registration in this class.

The development of the use of tar for road surfaces and the recognition that crude tar is not so desirable as the prepared material, from which water and naphtha have been removed, have led to a local demand in many districts, which has encouraged the erection of tar distillation plants to provide a convenient local supply of suitable material.

In Scotland, the number of works registered was one less than in 1911. 64,242 tons of bones and phosphates were dissolved, as compared with 60,284 tons in 1911, and 138,782 tons of pyrites have been burned, as against 133,740 tons in 1911. The production of ammonium salts (expressed as sulphate) and pitch amounted to 120,347 tons and 151,345 tons respectively, the corresponding figures for 1911 being 121,339 and 165,692 tons. It is noted that the life of lead-work of sulphuric acid chambers is much shorter than formerly, even where intensive practice is not in force. Great activity is reported at all the shale works, owing to the increasing demand for oil. The total shale mined and quarried in Scotland during 1912 was 3,184,826 tons, as compared with 3,116,803 tons in 1911, the yield of ammonium sulphate, per ton of shale, remaining stationary at 43·7 lb. During 1912 a smaller average number of iron blast furnaces were in operation than in any year since 1894, in which year also a prolonged coal strike occurred. The pig iron produced in 1912 was 1,198,000 tons, as compared with 1,401,000 tons in 1911.—F. Sodn.

Sulphuric acid and sulphuric anhydride. H. Giran. Comptes rend., 1913, **157**, 221—223.

The author has repeated and extended the investigation of Pickering (this J., 1890, 290) on the solidifying points of mixtures of sulphuric acid with water. Mixtures containing between 68 and 76 per cent. H_2SO_4 crystallise with extreme difficulty and only when subjected to prolonged and very energetic agitation. The portion of the curve corresponding to these mixtures has a maximum at —36·7° C. ($H_2SO_4,2H_2O$) and two eutectic points at —46° C. (67·5 per cent. H_2SO_4) and —41° C. (75 per cent. H_2SO_4) respectively. Pickering's results are confirmed. In the case of mixtures of sulphuric anhydride and water, the curve has a maximum at 35° C. ($H_2S_2O_7$), a change of direction at 26° C. ($S_4O_{13}H_2$), and two eutectic points at —9·5 ° C. (85·2 per cent. SO_3) and 4° C. (93 per cent. SO_2). The curve ends in a straight line terminating at the solidifying point of pure β-sulphuric anhydride (30° C.). Ordinary β-sulphuric anhydride is considered to be a mixture of a crystalline and an amorphous modification.—A. S.

Pyroligneous acid, crude and rectified. G. Frerichs. Apoth.-Zeit., 1913, **28**, 525—526.

Samples of crude acid, containing, respectively, acid corresponding to 8·4 and 8·7 per cent. of acetic acid, yielded distillates containing only 3·9 and 4·2 per cent. of acetic acid. A pure acetic acid solution of 6·3 per cent. strength yielded 80 per cent. of distillate containing 5·52 per cent. of acid, while a sample of crude pyroligneous acid 16 years old yielded a distillate with 7·02 per cent. of acid. It is concluded that crude pyroligneous acid as now sold contains acids other than acetic acid, is of inferior quality to that obtainable formerly, or may consist of a waste product from which much of the acetic acid has already been distilled.—R. G. P.

Ammonium sulphate; Influence of nitrous compounds in the sulphuric acid on the colour of —— from gas-liquor. I. Ceruti. L'Ind. Chim., 1913, **13**, 193—194.

It is stated that discolouration of ammonium sulphate made from gas-liquor is frequently due to the presence of nitrous compounds in the sulphuric acid used. The nitrous compounds interact with volatile organic impurities from the gas-liquor, with the formation of coloured substances.—A. S.

Potassium ferricyanide solution; Action of various metals on ——. G. McP. Smith. Z. anorg. Chem., 1913, **82**, 63—70.

Potassium ferricyanide solution, when heated with metallic iron, is reduced, probably in accordance with the equation, $4K_3FeCy_6+2Fe=Fe_2(FeCy_6)+3K_4FeCy_6$. Nickel (on prolonged heating) and zinc (at the ordinary temperature) likewise effect reduction, becoming coated with a greenish deposit, but neither metal is dissolved. Silver reacts in the cold according to the equation, $4Ag+4K_3FeCy_6=Ag_4FeCy_6+3K_4FeCy_6$, and on heating this change is succeeded by secondary reactions, part of the silver going into solution as a complex compound. Mercury is dissolved, with the separation of iron, apparently in the metallic state; the primary reaction is probably in accordance with the equation, $2K_3FeCy_6+3Hg=3K_2HgCy_4+2Fe$. Gold slowly dissolves in potassium ferricyanide solution with the production of ferrocyanide (compare Beutel; this J., 1912, 1123).—F. Sodn.

Lithium sulphate; Equilibrium of —— with the alkali sulphates in the presence of their mixed solution up to 100° C. C. Spielrein. Comptes rend., 1913, **157**, 46—48.

With a mixture of sodium and lithium sulphates in water, the double salt, $Li_2SO_4,Na_2SO_4,5·5H_2O$, can exist between 0° and 16° C. Between 16° and 24° C. $Li_2SO_4,3Na_2SO_4,12H_2O$ exists; at 28° C. $4Li_2SO_4,Na_2SO_4,5H_2O$, and between 32° and 100° C. $Li_2SO_4,Na_2SO_4,3H_2O$; the maximum solubility for the last-mentioned is between 53° and 63° C. The isotherms for a mixture of the sulphates of lithium and of potassium and ammonium respectively gave indications of the existence of Li_2SO_4,K_2SO_4 and $Li_2SO_4,(NH_4)_2SO_4$, up to 100° C.
—F. Shdn.

Bleaching powder solution; Rate of evolution of oxygen from —— in presence of small quantities of cobalt nitrate, and the influence of various compounds on this decomposition. N. M. Bell. Z. anorg. Chem., 1913, **82**, 145—163.

The rate of decomposition of bleaching powder solution in the presence of small quantities of cobalt nitrate is found to be proportional to the concentrations of the components, evolution of oxygen being very greatly accelerated, and the results obtained are in accordance with a unimolecular reaction. Further addition of acids (hydrogen ions) stimulates the reaction, and alkalis (hydroxyl ions) have a retarding effect, whilst salts may, like copper sulphate, increase or, like zinc sulphate, diminish the rate of decomposition, or they may, like sodium chloride, exert no influence. The reaction is accelerated by heating or shaking, and is more rapid when cobalt nitrate is added to bleaching powder solution, than when the solutions are mixed in the reverse order. Nickel sulphate and (in a feeble degree) ferrous sulphate behave like cobalt nitrate.—F. Sodn.

Hypochlorites into chlorates and hypobromites into bromates; Spontaneous transformation of ——. J. Clarens. Comptes rend., 1913, **157**, 216—219.

Evidence is brought forward showing that in the transformation of hypochlorites and hypobromites into chlorates and bromates respectively, chlorites and bromites are formed as intermediate products. If chlorite be added to a strongly alkaline solution of hypochlorite, it gradually disappears on keeping, but the content of hypochlorite remains constant. Only in solutions poor in hypochlorite does a notable quantity of chlorite remain undecomposed. In solutions only slightly alkaline, some hypochlorite disappears simultaneously with the chlorite. The author has detected appreciable quantities of chlorite in old commercial solutions of hypochlorite almost completely converted into chlorate.—A. S.

Magnesium carbonate; Thermal dissociation of ——. R. Marc and A. Simek. Z. anorg. Chem., 1913, **82**, 17—49.

The dissociation of perfectly dry magnesium carbonate proceeds with extraordinary slowness, and the longer the carbonate has been heated, the slower does the process become, owing probably to surface change. Dissociation is much accelerated by a trace of moisture, especially when this is present in the carbonate and evolved with the carbon dioxide, and the opposite process of carbonate formation is also accelerated by moisture. Magnesium carbonate retains moisture with great obstinacy, and its presence probably accounts for the dissociation in stages observed by Brill (Z. anorg. Chem., 1905, **45**, 283), and attributed to the formation of successive basic carbonates, as also the discordant results of other workers. The dissociation curve is given for the interval 330°—520° C., the dissociation pressure being 1 atmo. at 402° C. Specially prepared rhombohedral magnesite was employed in the investigation.—F. Sodn.

Calcium hydride [*; Thermal dissociation of* ——]. W. Moldenhauer and C. Roll-Hansen. Z. anorg. Chem., 1913, **82**, 130—140.

Determinations of the dissociation pressure of calcium hydride, heated in a porcelain tube lined with iron, have given values increasing from 11 mm. at 780° C. to 705 mm. at 1027° C.; with an unlined tube, the pressures observed are much too high, owing to the hydride subliming and attacking the walls of the tube. The results indicate the existence of a hydride, CaH, in addition to that already known, and curves are given showing the dissociation pressures of each.—F. Sodn.

Calcium hydride; Action of —— *on sulphates.* E. Ebler and K. Herrdegen. Ber., 1913, **46**, 2264—2266.

The authors recommend the use of calcium hydride as an autogenous reducing agent (acting like aluminium in thermite) for the reduction of insoluble sulphates. Barium sulphate yields barium sulphide and lime, the whole of the hydrogen being evolved as gas. The reaction would also take place with aluminium (or calcium) but in this case it is almost explosive, and the residue, composed mainly of fused alumina, must be subjected to a very tedious process of pulverisation before it can be extracted with acid. The residue from a calcium hydride reduction is completely soluble in acid, and is easily powdered. The reaction will probably be very useful in dealing with the rare earths.—W. H. P.

Rare earth salts of 1.4.2-*bromonitrobenzenesulphonic acid; Solubilities of the* ——. S. H. Katz and C. James. J. Amer. Chem. Soc., 1913, **35**, 872—874.

The lanthanum, cerium, praseodymium, neodymium, yttrium, samarium, europium, gadolinium, erbium, thulium, and ytterbium salts of 1.4.2-bromonitrobenzenesulphonic acid have been prepared: the first four crystallise with 8, the next four with 10, and the last three with 12 mols. H_2O. The solubilities of the salts (per cent. of anhydrous salt) in water at 25° C. are as follow: yttrium, 5·739; lanthanum, 4·771; cerium, 5·559; praseodymium, 5·730; neodymium, 6·762; samarium, 7·272; europium, 6·310; gadolinium, 5·938; erbium, 6·056; thulium, 6·379; ytterbium, 7·294.—A. S.

Carbides of the rare earths; Action of water on the ——. A. Damiens. Comptes rend., 1913, **157**, 214—216.

The carbides of cerium, lanthanum, neodymium, praseodymium, and samarium were prepared by Moissan's method, and their purity ascertained by metallographic examination. On decomposition with water the carbides yielded mainly acetylenic hydrocarbons, together with hydrogen, ethylene and its homologues, and ethane and its homologues; no methane was formed. By using an acid solution of ferric chloride in place of water, and moderating the reaction, the acetylenic hydrocarbons unmixed with other gases could be obtained. The reaction between these carbides and water is represented thus:

$$C_2M+3H_2O=M(OH)_3+C_2H_2+H_2;$$

ethylene and ethane and their homologues are formed by hydrogenation of the acetylenic hydrocarbons.—A. S.

Radioactive substances; Colloidal solutions of ——. F. Paneth. Kolloid-Zeits., 1913, **13**, 1—4.

Evidence is brought forward in favour of the view that the concentration of polonium and radium E in a nitrate solution by dialysis (see this J., 1913, 362) is due to the fact that these radioactive elements form nitrates which are readily hydrolysed, yielding colloidal solutions of the hydroxides.—A. S.

Aluminium nitride; Reactions of ——. F. Fichter and A. Spengel. Z. anorg. Chem., 1913, **82**, 192—203.

Aluminium nitride prepared by heating aluminium powder in a current of nitrogen, powdering the product, and renewing the treatment for 1—2 hours at 1100°—1200° C. (this J., 1907, 871), may be purified by heating for a short time to a red heat in the presence of dry hydrogen chloride; free aluminium and iron, which impart a grey colour to the crude nitride, are thus volatilised as chlorides, leaving a white product. The purified nitride is decomposed by fused alkalis or by aqueous solutions of acids or alkalis, with the production of ammonia, and may be analysed by fusion with potassium hydroxide, or better by 5—6 hours gentle boiling with dilute sulphuric acid (1 to 4) and subsequent distillation with alkali. It is slowly attacked, on heating, by dry halogens and more rapidly by sulphur chloride vapour, giving aluminium halide and nitrogen; it is slowly oxidised by heating with air or oxygen, and is more rapidly attacked by basic oxidising agents (lead oxide, sodium peroxide, etc.) than by those of a neutral or acid character (potassium nitrate, chlorate, etc.).; it is slowly attacked by sulphur, carbon bisulphide, or phosphorus at a high temperature, and on heating with a dry mixture of sodium and potassium carbonates and carbon in an atmosphere of carbon monoxide, at 750°—800° C., gives cyanide; ethyl alcohol, at 230° C., reacts to form triethylamine. The amorphous nitride prepared by the authors' method differs in specific gravity from the commercial crystallised product, but the two are identical as regards chemical properties.—F. Sodn.

Nitrogen; Fixation of atmospheric —— *by means of boron compounds. I. Reactions at high pressures.* A. Stähler and J. J. Elbert. Ber., 1913, **46**, 2060—2077.

The reaction between carbon and boric anhydride begins at about 1200° C. Calcium borate does not react with carbon alone at temperatures below 1700° C., but if nitrogen is present this gas begins to be absorbed at 1280° C. In the electrolysis of fused borax, the yield of elementary boron is only about 12·1 per cent. of the theoretical current yield, assuming that the sodium at the cathode reduces B_4O_7'' ions. Boric acid can also be reduced by calcium carbide with the formation of calcium boride. If boron nitride is heated in carbon vessels it does not begin to give off nitrogen till about 2450° C. The authors have devised and constructed a very convenient electric resistance furnace which can be used for pressures up to 500 atmospheres and for temperatures up to 2500° C. In this furnace starting with boric anhydride, charcoal, and nitrogen they find that the best yields of boron nitride are obtained at 1600°—1700° C.

At ordinary pressures they have obtained 26 to 28 per cent. and at higher pressures (about 70 atmospheres) they were able to obtain 85 per cent. calculated on the amount of boron in the trioxide used. From calcium borate (borocalcite), carbon, and nitrogen starting at about 1800° and allowing the temperature to fall to about 1400° C., a mixture is obtained containing both boron nitride and calcium cyanamide. The object of lowering the temperature is to bring it within the range of stability of the cyanamide which would be almost completely decomposed into carbide and nitrogen at 1800° C. Pressure has very little effect on the absorption of nitrogen by mixtures of borocalcite and carbon. The amount of nitrogen absorbed per gram of boron in the original mixture is greater for calcium borate mixtures at pressures up to 30 atmospheres, while at higher pressures the advantage is with the boron trioxide.—W. H. P.

Iodine ; A case of catalytic action of ——. [*Interaction of phosphorus trichloride and sulphur chloride.*] M. Kohn and A. Ostersetzer. Z. anorg. Chem., 1913, **82**, 240—241.

The reaction, $3PCl_3+S_2Cl_2=PCl_5+2PSCl_3$, is much accelerated by iodine, 70 per cent. of the calculated yield of phosphorus pentachloride being obtained by boiling a mixture of 15 grms. of sulphur chloride, 45 grms. of phosphorus trichloride, and 0·1 grm. of iodine for 2 hours.
—F. Sodn.

Precipitation of gold by manganous salts. Brokaw. *See* X.

Patents.

Sulphuric acid ; (1) *Process of manufacture of* —— *by means of towers, on the principle of lead chambers.* (2) *Apparatus for concentrating sulphuric acid.* A. G. Düron. Fr. Pats. 453,733 and 453,742, Jan. 29, 1913. Under Int. Conv., Feb. 14, 1912.

(1) Reaction towers take the place of chambers, each tower being fed with a portion of the acid produced in it, and supplied separately with nitrous products and water. Other towers provide as usual for concentration, denitration, and absorption. (2) The floor of the concentrator is divided into three approximately parallel channels, along which the acid, introduced through a regenerator column, flows in a zigzag path. Superheated gas passes in the opposite direction along the side channels and, in the central channel, is made to pass through the acid, on to which it is conducted in a number of parallel currents perpendicular to the direction of flow, by means of a series of "blind" transverse channels having walls depending into the acid and communicating alternately with each side channel. The acid is thus repeatedly subjected, as it flows through the central channel, to the action of superheated gas in a dry state, and concentration may be carried to a high degree.
—F. Sodn.

Boron-tungsten compound [for incandescensce filaments] ; Process for the production of a ——. F. Hansen and W. F. Mohr, London. Eng. Pat. 3525, July 25, 1912.

Tungsten trioxide is saturated with a solution containing 3 grms. of boric anhydride in 40 grms. of water, dried, and heated to about 700° C. in a neutral atmosphere. The resulting product is reduced by heating with an equal weight of zinc powder to about 1100° C. in a neutral atmosphere, after which the zinc is removed by means of acid, and the residue is washed and dried. The substance thus obtained is more infusible than pure tungsten and is particularly suitable for the manufacture of incandescence filaments.—O. R.

Aluminous materials ; Calcination of ——. I. P. Llewellyn, Goole, and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 12,308, May 24, 1912.

Non-combustible, aluminous materials (100 parts) are mixed with small coal (about 8 parts) and calcined in heaps or beds, the supply of air and fuel being such as to produce a slow and regulated calcination at a temperature below that at which alumina becomes insoluble.
—O. R.

Aluminium nitrides and the like ; Process and apparatus for making ——. C. Ellis, Montclair, N.J., U.S.A. Eng. Pat. 25,630, Nov. 8, 1912. Under Int. Conv., Jan. 30, 1912.

Alumina is fed into and through a furnace, and an explosive mixture of air and a suitable nitrogenous reducing gas, such as producer gas or coke-oven gas, is injected into the charge so as to produce "surface combustion" and a temperature high enough to produce nitrification. The products of combustion, as well as an additional supply of combustible gas and air, are passed through the charge at a point approaching the zone of intense combustion.—O. R.

Salts ; Treatment of solutions containing metallic ——. *for the removal of iron.* A. W. Gregory, Hendon. Eng. Pat. 17,672, July 30, 1912.

The solution of the salt is heated and treated with an oxidising agent in presence of alkali sulphate, when a basic sulphate of iron and alkali metal is precipitated. The latter may be used as a pigment, either directly or after calcination, or as a manure.—W. R. S.

Mother of pearl ; Process and apparatus for the manufacture of artificial ——. J. Rosen, London. Eng. Pat. 17,953, Aug. 2, 1912.

Artificial mother of pearl is prepared by the alternate superposition of extremely thin layers of (1), collodion and (2), an ammoniacal solution of a lime-alkali silicate, the latter preferably containing casein and being about ten times as thick as the collodion layer. A horizontally rotating disc or plate is used for the formation of the layers, the disc being placed inside a suitable drying oven, so that the required temperature may be maintained for liquefying or drying the substances. Colouring matter may be intermittently dropped on to the centre of the disc so as to form coloured lines, the casein may be rendered insoluble by exposing the layers to the action of formaldehyde vapour, and the resulting product may be subjected to hydraulic pressure to remove any air bubbles and thoroughly unite the various layers.—O. R.

Silicious material applicable as a heat insulator and for other purposes. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 19,927, Aug. 31, 1912.

A twenty per cent. solution of an alkali silicate is heated to the point of intumescence (300°—400° C.) and the puffy material, which has an apparent density of 0·01—0·03, is converted, either into silica by the action of hydrochloric acid and subsequent washing and heating, or into an insoluble silicate, such as aluminium silicate, by interaction with aluminium sulphate. In either case the resulting product is pseudomorphic with the light, frothy pellets of alkali silicate from which it was prepared.
—O. R.

Sodium silicate ; Process for making solutions of ——, *or for dissolving anhydrous crystallised sodium silicate in water.* V. Fortea. Fr. Pat. 453,539, Jan. 24, 1913.

Finely powdered anhydrous sodium silicate can, it is claimed, be dissolved in water without the use of an autoclave or other special apparatus.—F. Sodn.

Sulphur dioxide ; Reduction of ——. M. Ruthenburg, London. Eng. Pat. 29,030, Dec. 17, 1912.

Sulphur dioxide is passed through a column of coke or other carbonaceous material, which is heated electrically, and the sulphur vapour and carbon dioxide, which are formed, are condensed and washed.—O. R.

Ammonium sulphate from ammoniacal gases or vapours; Process of producing ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 834, Jan. 10, 1913.

Ammoniacal gases are passed into a saturator in two streams, one of which is introduced at a point near the surface, where there is an excess of acid, preferably the place where fresh acid and mother liquor enter the saturating vessel, the other stream being introduced into a neutral zone of the bath near the bottom, preferably close to the point where the ammonium sulphate is withdrawn. The salt is thus obtained as neutral as possible without loss of ammonia.—O. R.

Ammonia from coal-gas; Process for obtaining purified ——. C. G. Tufts, Syracuse, N.Y., Assignor to Semet-Solvay Co., Solvay, N.Y. U.S. Pat. 1,065,566, June 24, 1913.

Crude ammonium sulphate is rapidly heated so as to drive off ammonia with its accompanying impurities and leave acid ammonium sulphate. The evolved ammonia is then separated from the volatile impurities and recombined with the acid salt to form pure, normal ammonium sulphate.—O. R.

Compounds of nitrogen and hydrogen [*ammonia*] *and of nitrogen, hydrogen, and oxygen; Process of manufacture of* ——. F. Hlavati. Fr. Pat. 453,207, Jan. 15, 1913. Under Int. Conv., Jan. 15, 1912.

A mixture of nitrogen and hydrogen, or of nitrogen, hydrogen, and oxygen (pure, or composed for the most part of these gases), is ionised by electric discharges and, after cooling, is brought in contact with an insulated catalyst, consisting of indifferent material carrying a firmly adherent deposit of finely divided platinum (or other metal of the platinum group), intimately mixed with titanium, as far as possible in atomic proportions. The apparatus is so arranged, by duplicating, that the gases may be alternately submitted to the catalyst, at a temperature and pressure allowing of absorption, and that the temperature may be raised by reversing the direction of flow through the reaction chambers or the pressure reduced, so that the occluded gases are evolved in the active state. Instead of employing electric discharges to ionise the gas, the catalyst may be rendered active by emanations from pitchblende or the like.
—F. Sodn.

Nitrogen and oxides of nitrogen; Process for the simultaneous production of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 453,845, Jan. 31, 1913. Under Int. Conv., Feb. 19, 1912.

A homogeneous mixture of ammonia and air, containing a relatively large proportion (*e.g.*, 10—14·5 per cent.) of ammonia and only sufficient oxygen to convert the ammoniacal nitrogen into the desired oxides of nitrogen, is made to undergo combustion in the presence of a catalyst, and the oxides of nitrogen and water produced are separated (together or successively) from the reaction products, by means of apparatus for refrigeration or absorption, leaving pure atmospheric nitrogen as a residue.—F. Sodn.

Vanadium; Manufacture of a catalyst containing ——. Conidelon Soc. Anon., Antwerp. Eng. Pat. 5174, Mar. 1, 1913. Under Int. Conv., Mar. 2, 1912.

Ferric chloride is added to a cold solution of ammonium vanadate, which has been acidified with hydrochloric acid, and the precipitate, which is produced on the addition of ammonia, is washed, dried, and carefully ignited. The catalyst is for use in the manufacture of sulphuric anhydride.—O. R.

Hydrogen peroxide; [*Electrolytic*] *Manufacture of* ——. F. Fischer, Charlottenburg, Germany. Eng. Pat. 8582, April 11, 1913. Under Int. Conv., July 26, 1912.

Hydrogen peroxide is produced at the cathode by the electrolysis of solutions saturated with oxygen under pressure. Using a 1 per cent. solution of sulphuric acid, a current of 2 volts at a density of 5 amps. per sq. dcm., and oxygen under a pressure of 100 atmospheres, 90 per cent. of the theoretical yield of 3 per cent. hydrogen peroxide may be obtained.—O. R.

Hydrogen peroxide; Manufacture of ——. Henkel und Co., and W. Weber, Düsseldorf, Germany. Eng. Pat. 8890, April 15, 1913. Under Int. Conv., Jan. 29, 1913.

Oxygen, or air, and hydrogen are made to act upon each other under pressure in the presence of water and a hydrogen transmitter, such as palladium. Pure hydrogen peroxide solution is drawn off continuously and replaced by a corresponding amount of water. (See also Eng. Pat. 8582 of 1903; preceding.)—W. R. S.

Oxalates; Method for the manufacture of ——. L. W. Andrews, Davenport, Iowa. U.S. Pat. 1,065,577, June 24, 1913.

Sawdust and alkali are heated in a closed vessel by means of superheated steam under low pressure, and the temperature of the steam is continuously and gradually increased.—O. R.

Zinc sulphate; Production of ——. A. G. Betts, Troy, N.Y. U.S. Pat. 1,066,245, July 1, 1913.

Materials containing zinc oxide are treated with sulphuric acid in presence of an oxidising agent, such as permanganate, having a stronger oxidising action than ferric sulphate.—W. R. S.

Sulphur; Method of producing reversible colloidal ——. Aktiebolaget Kolloid, Stockholm, Sweden. Eng. Pat. 7238, March 26, 1913. Under Int. Conv., March 30, 1912.

Sulphurous acid and hydrogen sulphide are introduced into *N*/10 acid; the colloidal sulphur, precipitated by addition of sodium chloride, can again be dissolved colloidally.—W. R. S.

Hydrogen; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 453,077, Jan. 11, 1913. Under Int. Conv., May 14, 1912.

Steam is decomposed by means of heated spongy iron which is prepared by the reduction of minerals or oxides of iron by means of carbon by external heating. The metal is regenerated from the oxide formed by the action of reducing gases and is said to retain its porosity after repeated use. "Spongy Swedish iron" prepared in the above manner, is specially suitable.—F. Sodn.

Hydrogen; Manufacture of ——. Soc. L'Air Liquide (Soc. anon. pour l'Etude et l'Exploit. des Procédés G. Claude). Fr. Pat. 453,187, March 28, 1912.

Water-gas or analogous gaseous mixture is partially liquefied, so as to give pure hydrogen and carbon monoxide containing hydrogen in solution, and the latter mixture is submitted to the action of heated slaked lime or other material capable of reacting to yield more or less pure hydrogen which is added to the water-gas about to be treated.—F. Sodn.

Sulphuric acid; Tower system for the manufacture of ——. A. G. Düron, Wiesbaden, Germany. Eng. Pat. 2408, Jan. 29, 1913.

See Fr. Pat. 453,733 of 1913; preceding.—T. F. B.

Sulphuric acid; Apparatus for concentrating ——. P. Vialleix and F. Perrin, Volvic, France. U.S. Pat. 1,066,557, July 8, 1913.

See Fr. Pat. 420,563 of 1910; this J., 1911, 360.—T. F. B.

Manganese sulphate; Production of ——. A. G. French, Nelson, British Columbia. Eng. Pat. 22,078, Sept. 28, 1912.

See U.S. Pat. 1,055,158 of 1913; this J., 1913, 431.—T. F. B.

Ammonium sulphate ; Apparatus for the treatment [grinding] of ——. J. Vorraber, Cologne-Lindenthal, Germany. U.S. Pat. 1,066,067, July 1, 1913.

See Eng. Pat. 14,638 of 1910 ; this J., 1911, 955.—T. F. B.

Hydrogen ; Process and apparatus for the production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 12,242, May 23, 1912. Under Int. Conv., July 8, 1911.

See Fr. Pat. 444,105 of 1912 ; this J., 1912, 1126.—T. F. B.

Hydrogen ; Apparatus for the production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 12,243, May 23, 1912. Under Int. Conv., Feb. 8, 1912. Addition to Eng. Pat. 12,242 of 1912, dated July 8, 1911.

See Fr. Pat. 444,105 of 1912 ; this J., 1912, 1126.—T. F. B.

VIII.—GLASS ; CERAMICS.

Clays ; Thermal analysis of ——. R. Wallach. Comptes rend., 1913, **157**, 48—50.

Several varieties of clay were made into a paste with water and heated slowly in an electric furnace. During the heating the temperatures of the inside of the furnace and of the mass of clay were continuously recorded. The results were plotted, the abscissæ being the temperature of the substance and the ordinates the differences between these temperatures and those of the furnace. Indications were obtained of the temperatures of dehydration, leaving out of account the initial vapourisation of the water used to mix the clay. Kaolin and a pure clay (*terre de Cézanne*) were dehydrated between 450° and 600° C., whilst between 900° and 1000° C. a slight amount of heat was evolved. White mica when finely powdered was fully dehydrated at 840° C. Clay from Fresnes showed two stages of dehydration. Glauconite and clay from Salernes did not give any striking result.—F. Shdn.

Clays ; Colloid constituents of ——. [Adsorption of dyestuffs]. P. Rohland. Kolloid-Zeits., 1913, **13**, 62—63. (See also this J., 1913, 209, 244.)

There appears to be some connection between the constitution of dyestuffs and the ease with which they are adsorbed by colloidal clay. For the complete adsorption of 0·003 grm. of dyestuff. 5 grms. of clay are required in the case of Aniline Blue, Victoria Blue, Violet, and Diamond Green, 10 grms. in the case of Orange and Vesuvin, and 30 grms. in the case of Metanil Yellow. Dyestuffs derived from azo and diazo compounds are adsorbed only to a slight extent.—A. S.

Patents.

Glass and other substances ; Method of producing bodies and coatings of ——. E. Morf, Zürich, Switzerland. Eng. Pat. 28,001, Dec. 4, 1912. Under Int. Conv., Dec. 18, 1911.

Surfaces are covered with a coating of glass, metal, or other fusible substance, by feeding a solid, non-pulverulent mass of the fusible substance towards a melting appliance, such as a blowpipe flame or an electric arc, at the rate at which fusion takes place, and simultaneously blowing the melted substance against the surface to be covered by means of compressed air or steam.—O. R.

Ovens suitable for use in the manufacture of tiles, pottery and analogous ware and for other purposes. C. Dressler, London. Eng. Pat. 8228, April 4, 1912.

In a tunnel kiln, combustion chambers, preferably of curvilinear section, are arranged longitudinally within and structurally independent of the main chamber, in which a wheeled vehicle or truck carries the goods to be burnt, supporting them in such a manner that they lie above or mainly above the level of the combustion chambers. The air, heated between the outer sides of the combustion chambers and the oven wall, flows amongst the goods in the upper part of the oven and descends, through flues provided in the truck itself, to horizontal outlets under the combustion chambers, where it is again heated and circulated. The heat radiated from the inner and upper sides of the chambers is directed against the platform of the truck and is utilised by conduction. The upper part of the vehicle comprises a number of transverse walls, spaced apart longitudinally and connected together at their central portions by vertical partitions, thus forming a row of vertical flues communicating with horizontal passages at their lower ends ; the lower portion of the truck is of cellular construction and is filled with loose material which is a bad conductor of heat.—O. R.

Fire-resistant grate bars ; Process for the manufacture of ——. W. P. Thompson and Co., London. From S. Szönyi, Budapest. Eng. Pat. 26,913, Nov. 22, 1912.

Bars of fireclay, with or without the addition of magnesite or kieselguhr, are burned for 2—3 days at a moderate temperature, ground, mixed with quartz and water, moulded, and burned again at a slowly and continuously increasing temperature for 8—10 days.—O. R.

Ceramic or fireproof material. E. Podszus, Neu-Kölln, Germany. Eng. Pats. 3138 of 1913, date of appl., May 17, 1912, and 11,771, May 17, 1912. Under Int. Conv., May 17, 1911.

(1). Ceramic materials not containing clay are prepared from rare earths, alumina, quartz, magnesia, thoria, zirconia, or other sparingly soluble oxide, or a mixture of these, by grinding the mass to an extremely fine powder of the order of 0·005 to 0·0001 mm., mixing the powder with at least 0·5 per cent. of a binding agent, the paste or "slip" being then moulded and fired. Suitable binding agents are organic materials, such as gum, gelatin, and the like, or a salt of the earth used, such as the corresponding nitrate, which decomposes slowly on heating and yields a perfectly pure product. (2). A colloidal substance, such as the hydrosol corresponding to the substance used, prepared by dialysis or otherwise, is added to the mass to give it the desired degree of plasticity.—O. R.

Enamel from enamelled goods ; Process of removing ——. G. Spitz, Brünn, Austria, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,065,401, June 24, 1913.

The goods are heated with a paste consisting of a mixture of caustic soda and sodium carbonate, and the soluble compounds, which are formed, are washed out with water.—O. R.

Ceramic objects ; Process of making —— from materials which sinter and melt at the same temperature. Ges. f. Elektro-Osmose m. b. H., Frankfort, Germany. Eng. Pat. 3434, Feb. 10, 1913. Under Int. Conv., Feb. 9, 1912.

See Addition of June 22, 1912, to Fr. Pat. 426,072 of 1911 ; this J., 1912, 1180.—T. F. B.

IX.—BUILDING MATERIALS.

Firebricks ; Deterioration of —— during service. G. Rigg. J. Ind. Eng. Chem., 1913, **5**, 549—554.

The author discusses the causes of the deterioration of firebricks during use and concludes that other things being equal the resistance to the action of corrosive slags and gases is greater the more compact and close-textured the brick is. "Spalling" of close-textured brick is due to the use of unsuitable clay, or poor workmanship, or both. It is possible to prepare close-textured firebrick containing considerable amounts of coarse material, provided that sufficient care be taken in sizing the grog, so that the interstices between the larger fragments shall be filled as completely as possible by smaller fragments.—A. S.

Patents.

Cement or hydraulic lime from plaster; Process of manufacturing ——. L. P. Basset, Montmorency, France. Eng. Pat. 12,027, May 21, 1912.

An intimate mixture of calcium sulphate (gypsum, anhydrite, or plaster of Paris) and clay, with coal (10 per cent.), and ferric oxide (2 per cent.) is burnt in a rotary furnace and at the same time subjected to the action of superheated steam. The products of the reaction are cement clinker or hydraulic lime and sulphur dioxide.—O. R.

Kiln; Cement-burning ——. T. A. Edison, Llewellyn Park, Orange, N.J. U.S. Pat. 1,065,597, June 24, 1913.

The upper end of a rotary kiln is combined with a settling chamber, which contains a hopper and a conveyor, so arranged as to return into the kiln any material which may be deposited in the settling chamber.—O. R.

Artificial stone and other slabs and the like; Process and apparatus for the continuous manufacture of ——. A. P. Bock, Vienna. Eng. Pat. 5516, Mar. 5, 1913. Under Int. Conv., Mar. 18, 1912.

Slabs, prepared from cement and filling materials, are conveyed from the press through connected chambers, in which they are subjected, first to a setting process in a counter-current of hot, moist air, then to a drying process in a current of hot, dry air, and finally to a cooling process in a sealed air chamber. The apparatus is similar in type to a tunnel kiln, the slabs being carried on waggons which run on rails, the circulation of the air being effected by means of fans, and the heat and moisture which escape from the drying chambers being utilised in the setting chambers. A furnace situated above the tunnel provides the heat required for raising the air to the required temperature.—O. R.

Stone; Manufacture of artificial ——. J. A. Lucardi, St. Veit an der Glan, Austria. Eng. Pat. 6445, Mar. 15, 1913.

A mixture of prepared, fibrous material, preferably carded, with a hydraulic binding agent, is formed into a paste and introduced into a centrifugal apparatus, the blades of which project it on to a rotating filtering drum. A layer of suitable consistence is formed on the drum, from which it is carried away by means of a travelling apron and rolled to the required thickness, the slabs so produced being finally pressed to the required form.—O. R.

Wood; Preservative treatment of ——. P. N. Stankovitch, Washington, U.S.A. Eng. Pat. 14,628, June 22, 1912.

The grain of timber is cross-cut by means of zigzag passages, the inner end of one passage connecting with the outer end of the next and the whole series of passages being filled with powdered cupric sulphate.—O. R.

Woods; Process for the scientific curing of ——. F. A. Palen, New York. U.S. Pat. 1,066,523, July 8, 1913.

See Eng. Pat. 94 of 1912; this J., 1913, 143.—T. F. B.

Machine for drying and mixing heterogeneous materials. Fr. Pat. 453,614. *See* I.

Process for the electrical treatment [preservation] of cellulose. Fr. Pat. 453,111. *See* V.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

[*Gold; Vacuum filtration at the Victoria Mill of the Waihi Gold Mining Co., New Zealand.* W. Macdonald. J. Chem., Met. and Min. Soc., S. Africa, 1913, 13, 527—539.

Filter-presses of the Martin and Johnson type previously in use were found too cumbersome and with too high working costs, and with the large increase in the output of slime due to the introduction of tube-mills, Moore vacuum filters as modified by Banks were introduced. Descriptions are given of the plant, the vacuum filters, the character of the slime pulp, the routine work of the plant, the washing efficiencies and extractions, and the labour and operating cost, together with tabulated results and diagrams. It is concluded that: (1). Ample settling capacity in vats should be provided so that a vacuum filtration plant is not called upon to do work which might be done to better advantage by settling and decantation. (2). In a plant treating 700 tons a day a saving of 0·003 dwt. of gold per ton is of greater importance than a reduction in labour of one man at 8s. 6d. a day. (3). Systematic inspection of all wearing parts, especially cloths, is essential. (4). Accurate and daily determinations of the soluble gold left in the residue must be made. —A. H. C.

Gold; Precipitation of —— *by manganous salts.* A. D. Brokaw. J. Ind. Eng. Chem., 1913, 5, 560—561.

When solutions of auric chloride and manganous chloride are mixed, no reaction can be detected, even when the mixture is boiled, but on addition of a small amount of alkali, and more slowly by adding a crystal of Iceland spar (calcium carbonate), manganese dioxide and metallic gold are precipitated. Manganous carbonate is also capable of reducing gold chloride.—A. S.

Argentiferous lead ore from Southern Nigeria. Bull. Imp. Inst., 1913, 11, 249—250.

Six samples of lead ore (galena) from the Ogoja and Abakaliki districts were examined, with the results shown in the following table:—

	Ogoja district.		Abakaliki district.			
Origin of sample.	Warankandi.	Wurkum.	Mkpume.	Igwenidor.		
	1	2	3	4	5	6
Pb, per cent...	32·97	60·71	58·48	53·69	65·14	61·59
Zn, per cent...	trace	0·12	0·20	0·16	0·02	0·19
Cu, per cent...	trace	0·18	0·23	0·18	0·19	0·10
Ag, oz. per ton	2·6	98·0	73·1	94·6	112·3	73·5
Value per ton, c.i.f. Swansea, with "soft foreign" lead at £16 10s. per ton and silver at 2s. 5d. per oz.	£2 16s.	£18 7s.	£15 2s.	£16 15s.	£20 13s.	£15 13s.

—A. S.

Minerals from the Federated Malay States. Bull. Imp. Inst., 1913, 11, 243—248.

Cerussite concentrate from Ipoh, Perak. Chiefly ferruginous cerussite, together with some tinstone and quartz and small quantities of other minerals. Pb 41·57 per cent., Sn 10·99 per cent., Ag 2·819 oz. per ton. Value about £12 10s. per ton delivered Bristol (Feb. 1913). *Tungsten ore from Kinta, Perak.* A black coarse concentrate containing about 53 per cent. of ilmenite and 35 of wolframite, together with smaller quantities of tinstone and other minerals. SnO_2 5·86, WO_3 26·15, TiO_2 27·50, Yt_2O_3 etc. 0·56 per cent. *Tin-bearing sands from Kelantan.* Four samples of concentrates containing:—

	No. 1.	No. 2.	No. 3.	No. 4.
	per cent.	per cent.	per cent.	per cent.
SnO_2	18·41	16·52	85·83	72·5
ThO_2	0·82	2·10	—	—
Ce_2O_3, etc.	5·15	8·37	1·55	1·10
$Cb_2O_5 + Ta_2O_5$	2·8	2·95	1·90	2·22
Au	—	0·185	1·62	1·05

The mixed bullion from samples 2, 3 and 4 contained 897 parts of fine gold per 1000, the rest being silver. *Concentrate from near Kulim, S. Kedah.* Consisted almost entirely of ilmenite (39), monazite (41) and tinstone (20 per cent.). Ce_2O_3, etc. 27·41, ThO_2 1·50, and SnO_2 16·04 per cent. The monazite and tin could be obtained separately by electromagnetic separation. *Manganese ore from Tambun.* The sample was of poor quality owing to the inclusion of brown earthy material with the lump ore. *Minerals from Kinta, Perak.* A sample of a conglomerate consisting chiefly of quartz fragments set in a matrix of calcite, together with some fine-grained tinstone and other minerals, contained SnO_2 2·14 per cent.—A. S.

Galvanised iron wire ; Investigations on ——. H. Fleissner. Oesterr. Zeits. Berg- u. Hüttenw., 1913, **61**, 379—384 and 393—396.

To ascertain the process used in galvanising, the wire is examined microscopically; the presence of crystalline forms on its surface, due to an iron-zinc alloy, is considered to be evidence of the use of the hot galvanising process. —W. R. S.

Zinc ; Effect of foreign metals on the rolling of ——. E. Prost and A. Van de Casteele. Bull. Soc. chim. Belg., 1913, **27**, 175—189.

Ingots weighing 40 lb. were prepared by casting together zinc alloys of various metals, with spelter containing Pb 1·05—1·25, Cd 0·076—0·11, and Fe 0·03—0·039 per cent. The following conclusions are drawn : *Cadmium* is harmful above 0·25 per cent. ; with 0·50 per cent. rolling is no longer possible. *Arsenic :* 0·02 per cent. markedly increases the hardness, and with 0·03 per cent. the metal is too brittle for practical purposes. *Antimony* is less objectionable than arsenic as regards hardness, as 0·07 per cent. does not increase the latter ; but 0·02 per cent. is sufficient to produce a striated surface on the rolled sheet which makes it unsaleable. *Tin* is objectionable above 0·01, and prohibitive at 0·03 per cent. *Copper* is without hardening effect until it reaches 0·08, and with 0·19 per cent. the zinc is unworkable. *Iron :* 0·12 per cent. is a permissible maximum, but this is easily reduced in refining. *Lead :* Though 1—1·25 per cent. does not interfere with the rolling, a slight increase not only seriously affects malleability but the excess of lead remains unalloyed and forms patches on the sheet. The presence of two or more impurities together results in a combination of the injurious effects of each.—W. R. S.

Osmium ; Study of [preparation of pure] ——. A. Gutbier. Chem.-Zeit., 1913, **37**, 857—859.

The author reviews the various methods of treating osmium residues and of reducing osmium tetroxide to the metallic state. Residues, which are usually contaminated with carbonaceous impurities, are best heated to redness in a current of oxygen as suggested by von Knorre (Z. angew. Chem., 1902, **15**, 393) and the tetroxide reduced by the method of Paal and Amberger by means of a mixture of alcohol, ammonia, and ammonium chloride (Ber., 1907, **40**, 1378). The solution is evaporated on the water-bath, the residue carefully reduced by means of hydrogen, and the finely-divided osmium, which is formed, is strongly ignited in a current of hydrogen and allowed to cool in a current of carbon dioxide free from oxygen.—O. R.

Action of various metals on potassium ferricyanide solution. Smith. *See* VII.

Patents.

Iron and steel ; Process for the cementation and hardening of ——. H. Nettgens, Küsnacht, Switzerland. Eng. Pat. 6489, Mar. 15, 1913. Under Int. Conv., Mar. 15, 1912.

The iron or steel article, after the usual cementation process, is coated cold at those parts which are to be hardened, with a viscous well-adhering carbonaceous substance, such as horn or leather waste. It is then heated to the requisite temperature for forging, and while still coated is forged and finished off. It is again coated, heated to a suitable hardening temperature, and quenched and tempered as desired. The covering prevents the formation of scale during forging, and by reason of the lower temperatures possible by the process, distortion during hardening is avoided.—T. St.

Iron and steel ; Process for the cementation of ——. C. Gendre. Fr. Pat. 453,542, April 5, 1912.

The carburising material consists of a mixture of coke or charcoal powder, or the like, with potassium carbonate and soya bean, either in the natural state, or as an oil cake, or in any other form.—T. St.

Iron and similar metals ; Process of removing sulphur and phosphorus from ——. A. E. Greene, Chicago, Ill., Assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. U.S. Pat. 1,065,605, June 24, 1913.

The process consists in "subjecting lime to electric heat in the presence of a gaseous reducing agent, and introducing the resultant vapours and gases into the body of the metal under treatment."—T. St.

Steel ingots and castings ; Thermal treatment of ——. Soc. Anon. Italiana Gio. Ansaldo & Co. Fr. Pat. 453,712, Jan. 28, 1913. Under Int. Conv., Oct. 9, 1912.

Piping and liquation of steel ingots are prevented by heating the ingot externally progressively from the bottom to the top as solidification takes place. A hollow sleeve with a refractory lining, carrying the source of heat (which may be gas, oil, solid fuel, or electricity), fits round the mould, and is moved upwards from the bottom as the ingot solidifies. In another form, the sleeve extends the whole length of the ingot, and heat is applied in sections.—T. St.

[Iron and steel.] Metals ; Process of producing clad ——. W. M. Page, Philadelphia, Pa. U.S. Pat. 1,066,312, July 1, 1913.

By oxidation and subsequent heating, a superficial layer of decarburised iron is produced upon the iron or steel base with which a layer of high-melting, ductile metal (*e.g.*, copper) is then united.—W. E. F. P.

Blast furnaces. W. J. Foster, Walsall, Staffs. Eng. Pat. 12,390, May 25, 1912.

The tapering bosh portion of the furnace is lined with infusible, hard-setting, carbonaceous material which is rammed into position (while wet) between moulding boards and the interior brickwork of the bosh. (Reference is directed to Eng. Pats. 1089 of 1879, and 2639 of 1881.)—W. E. F. P.

Furnace for roasting ores. J. B. L. Herreshoff, Assignor to Nichols Copper Co., New York. U.S. Pat. 1,066,110, July 1, 1913.

Relates to means for supporting and rotating, from a central, vertical, hollow shaft, the detachable rabble-arms of a roasting-furnace.—W. E. F. P.

Furnace ; Mechanical —— *for the continuous roasting of sulphide ores.* X. de Spirlet. First Addition, dated Jan. 22, 1913, to Fr. Pat. 415,338, April 28, 1910 (this J., 1910, 1392). Under Int. Conv., Dec. 28, 1912.

The furnace originally described is modified by making the superposed hearths annular instead of circular, the hearths being supported on pillars disposed in two concentric rings. The central space is used to create a natural draught, whereby cooling air is drawn through channels in the brickwork of the hearths and the projections which stir and move the ore. Some of the hearths are provided with discharge holes, so that the ore can be removed at the inner circumference. Incipient fusion, due to a relatively large quantity of hot ore being momentarily concentrated in one spot, such as was the case in the original furnace, is thus avoided.—T. St.

Furnace for the roasting of ores. C. Gabrielli. Fr. Pat. 453,808, April 13, 1912.

A cylindrical vertical furnace has a continuous hearth consisting of horizontal sectors alternating with helicoidal sectors sloping at not more than 35°. Stirring arms provided with teeth are attached to a central shaft, which besides rotating is capable of vertical movement, and is controlled by a collar in which is a groove exactly reproducing the form of the hearth. The collar itself is capable of a vertical movement sufficient to allow of the shaft being raised or lowered relative to the hearth, whereby the teeth on the stirring arms may be lifted clear of the ore. The shaft being in its topmost position, the collar with the shaft is lowered so that the teeth are embedded in the ore. The shaft then descends, the arms rotating and working the ore forwards and downwards. At the end of the downward course, the teeth are raised clear of the ore, and the shaft is rotated in the opposite direction. It thus rises until it again attains its topmost position. Projections on the shaft and collar engage with suitable levers at the proper positions to throw in and out of gear suitable toothed pinions on revolving shafts to give the central shaft and collar their proper movements and so make the working automatic.—T. St.

Tantalum; Process for the manufacture of heat-refractory articles from ——. Siemens und Halske Akt. Ges., Berlin. Eng. Pat. 23,050, Oct. 9, 1912. Under Int. Conv., Oct. 21, 1911.

Tantalum or a tantalum alloy is plated, coated, or sheathed with platinum. The coated metal combines the advantages of platinum and tantalum, and is suitable for all the purposes which have up till now been closed to tantalum on account of its property of oxidising when heated in the air. The improved metal welds very well with platinum, copper, and a number of other metals. —T. St.

Gold or other metals or material; Process and apparatus for the separating of a solution containing —— *from finely crushed insoluble substances.* E. C. R. Marks, London. From D. W. Stacey, Buluwayo, S. Rhodesia. Eng. Pat. 23,165, Oct. 10, 1912.

The apparatus (intended more particularly for use in the cyanide treatment of "slimes") consists of three intercommunicating tanks (preferably of inverted conical shape) the upper two of which are connected together in an air-tight manner. The middle tank being filled with cyanide solution, the slimes are allowed to fall into it slowly from the upper vessel into which the solution is thus caused to ascend. The insoluble residue is finally allowed to pass into the lower, or settling, tank for separation by ordinary means.—W. E. F. P.

Gold, silver and platinum; Method of manufacture of the precious metals ——. J. Picard and A. Verley. Fr. Pat. 453,268, Mar. 30, 1912.

Precious metals are stated to be formed by treating magnetised steel with hydrochloric acid, heating the solution in an autoclave, evaporating, and fusing the residue at a bright red heat.—T. St.

Tin ores, and other materials containing tin, for example, pyritic or other tin ores, tin ore concentrates, tin waste, tin-plate waste, stanniferous slag, tin slag, and the like; Treatment of ——. J. Rueb, The Hague, Netherlands. Eng. Pat. 27,148, Nov. 26, 1912.

The tin-bearing material is smelted with sufficient iron pyrites or copper pyrites together with fluxes, but without the addition of oxidising material, to form a tin-iron matte, or a tin-copper matte, consisting essentially of a mixture of sulphides containing practically all the tin as sulphide. The tin sulphide may be leached out of the tin-iron matte by solutions of alkali sulphides, but it may be preferable to roast the tin-copper matte and leach out the copper before leaching for tin. The tin may be recovered by electrolysis.—T. St.

Tin ores; Treatment of ——. J. W. Chenhall, Totnes, Devon. Eng. Pat. 1181, Jan. 15, 1913.

The finely ground ore is mixed with finely ground carbonaceous material and heated in a fire-clay retort in a current of coal gas under pressure. The reduced or partially reduced mass is discharged, with exclusion of air, and treated with dilute sulphuric acid, or with a mixture of sulphuric and hydrochloric acids. When sulphuric acid is used alone, and the ore contains little or no iron, a small quantity of metallic iron, from 2 to 12 per cent., is preferably added to the reduced mass, as the presence of ferrous sulphate facilitates the extraction of the tin. The solution is run off, and the tin precipitated with hydrogen sulphide. The tin sulphide is collected, dried, roasted to oxide, and reduced. The ferrous sulphate solution is evaporated to dryness, and the residue may be roasted to oxide, the sulphur oxides formed being used for the manufacture of sulphuric acid, as is also the sulphur dioxide formed when the tin sulphide is roasted. The method is stated to be profitable for the treatment of tailings, etc., containing as little as 10 lb. of tin to the ton.—T. St.

Solder for aluminium and other metals and method of making the same. D. Macfarlane, Glasgow. Eng. Pat. 2036, Jan. 25, 1913.

An alloy composed of Al 1, Zn 1, and Sn 12, parts by weight, approximately; part of the tin may be replaced by lead, and sulphur may also be added.—W. E. F. P.

Ore crushing and concentrating plants; Treatment for the precipitation of ore values from the effluent waters of ——. A. G. French, Nelson, B.C., Canada. U.S. Pat. 1,065,678, June 24, 1913.

Mineral matter in suspension in the water is precipitated by the addition of 1 part of a solution of gelatin and a metallic sulphate (1 part of gelatin and sulphate in 2500 parts of water) to 17 parts of the water, and stirring. —T. St.

(1) *Lead-copper,* (2) *lead-copper-tin alloy.* E. D. Gleason, New York, Assignor to Plastic Metal Co., Inc., Brooklyn, N.Y. U.S. Pats. 1,066,403 and 1,066,428, July 1, 1913.

Claim is made for: (1) a Pb-Cu-B alloy and (2) a Pb-Cu-B-Sn alloy.—W. E. F. P.

Ores [blende, etc.]; Furnaces and apparatus fo roasting ——. A. Binard, Brussels. Eng. Pat. 14,637, June 22, 1912.

See Ger. Pat. 253,051 of 1911; this J., 1912, 1186.—T. F. B.

Zinc blende; Method of and apparatus for roasting ——. A. L. J. Queneau, Philadelphia, U.S.A. Eng. Pat. 15,460, July 2, 1912. Under Int. Conv., July 19, 1911.

See Fr. Pat. 445,233 of 1912; this J., 1912, 1186.—T. F. B.

Roasting-furnace. M. van Marcke de Lummen, Cologne, Germany. U.S. Pat. 1,067,045, July 8, 1913.

See Eng. Pat. 13,549 of 1912; this J., 1913, 369.—T. F. B.

Briquetting fine ores and more particularly iron ore; Process for ——. E. C. R. Marks, London. From Maschinenbau-Anstalt Humboldt, Cöln-Kalk, Germany. Eng. Pat. 14,896, June 26, 1912.

See Ger. Pat. 249,085 of 1911; this J., 1912, 931.—T. F. B.

Furnaces for melting metals and their alloys and for other metallurgical operations; Liquid fuel ——. A. Etienne, L. Cauet, L. and H. Mercier, Montdidier, France. Eng. Pat. 15,252, June 29, 1912. Under Int. Conv., March 30, 1912.

See Fr. Pat. 441,951 of 1912; this J., 1912, 932.—T. F. B.

Ore concentration; Apparatus for ——. Minerals Separation, Ltd., London. From J. Hebbard, Broken Hill, N.S.W. Eng. Pat. 15,546, July 3, 1912.

See U.S. Pat. 1,064,209 of 1913; this J., 1913, 755.—T.F.B.

Metal; Thermal treatment of —— in electrically-heated furnaces. P. Girod, Ugines, France. U.S. Pat. 1,066,810, July 8, 1913.

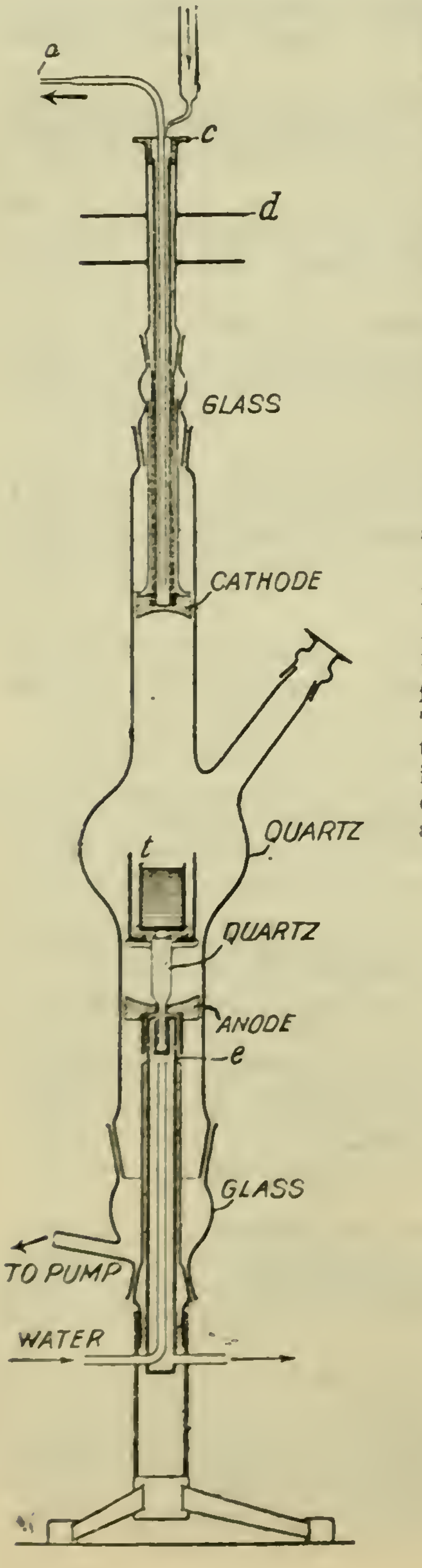
See Addition of June 7, 1909, to Fr. Pat. 402,758 of 1909; this J., 1910, 361.—T. F. B.

Ores; Process for the separation of ——. Treating complex ores or their concentrates. W. M. Martin, Redruth. U.S. Pats. 1,066,828, 1,066,829, and 1,066,830, July 8, 1913.

See Eng. Pats. 4531 and 9300 of 1909; this J., 1910, 825.
—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Cathode ray vacuum furnace. E. Tiede. Ber., 1913, 46, 2229—2233.



The vacuum furnace shown in the diagram is capable of producing temperatures at which iron, nickel, platinum, boron, etc., may be very rapidly melted and obtained in the massive form free from gases. Calcium carbide can be dissociated, the metal subliming on the edge of the crucible. The crucible itself does not become very hot, and the radiation may be directed to different parts of the charge by means of a magnet. The electrodes are of aluminium mounted in brass tubes, *e*, which can be kept quite cool by running water. Glass plates, *d*, *d*, serve to protect the apparatus from sparks from *c*. The length of the quartz tube used by the author is 47 cm. and the small crucible, *t*, is 3 cm. high and 3 cm. in diameter.
—W. H. P.

Patents.

Mica plates for electrical resistances and the like. C. Fischer, Porz am Rhein, Germany. Eng. Pat. 23,869, Oct. 18, 1912.

Waste fragments of mica are sewn together by means of thin resistance wire or strip. Or, the fragments may be riveted together with hollow rivets, the resistance wire or strip being passed between the rivets, or embedded as an intermediate layer between the pieces of mica.—B. N.

Batteries; Primary electric ——. G. S. Engle, Washington, U.S.A. Eng. Pat. 3861, Feb. 14, 1913. Under Int. Conv., Oct. 8, 1912.

The electrolyte consists of a solution of sodium hydroxide mixed with a second similar solution containing zinc hydroxide in the hydrosol form, and the negative element comprises carbon mixed with a depolarising metallic oxide, such as copper oxide, or manganese dioxide.—B. N.

Metallic article [aluminium electrode]; Film-coated —— and method of making same. R. D. Mershon, New York. U.S. Pat. 1,065,704, June 24, 1913.

The aluminium electrode has on its surface a dense, closely adherent, durable film, composed partly of aluminium in chemical combination with another element or elements. The film is stated to possess high dielectric strength and specific resistance, and to be capable of withstanding electrolytic attack at high temperatures.—T. St.

Ozonized air; Method of producing ——. J. Todd, Sewickley, Pa. U.S. Pat. 1,066,065, July 1, 1913.

The amount of air passing to the ozonizer is increased or decreased in proportion to the fall or rise in the temperature of the surrounding atmosphere.—W. R. S.

Ozone generator. W. O. Freet, Hackensack, N.J., Assignor to Steynis Ozone Co., New York. U.S. Pat. 1,066,484, July 8, 1913.

Several ring-shaped hollow electrodes, spaced apart and in line with one another, are held in fixed relationship by parallel strips extending along and secured to their outer walls. A second set of similar electrodes alternate with these, and are attached to the strips by means of insulators. Dielectric ring-shaped plates, having openings at their centres, are interposed between the electrodes, and the latter are provided with air openings adjacent to their edges.—B. N.

Ozone; Production of ——. J. Steynis, Assignor to Steynis Ozone Co., New York. U.S. Pat. 1,066,674, July 8, 1913.

Air moving in one direction is subjected progressively to a series of electrical discharges and to the action of a cooling fluid moving in the opposite direction. The apparatus comprises upper and lower casings disposed opposite to each other, these being divided into separate compartments. Several hollow electrodes connect together the upper and lower compartments, so that the air is passed through the series of electrodes. The hollow electrodes contain inner electrodes, from which they are separated by dielectric tubes, extending below both electrodes. Distributing bars are disposed at the ends of the electrodes, and pivoted connections extend from the bars to the inner electrodes.—B. N.

Conductors; Electrical ——. W. Deats and C. Scott, Yonkers, N.Y., Assignors to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,067,003, July 8, 1913.

Carbon and metallic copper, both in a finely powdered condition, are mixed, and subjected to a high pressure to form a solid block which is then baked.—B. N.

Electrode for use in electrothermal processes. E. B. Jewett, Clarksburg, W. Va., Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,067,031, July 8, 1913.

The electrode consists of "carbon flour" agglomerated by coke, with relatively large particles of carbonaceous material distributed throughout its mass.—B. N.

[*Electrolytic*] *manufacture of hydrogen peroxide.* Eng. Pat. 8582. *See* VII.

XII.—FATS; OILS; WAXES.

African palm oil industry; The ——. II. Bull. Imp. Inst., 1913, **11**, 206—221.

Since the publication of the previous article (this J., 1910, 287) considerable progress has been made in the installation in West Africa of machinery for the extraction of palm kernels and palm oil under European supervision. In the present article the results of the examination of samples of palm fruits, nuts, kernels, and oils from the Gold Coast, S. Nigeria, Nyasaland, Uganda, and Mozambique are given. It is stated that recently "mixed" or "semi-hard" oils have been shipped from W. African ports from which formerly only the more valuable "soft" oils were exported. The "soft" oils yield more glycerin as a by-product in soap manufacture than the "hard" oils. An investigation carried out by the Agricultural Department, Gold Coast, 1912, showed that when palm fruits are allowed to ferment for a considerable period, they yield a "hard" oil of much lower commercial value than the "soft" oil prepared from the fresh fruits.—A. S.

Cohune nuts from British Honduras. Bull. Imp. Inst., 1913, **11**, 226—230.

The nuts of the cohune palm (*Attalea Cohune*) have not yet been utilised for oil extraction on a commercial scale, owing to the difficulty of cracking the very hard shells, but machines for this purpose are now being tried in British Honduras. Samples of cohune fruits and kernels have been examined. The kernels yielded from 65·4 to 71·6 per cent. of a solid, white, crystalline fat, resembling cocoanut oil in appearance and smell, and having the following characters: sp. gr. at 100°/15·5° C., 0·868—0·871; acid value, 1·2—20·4; saponif. value, 252·4—256·5; iodine value, 11·0—13·7; solidif. pt. of fatty acids, titer test, 19·7°—21·0° C.; Hehner value, 87·7; Reichert-Meissl value, 6·8—8·3; Polenske value, 12·5—15·4; unsaponifiable matter, 0·23—0·28 per cent.—A. S.

Rape oil; Method for the detection of —— in mixtures, H. Kreis and E. Roth. Z. Untersuch. Nahr. Genussm.. 1913, **26**, 38—42.

For the detection of small amounts of rape oil in admixture with other oils, the following modification of the method suggested by the authors (this J., 1913, 150, 201) is recommended. The fatty acids obtained from 20 grms. of oil by precipitation with 1·5 grms. of lead acetate are dissolved in 100 c.c. of alcohol, boiled with a solution of 1 grm. of lead acetate in 50 c.c. of alcohol and the mixture allowed to stand overnight. The filtrate from the separated lead salts is freed from alcohol by evaporation and the residue boiled with 5 per cent. hydrochloric acid. In the case of rape oil the fatty acids thus separated melt at 24°—25° C., whilst the acids from olive oil melt at 47° C. Mixtures of the two oils give acids whose m. pts. are proportional to the composition of the mixture. —J. A.

Cottonseed oil; Bleaching refined ——. F. Paquin, E. R. Barrow, T. C. Law, F. N. Smalley, and R. G. Warren (Chemists' Committee of Interstate Cotton Seed Crushers' Assoc., U.S.A.). Oil, Paint and Drug Rep., June 30, 1913.

The official methods for the analysis of cottonseed products (this J., 1911, 906) have been left unchanged, but the following method for bleaching refined cottonseed oil has been added. 300 grms. of oil are heated to 120° C., allowed to cool to 105° C., treated with 6 per cent. of 200 sq. mesh standard English fullers' earth (obtained from the Society of Cotton Products Analysts), agitated for 5 mins. at 105° C., and filtered, about 100 c.c. being returned to the filter and the depth of colour of the second filtrate measured. An investigation, in co-operation with the U.S. Bureau of Standards, of the Lovibond tintometer glasses has not yet been completed, but temporarily the complete set of glasses owned by the Bureau of Standards and known as set 9940 has been adopted as a standard. —A. S.

Hardened oils; Analysis of ——. W. Normann and E. Hugel. Chem.-Zeit., 1913, **37**, 815.

The acid value, saponification value and amount of unsaponifiable matter are not materially affected on hydrogenising an oil, but hydroxyl groups are more or less split off. For example, the hydroxyl value of castor oil fell from 156 to 102. Arachidic and behenic acids are formed (20 per cent. and upwards) on hydrogenising marine animal oils, whilst behenic acid is also formed on treating rape seed oil. In applying the method of Kreis and Roth (this J., 1913, 201) to the detection of arachidic acid in hardened marine animal oils and rape seed oil it is not necessary to allow the flask to stand for 3 hours after the addition of the lead acetate, but it is sufficient to cool the liquid to the ordinary temperature (see also this J., 1913, 665).—C. A. M.

Ricino-stearolic acid. G. Mühle. Ber. 1913, **46**, 2091—2098.

Ricino-stearolic acid di-iodide was obtained by digesting a solution of the acid in carbon bisulphide for two months in the dark with the calculated amount of iodine and about 1 per cent. of ferrous iodide. The di-iodide is refractive to light. It is readily soluble in most organic solvents, but is sparingly soluble in petroleum spirit. Ricino-stearolic acid prepared from castor oil by the method of Hoffmann-La Roche (Ger. Pat. 243,582 of 1909; this J., 1912, 398) melts at 51° C., and distils unchanged at 260° C. under a pressure of 10 mm. When treated with petroleum spirit it leaves an insoluble residue identified as Hazura and Grüssner's α-isotrihydroxystearic acid. Contrary to the assertion of Krafft (Ber., 1888, **21**, 2735) and of Mangold (Monatsh. Chem., 1894, **15**, 308) ricinoleic and ricinelaïdic acids do not yield a crystalline acid, $C_{18}H_{32}O_2$, when distilled under a pressure of 15 mm. The former distils unaltered at 226° to 228° C. and the latter at 240° to 242° C. under a pressure of 10 mm., and neither decomposes below a pressure of 60 mm. At that pressure liquid but no solid decomposition products are formed.—C. A. M.

Fluidity of butter fat and its substitutes. White and Twining. *See* XIXa.

Patents.

Fatty acids and their esters; Method of producing saturated —— from their unsaturated compounds. A. de Kadt, Harburg a/E., Germany. Eng. Pat. 18,310, Aug. 9, 1912.

The hydrogenation of unsaturated fatty acids and their esters may be effected by means of hydrogen in presence of a catalyst consisting of a soap of a heavy metal or of a noble metal, made from a fat or fatty acid having a melting point higher than that of the saturated compound to be produced. For example, the nickel soap, or preferably a mixture of the nickel and iron or copper soaps of the fatty acids of stearine or Japan wax is dried and powdered, and can then be intimately mixed with the oil to be hydrogenated. After hydrogenation the oil is left quiescent at a temperature above its melting point, when the soap particles will agglomerate and settle on cooling. If, however, the oil is kept in motion and filtered, the soap does not pass through the filter. It is stated that this process is more efficient than when metallic catalysts are used, owing to the more intimate contact between the catalyst and oil or fat which is here obtained.—T. F. B.

Fatty acids and their glycerides; Process for saturating unsaturated —— by combining them with hydrogen. E. Utescher, Hamburg, Germany. Eng. Pat. 20,061, Sept. 3, 1912. Under Int. Conv., Feb. 17, 1912.

An unsaturated fatty acid or a glyceride thereof is treated with hydrogen in presence of a finely-divided catalytic agent, and at the same time the mixture is subjected to the action of silent electric discharges. In a description of the process, it is stated that the silent discharge is prevented from coming into actual contact with the fatty substance, only the chemically active rays (*e.g.*, from a mercury vapour lamp) being utilised. It is also stated that the process may be effected by allowing the rays of the silent discharges to impinge on the surface of the catalytic substance, which may be used in the form of plates. —T. F. B.

Saturated fatty acids and their esters from the corresponding unsaturated compounds; Process for producing ——. Naamlooze Vennootschap Ant Jurgens' Vereenigde Fabrieken. Ger. Pat. 260,885, Feb. 3, 1911.

Unsaturated fatty acids and their esters are hydrogenised by treatment with hydrogen in presence of a small quantity of a solid salt of a platinum-metal (*e.g.*, palladous chloride, sulphate, or nitrate, platinous or platinic chloride or sulphate, or a double salt), at temperatures below 100° C. If necessary, a solid neutralising agent may be added.—T. F. B.

Oils and fats; Process for bleaching and thickening ——. F. Gruner. Fr. Pat. 453,664, Jan. 27, 1913.

The oils or fats are subjected to the action of a silent discharge of electric currents of very high tension and frequency.—W. H. C.

Turkey-red oil; Process for preparing ——. A. Grün. Ger. Pat. 260,748, March 29, 1911.

Castor oil or other ester of ricinoleic acid is treated with chlorosulphonic acid, either in solution or suspension, and the reaction product is dissolved in water and neutralised. The products are stated to have a very high content of sulphonic esters compared with that of the oils prepared by aid of concentrated sulphuric acid. —T. F. B.

Grease; Apparatus for extracting —— from grease-bearing materials. C. R. Mayo, London. U.S. Pat. 1,066,028, July 1, 1913.

See Eng. Pats. 8600, 17,125, and 22,615 of 1909; this J., 1910, 941.—T. F. B.

Composition and rubber substitute for waterproofing. Eng. Pat. 14,665. *See* XIV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Ochre. M. Sirot and G. Joret. Bull. Soc. d'Encour., 1913, **119**, 769—789.

The deposits of ochre in Yonne, France, are described. Analyses are given of the different strata and of crude and refined ochres and the question of the formation of ochre is discussed. The crude ochre is ground, sifted, levigated, etc., to prepare it for use. 1 cubic metre of crude ochre as mined weighs about 2150 kilos. and yields 1000 kilos. of refined ochre of medium quality. Commercial samples of prepared ochre gave the following figures:—

Colour of ochre.	Yellow.	Red.	Brown.
No. of samples	7.	5.	2.
	per cent.	per cent.	per cent.
Water	0·82— 3·70	0·90— 3·20	—
Loss on ignition	7·80— 9·10	3·25— 5·00	—
Sand and silica	60·10—68·50	59·00—65·30	35·10—37·75
Iron oxide	19·52—22·70	23·50—59·71	43·75—30·20
Alumina	1·50— 4·50	0·15— 5·39	—
Manganese	—	—	3·52— 3·80
Undetermined	0·15— 0·87	Traces— 0·31	—

Although ochre is generally described as being of a clayey nature the authors point out that it is really silicious and only contains small amounts of alumina. Three classes of natural ochres are found; yellow, the colour of which is due to hydrated iron oxide; red, containing anhydrous iron oxide; brown, the colour in this case being due to anhydrous iron oxide mixed with oxide of manganese. Red ochres may be produced by igniting the yellow varieties.—R. G. P.

Copals from Mozambique. Bull. Imp. Inst., 1913, **11**, 221—226.

The results of the examination of nine samples of "recent" copals (*i.e.* from existing trees) are given. Most of the samples were of poor quality and too soft to produce satisfactory varnishes, but the "Mgeji" copal from trees growing in the Madanda forest was of good quality. Four grades of this copal were supplied and they were valued at about £5, 85s., 50s., and 25s. respectively. They were not completely soluble in alcohol, ether, chloroform, benzene, or oil of turpentine, practically insoluble in a mixture of benzene and oil of turpentine, but partially soluble in mixtures of alcohol and ether, alcohol and benzene, and alcohol and oil of turpentine. They all became soluble in oil of turpentine on "melting" for 1½ hours, and in this process lost 14, 16, 21 and 30 per cent. respectively in weight. Varnishes prepared by dissolving the "melted" copals in oil of turpentine gave almost colourless, hard and glossy coatings in the case of the two more valuable grades and pale yellowish-brown coatings in the case of the other two.—A. S.

Paints and varishes; Preliminary report upon a practical accelerated test for ——. A. M. Muckenfuss. J. Ind. Eng. Chem., 1913, **5**, 535—549.

The method consists essentially in exposing porous surfaces coated with the paint to "artificial climates" (water-spray, warm and cold air, light from a combination of mercury vapour and tungsten filament lamps, etc.) and determining and comparing the permeability of the paint films after varying periods of exposure. The surfaces used are of the same material, as far as possible, as the surfaces on which the paint is to be used in practice, *e.g.* steel wire cloth for steel, hardened paper for wood, or cement and sand for concrete. The method of determining the permeability consists broadly of interposing the painted surface between a receptacle containing water and a water-absorbent, so that vapour from the water, in order to reach the water-absorbent, must pass through the paint film. A blank is run under similar conditions with an unpainted steel wire screen. The results of a considerable number of experiments on different paints and varnishes are given, together with tables and diagrams.—A. S.

What is white lead. Chem. Trade Journal, July 12th, 1913.

In the King's Bench Division, on July 8th, before Mr. Justice Avory, a settlement was announced in the case of Thomas Raban and Son, of Baldock, Herts. v. Thomas Merry and Co., Ltd., of Suffolk Street, Birmingham, as follows:—The defendants admitted that, on a sale of goods by or under the description of "White Lead," it is the custom of the trade that the substance sold and delivered should be hydrated oxycarbonate of lead, and that they supplied to the plaintiff a different pigment, viz.: sulphate of lead. They undertook not to offer in future for sale any pigment under the name of "white lead" other than the substance commonly known as white lead, viz., hydrated oxycarbonate of lead.

Patents.

Paint mills or the like. T., J. R., and H. N. Torrance, and Torrance and Sons Ltd., Bitton, Gloucester. Eng. Pat. 14,733, June 24, 1912.

The relative motion of two horizontal grinding discs of a mill is arranged to be of an undulating character, the upper disc being concave and stationary, whilst the lower, convex disc is given a rotary motion about its axis and is at the same time moved bodily in a lateral direction relatively to the upper disc.—O. R.

Paints and varnishes for the prevention of corrosion and fouling. L. Collardon. Fr. Pat. 453,395, Jan. 20, 1913. Under Int. Conv., Jan. 20, 1912.

CARBOLIC acid or other phenol or cresol is condensed with formaldehyde or paraformaldehyde in presence of one or more organic or inorganic compounds having toxic properties, *e.g.*, copper sulphate or acetate, or compounds of lead, mercury, antimony, arsenic, zinc, etc. The product is mixed with one or more cellulose esters of the fatty series, *e.g.*, formate, acetate, butyrate, palmitate, a solvent such as dichloroethylene, trichloroethylene, dichlorobenzene, acetone or carbon tetrachloride, and a pigment. Other substances such as jelutong or other rubber resins may be added to the phenol before condensing with formaldehyde. In the case of the manufacture of a varnish, an oxidising bleaching agent is added with the formaldehyde; such agents are alkali peroxides, hydrogen peroxide, perborates, alkali percarbonates, persulphates or other alkali per-salts, hypochlorites, sulphur dioxide, either alone or in combination with borax or magnesia, hydrosulphites, ozonised water, etc.—E. W. L.

Litharge; Apparatus for the manufacture of ——. Lindgens und Söhne and Bergmann und Simons, G. m. b. H. Fr. Pat. 453,489, Jan. 23, 1913.

LEAD is maintained in a liquid state in the bottom of a tall heating chamber into which heated air or superheated steam or a mixture of the two can be blown, and is thrown against the walls of the chamber by means of paddles or discs revolving rapidly on a horizontal shaft, and dipping just below the surface of the lead. The finely divided litharge is carried away in the form of dust, any unburnt lead falling back on to the hearth.—E. W. L.

Zinc white; Furnace for the manufacture of —— *from zinciferous products.* P. Schmidt und Desgraz, G. m. b. H. Fr. Pat. 453,642, Jan. 27, 1913.

A REGULAR heat throughout the furnace is ensured by causing the flame from a lower pair of gas-burners, situated at the furnace mouth below the double bank of muffles, to pass upwards through the first section of muffles at the top of which, passing over a fire-bridge, it meets the flame from an upper pair of burners and passes downwards with it through the second section of muffles. The waste gases pass to a regenerator for heating the in-going air at the burners.—E. W. L.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Oxidation of ——. F. Kirchhof. Kolloid-Zeits. 1913, **13**, 49—61.

EXPERIMENTS on the action of atmospheric oxygen on raw and vulcanised rubber suggest that the process is an autoxidation, in which relatively unstable peroxides (*e.g.*, $C_{10}H_{16}O_2$) are first formed, while secondary reactions occur later, *e.g.*, giving $C_{10}H_{16}O$ and $C_{10}H_{16}O_3$ (compare this J., 1912, 1103; 1913, 179). In the case of raw rubber these reactions, accelerated by light and heat, first result in softness and then in hardness on the surface, by the formation of higher oxidised products. In the case of vulcanised rubber peroxides are also formed first, and then decompose, making the surface tacky. Higher oxides are then formed together with acid substances and free sulphuric acid. The deleterious action of sulphuric acid appears to be due to an oxidation of the rubber, with formation of sulphur dioxide. Vulcanised rubber, unlike raw rubber, gives off water when treated with atmospheric oxygen at fairly high temperatures; this is apparently connected with the formation of sulphuric acid. When acetone-extracted vulcanised rubber is oxidised, the product yields a considerable amount of extract to acetone and then to alcoholic alkali. The insoluble residue contains about $\frac{2}{3}$ of the combined sulphur present in the original rubber, which strongly confirms the theory that sulphur adds on to rubber as thiozone, S_3, the S atom unconnected with a carbon atom being more readily oxidised than the other two. It is suggested that this thiozone theory (see Erdmann, this J., 1908, 934) may be applied to the ageing phenomena of rubber goods. It is shown that these oxidation-products will seriously interfere with determinations of caoutchouc content by the tetrabromide method.—H. E. P.

PATENTS.

Indiarubber; Extraction or coagulation of —— *from the latex.* S. C. Davidson, Belfast. Eng. Pat. 11,470, May 14, 1912.

LATEX prior to coagulation is treated with a dilute (1 : 20) alkaline solution of creosote or carbolic acid or a mixture of the two, in quantity just sufficient to render the latex alkaline to test paper. A small quantity of formaldehyde may be added in some cases. The latex is then coagulated by the addition of acetic or other acid in the ordinary way. Heat may be applied at any or all of the various stages (see also Eng. Pat. 25,256 of 1911; this J., 1913, 98).
—E. W. L.

Rubber substitute; Composition and —— *for waterproofing and the like, and process for preparation.* G. d'Almeida, Singapore. Eng. Pat. 14,665, June 22, 1912.

"TANG IU" or "Thang Iu" oil—obtained from the fruit of the Tang or Thang tree (*Aleurites Fordi*), indigenous more particularly to S. China, is boiled for 3—4 hours, and is then mixed with 5—6 drams per lb. of oil of "Tam Ti" powder—the powdered matrix of a gold- and silver-bearing quartz of the Straits Settlements. The "solution" thus obtained is applied to fabrics by brushing, etc., and allowed to dry, preferably in the shade. Or the oil may be boiled longer or more vigorously so as to produce an elastic mass which may be employed as a rubber substitute. The "solution" may also be mixed with waste or bamboo paper and various other materials for the production of a variety of articles.—E. W. L.

Rubber and like gums containing resins; Treatment of ——. E. S. Ali-Cohen, The Hague, Holland. Eng. Pat. 18,851, Aug. 16, 1912.

PONTIANAC, or similar gum is, if necessary, cleaned and dried, and is then dissolved in a suitable neutral solvent such as petroleum spirit, and mixed with two-thirds of its weight of oxidised linseed or other vegetable oil. The mixture is filtered or strained, if necessary, the solvent distilled off, and the residue heated slowly to about 90° C. About 8—12 per cent. of sulphur is then added and the temperature raised to 140°—155° C. in a closed vessel. After cooling the mass is well worked in a mixing machine with the aid of heat and pressure. The product may be used without further treatment, or it may be incorporated with bitumen, petroleum jelly, magnesia, zinc oxide, fibrous material, rubber, gutta percha, etc. The oxidation of the vegetable oil is effected by heating it to near its ignition point for a considerable time and afterwards heating it with a suitable oxidising agent not containing lead. In the case of linseed oil the oil is first heated at 300°—325° C.—conveniently 300°—305° C.—for 24 hours, then cooled to 260°—275° C., at which temperature it is oxidised with, for example, manganese perborate.
—E. W. L.

Rubber; Industrial manufacture of ——. G. Reynaud. Second Addition, dated March 12, 1912, to Fr. Pat. 419,860, Nov. 6, 1909 (this J., 1911, 226, 968).

IN order to free it completely from sulphuric acid and to destroy its tackiness, the mass obtained by the process described in the original patent and first Addition (*loc. cit.*) is mixed with 10 to 40 per cent. of its weight of lime and 5 to 20 per cent. of sulphur, and the mixture is heated at 100°—130° C. The excess of sulphur and the lime are then removed, the former by boiling with caustic alkali solution, the latter by treatment with hydrochloric acid, and the product is washed with water and dried.—E. W. L

Vulcanising indiarubber, unsaturated fatty oils, or their derivatives ; Process for ——. H. Klopstock. Ger. Pat. 260,916, Sept. 21, 1912.

Indiarubber may be vulcanised by treating it with a halogen compound of selenium or tellurium. Similarly, fatty oils, unsaturated fats, lecithin, and similar compounds can be vulcanised by the selenium or tellurium compounds as with sulphur compounds. Rape oil gives rise to a factice, whilst fats, lecithin, etc., furnish products said to be suitable for use in medicine.—T. F. B.

Rubber or rubber-like substances ; Manufacture of —— *from halogen compounds with organic substances.* Obstchestvo proizvodstva & torgovli resinovymi izdeliami "Bogatyr," and I. Ostromislensky, Moscow. Eng. Pat. 7457, March 27, 1912.

See Fr. Pat. 442,991 of 1912 ; this J., 1912, 1043.—T. F. B.

Preparing erythrene and isoprene. Ger. Pat. 261,876. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Pelt ; The differential staining of bacteria in the investigation of tuberculosis and its application to the qualitative examination of ——. E. O. Sommerhoff. Collegium, 1913, 377—380.

Bacterial cells are the simplest organized colloidal albumins which are known and may be regarded as a permeable albuminous membrane enclosing the albuminous contents containing more water. Two different kinds of colloidal albumins are distinguishable by their behaviour towards staining agents, α, those which swell in the cold and are easily stained with methylene blue ; these are similar in their properties to egg-albumin ; β, those which swell only on heating and only then are easily stained with phenol-fuchsin (1 grm. of phenol and 1 grm. of fuchsin to 100 c.c. of water) ; these are similar to fresh meat jelly. Freshly precipitated stannic acid may be considered as a mixture of α- and β-stannic acid. The colloidal α-stannic acid is very reactive in the cold ; by heating it is coagulated and the reactions of the much less reactive β-stannic acid may then be observed. In a colloidal albumin solution, at ordinary temperatures, it may be assumed that there are present α- and β-albumin cells analogous to the two varieties of stannic acid ; in some colloidal solutions the α-cells predominate as in egg albumin, while in others the β-cells predominate as in flesh jelly. These voluminous albumin cells will, in their active strongly-swollen condition (hydrosol condition) take up the colouring matter by diffusion through the cell wall and the molecule of colouring matter will, in the intracellular space, combine with the albumin molecule to form a complex molecular addition product. This results in the splitting-off of a small quantity of water and the coloured albumin cells pass into the gel state. With crystalloidal dyestuffs, such as picric acid, the cell membrane may be ruptured (coagulation by momentary splitting-off of water). If a colloidal albumin solution as free as possible from electrolytes, is evaporated, an unorganised skin is produced composed of a countless number of α and β cells. If the evaporation is carefully carried out and coagulation avoided, the skin can be swollen again with water and the reaction of the α and β cells again be observed. In the swelling of hide with water the reaction both of the α- and the β-albumin cells must be observed and these depend on the temperature. In the cold the α-albumin cells are in active hydrosol condition and they can be stained with methylene blue similarly to bacteria. Regions of the hide which are strongly coloured with the blue pigment can be assumed to be rich in α cells. The number of cells which are coloured by a quick immersion depends on its duration, the concentration of the colour solution and the strength of the chemical affinity of the dye. Of bacteria the strongly colloidal colour well and the coagulated not at all and fresh hide colours more strongly than old. Hide may be stained in warm phenol-fuchsin solution but the red colouring has less interest for the tanner than for the glue maker. The basic aniline colours provide a means of classifying the colloidal albumins which have, as yet, been imperfectly investigated.—D. J. L.

Logwood ; The tanning properties of ——. R. H. Wisdom. J. Amer. Leather Chem. Assoc., 1913, 8, 274—275.

A representative sample of logwood analysed by the official method of the Amer. Leather Chem. Assoc., gave a tannin content of 7·82 per cent. and non-tannin content of 5·83 per cent. A pure clarified logwood extract gave 23·9 per cent. of tannin and 20·8 per cent. of non-tannin. These results indicate that logwood might reasonably be used for making leather and the author states that an excellent quality of leather has been prepared with logwood. It is suggested that a certain proportion of logwood might be used along with the other tanning materials for leather which is subsequently to be dyed by means of logwood, particularly for blacks.—J. R. B.

Tannage of hide by means of "insoluble" metallic jellies and their influence on tannin analysis. E. O. Sommerhoff. Collegium, 1913, 381—382.

Freshly precipitated phosphates, hydroxides, sulphides and silicates of the heavy metals which are completely insoluble in water have a strong tanning action on skin. The tanning action is due entirely to mechanical absorption in contrast to the usual tanning process in which chemical action plays a part. A piece of hide shaken for 2 hours with precipitated copper phosphate was completely tanned, the ash being increased to 13 per cent. as compared with 4 per cent. in the raw skin. Similar results were obtained with chromium hydroxide, zinc hydroxide, copper sulphide and even the completely insoluble ultramarine. The insoluble phlobaphenes in tanning materials must take part in the tanning process by direct absorption. Analysis of tanning materials which neglects the insoluble portions must give results not in accordance with those obtained in practice, as the tannin strength must always be returned as too low. It is not important to make a tanning extract completely soluble in the cold as the undissolved tannins in colloidal suspension are capable of tanning. The tanning effect of sparingly soluble bodies has always been considered as taking place owing to a very small quantity becoming dissolved but in the case of copper phosphate and ultramarine, where traces in solution could easily be found, this hypothesis is untenable.—D. J. L.

Aluminium ; Applications of activated ——. [*Precipitation of tannin.*] *Alumgallins.* E. Kohn-Abrest. Bull. Assoc. Chim. Sucr., 1913, 30, 862—868.

Amalgamated or activated aluminium (this J., 1912, 645, 689) precipitates a larger proportion of tannin from solution than was previously supposed (this J., 1911, 836), and the products of oxidation of the metal continue to exert a precipitating effect after the metal itself has been removed from the solution. The precipitates obtained from various vegetable extracts, when treated with hydrochloric or sulphuric acid, yield yellowish products, which are almost completely soluble in water, and the solutions give all the reactions of tannin. The author terms these products "alumgallins." One such product was found to consist of : Al_2O_3 13·4, SO_3 30·0, tannin 37·62, and H_2O 18·98 per cent. It should be possible to obtain products of much higher tannin-content, and the author suggests that they may find industrial applications, *e.g.*, as tanning materials. In the purification of extracts containing alkaloids (this J., 1913, 44), it may be practicable to use the precipitates for the preparation of alumgallins. For determining tannin, the author recommends the following modification of Wislicenus's method (this J., 1904, 765) :—A sheet of active aluminium, about 1 mm. thick and about 3 grms. in weight, is immersed in 100 c.c. of the solution (containing 0·5—1 per cent. of tannin) : the activation of the metal is effected by immersing it for 3 minutes in a 1 per cent. solution of mercuric chloride, after which it is rinsed with water. When all the tannin has been thrown down (generally in 4—5 hours or in about one hour if a mechanical stirrer is used), the precipitate is filtered off under pressure and washed twice with water. The united filtrate and washings are evaporated to the original volume, and equal portions of this solution and of the original solution are evaporated to dryness. If extreme accuracy is required, the small quantity of alumina in the treated solution must be allowed for; this is represented by the difference between the weights of the ignited residues.—L. E.

Patents.

American cloth; Manufacture of —— and the like waterproof fabrics and substitutes for leather. W. Kaempfe, Grossenhain, Saxony. Eng. Pat. 15,965, July 8, 1912.

The linseed or other drying oil hitherto used in the manufacture of American cloth is replaced by an animal oil such as train oil, which has been heated for about 2 hours at 235°—240° C., and then directly subjected to distillation by means of superheated steam at about 375°—400° C., until the saturated fatty acids have distilled over, and the contents of the still have assumed a varnish-like consistence. To produce a particularly strong varnish the product is afterwards boiled in an open boiler at a temperature up to 315° C. The varnish may be mixed with varnishes from ordinary drying oil, or with melted resin or copal gums.—E. W. L.

Tanning hides and skins and apparatus therefor. J. Durio, London. Eng. Pat. 15,346, July 1, 1912.

See Fr. Pat. 448,321 of 1912; this J., 1913, 438.—T. F. B.

Leather; Process and composition for the treatment of —— and the like. G. Bork, Dortmund, Germany. Eng. Pat. 29,521, Dec. 21, 1912.

See Ger. Pat. 256,580 of 1911; this J., 1913, 438.—T.F.B.

Leather and leather-like products; Manufacture of ——. W. Spalteholz, Leipzig, and K. Haring, Assignors to Chem. Technologische Studienges. m. b. H, Hersfeld, Germany. U.S. Pat. 1,066,231, July 1, 1913.

See Ger. Pat. 258,992 of 1911; this J., 1913, 668.—T. F. B.

Agglutinant for manufacturing agglomerates. L. Penkala, Paris. Eng. Pat. 3313, Feb. 8, 1913. Under Int. Conv., Feb. 14, 1912.

See Fr. Pats. 451,522 and 451,523 of 1912; this J., 1913, 618.—T. F. B.

Process of compression for the impregnation of porous materials by liquid products to render them fireproof or impermeable, or to dye or tan them. Fr. Pat. 453,730. *See* I.

Producing lustrous effects on paper, fabrics, leather or the like. Eng. Pat. 16,156. *See* VI.

XVI.—SOILS; FERTILISERS.

Ammonium citrate solution; Simple method for preparing neutral ——. A. J. Patten and W. C. Marti. J. Ind. Eng. Chem., 1913, 5, 567—568.

For the preparation of a neutral solution of ammonium citrate for the determination of available phosphoric acid in fertilisers, the authors make use of the quantitative liberation of the acid from ammonium salts by the action of formaldehyde. A known quantity of an acid solution of ammonium citrate is diluted and in equal portions of the diluted solution there are determined: (1) the free acid after treatment with formaldehyde, and (2) the ammonia by distilling with magnesia. The difference between the two results shows the amount of acid required to neutralise the citrate solution. The results agree with those obtained by the conductivity method (this J., 1911, 1079) in indicating that in a neutral solution of ammonium citrate the ratio of ammonia to anhydrous citric acid is 1 : 3·765.—A. S.

Phosphoric acid; Volumetric determination of —— applied to the analysis of fertilisers. L. Ledoux. Bull. Soc. chim. Belg., 1913, 27, 170—172.

Pemberton's volumetric method (this J., 1894, 176, 667; 1895, 511) consists in dissolving ammonium phosphomolybdate in excess of $N/1$ alkali and measuring the excess with standard acid. The composition of the precipitate obtained by the ordinary method is not quite constant, but by carrying out the precipitation in the cold with the help of a mechanical agitator, the author has obtained uniformly concordant results (compare this J., 1913, 738).—W. R. S.

The production and consumption of chemical fertilisers in the world.

A publication of the Bureau of Agricultural Intelligence and Plant Diseases of the International Institute of Agriculture (Rome) has recently been issued entitled "Production et consommation des engrais chimiques dans le monde."

Some of the data therefrom concerning the world's production are given in the subjoined table:—

	Production in metric tons.		
	1903	1910	1911
Phosphatic fertilisers:			
Mineral phosphates	2,433,779	5,344,981	6,055,073
Basic slag	2,243,500	3,275,845	(3,485,500)
Superphosphates	5,130,900	9,604,260	—
Guano	(56,000)	(66,044)	—
Potash salts (for agriculture):			
Potash salts (calculated as pure potash)	301,144	766,583	840,000
Indian salpetre	20,570	15,581	15,273
Other potash fertilisers (calculated as pure potash)	—	—	40,000
Nitrogenous fertilisers:			
Nitrate of soda	1,466,993	2,432,949	2,487,000
Sulphate of ammonia	537,520	1,045,905	1,187,425
Cyanamide	—	30,000	52,000
Nitrate of lime	25	25,000	50,000
Total nitrog. fertil. ..	2,004,538	3,533,844	3,786,425

It is believed that 1,000,000 metric tons of chloride of potash, corresponding to 630,000 metric tons of pure potash, could be produced yearly in the United States from seaweeds. It has also been proposed in the United States to use felspars for the extraction of potash in a soluble form; a yield of 400,000 metric tons of pure potash could thus be obtained yearly. The production of sulphate of ammonia has increased five-fold in twenty years. The Mond-Frank-Caro process would allow of the manufacture of 88 to 176 lb. of sulphate of ammonia per metric ton of peat. The production and probable consumption of synthetic nitrogenous fertilisers has been calculated for the years 1913 and 1914. The figures which have been estimated are enclosed in brackets:—

	Calcium cyanamide.	Nitrate of lime.
	metric tons.	metric tons.
1903......	—	25
1904......	—	550
1905......	—	1,600
1906......	500	1,600
1907......	2,200	15,000
1908......	8,300	15,000
1909......	16,000	25,000
1910......	30,000	25,000
1911......	52,000	(50,000)
1912......	95,000	(75,000)
	204,000	—
1913......	(97,000)	(140,000)
1914......	(208,000)	—

The world's consumption of fertilisers in 1911 represented a value of about £80,000,000, and was made up as follows:—

	metric tons.
Lime phosphates	5,669,000
Superphosphates	8,604,000
Basic slag	3,300,000
Guano	70,000
Potash salts	4,100,000
(Pure potash)	(848,400)
Nitrate of soda	2,313,450
Sulphate of ammonia	1,100,000
Synthetic nitrogenous fertilisers	100,000

Data are given on the consumption of fertilisers per unit of area in the different countries. Belgium, Mauritius, and Luxemburg use upwards of 278 lb. per acre of cultivated area; Germany and the Netherlands from 89 to 178 lb. per acre; Denmark, United States (Southern States), France, England, Australia, Italy, and Switzerland from 45 to 89 lb. per acre; next follow the countries consuming from 9 to 45 lb. per acre of cultivated land: Austria, Hungary, Spain, United States (North-East), Norway, Dutch East Indies, Portugal, Sweden. All the remaining countries consume less than 9 lb. per acre or an unknown amount.

Zinc arsenite as an insecticide. Schoene. *See* XIXb.

Soluble arsenic in mixtures of lead arsenate and soap. Tartar and Bundy. *See* XIXb.

Patent.

Manure; Manufacture of ——. L. von Alphen, Soerabaya, Java. Eng. Pat. 10,996, May 9, 1913.

A manure consisting of pulverised peat-dust, saturated with compounds of the constituents (ammonia, potash, phosphoric acid, etc.), which are drawn from the soil by the plants for which the manure is intended, lime being replaced by ferrous sulphate.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Beet juices; Preservation of —— for analytical purposes. V. Stanek. Z. Zuckerind. Böhm., 1913, **37**, 501—609.

Of the substances tried, mercuric chloride, formaldehyde, phenol, chloroform, and carbon bisulphide either affected the density of the juice, or else had a reducing action on Fehling's solution. Carbon tetrachloride and thymol, whilst satisfactory in other respects, were not capable of inhibiting the alteration of samples for any considerable period of time, excepting in the case of juices containing an unusually small number of micro-organisms.—J. P. O.

Sugar; Available —— and a system of control in the boiling house. N. Deerr. Bull. 41, Expt. Station, Hawaiian Sugar Planters' Assoc., 1913.

For calculating the available sugar in the cane sugar factory boiling house, the author suggests the following formula, expressing the result as a percentage on the sucrose in the original material: $\frac{s\,(j-m)}{j\,(s-m)}$, s, j, and m being the purities of the commercial sugar, juice, and waste molasses respectively. With this formula the sucrose lost in the press-cake and by entrainment is reckoned as available. The apparent purity values, found from the polarisation and Brix figures, may be accepted as the basis of the calculation in place of the true quotients. The following scheme of boiling house control is recommended for practical work: (1) As sucrose entering the boiling house, that found in the mixed juice by double polarisation is taken. (2) The value for j is that found for the syrup (provided no product is remelted in it), and it is determined once daily on an average sample diluted to about 15° Brix, the syrup being used, and not mixed juice, since it is the finally purified product going to the pans, and since there is generally a distinct rise in the purity between clarified juice and syrup. (3) The sucrose content of the sugar is determined as well as the polarisation, and the ratio between these two values is ascertained weekly. (4) The value for s is that found for the sugar in a dilution of about 15° Brix, and is determined weekly. (5) The value taken for m is that found for the waste molasses in a dilution of about 15° Brix. Finally, a further control based on balance sheets of the dry substance and the non-sugars, as well as of sucrose, is advocated; and here also the apparent values and not the true quotients are used, corrections being made for the suspended solids in the mixed juice and for the lime added in defecation. Inversion or destruction of sucrose can thus be readily indicated if the non-sugars show an increase; while a loss by entrainment in the evaporators can be deduced if the loss shown in the dry substance balance sheet is approximately the same as that found for the sucrose balance.—J. P. O.

[*Sugar.*] *Carbosulphitation at a low temperature; Process of ——.* J. Robart. Bull. Assoc. Chim. Sucr., 1913, **30**, 836—837.

According to this process (see this J., 1913, 375), the crude sugar juice, after treatment with lime, is re-heated to 58°—60° C., carbonated until its alkalinity is reduced to 0·7—1·3 grms. per litre, then heated to 65°—68° C., and filtered. The filtrate is treated with more lime if necessary, and, without being further heated, is carbonated until its alkalinity is reduced to 0·15—0·35 grm., and sulphitated in the same vessel until its alkalinity (to phenolphthalein) is reduced to 0·08—0·20 grm. per litre. The juice, which is now at a temperature of about 60° C., is then heated and filtered.—L. E.

Patents.

Sugar cane; Process for the preparation of ——, a new product resulting therefrom, and its applications. E. Disdier, Malaga, Spain. Eng. Pat. 5145 of 1913, date of Appl., Aug. 21, 1912.

Sugar-cane is cut up into thin slices or shavings, the cuts being made at an acute inclination to the axis of the cane, and these slices are then dried, slashed, crumbled, and pounded at a temperature of about "300° C.," in an apparatus of the type described in Eng. Pat. 25,251 of 1911 (this J., 1912, 911). The dry, powdered product obtained lends itself readily to diffusion operations for the extraction of the sugar, and the diffusion residue may be used for the manufacture of paper pulp or for the preparation of a fodder.—W. P. S.

Sugar-crystals; Process and contrivance for production particularly of —— in vacuum. O. Fromm and M. Schodly, Schwartau, Germany. U.S. Pat. 1,066,397, July 1, 1913.

See Eng. Pat. 28,074 of 1912; this J., 1913, 761.—T. F. B.

Starch; Process of converting —— into derivatives, dextrin, dextrose, etc. S. M. Lillie, Philadelphia. Reissue No. 13,592, July 8, 1913, of U.S. Pat. 959,237, May 24, 1910.

See this J., 1910, 834.—T. F. B.

Gums; Process for producing solutions of insoluble ——. E. Siefert-Schwab, Neunkirchen, Austria-Hungary. U.S. Pat. 1,066,852, July 8, 1913.

See Eng. Pat. 23,629 of 1912; this J., 1913, 302.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast protein; The complete hydrolysis of ——. H. Pringsheim. Woch. Brau., 1913, **30**, 399—400.

The author hydrolysed pressed yeast by hydrochloric acid and by sulphuric acid and distilled the volatile esters of the amino-acids according to Fischer's procedure (Ber., 1901, **34**, 433; Z. physiol. Chem., 1901, **33**, 151;

1902, **36**, 268). It was noted that the simplest members of the amino-acid group, glycocoll and alanine, which are obtained by the hydrolysis of almost all other protein substances, were absent from the products from yeast. Small proportions of proline, phenylalanine and glutamic acid were identified, and it is probable that serine also was present. The major portion of the amino-acids distilled as esters was composed of valine and leucine, and these groups must exist in yeast protein in proportions larger than have hitherto been recorded for other proteins. According to Ehrlich's investigations these two amino-acids are the source respectively of isobutyl and amyl alcohols, the main constituents of fusel oil. The formation of fusel oil even in pure sugar worts, is to be ascribed to the formation of valine and leucine by the natural proteolysis of the yeast substance. The author was unable to identify any amino-acid which could similarly be recognised as the mother-substance of the *n*-propyl alcohol, which is always produced in alcoholic fermentations. On the other hand, the glutamic acid found might be regarded as giving rise to succinic acid and the tyrosine of the yeast protein to tyrosol which are always present in spent wash. —J. F. B.

Yeast; Protein substances of —— and their products of hydrolysis. P. Thomas and S. Kolodziejska. Comptes rend., 1913, **157**, 243—246.

On hydrolysis with concentrated hydrochloric acid the protein of yeast recently isolated (this J., 1913, 762) and resembling casein in its properties gave the following results (referred to total nitrogen): ammoniacal nitrogen, 6·86, 6·89; humic nitrogen, 4·02, 2·54; basic or diamine nitrogen, 26·67, 26·03; monoamine nitrogen, 60·39, 60·33 per cent. The yeast albumin (cerevisin) gave: ammoniacal nitrogen, 5·89; humic nitrogen, 1·69; basic or diamine nitrogen, 23·69; monoamine nitrogen, 67·03 per cent. The results of hydrolysis experiments with sulphuric acid and subsequent determinations of the hexonic bases, indicated that the yeast protein yields 2·63 per cent. of histidine, 3·58 of arginine, and 4·09 of lysine (in the form of picrate), whilst cerevisin yields 2·02 per cent. of histidine, 3·95 of arginine, and 7·14 of lysine. —A. S.

Yeasts; Assimilation of maltose by ——. A. J. Kluyver. Biochem. Zeits., 1913, **52**, 486—493.

The investigations of Rose and of Lindner and Saito (this J., 1910, 1221) appear to indicate that, of the sugars, maltose is most generally assimilated by yeasts, but the author shows that this is due to impurity of the maltose used. Thus, a sample of maltose, which, unlike dextrose, was assimilated by *Endomyces Magnusii*, *Saccharomyces exiguus*, *Schizosacch. Pombe*, and a yeast isolated from milk, was found to contain nitrogen equivalent to 0·22 per cent. of protein. The same maltose, after two crystallisations (whereby its protein-content was reduced to 0·04 per cent.), was not assimilated by these organisms or only to a very slight degree.—L. E.

Yeast; Formation of higher alcohols from aldehydes by ——. I. Conversion of valeric aldehyde into amyl alcohol. C. Neuberg and H. Steenbock. Biochem. Zeits., 1913, **52**, 494—503.

It has been shown (this J., 1911, 1179, 1465) that aldehydes are formed in the fermentation of α-keto-acids, and more recently that aldehydes may constitute an intermediate stage in the formation of alcohols by fermentation processes. The authors have now investigated the action of yeast on purified, commercial valeric aldehyde (a mixture of isovaleric aldehyde and optically active methylethylacetaldehyde) both in presence and absence of sucrose. In presence of sucrose, the aldehyde was largely converted into amyl alcohol, the lowest yield being 66·4, and the highest, 84·1 per cent.; in the latter case, the aldehyde was used in the form of its ammonia compound. The amyl alcohol consisted of a mixture of isobutyl carbinol and *l*-methylethyl carbincarbinol in approximately the same proportions as those of the corresponding constituents of the valeric aldehyde. In absence of sucrose also, amyl alcohol was obtained though the yield was only 26·1 per cent. According to Neubauer and Fromherz (this J., 1911, 231), keto-acids are intermediate products in the alcoholic fermentation of amino-acids whilst Ehrlich had previously suggested (this J., 1909, 848) that aldehydes were formed. In the light of the present and earlier investigations, it appears that keto-acid and aldehyde represent successive stages of this fermentation.—L. E.

Yeast fermentation; Processes in ——. C. Neuberg and J. Kerb. Ber., 1913, **46**, 2225—2228.

Experiments on a much larger scale have confirmed the statement made previously (Z. Gärungsphysiol, 1912, **1**, 114) that in the fermentation of a mixture of pyruvic acid and glycerin by yeast, considerable quantities of alcohol are formed. Alcohol is also formed in the fermentation of pyruvic acid alone by yeast. (See also this J., 1913, 102, 620.)—A. S.

Cream of tartar; Solubility of —— in wines. L. Mathieu and P. Chauvet. Bull. Assoc. Chim. Sucr., 1913, **30**, 845—853.

The solubility of cream of tartar in musts and wines is diminished by addition of tartaric acid. Hence, the fact that addition of this acid to must does not increase the acidity of the latter to a corresponding degree may be partly due to precipitation of some of the cream of tartar originally present in the must. Acetic, malic, and citric acids, on the other hand, increase the solubility of cream of tartar. The use of lime in extracting tartar from wine lees, etc., serves, not only to precipitate free tartaric acid, but, by neutralising other organic acids, to diminish the solubility of the cream of tartar.—L. E.

Alcohol from the fruit of Arbutus unedo. G. Sani. Atti R. Accad. dei Lincei, Roma, 1913, **22**, I., 884—885.

The ripe fruits of the strawberry-tree (*Arbutus unedo*) contain, on the average, 18·8 per cent. of sugar, and on fermentation yield a wine containing from 9·15 to 10·5 per cent. of alcohol. Contrary to what happens in ordinary vinous fermentation, *Sacch. ellipsoideus* is the predominant yeast throughout the fermentation. A sample of the wine gave the following results on analysis: sp. gr., 1·030; alcohol, 9·15 per cent.; total acidity, 14·1 grms. per litre; potassium bitartrate, 3·96; tartaric acid, 0·06; volatile acids, 0·55; tannin, 0·781; dry extract, 102·20 grms. per litre.—A. S.

Amyl alcohol and other aliphatic alcohols and their esters; Detection of——. T. Takahashi. J. Coll. Agric., Imp. Univ., Tokyo, 1913, **5**, 167—177.

Koshino (J. Pharm. Soc. Japan, No. 351) has shown that when using the author's vanillin-sulphuric acid reagent (this J., 1905, 692) a blue colour is produced with ethyl alcohol alone, and that the characteristic colour produced by fusel oil in the test is not blue but purplish-red. In order to avoid, as far as possible, the interfering action of ethyl alcohol, the test is now carried out as follows: 2 c.c. of a solution of 1 grm. of vanillin in 200 c.c. of sulphuric acid of sp. gr. 1·84 are treated with 1 c.c. of the liquid to be tested and water is then added, drop by drop, with agitation after each addition. With fusel oil (a 0·002 per cent. solution in 15 per cent. alcohol) a heavy dark shade was observed after addition of 20 drops of water, and a further addition of 1 c.c. of water produced a purplish-red colour, which could be observed from the side of the tube. The colour changes produced on subjecting a number of alcohols and esters to the test under varying conditions are described. In general the higher alcohols give red, reddish purple or bluish purple colourations, while ethyl alcohol in moderate concentrations gives a blue or greenish colour; methyl alcohol gives a red colouration. Furfural gives a dark colouration and should be removed before applying the test. Esters and ethers behave very similarly to the corresponding alcohols. The colour changes produced by ethyl acetoacetate (green, reddish-green, red, green, blue) and methyl lactate (green, dark green, reddish green, reddish blue-green) are very characteristic.—A. S.

PATENTS.

Malt ; Treatment of grain in the production of ——. R. E. Chichester, Norwich. Eng. Pat. 17,904, Aug. 2, 1912.

A PERFORATED revolving drum, furnished with a central tube, is supported in an air-tight casing, and contains the grain to be treated. The central tube helps to mix the grain which falls over it during the revolution of the drum. Air or other gas is admitted and passes over the moving surface of the grain.—J. H. J.

Malt-drum. F. Knüttel, Charlottenburg, Germany. U.S. Pat. 1,064,490, June 10, 1913.

A NON-PERFORATED drum mounted so as to rotate on rollers is fitted inside with a perforated casing extending from one end to a partition spaced apart from the other end of the drum. A central perforated pipe extends longitudinally through the drum and in the ends of the outer drum are axial openings enclosed by chambers connected with air-supply and discharge pipes respectively. The openings are fitted with valve-seats with valve-discs mounted movably thereon. Air enters from the air-supply pipe at one end into the space between the outer drum and the inner perforated casing, passes through the latter and through the perforated central pipe, and escapes at the opposite end.—A. S.

Citric acid [from sugar] ; Method of producing ——. B. Zahorski. U.S. Pat. 1,066,358, July 1, 1913.

A CULTURE of the fungus, *Sterigmatocystis nigra*, is cultivated in a medium containing about 15 per cent. of citric acid, and a sugar solution is then inoculated with this culture, the temperature being kept between 10° and 35° C. A small quantity of "mineral salts" may be added to the sugar solution. It is stated that citric acid is produced as a result of the growth of the fungus.—T.F.B.

Hops ; Process and device for obtaining extractive matter from ——. W. Ponndorf and J. ten Doornkat Koolman, Kassel, Germany. Eng. Pat. 18,270, Aug. 8, 1912.

SEE Fr. Pat. 448,723 of 1912 ; this J., 1913, 444.—T. F. B.

Yoghurt milk ; Manufacture of ——. A. J. Boult, London. From Milchtechnisches Laboratorium Dr. Thomas, Dr. Deleré, und Dr. Ridder, m. b. H., Cologne, Germany. Eng. Pat. 22,554, Oct. 3, 1912.

SEE Fr. Pat. 450,246 of 1912 ; this J., 1913, 504.—T. F. B.

XIXa.—FOODS.

Butter fat and its substitutes ; Fluidity of ——. G. F. White and R. H. Twining. J. Ind. Eng. Chem., 1913, **5**, 569—573.

THE viscosities of butter fat and some substitutes were determined in a slightly modified form of the viscometer described previously (this J., 1912, 239), and the results are given in tables and curves. Unless large quantities of liquid fats are added (which can be detected by chemical analysis), oleomargarine fats are always more viscous than butter fat. On standing butter fat first becomes more viscous, probably owing to loss of volatile acids and then becomes less viscous as putrefaction begins. For both butter fat and oleomargarine fats, the viscosity varies somewhat in products from different sources, but an adulteration of 10 per cent. of oleomargarine can be detected by using the mean values for the two kinds of fat, viz., viscosity at 40° C. : $\eta=0{\cdot}3200$ for butter, 0·3500 for oleomargarine ; or fluidity : $\psi=3{\cdot}125$ for butter, 2·857 for oleomargarine. The fluidities of the mixtures are additive, but not the viscosities. The fluidities are practically linear functions of the temperature.—A. S

Tea ; Determination of tannin in ——. H. L. Smith. Analyst, 1913, **38**, 312—316.

THE cinchonine method devised by Chapman (see this J., 1908, 135 ; 1909, 618) for the determination of tannin in hops may be applied to the determination of this constituent in tea ; it is necessary, however, to remove the caffeine previously, as a portion of the alkaloid is carried down with the cinchonine tannate. Ten grms. of tea are boiled for 30 minutes with 800 c.c. of water, the decoction is filtered hot, and the leaves are washed with 200 c.c. of boiling water ; after cooling, the solution is diluted to 1 litre, and 50 c.c. are shaken with four successive quantities of 30 c.c. of chloroform in order to remove caffeine. The aqueous liquid is then evaporated to about one-third of its volume, and while still hot, is treated with 50 c.c. of a saturated solution of cinchonine sulphate. After standing for some hours, the precipitate is collected on an asbestos filter which has been washed previously with a half-saturated solution of cinchonine sulphate and dried at 100° C. The precipitate is also washed with this half-saturated solution, then dried over sulphuric acid under reduced pressure, and finally to constant weight at 100° C. The damp precipitate must not be heated, as it fuses and it is difficult then to get constant results. The precipitate contains 54·9 per cent. of tannin. The results obtained by the method are concordant and somewhat higher than those yielded by the permanganate process.
—W. P. S.

Coffee essence ; Composition of —— *; presence of pyridine.* G. Bertrand and G. Weisweiller. Comptes rend., 1913, **157**, 212—213.

FIVE kilos. of freshly-roasted and ground coffee were subjected to steam distillation and the distillate concentrated so as to obtain finally about 20 c.c. of liquid containing the whole of the volatile constituents of the coffee. This liquid consisted of a heavy oil (see Erdmann, this J., 1902, 871) and an aqueous layer, and from the latter the authors succeeded in isolating pyridine. The yield of pyridine varied from 200—250 mgrms. per kilo. in several samples of roasted coffee. If the part of the volatile oil insoluble in hydrochloric acid be added to sweetened water, the aroma of coffee cannot be reproduced exactly unless a corresponding quantity of pyridine be also added.—A. S.

PATENTS.

Baking powder ; Process of manufacturing ——. Malz- und Nährpräparateges. m. b. H., Munich, Germany. Eng. Pat. 14,670, June 22, 1912. Under Int. Conv., Oct. 23, 1911.

THE use of per-salts in the manufacture of baking powders is claimed. For instance, the baking powder may consist of sodium percarbonate, 16·5, sodium bicarbonate, 17, tartaric acid, 25, and starch, 50 grms. A modification of the well-known Horsford powder may be prepared by mixing sodium percarbonate, 100, sodium bicarbonate, 400, and potassium chloride, 443 parts.—W. P. S.

Coffee ; Process for the production of an extract of ——. K. Baron von Victinghoff, Berlin. Eng. Pat. 10,262, May 1, 1913.

RAW coffee beans are treated with a suitable solvent in order to remove fatty substances, and are then extracted with water ; the aqueous extract is evaporated under reduced pressure and the dry residue is roasted. The residue of the raw beans remaining after the extraction is dried separately, roasted, extracted with water, the extract is evaporated, and the dry residue is added to the first roasted residue.—W. P. S.

Albumin powder ; Soluble ——. R. Bass, Kgl. Weinberge Austria. U.S. Pat. 1,066,364, July 1, 1913.

COOKED flesh is hydrolysed with ammonia at a temperature not exceeding 107° C., and the resulting liquid brought into contact with lime, either hot or after cooling to below 45° C. When the reaction is completed, the calcium is precipitated and the albumin prepared from the filtered solution in the usual way. Soda lye may be added with or after the lime, and then neutralised with hydrochloric acid.—J. H. J.

[*Cocoa mixtures.*] *Compressed masses; Process for preparing durable —— from powders.* P. Schnuse. Ger. Pat. 260,680, March 28, 1912.

The powders, especially cocoa mixtures containing sugar or starch, are lightly compressed, and then subjected first to moist steam for a short time and afterwards to dry heat. The masses before being heated may be provided with a coating of sugar or the like.—A. S.

Preparation of sugar cane, a new product resulting therefrom, and its applications. Eng. Pat. 5145. *See* XVII.

XIXb.—WATER PURIFICATION; SANITATION.

Mercuric chloride; Disinfecting power of ——. M. Steiger and A. Döll. Z. Hyg. u. Infekt.-Krankh., 1913, **73**, 324—344. Chem. Zentr., 1913, **2**, 290.

Contrary to the general belief a 1 : 1000 aqueous solution of mercuric chloride does not kill pathogenic germs in a short time. Even after contact for 30 minutes, about 0·25 per cent. of the micro-organisms are still capable of growth. If a mercuric chloride solution holding microbes in suspension be treated with hydrogen sulphide after a certain time, it is found that the virulence of some of the germs (paratyphus B.) has been reduced in a greater degree than that of others (pneumococci). Mercuric chloride is much less effective as a disinfectant in presence of albumin.—A. S.

Zinc arsenite as an insecticide. W. J. Schoene. New York Agric. Exper. Stat., Tech. Bull., No. 28, March, 1913, 1—16.

Experiments showed that one part by weight of zinc arsenite was as effective as three of lead arsenate. When used in conjunction with calcium hydroxide or Bordeaux mixture, zinc arsenite caused no injury to apple foliage, but more or less spotting of apple leaves occurred when it was used alone or with lime-sulphur or glucose. Zinc arsenite alone or with glucose caused severe "burning" of grape foliage; laboratory tests indicated that the injury might be due in part to the solubility of the zinc arsenite in carbon dioxide contained in solution in the moisture on the leaves. Zinc arsenite or lead arsenate with Bordeaux mixture, soap, or glue remained effective for 25 days; either of the substances alone or with glucose lost its poisonous properties on exposure to weather and by the end of this period had ceased to protect the foliage. It was also found, incidentally, that lime-sulphur solution does not resist wet weather as well as Bordeaux mixture does.—W. P. S.

Lead arsenate and soap; Soluble arsenic in mixtures of ——. H. V. Tartar and L. A. Bundy. J. Ind. Eng. Chem., 1913, **5**, 561—562.

The use of soap solution as a medium for keeping lead arsenate in suspension for application as an insecticide has been recommended, but practical trials have shown that in some instances considerable injury is done to the foliage of trees by mixtures of lead arsenate and soap solution. It is now shown that whilst soap solution has little effect on normal lead orthoarsenate, it converts a considerable proportion of the arsenic of acid arsenates of lead into a soluble form.—A. S.

Patents.

Sewage-treating installations; Construction of ——. A. Haussmann, Ravensburg, Germany. Eng. Pat. 13,659, June 11, 1912.

The installation consists of a covered circular apparatus containing a detritus and fat chamber, a collecting chamber, and a putrefying trough, arranged in the outer circumference, and inside these, and arranged around a central pit, is a percolating bed. From the putrefying chamber the sewage passes to a distributing gutter round the central pit, which delivers it into radial gutters on the surface of the percolating bed. These radial gutters are V-shaped and along their sides are provided with short outlet tubes in the form of hollow adjustable screws. The inner mouth of each screw is of triangular section, so as to enable the effluent to escape without head in the form of drops. The effluent from the bed passes into a collecting tank at the bottom of the central pit. This tank has an air inlet and the air passes up through the bed and out at the top of the apparatus.—J. H. J.

Sewage; Treatment of ——. R. England, London. Eng. Pat. 15,247, June 29, 1912.

The sewage is precipitated by means of calcined Belgian and French phosphates containing a large proportion of lime, these phosphates being applied in such proportion that the amount of lime required for precipitation is furnished. A solution of phosphoric acid or of superphosphates is then added to neutralise the lime. The sludge produced is thus enriched in its phosphatic contents. It is pressed with addition of peat powder to increase the amount of nitrogen present. The sewage after precipitation, and the sludge also, may be treated further by addition of more phosphate, followed by sulphurous acid in quantity sufficient to neutralise the lime, thus producing calcium sulphite which acts as a disinfectant.
—J. H. J.

Clarifying or precipitating chambers; Continuously working ——. Naamlooze Vennootschap "Tymoor" Eerste Nederlandsche Ouderneming tot het zuiveren van water, J. J. van Oorde and I. W. E. Opstelten, Haarlem, Holland. Eng. Pat. 1840, Jan. 22, 1913.

The liquid to be clarified enters at one end of the tank and passes down and up a baffle-plate, where the heavy solids are deposited, into side chambers through which it passes downwards and then up through the bottom of the precipitation chamber proper, which lies between the side chambers and is thus prevented from heat exchange through the outside walls. The bottom of the precipitation chamber is furnished with openings with flanges extending downwards.—J. H. J.

Water; Means for and method of softening ——. T. A. Venables, F. P. Carroll, and W. H. Fielding, London. Eng. Pat. 14,351, June 19, 1912.

The water to be treated, a softening agent such as sodium hydroxide solution, and steam are admitted through ported inlet plugs to a cylindrical chamber mounted horizontally in a casing. The plugs may be adjusted so as to regulate the supply of the water, steam, etc., to the chamber. The treated water passes from the chamber into a settling tank from which it is withdrawn as required. A ball-float in the settling tank is connected with the cylindrical chamber and rotates the latter, thereby closing the ports, when the settling tank is full.—W. P. S.

Refuse; Method of burning ——. J. A. Fried, Barmen, Germany. U.S. Pat. 1,065,516, June 24, 1913.

A charge of refuse is ignited in a furnace and a current of air under pressure is blown into the mass until the temperature reaches about 1000° C.; this supply of air is then restricted, and air is supplied above the burning mass in quantity sufficient to burn the carbon monoxide, the burning gases being conducted to a heater and the heat there utilised. The partially burnt refuse is then removed to a second furnace and used to heat the air admitted to the top of the first furnace after a second charge of refuse has been introduced.—W. P. S.

Destructor furnaces. P. D. Canham, Assignor to Power Specialty Co., New York. U.S. Pats. 1,066,184, 1,066,185, and 1,066,186, July 1, 1913.

(1). The destructor consists of a combustion chamber with a grate which can be withdrawn into an air-tight

chamber outside. Below the grate is a clinker pit with a grate at the bottom to receive the hot clinker from the grate above. An air chamber is situated underneath the clinker pit, and air from this chamber passes through the hot clinker to the combustion chamber. The cooled clinker is discharged mechanically from the clinker grate. (2). The destructor consists of a grate chamber with a clinker pit below. This pit has an opening in front and contains a clinker-cooling receptacle consisting of a grate enclosed by walls on three sides and mounted on wheels by which means it can be easily drawn out of the clinker pit to discharge the clinker when cooled. An air chamber below the clinker pit permits of air being passed through the hot clinker in the cooling receptacle to the combustion grate. (3). The destructor consists of a grate chamber from which the clinker is discharged into a pit below on to a belt grate, which discharges the clinker when cooled into an outside receptacle. The clinker is cooled by a current of air from an air chamber below the belt grate, the heated air passing to the grate chamber above.
—J. H. J.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Carpiline or pilosine; Study of ——. E. Léger and F. Roques. J. Pharm. Chim., 1913, **8**, 56—63.

Carpiline or pilosine (this J., 1912, 1145) was heated with water to 140° C. when anhydropilosine was obtained. The base is decomposed by heating to 140° C. with a strong solution of potassium hydroxide, the decomposition products being the same as those obtained by distilling the base with potassium hydroxide solution (*loc. cit.*).
—F. Shdn.

α- and β-Antiarin and the crystalline albumin from Antiaris sap. H. Kiliani. Ber., 1913, **46**, 667—680.

The composition of α- and β-antiarin is more correctly represented by the formula, $C_{27}H_{40}O_{10}$ than by $C_{27}H_{42}O_{10}$ as given previously, and the composition of antiarigenin is $C_{21}H_{28}O_5$. The two glucosides were hydrolysed in several ways and the decomposition products further examined. The portion of the sap precipitated with alcohol was extracted with weak acetic acid. After concentrating the extract a crystalline albumin was obtained. The composition is $(C_{36}H_{50}N_{10}S_2O_{13})_2$, and it has $[\alpha]_D = -15{\cdot}2°$ in 20 per cent. acetic acid.—F. Shdn.

Antiaris sap. H. Kiliani. Ber., 1913, **46**, 2179—2188.

The sap of Antiaris (obtained from Borneo) contains another glucoside, γ-antiarin, in addition to the α- and β-antiarin which have been isolated previously (see this J., 1911, 107 and preceding abstract). γ-Antiarin is precipitated from the mother liquors of β-antiarin by means of tannic acid. Larger yields of the crystalline albuminous substance (*loc. cit.*) were obtained. Small amounts of an unstable crystalline acid were obtained, which appeared to have the composition, $C_{16}H_{14}O_7$, and to be a derivative of *o*-dihydroxybenzene.—F. Shdn.

β-Geranylglucoside; Synthesis of —— *by means of emulsin. Presence of the glucoside in plants.* E. Bourquelot and M. Bridel. Comptes rend., 1913, **157**, 72—74.

Geraniol was saturated with water, shaken with pure dextrose and left in contact with emulsin at 33° C. for two months. The mixture was filtered, treated with water and the aqueous portion freed from geraniol. This aqueous portion was then subjected to the action of emulsin, when it became optically active and small amounts of geraniol were liberated. Using a mixture of acetone and water, a larger amount of the β-geranylglucoside was prepared. It is soluble in water and ethyl acetate and has $[\alpha]_D = -25° 49'$ in aqueous solution. Basic lead acetate precipitates the glucoside. Indications were obtained of the presence of this substance in fresh specimens of *Pelargonium odoratissimum*.—F. Shdn.

Tyrosine; Preparation of ——. E. K. Marshall, jun. J. Biol. Chem., 1913, **15**, 85—86.

The pancreas obtained from a pig is ground with water and digested at 38° C. for 24 hours. The liquid is filtered when cold and casein added. The whole is made slightly alkaline with ammonia and digested at 38° C. for several days. After filtering, the aqueous portion is concentrated, when tyrosine separates on cooling.
—F. Shdn.

Essential oils; Bisulphite-compounds of the unsaturated constituents of ——. J. Dupont and L. Labaune. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1913, [3], **7**, 3—12. Chem. Zentr., 1913, **2**, 262—263.

The reagent used was prepared by dissolving 252 grms. of crystallised sodium sulphite in 600 c.c. of water, adding slowly a cooled mixture of 50 grms. of sulphuric acid (sp. gr. 1·84) and 100 c.c. of water, until the solution was acid to methyl orange, then making exactly neutral by a few drops of sodium sulphite, and diluting to 1 litre. Besides aldehydes, other unsaturated compounds, such as geraniol, linalool, and rhodinol, dissolve freely when shaken for several hours with the cold bisulphite solution. The reaction products are stable salts of hydrosulphonic acids (Labbé, Bull. Soc. Chim., 1899, [3], **21**, 1077), from which the original alcohol cannot be recovered by making the solution alkaline. The maximum reaction is attained after shaking for 8—10 hours. Esters, ethers, and hydrocarbons do not react with the bisulphite solution. Of the cyclic ketones, α- and β-ionone do not react, but methylheptenone dissolves completely. Carvone dissolves almost completely, but pulegone only to a small extent. Benzalacetone reacts but isoeugenol does not. Geraniol, linalool, and rhodinol dissolve almost completely, but not so cinnamyl alcohol. The bisulphite-compounds were isolated in several cases in the form of very hygroscopic crystalline masses. The linalool compound, $C_{10}H_{18}O,2NaHSO_3$, in concentrated solution (12·6 grms. in 110 c.c. of water), had the rotatory power, $[\alpha]_D = +0{\cdot}17°$.
—A. S.

Ketones; Catalytic preparation of —— *with oxides of iron.* A. Mailhe. Comptes rend., 1913, **157**, 219—221.

Ferric and ferrous oxides are efficient catalysts for the preparation of ketones from acids. If ferric oxide be used it is converted in part into ferrous oxide during the process. A layer, about 50 cm. long, of the oxide is placed in a tube of Jena glass which is heated to 430°—490° C. The acid is introduced, drop by drop, from a capillary tube at one end, and the vapours escaping from the other end of the tube are condensed in a water-cooled U-tube. The preparation of a number of ketones from aliphatic acids, and mixtures of aliphatic and aromatic acids, is briefly described. Good yields were obtained in most cases, the poorest yields being from isovaleric and isobutyric acids.—A. S.

Composition of coffee essence; presence of pyridine. Bertrand and Weisweiller. *See* XIXa.

Patents.

Diacetone alcohol; Process of producing ——. W. F. Doerflinger, Halesite, N.Y. U.S. Pat. 1,066,474, July 8, 1913.

Acetone is converted into diacetonyl alcohol by treating it at about the ordinary temperature with an alkaline condensing agent, in presence of an inert organic liquid which dissolves the condensing agent and is soluble in acetone; *e.g.*, an alkali hydroxide in presence of an aliphatic alcohol may be used.—T. F. B.

Chloroform; Art of purifying ——. V. C. Best, Oak Park, Ill. U.S. Pat. 1,066,877, July 8, 1913.

Chloroform is passed in a state of vapour through a solution of a salt which is capable of combining with the free chlorine.—T. F. B.

Methyl ethers of alcohols ; Process for preparing the ——. J. D. Riedel A.-G. Ger. Pat. 261,588, Dec. 23, 1910.

An alcohol is treated with a methylating agent in presence of aqueous alkali, with or without addition of an indifferent solvent, care being taken that saponification does not take place. When the methylation is complete, the excess of alkylating agent is removed by heating or by steam distillation and the methyl ether is isolated and purified in the usual manner.—T. F. B.

Esters from alcohols and organic acids ; Process for preparing ——. O. Hauser and A. Klotz. Ger. Pat. 261,878, July 21, 1912.

When beryllium compounds are used as catalysts in the preparation of esters from organic acids and alcohols, better yields are said to be obtained than when thorium or titanium oxides are used.—T. F. B.

Halogen-propanes ; Process for preparing ——. H. J. Prins. Ger. Pat. 261,689, March 2, 1912.

Halogen derivatives of ethylene of the formula, $CX_2 : CHX$ or $CHX : CHX$ (where X represents halogen) are treated with a large excess of a halogen derivative of methane in presence of a small quantity of aluminium chloride or bromide or other suitable catalyst, at a temperature not above 20° C. A suitable diluent should be added to the halogen-methane. The halogen-propanes obtained may contain 5, 6, or 7 atoms of halogen, and are useful as solvents of sulphur, resins, etc. : when treated with sulphuric acid, diahalogen-acrylic acids are produced ; these have powerful antiseptic properties, as also have the corresponding acid amides or anilides. —T. F. B.

Erythrene and isoprene ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 261,876, May 31, 1912.

When the hydrohalogenides of 1-dimethylaminobutene-3 or 1-dimethylamino-2-methylbutene-3 (see Ger. Pat. 254,529 ; this J., 1913, 212) are heated, erythrene or isoprene is produced.—T. F. B.

Ethereal oils ; Process for the introduction of —— into bodies soluble in water. J. H. Smith, La Garenne-Colombes, France. Eng. Pat. 22,634, Oct. 4, 1912. Under Int. Conv., Oct. 4, 1911.

See Fr. Pat. 446,570 of 1911 ; this J., 1913, 150.—T. F. B.

Citric acid-hexamethylenetetramine tablet ; Effervescent ——. H. Umber, Assignor to J. A. von Wülfing, Berlin. U.S. Pat. 1,065,988, July 1, 1913.

See Eng. Pat. 26,160 of 1911 ; this J., 1912, 458.—T.F.B.

Producing citric acid [from sugar]. U.S. Pat. 1,066,358. *See* XVIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Chloranol [photographic developer] ; Preparation and properties of ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1913, 59, 223—227.

When an aqueous solution of two mols. of methyl-*p*-aminophenol is mixed with a solution of one mol. of chloroquinol, and sodium sulphite is added, white crystals are slowly deposited from the solution. They dissolve in water to the extent of 2 per cent. at 18° C., and are soluble in alcohol and acetone. The product, called *chloranol*, m.pt. 99°—100° C., is very stable in air, as also are its aqueous solutions, even without addition of sulphite. It is resolved into its components by acids. Chloranol acts as an energetic photographic developer ; in solutions with sodium sulphite alone it is less active than metoquinone (see this J., 1903, 759). The best results are obtained with a solution containing chloranol, 5 grms. ; anhydrous sodium sulphite, 30 grms. ; 10 per cent. potassium bromide solution, 10 c.c. ; anhydrous sodium carbonate, 5 grms. ; water, 1000 c.c. The sodium carbonate may be replaced by 10 c.c. of acetone, or the sulphite and carbonate by 30 grms. of formosulphite. For under-exposure the solution is diluted with 0·5 per cent. sodium carbonate solution, and for over-exposure the carbonate is omitted and the bromide modified according to circumstances. The contrasts are slightly stronger and the colour of the reduced silver somewhat less blue than when metoquinone is used.—T. F. B.

Photographic toning baths. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 4513, Feb. 21, 1913. Under Int. Conv., Oct. 3, 1912.

See U.S. Pat. 1,064,379 of 1913 ; this J., 1913, 712. As an example of the preparation of such baths, the following solution is mentioned, 100 grms. of sodium thiosulphate, 1·5 grms. of sodium selenium sulphate, and 15 grms. of sodium sulphite in one litre of water. —T. F. B.

Colouring process [for photographs]. A. M. Sandig, Chicago. U.S. Pat. 1,067,198, July 8, 1913.

Permeable films or the like containing photographic images are immersed in solutions of vat dyestuffs (*e.g.*, in alkali and hydrosulphite) and rinsed, and the colour is developed by oxidation.—T. F. B.

p-Aminophenol ; Process for preparing N-monoalkyl derivatives of ——. E. Merck. Ger. Pat. 260,234, May 18, 1912.

When quinol is heated to a high temperature with a primary aromatic amine, with or without addition of a condensing agent, the corresponding alkyl derivative of *p*-aminophenol is obtained in high yield. This process affords an advantageous method of preparing "metol" from quinol and methylamine hydrochloride.—T. F. B.

Grains from coloured resin or other colloidal solution for colour photography ; Process for producing ——. Comp. Gén. des Etabl. Pathé frères Phonographe et Cinématographe. Ger. Pat. 261,161, Nov. 16, 1912.

The resinous or other solution to be converted into fine particles, is atomised in a vertically ascending stream of a gaseous medium, which moves with decreasing velocity. The particles may then be collected at different heights, according to their size or weight. The apparatus may consist of a series of superposed vessels, each larger than the one below it, and each provided at the top with a funnel-shaped mouth, above which, in the next vessel, is a conical distributor. In the lowest vessel is a suitable atomiser, preferably provided with a needle-valve to permit the regulation of the atomising process.—T. F. B.

Photographs in natural colours ; Preparation of a film-band for use in producing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 261,341, July 19, 1911.

Coloured emulsified droplets of suitable substances are introduced into a centrifugal machine, where they are thoroughly agitated, and in which they continuously and evenly fall on a suitable, moving support, which is protected from the direct centrifugal action. The whole is finally covered with a silver-halogen emulsion.—T. F. B.

Colour photography ; Manufacture of screens for ——. L. Dufay, Chantilly, France. Eng. Pat. 15,027, June 27, 1912. Under Int. Conv., June 30, 1911.

See Fr. Pat. 442,881 of 1911 ; this J., 1912, 1008.—T. F. B.

Photographs in natural colours ; Production of ——. R. Fischer, Steglitz, Germany. Eng. Pat. 15,055, June 27, 1912.

See Ger. Pat. 257,160 of 1911 ; this J., 1913, 674.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives used in engineering and mining operations; The selection of ——. C. Hall and S. P. Howell. Dept. of Interior, Bureau of Mines, U.S.A. Bull. 48. 50 pages.

This bulletin deals with the characteristic features of the principal explosives used in mining and engineering operations, and especially with the tests that show the suitability of different classes of explosives for different kinds of work. According to a preliminary report issued by the Bureau of the Census, 469 million pounds of explosives were manufactured in the United States during 1909, and the greater part of this production was used for industrial purposes. The report embraces such investigations as the gases and pressure produced on the explosion of gunpowder, granulated nitroglycerin powders, "straight" dynamites, low freezing dynamites, ammonia dynamites, gelatin dynamites, the gases evolved in the burning of explosives, substances proposed for neutralising poisonous gases, tests of electric detonators, ballistic pendulum tests, velocity of detonation tests, pressure gauge tests and comparison of explosives as to energy. The report contains extensive tabulations of the results obtained.
—G. W. McD.

Dust explosions, and the surface areas of certain finely divided combustible solids. W. R. Lang. Chemical Society Proc. No. 168, 1911.

In order to test the liability to explosion of starch and coal-dust when mixed with air, a glass cylinder, about seven feet long and four inches wide and open at both ends, is set up vertically, wires from an induction coil being led through glass tubes into the middle of the chamber. Lycopodium, starch and coal-dust, when allowed to fall into the tube and a spark passed through the mixture, ignite with explosive violence, the combustion being propagated throughout the length of the tube, and the flames issue a considerable distance from either end. Direct application of a lighted taper produces the same result. The dimensions of the particles of the substances employed were ascertained by a microscopic examination, and the surface-area per hundred grams calculated. In like manner, "pyrophoric carbon" and "pyrophoric iron" were examined. The results summarised are :—

Substance.	Mean diameter of particles in millimetres.	Total surface-area for 100 grams substance.
		square metres
Lycopodium	0·028	20·92
Maize starch	0·0122	32·78
Coal dust (*a*) medium	0·012	33·33
,, ,, (*b*) fine	0·0016	250·00
"Pyrophoric carbon"	0·00125	332·00
"Pyrophoric iron"	0·0054	15·08

Patents.

Nitroglycerin; Production of ——. [*Separation from waste acid.*] A. J. Boult, London. From Rheinische Dynamitfabrik, Cologne, Germany. Eng. Pat. 14,586, June 21, 1912.

Hydrofluoric acid, or salts such as sodium silicofluoride, and silica, or silicic acid, or readily decomposable silicates, such as kieselguhr, are mixed with the glycerin, so as to produce silicon tetrafluoride, and accelerate the subsequent separation of the nitroglycerin from the waste acids.—B. N.

Blasting powder. R. Ponnay, Los Angeles, U.S.A. Eng. Pat. 27,843, Dec. 3, 1912. Under Int. Conv., Feb. 16, 1912.

See U.S. Pat. 1,033,927 of 1912; this J., 1912, 798.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Constant temperature apparatus. F. H. and P. V. Dupré. Analyst, 1913, 38, 308—311.

The apparatus comprises a boiler about one-third full of water, a reflux condenser, a water-jacketed pressure bulb, and a screw valve. When the latter is closed the apparatus is absolutely air-tight. The boiler is heated by a gas flame and, when the water boils, the air from the boiler is driven over into the pressure bulb, thus causing a definite pressure in the latter, whilst the steam is condensed and returned to the boiler. The pressure in the bulb determines the temperature of the steam evolved in the boiler and this temperature remains constant as long as sufficient heat is applied to the boiler to keep the water boiling without producing more steam than can be dealt with by the condenser. The temperature is regulated by allowing air to escape from the valve. Constant temperatures as low as 27° C. may be maintained by exhausting the air from the apparatus, whilst when working under pressure, the temperature may be kept constant up to 130° C., or a little higher. The water supply for the condenser is first passed through the jacket of the pressure bulb, and, provided that the temperature of this water remains constant (it is preferable to take the supply direct from the main) the temperature in the boiler will not vary by more than ±0·05° C., however long the apparatus is working. An illustration is given of one form of the apparatus which was designed for the purpose of heating test-tubes, these being placed in metal tubes extending into the upper part of the boiler, but the boiler could be provided with an inner compartment for containing the substances to be heated at a constant temperature.
—W. P. S.

Carbon dioxide; Determination of ——. A. Dejeanne. Ann. Falsif., 1913, 6, 335—339.

In the determination of carbon dioxide by absorption in an excess of standardised barium hydroxide solution, and subsequent precipitation of the excess of baryta as sulphate, magnesium chloride solution is added, the mixture is diluted to a definite volume, boiled and cooled before filtering off the barium carbonate. The addition of magnesium chloride converts the excess of barium hydroxide into barium chloride, an equivalent quantity of magnesium hydroxide being precipitated and removed together with the barium carbonate. Influence of atmospheric carbon dioxide is thus avoided.—W. P. S.

Zinc sulphide precipitates; Roasting of ——, *and a means for the rapid coagulation of these precipitates from acid solution.* (*Simultaneous precipitation of two colloids, applied to an analytical problem* [*determination of zinc*].) K. Bornemann. Z. anorg. Chem., 1913, 82, 216—239.

In the presence of a weak acid, zinc sulphide, in the form of a fine suspension or colloidal solution, may be readily coagulated by means of sulphur in a similar state, prepared by precipitating sulphurous acid solution with hydrogen sulphide in the presence of a weak acid. For the determination of zinc, sodium carbonate is added to the solution (containing 0·05—0·5 grm. of zinc oxide) until a slight precipitate is produced, then 2 c.c. of ammonia (sp. gr. 0·92), 11—12 c.c. of monochloracetic acid (400 grms. per litre) or 40—50 c.c. of glacial acetic acid, a solution of 0·2—0·3 grm. of sodium bisulphite, and water to 250 c.c. (or 500 c.c. when using acetic acid); a vigorous current of hydrogen sulphide is passed through the solution for 15—20 minutes, and, after allowing to settle for a few minutes (50—60 minutes, with acetic acid), the precipitate is filtered off and washed with a 1 per cent. solution of ammonium nitrate. With monochloracetic acid these operations are completed in less than an hour, and the precipitate may then, without previous drying, be directly converted into oxide as follows :—The filter and precipitate are transferred to an open crucible and heated so as to incinerate the filter paper at the lowest possible temperature (if a platinum crucible be used, the bottom should not be heated above dull redness). When the filter

paper is completely incinerated and the precipitate has lost any grey tint, the crucible is covered and heated very strongly (preferably above 935° C.) so as to convert zinc sulphate into oxide. If gas be employed for the last heating, care must be taken that reducing gases do not gain access to the material. Under the given conditions there is no loss of zinc. In the presence of metals of the iron group, the precipitate is liable to contain small quantities of the corresponding oxides; these may be readily determined in the precipitate after weighing.
—F. Sodn.

Detection of rape oil in mixtures. Kreis and Roth. *See* XII.

Analysis of hardened oils. Normann. *See* XII.

Applications of activated aluminium. [*Precipitation of tannin.*] *Alumgallins.* Kohn-Abrest. *See* XV.

Simple method for preparing neutral ammonium citrate solution. Patten and Marti. *See* XVI.

Volumetric determination of phosphoric acid applied to the analysis of fertilisers. Ledoux. *See* XVI.

Preservation of beet juices for analytical purposes. Stanek. *See* XVII.

Detection of amyl alcohol and other aliphatic alcohols and their esters. Takahashi. *See* XVIII.

Fluidity of butter fat and its substitutes. White and Twining. *See* XIXa.

Determination of tannin in tea. Smith. *See* XIXa.

"*Sulphuretted hydrogen burette.*" Alkali Inspectors' Report *See* VII.

XXIV.—MISCELLANEOUS ABSTRACTS.

Patent.

Liquid films; Apparatus for treating ——. C. V. Boys, London. Eng. Pat. 22,886, Oct. 8, 1912.

The invention relates to improvements in the film carrier described in Eng. Pat. 16,732 of 1911 (this J., 1912, 260) and consists in supporting the box or cup on the point of a vertical flexible wire, which enters a wide-angled conical depression in the bottom of the cup. The latter is provided with vanes by which it can be caused to rotate by a current of air.—W. H. C.

*New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Witt*, Dr. A.: Die Verbrennungsmaschinen. Mit 97 Abbildgn. im Text u. 2 (farb.) zerlegbaren Modellen (Liegende Viertaktgasmaschine v. Gebr. Körting —Der Dieselmotor). (S. 93—145 m. 2 Bl. Erklärgn.) Hrsg. v. H. Blücher. Einzelausg. 35.5×26.5 cm. Leipzig, Bibliograph. Institut. 1913. M. 4.

IIa. *Kohlen-Untersuchungen* 1912. Im Auftrag des Vereins f. Feuerungsbetrieb u. Rauchbekämpfg. in Hamburg ausgeführt durch die thermochem. Prüfungs- u. Versuchs-Anstalt Dr. Aufhäuser, Hamburg. (24 S.) Lex. 8°. Hamburg (Boysen & Maasch). 1913. M. 2.

Redwood, Sir B.: Petroleum, 3rd edition, revised throughout and largely added to. 3 vols. 8vo, pp. 400, 422, 388. C. Griffin. London. 1913. Net 50s.

III. *Lindner*, Dr. J.: Die Konstitution des Benzols. Entwurf zur Stereochemie der aromatischen Verbindungen. Mit 19 Abbildgn. (24 S.) gr. 8°. Berlin. R. Friedländer & Sohn. 1913. M. 1.

V. *Neu*, H.: La chaleur et l'humidification dans le travail des textiles, 26 fig., 32 tabl., in-8°. Libr. générale, Lille. 1913. 7 fr. 50.

VI. *Beaumont*, R.: Apprêt des tissus cardés, peignés, mixtes ou union et autres draps, trad. par P. Texier et A. Delage, 151 fig., in-8°. Ch. Béranger, Paris. 1913. Cloth 12 fr. 50.

VII. *Le Chatelier*, H.: Vom Kohlenstoff. Vorlesungen üb. die Grundlagen der reinen u. angewandten Chemie. Uebers. v. Herm. Barschall. Mit e. Vorwort v. F. Haber. (XIV, 324 S. m. 52 Abbildgn. u. Bildnis.) gr. 8°. Halle. W. Knapp. 1913. M. 18.

Lemberg, H.: Jahrbuch der deutschen Kaliwerke. Nach zuverläss. Quellen bearb. u. hrsg. 4. Ausg. Jahrg. 1913. Mit den Beteiligungsziffern, Lieferungsbedinggn. usw. des Kalisyndikates u. dem Gesetz üb. den Absatz v. Kalisalzen. (121 S.) 8°. Leipzig, Dr. M. Jänecke. 1913. M. 1.20.

VIII. *Eyer*, Ph.: Anlagen u. Einrichtungen e. Emaillierwerkes. (44 S. m. 65 Abbildgn.) gr. 8°. Berlin. Keram. Rundschau. 1913. Cloth M. 3.

Wahlburg, V.: Die Schleif-, Polier- u. Putzmittel für Metalle aller Art, Glas, Holz, Edelsteine, Horn, Schildplatt, Perlmutter, Steine, u.s.w., ihr Vorkommen, ihre Eigenschaften, Herstellung. u. Verwendung., nebst darstellung d. gebräuchl. Schleifvorrichtgn. 3. vollstaendig umgearb. Aufl. (VIII, 381 S. m. 96 Abbild.) Bibliothek, Chemisch-Technische. 8°. Wien, Hartleben. 1913. Cloth M. 5.30.

IX. *Crefcœur*, A. J. M.: Manuel théorique du constructeur de travaux en béton armé, fig., in-8°. Ch. Béranger. Paris. 1913. 10 fr.

X. *Carnegie*, D. and S. C. *Gladwyn*: Liquid Steel, its Manufacture and Cost. 8vo., pp. 346. Longmans. London. 1913. Net 25s.

Nicou, P.: Le haut-fourneau électrique, 22 fig., 5 pl., in-8°. Dunod et Pinat, Paris. 1913. 7 fr. 50.

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Malaise, C.: Manuel de minéralogie pratique, 4e édit. rev. et augm., fig., in-8°. Ch. Béranger. Paris. 1913. 7 fr. 50.

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XIV. *Zimmermann*, Prof. A.: Der Manihot-Kautschuk. Seine Kultur, Gewinng. u. Präparation. (IX, 342 S. m. 151 Fig.) Lex. 8°. Jena, G. Fischer. 1913. Cloth M. 10.

XVI. *Kahlenberg*, L., and E. B. *Hart*: Chemistry and its relations to daily life; a text-book for students of agriculture and home economics in secondary schools. N.Y., Macmillan. c. 7+393 p. il. por. D. 1913. $1.25.

XVII. *Armstrong*, Dr. E. F.: Die einfachen Zuckerarten u. die Glucoside. Autoris. Uebersetzg. der 2. engl. Aufl. v. Eug. Unna. Mit e. Vorwort v. Emil Fischer. (VII. 190 S.) 8°. Berlin, J. Springer. 1913. Cloth M. 5.60.

XVIII. *Piaz*, A. dal: Die Obstweinbereitung nebst Obst- u. Beernbranntwein-Brennerei. 2. Aufl. (VIII, 331 S. m. 70 Abbildgn.) Bibliothek, Chemisch-Technische. 8°. Wien, Hartleben. 1913. Cloth M. 5.30.

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XX. *Fischer*, E., u. H. O. L. *Fischer*: Synthese der o-Diorsellinsäure. [Aus.: "Sitzungsber. d. preuss. Akad. d. Wiss."] (S. 507—512.) Lex. 8°. Berlin, G. Reimer. 1913. 50 Pf.

——u. M. *Rapaport*: Ueber die Carbomethoxyderivate der Phenolcarbonsäuren u. ihre Verwendung f. Synthesen. IX. [Aus: "Sitzungsber. d. preuss. Akad. d. Wiss."] (S. 493—506.) Lex. 8°. Berlin. G. Reimer. 1913. 50 Pf.

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XXIII. *Thies*, F. H.: Ueber die Bestimmung der fortschreitenden Oxydation mittels Zellulose. Beiträge zur Elementaranalyse auf nassem Wege. (VII, 46 S. m. Abbildgn. u. 1 Taf.) 8°. Münster, Theissing. 1913. M. 1.50.

XXIV. *Boys*, C. V.: Seifenblasen, ihre Entstehung u. ihre Farben. Vorlesungen üb. Kapillarität. Autoris. deutsche Ausg. v. Prof. G. Meyer. 2., verm. Aufl. (VIII, 152 S. m. 79 Fig. u. 2 [1 farb., 1 lith.] Taf.) gr. 8°. Leipzig, J. A. Barth. 1913. Cloth M. 6.

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Ridgway, R.: Color Standards and Color Nomenclature, with 53 colored plates, and 1115 named colors. 8vo. pp. 44. Wesley, London. 1913. Net 35s.

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[Prices vary, ranging from two to three shillings.]

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V. *v. Allwörden*, K.: Studien über die Einwirkung von Chlor auf Schafwolle. Berlin (Techn. Hochsch.). 1913. 64 S. 8°.

VII. *Bauhans*, H.: Aetz- und Lösungsversuche am Alaun. Greifswald. 1913. 36 S. mit 4 Fig. u. 4 Taf. 8°.

Gniadeck, B.: Ueber Darstellung u. Verhalten des Aluminiumkarbids. München (Techn. Hochsch.). 1913. 81 S. 8°.

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X. *Eger*, G.: Studien über Konstitution der ternären Magnesium-Aluminium-Zink-Legierungen. Dresden (Kgl. Sächs. Techn. Hochsch.). 1913. 102 S. m. 21 Fig. u. 23 Tab. 8°.

Fischmann, E.: Ueber das Spiegelsilber. Bern. 1912. 37 S. m. 2 Abb. 8°.

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Röhl, G.: Beiträge zur Kenntnis der sulfidischen Einschlüsse im Eisen u. Stahl; ihre Erkennung, Unterscheidung u. Konstitution. Dresden. 1913. 58 S. m. 3 Fig. u. VII. Taf. 8°.

XI. *Möller*, M.: Die Ozonbildung durch Lenardstrahlen. Ein Beitrag zur Kenntnis vom Bildungsmechanismus des Ozons bei der sogenannten "stillen elektrischen Entladung." Danzig. 1913. 45 S. 8°.

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Windisch, E.: Ueber die Hydrogenisation ungesättigter organischer Verbindungen durch Platin- und Palladiumwasserstoff und die antikatalytische Wirkung von Fremdstoffen auf den Hydrogenisierungsprozess. Erlangen. 1913. 90 S. m. 1 Fig. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

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Manchester Section.

CONTRIBUTION TO THE STUDY OF THE ACTIONS OF VARIOUS WATERS UPON LEAD.

BY HARRI HEAP, M.SC.

(Continued from August 15th issue, p. 775.)

Methods used for the determination of the effect of water upon lead.

The methods generally used are:—

1. *Frankland's method.* Briefly this method is to bend into a U shape a piece of half-inch water pipe three feet long. This tube is filled with water, sealed at both ends and allowed to stand for 24 hours. The pipe is then emptied, rinsed with the water, refilled, and allowed to stand with sealed ends for a period of 24 hours. The water is removed from the pipe and the amount of lead in the water estimated. A practical objection to this method is the large amount of piping needed and the fact that the pipes cannot be used repeatedly, on account of their becoming coated in some cases with insoluble compounds, thus preventing the actual contact of the lead and the water. In other cases, the surface of the lead is so altered by the action of a very pure water, that a second water submitted to a test in this same pipe would show a greater activity than it would in a new pipe or a piece of old pipe which had been treated with a less pure water. Then again, the strain on the pipe, produced in making the U, interferes with the constancy of the lead factor in the reaction, due to difference in potential between the strained and unstrained portions, because it is impossible to bend the pipes in such a way as always to produce the same degree of strain. In cases where lead pipes are used, the varying composition of the metal must enter largely into the question, although lead is one of the purest of our commercial metals.

2. *Dumas' method* is to allow the water to act on lead shot in closed and open flasks.

3. In *Houston's method* specially prepared shot, which is all lead, is used. The water is allowed to percolate upwards through 50 c.c. of the shot contained in three-quarter inch diameter glass tubing and the water collected in 50 c.c. Nessler glasses, and then tested for lead. The length of time the water is in contact with the shot is governed by rate of flow or by stopping the flow altogether. The objections to this method are very similar to those experienced in using Frankland's method. The shot, no doubt, is under various compression strains, and the surface is exposed to injury from friction. The surface of the shot will become altered by deposits from the water examined, and for further use would then have to be washed, which procedure is very unsatisfactory when conducting a series of experiments for comparative purposes, because in washing "pitting" takes place. Other waters would render the surface much more liable to be attacked, especially very pure waters, and the shot would thus be in ever varying physical states. The motion of the water over the shot is an unsatisfactory feature, because no doubt a particular channel would be established through the shot, and thus the surface relation between water and lead would vary still more. The cleaning of the shot prior to experiment is also very awkward, and any washing with water introduces further difficulty.

Many observers take no account of the volume of air in contact with the water.

Another point of importance is the nature of the glassware used as regards its solubility in the water. Garrett noticed this, and accordingly modified his experiments. Lack of attention to the temperature under which the experiments were made deteriorates the value of many experiments which could otherwise be made comparative.

Diffused daylight fortunately has not a very great effect upon the various reactions; that is to say, the quantities of lead found in two cases, one being made in the absence and the other in the presence of diffused daylight, are almost identical, though the one made in daylight shows a slightly increased amount of lead dissolved.

In direct sunlight the action seems to increase further, but no great number of experiments was made with a view to working out this point, although it is of much interest in many other directions.

In our experiments we used two methods: the first to observe what took place in more or less impure lead pipes: the second was used for studying accurately the action of water and various solutions on pure lead.

1. (*a*) The waters under examination were allowed to remain in ten yard lengths of coiled lead piping, such as is ordinarily used for gas lighting purposes.

(*b*) In this case the experiment was performed in similar fashion, but the piping used was ordinary half-inch water service pipe.

2. (*a*) In this case pieces of pure lead foil of definite dimensions were used. These strips of lead had a surface area of practically 32 sq. cm. and the volume of water exposed was 120 c.c.

The glass vessels for holding the water to which an exposure of lead was about to be made were of a particular kind in that, when filled with water, the stoppers could be inserted so as to render the contents out of contact with the atmosphere and at the same time enclosing no air.

In our experiments with lead pipes we found that they could not be used continuously for a series of comparable experiments with different waters; the strip method, however, could be used with great advantage, and coincidently water tested by Frankland's method was found to give nearly the same amount of lead as water tested by our method, when previously unused pipes of good quality were used.

The influence of temperature on the action could be determined without any difficulty, by introducing the vessel containing the water and lead into a water bath, or an air oven, which could be regulated as regards its temperature.

Methods used in experiments.

1. *Using pipes.* A cylinder about 4½ feet high and 18 inches diameter had three leaden gas pipes, A., B., and C., coiled round it, also one leaden water pipe, D. Each coil was exactly 10 yards long. The arrangement was on a small scale similar to that of lead pipe connected with a domestic tap. The dimensions of pipes A., B., and C., were: Internal diameter, 1·3 cm.; external diameter, 1·7 cm.; thickness of lead wall, 0·2 cm. The dimensions of pipe D. were:—Internal diameter, 1·0 cm.; external diameter, 2·4 cm.; thickness of lead wall, 0·7 cm.

Each pipe was fitted at its lower end with a brass tap and at the upper end with a rubber bung. The pipes, B., C., and D., were newly made, but pipe A. had been kept in stock some time by the retailer, and had a dull appearance, whereas the others were quite bright. The capacities of the pipes were measured by filling with water, then emptying and measuring the volume of the water. This, of course, is not the calculated capacity of the pipe but somewhat less, due to the water not draining out completely. The volumes found by filling and draining the pipes were:—

At 10° C., A. 1020 c.c., B. 1070 c.c., C. 1050 c.c., D. 1070 c.c. The calculated volumes were:—A. B. and C. 1188·72 c.c., D. 914·40 c.c.

These apparent discrepancies are probably due to the unevenness of the bore of the tubes and the temperature of the water placed in the pipes and also the incompleteness of the emptying.

An experiment was made by filling the pipe with the water in question and connecting it to a further supply of the same water, and running off the water until 5 litres had passed through to waste. The tap of the pipe was closed and the coupling at the other end which served to connect the pipe with the reservoir of water was removed and the rubber bung pressed into this end of the pipe and secured. The water was allowed to remain in the pipes for a certain length of time and the temperature at the beginning and at the end of the experiment observed. The temperature of the cellar in which these experiments were conducted was fairly constant. The acidity or alkalinity of the water was determined prior to being placed in the pipe and afterwards the lead in the water was estimated.

2. *Using lead foil.* In these experiments special glass vessels were procured, cylindrical in shape and fitted with a broad conical stopper, so that by filling the vessel with water and inserting the stopper, water was displaced until the stopper fitted tightly, rendering the contents practically air tight. First the bottles were well washed and steeped in acid, then washed with distilled water and left to soak in distilled water until no alkali was given up by the glass. The bottles were used only after it had been found that water kept in them for 24 and 48 hours was not alkaline and did not contain lead. The volume of liquid held by the bottles was 120 c.c. The lead used in these experiments was pure lead foil. On analysis we found it to be 99·81 per cent. of metallic lead.

I have to thank Mr. J. H. Andrew, of the Metallurgical Department of the University, who kindly made an analysis of the same lead foil for me, and found it to contain 99·65 per cent. of metallic lead. The lead was polished brightly by vigorous rubbing with well washed wash-leather. The lead was cut up into pieces of: length, 6·35 cm.; breadth, 2·54 cm.; thickness, 0·012 cm. The area is practically 32·26 square cm.

In making an experiment the bottles were washed with the water under examination, then filled with the water under investigation, and a strip of lead foil inserted. The stopper was pressed in and secured and the whole apparatus placed in an incubator kept at 20° C. for a definite period of time, after which the apparatus was removed and the appearance of the water and the lead strip noted. The stopper was now removed, the lead taken out, and the water examined for lead. In some experiments the water was placed under anaerobic conditions. The gases were pumped off by making use of Adeney's gas analysis apparatus. This apparatus offered another advantage in that various gases could easily be introduced at definite pressures to the gas-free water. In certain cases extracts and infusions of organic matter and peat were made, some by simple digestion of the matter with water, others by percolating the water through the matter. The method used for estimating the amount of lead in the water was as follows:—The water which had been kept in contact with the lead was poured into a Nessler glass up to the 50 c.c. mark: 0·5 c.c. of a 0·5 per cent. solution of acetic acid was added, and then 5 c.c. of a saturated watery solution of sulphuretted hydrogen. According to the amount of coloration produced, it was judged whether the water contained more or less than the amount of lead which one can estimate by this reaction. In cases where the amount was too small the water was concentrated if a positive figure was required and where the lead was in too great quantity the water was diluted. The amount of colouration produced, depending upon the amount of lead present, was estimated by matching the colour with a standard solution of lead acetate and hydrogen sulphide water. The lead solution was made so that 1 c.c. contained the equivalent of 0·0001 grm. of lead. A blank test was made to compensate for the natural colour of the water and variation of tints which are not due to the presence of lead. In cases where it was wished to differentiate between lead in solution and lead in suspension the method adopted was to estimate the total lead and afterwards filter the liquid through asbestos wool and estimate the lead in the filtrate. The difference would give the lead in suspension. Asbestos was used because ordinary cellulose filter papers absorb dissolved lead out of certain solutions. In other cases the amount of lead disappearing from the strip was estimated by direct weighing. The reaction of the water was determined in most cases by titrating 100 c.c. with a centi-normal caustic soda or sulphuric acid solution using phenolphthalein, lacmoid, and methyl orange as indicators. In other cases more complete analyses of the waters are given, and all results are expressed in parts per 100,000 parts.

Theories which may possibly explain the action of water on lead.

1. *The oxidation theory.* Dumas and Yorke put forward this theory about the same time. They explained the action by assuming first of all an oxidation of the lead, then the production of the hydrate which remains in solution. This hydrate combines with the carbonic acid and forms an insoluble compound which is precipitated. More lead is now oxidised with subsequent production of hydrate and afterwards insoluble carbonate by the action of carbonic acid. In the presence of an excess of oxygen and carbonic acid the action is progressive.

2. *The acid theory* of Grace Calvert, put forth with special regard to iron, was that water and oxygen are alone insufficient to cause corrosion of iron, but that carbon dioxide is also necessary. Crum Brown supported this theory in a slightly modified form in that he asserted the destruction of iron may be due to attack by any acid, but that the acid most generally observed to attack was carbonic acid. The acid combined with the metal to form a carbonate or a bicarbonate and the hydrogen liberated formed water with dissolved or atmospheric oxygen.

Lead carbonate is only slightly soluble in water but the bicarbonate is very soluble. Lead produces basic salts and the reaction might be expressed:—

$$6Pb+4CO_2+3O_2+2H_2O=2(2PbCO_3.Pb(OH)_2)$$

If the reaction is viewed in this light an excess of carbon dioxide is required for a progressive reaction. With a small quantity of carbon dioxide the progressive reaction may be expressed as follows:—$Pb+CO_2+O=PbCO_3$. This small amount of lead carbonate would dissolve in the water and no further action would take place due to carbon dioxide beyond this; but supposing the lead carbonate is acted on thus:—$PbCO_3+H_2O=Pb(OH)_2+CO_2$. Then a minimum of carbon dioxide would cause the action to progress until the water was saturated with lead hydrate. After this stage the action would proceed with precipitation of lead hydrate and probably form basic lead carbonate with the carbon dioxide which compound is insoluble and this action would now be at a maximum and so equilibrium would be established.

3. *Hydrogen peroxide theory.* Traube assumed that firstly the metal was oxidised by water with liberation of hydrogen which combined with oxygen to form hydrogen peroxide. This then attacked the oxide of the metal to form the hydrate. The excess of hydrogen peroxide attacks any unoxidised metal to form water and the oxide of the metal. The oxide then combines with more hydrogen peroxide and forms more hydrate.

4. *The ionic theory.* According to this theory, which also was put forth to explain the corrosion of iron by Whitney, acid is not necessary. The process is entirely electro-chemical. The water is assumed to be ionised containing equal quantities of hydrogen and hydroxyl ions. On introducing the metal into the water a certain amount passes into solution forming ions and the hydrogen set free on the surface of the metal being in a nascent state is oxidised by any oxygen which is present to produce water.

5. *The biological theory.* This theory assumes that certain forms of living matter produce substances which

will attack the lead. Houston asserted that certain bacteria flourishing in peaty substances produce acids which dissolve lead. Thus the biological theory accounts for the action to a limited extent, but as far as the mechanism of the reaction is concerned, it is dependent on one of the foregoing or some other purely chemical theory for further explanation.

Experimental.

Experiment I. A. The 10-yard lengths A., B. and C. of lead gas-piping were filled with raw upland lake water, and allowed to remain in contact for certain periods of time.

Table I.

Expt.	Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
a.	A.	24	11—11	0·04
	B.	24		0·10
	C.	24		0·10
b.	A.	48	10—10	0·04
	B.	48		0·18
	C.	48		0·16
c.	A.	72	10—10	0·08
	B.	72		0·22
	C.	72		0·22
d.	A.	96	10—10	0·08
	B.	96		0·22
	C.	96		0·22
e.	A.	120	10—10	0·08
	B.	120		0·24
	C.	120		0·26
f.	A.	144	9—13	0·10
	B.	144		0·28
	C.	144		0·28
g.	A.	240	9—13	nil
	B.	240		0·28
	C.	240		0·28

From the experiments on the pipes A., B., and C., it is seen that the lead content of the water increases the longer it remains in the pipe up to an exposure of six days. Pipes which have been kept for some time are less active than new pipes; this is an inference drawn from the difference in behaviour of pipe A., but it might have been due to a difference in composition of the lead or to dust which had accidentally accumulated in the pipe whilst being stored by the plumber. The latter interpretation seems to explain the difference best because the pipe eventually ceased to yield lead to the same water which was contaminated by exposure to the pipes B. and C. The pipe probably became coated by an insoluble coating precipitated upon the lead.

Table II.

Expt.	Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
a.	B.	1	4·5—10	0·06
	C.	1		0·06
b.	B.	2	4·5—10	0·14
	C.	2		0·14
c.	B.	4	4·5—10	0·18
	C.	4		0·18
d.	B.	6	4·5—10	0·22
	C.	6		0·22
e.	B.	18	4·5—10	0·26
	C.	18		0·26
f.	B.	24	4·5—10	0·26
	C.	24		0·26
g.	B.	72	4·5—10	0·26
	C.	72		0·26
h.	B.	240	4·5—8	0·36
	C.	240		0·36

Experiment I. B. Ten-yard lengths of lead gas-piping B. and C. were exposed to the action of raw upland lake water for shorter periods of time. (See Table II.).

These experiments show that the action proceeds more vigorously in the earlier period of contact and that the reaction approaches its maximum in about 10 days.

Experiment I. C. A 10-yard length of ordinary half-inch water service pipe D. was treated with raw upland lake water.

Table III.

Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
D.	1	4·5— 7·0	0·06
D.	2	4·5—10·0	0·14
D.	3	4·5—10·0	0·20
D.	4	4·5— 9·5	0·23
D.	5	4·0— 8·6	0·23
D.	6	4·0— 8·0	0·23
D.	24	4·0— 8·0	0·24
D.	72	4·5— 8·0	0·28
D.	240	4·0—10·0	0·30

By comparing the experiments made in pipes B. and C. with those of pipe D. one finds that the amounts of lead are very nearly the same and the three pipes can be compared as regards their action in general terms. This pipe shows the same results as the pipes B. and C.

Experiment II. A. The 10-yard lengths B., C., and D. of lead piping were filled with ordinary distilled water and allowed to remain in contact for certain periods of time.

Table IV.

Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
B.	1	7—7·5	0·28
B.	2	7—11	0·36
B.	3	7—7·5	0·31
B.	5	7—8·5	0·32
B.	72	7—8·5	0·65

In the 72 hours' experiment in the above table the water on exposure to the air became "silky." Whilst these experiments were being made the pipes C. and D. were filled and washed just as pipe B. was, in the hope that all three pipes would be in the same state for the next set of experiments.

It was found, however, on making experiments on the pipes with distilled water for longer periods that the lead content of the water increased enormously. This fact was explained by assuming that first of all the pipes had been coated to some extent by the upland lake water in the previous set of experiments and now this coating was being gradually dissolved and the lead surface becoming exposed.

Table V.

Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
B.	1	11—8·5	0·8
B.	2	11—8·5	2·0
B.	3	11—10	3·00
B.	24	10—10	14·00

Table V. shows the action of distilled water on pipe B. after making a few experiments with distilled water.

By comparing Tables IV. and V. it is seen that distilled water acts much more vigorously than lake water. Also that lake water either coats the pipe with some protective agent or modifies the pipe in some way so that distilled water has a reduced action on the lead. After a time though the distilled water exerts an increased action and attacks the lead much more vigorously.

Pipes D. and C. were again filled for a few times with raw upland lake water, pipe B. being filled the same number of times with distilled water and afterwards experiments made for certain periods of time, filling pipes D. and C. with raw upland lake water and pipe B with distilled water and estimating the amount of lead.

TABLE VI.

Expt.	Pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
a.	B.	2	10—12	4·00
	C.	2		0·04
	D.	2		0·08
b.	B.	4	10—12	4·00
	C.	4		0·06
	D.	4		0·24
c.	B.	24	10—12	6·00
	C.	24		0·04
	D.	24		0·20
d.	B.	192	10—12	6·00
	C.	192		0·04
	D.	192		0·30

From Table VI. it is seen that the rate of action of the lake water is much slower than that of distilled water, because the maximum amount of lead is reached in the case of distilled water in 24 hours, but in the case of lake water the action is still progressing after an exposure of 192 hours. In the case of pipe C. the amount of lead taken up by the water was so small that no increase in amount in the series of exposures could be demonstrated.

PART II.

Experiments with infusions of peat.

All the pipes were filled with distilled water and allowed to remain for a period of time and the water then run off. The pipes were filled again with distilled water, and this process continued until all three pipes, B. C. and D., were turning out water which turned "silky" on exposure to air. The object of this was to try to render the pipes clean and to make them as nearly as possible equal as regards their action on distilled water so that the experiments on the next water would be more comparable. They were then filled with distilled water and allowed to stand for 2 hours. The water was then run off and the lead estimated, with the following result :—Pipe B. 4·0 parts of lead per 100,000; pipe C. 3·8 parts; pipe D. 4·0 parts per 100,000.

The pipes were now assumed to be in similar states and infusions of peat which had been previously made were exposed to the pipes.

I. Two litres of water and 40 grms. of peat were thoroughly agitated and allowed to stand in a stoppered thoroughly cleaned and tested hard glass flask for 24 hours. This was filtered through filter paper and the first washing rejected. The remainder was collected to be used in the pipe experiments.

II. Two litres of water and 100 grms. of partially formed peat were mixed as in case I. and the filtered infusion experimented with.

TABLE VII.

Nature of water and pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
a. Peat infusion I. in Pipe D.	2	10—12	2·00
b. Distilled water in Pipe B.	2	10—12	4·00
c. Infusion II. in Pipe C.	24	9—12	5·00
d. Distilled water in Pipe B.	24	9—12	6·00

In both cases the peaty waters showed less action than the distilled water.

Five infusions of peat were made as follows :—

No. I. 5 grms. of peat and 2 litres of distilled water.

No. II. 20 grms. of partially formed peat and 2 litres of distilled water.

No. III. 5 grms. of peat and 2 litres of raw upland lake water.

No. IV. 40 grms. of peat and 2 litres of distilled water.

No. V. 100 grms. of partially formed peat and 2 litres of distilled water.

The mixtures of peat and water were thoroughly well mixed in hard glass flasks and then allowed to stand covered at the neck with an inverted beaker in the open air for 45 days. The infusions were filtered through paper, the first drainings being wasted, and the after portions collected and tested with the following results :—

TABLE VIII.

Reactions of the various infusions before being placed in the lead pipes.

Infusion	Chlorine parts per 100,000.	Reaction to			
		Phenolphthalein.	Lacmoid.	Litmus.	Methyl orange.
No. I.	0·4	Acid	Faintly acid	Alkaline	Alkaline
II.	1·6	Acid	Alkaline	Alkaline	Alkaline
III.	0·4	Acid	Alkaline	Alkaline	Alkaline
IV.	0·4	Acid	Acid	Acid	Acid
V.	0·4	Acid	Acid	Acid	Acid

TABLE IX.

Action of the various infusions on lead.

Infusion and pipe used.	Exposure in hours.	Initial and final temperatures, °C.	Lead found parts per 100,000.
a. No. I. Pipe D. ..	4	8—10	1·40
b. No. II. Pipe D. ..	4	8—10	1·30
c. No. III. Pipe D.	4	8—10	0·35
d. No. IV. Pipe D. ..	4	8—10	1·40
c. No. V. Pipe D. ..	4	8—10	0·90

In making the above experiments the Pipe D. was carefully prepared before being exposed to the action of the various infusions by flushing with distilled water. After flushing it was allowed to remain full of distilled water for a period of 24 hours; the pipe was emptied, re-filled with distilled water, and allowed to remain for a further period of 24 hours. The pipe was now emptied, flushed with distilled water, and filled with distilled water which was exposed for a period of one hour. On emptying this water should contain lead and turn silky on exposing to the atmosphere. By adopting this course it was hoped to get a maximum action by the lead upon the water which was exposed to it. From my experiments I find that the action of the particular waters upon lead was decreased by contamination with peaty matter.

The addition of various substances to lake water.

The pipes before filling with the various waters which are detailed in the following table were prepared by exposing to distilled water in the same manner as was the case in the infusion experiments. An analysis of an average sample of the raw lake water used in these experiments was as follows:—

Oxygen absorbed from potassium permanganate in 4 hours at 27° C.	0·072
Ammonia, free	0·0006
Ammonia, albuminoid	0·0010
Nitrous nitrogen	None
Nitric nitrogen	0·020
Chlorides	0·90
Total hardness	2·00

The water was odourless and yellowish-green in colour, and slightly turbid but not opalescent. There was a slight sediment and also a slight quantity of suspended matter.

Action of raw upland lake water containing various substances.

TABLE X.

Substance added to the water.	Alkalinity of 100 c.c. of the water to methyl orange in centinormal terms.	Exposure in hours.	Lead found parts per 100,000.
	c.c.		
Sodium carbonate			
1 part per 100,000....	3·0	24	0·08
2 parts per 100,000 ..	4·4	24	0·02
Whiting			
1 part per 100,000....	2·5	24	0·06
2 parts per 100,000 ..	3·3	24	0·06
3 parts per 100,000 ..	6·8	24	0·02
Calcium oxide			
1 part per 100,000....	4·4	24	0·03
2 parts per 100,000 ..	7·4	24	0·50
3 parts per 100,000 ..	10·6	24	0·80
Calcium carbonate			
1 part per 100,000....	1·4	24	0·06
2 parts per 100,000 ..	2·0	24	0·08
3 parts per 100,000 ..	2·5	24	0·12
Calcium sulphate			
1 part per 100,000....	1·4	24	0·2
2 parts per 100,000 ..	1·7	24	0·24
3 parts per 100,000 ..	2·0	24	0·28
Calcium nitrate			
1 part per 100,000....	1·5	24	0·20
2 parts per 100,000 ..	1·5	24	0·24
3 parts per 100,000 ..	1·5	24	0·28
Calcium chloride			
1 part per 100,000....	1·2	24	0·24
2 parts per 100,000 ..	1·5	24	0·24
3 parts per 100,000 ..	1·5	24	0·24
Calcium acetate			
1 part per 100,000....	3·0	24	0·16
2 parts per 100,000	3·2	24	0·24
3 parts per 100,000 ..	4·0	24	0·24
Magnesium carbonate			
1 part per 100,000....	3·1	24	0·03
2 parts per 100,000 ..	4·3	24	0·04
3 parts per 100,000 ..	7·0	24	0·01
Magnesium chloride			
1 part per 100,000....	1·4	24	0·12
2 parts per 100,000 ..	1·5	24	0·30
3 parts per 100,000 ..	2·0	24	0·32
Magnesium nitrate			
1 part per 100,000....	2·2	24	0·26
2 parts per 100,000 ..	2·0	24	0·28
3 parts per 100,000 ..	2·0	24	0·30
Lake water alone	1·2	24	0·28

Thus the alkali carbonates have a protective action. Sulphates, nitrates, and chlorides do not possess this property but exert a greater solvent action than the carbonates. The amount of lead found is but slightly greater in the cases of these salts than in the case of the lake water alone, but calcium oxide markedly increases the action.

In experimenting with the pipes many difficulties were encountered. The pipes could not be kept in such states that ensured comparable figures, even when working with the same water throughout. The next series of experiments was made by using the strips of pure lead and the special glass bottles.

(To be concluded.)

Journal and Patent Literature.

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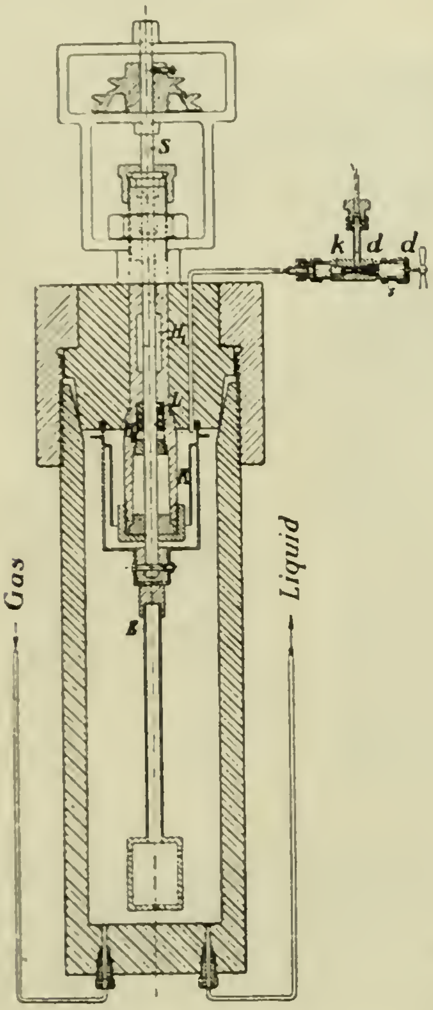
I.—GENERAL PLANT; MACHINERY.

Bomb with stirring arrangement for high pressures and temperatures and a new reducing valve. L. Stuckert and M. Enderli. Z. Elektrochem., 1913, 19, 570—572.

THE diagram shows a reaction bomb constructed for reactions between gases and liquids at pressures up to 80 atmospheres and temperatures up to 200° C. The stirrer can be worked at 2100 revolutions per minute. The ball bearings, L, are completely embedded in oil, which also fills the cavities, H_1 and H_2. The lower bearing is attached to the spindle, S, and the upper one is pressed against the core, K. The apparatus is made gas-tight by accurately fitting conical stoppers at the top and bottom of K. The material used for packing the joints is the so-called "Klingerit." The stirrer itself is of the Witt type, with orifices at E and in the cylindrical lower portion. Attached to the stirrer is a double cylinder of brass to prevent oil reaching the liquid in the bomb. The valve has a cone, *k*, in a seating which is also conical but with a different angle. Pressure is released by screwing up the handle which moves the spindle, *s*, forward, thus pushing *k* away from its seating. The packing material, *d*, can thus be replaced without releasing the pressure in the apparatus. The valve can be used for bombs, gas cylinders, etc., and does not need a second valve for fine regulation.—W. H. P.



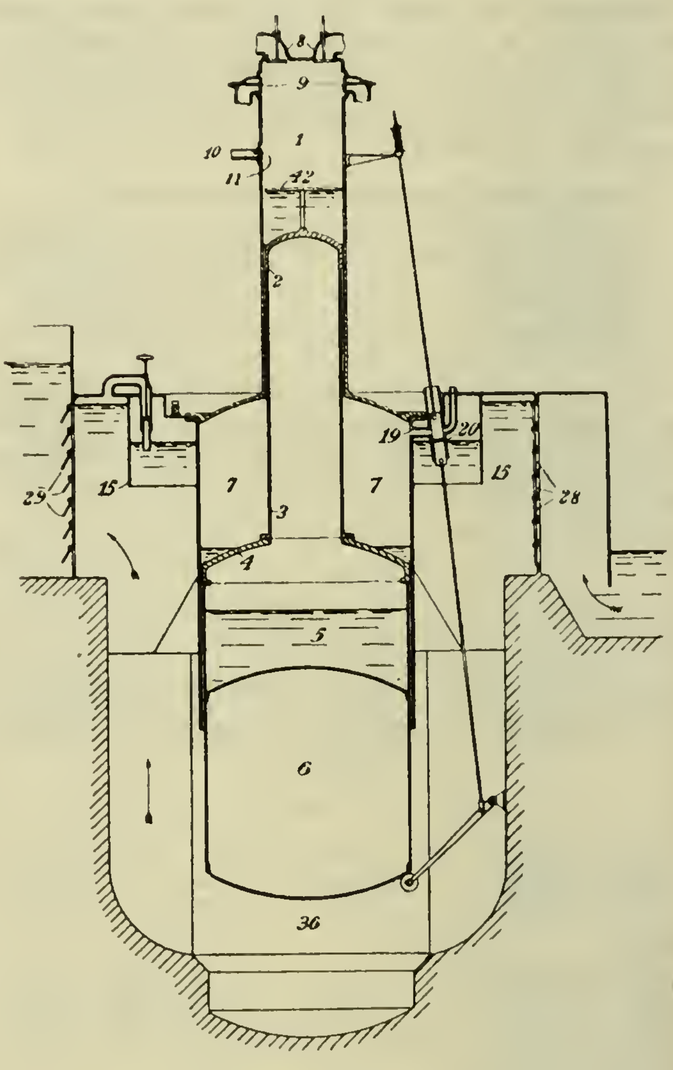
Patents.

Heating granular or pulverised materials; Rotary apparatus for uniformly ——. T. L. G. Bell, London. Eng. Pat. 15,906, July 8, 1912.

The patent relates to inclined rotary kilns and similar heating and drying apparatus of the type described in Eng. Pat. 2350 of 1865, and having radial partitions divided into short lengths out of alignment with one another for lifting the material as the chamber rotates. The invention consists in mounting the radial partitions on a spindle extending axially through the drum; using three radial partitions at an angle of 120° forming these of separate elements bolted or riveted to a sleeve on the shaft; providing ribs or shelves both on the partitions and on the drum, and inclining the ribs on the partitions towards the axis.—A. T. L.

Raising or forcing liquids or compressing elastic fluids; Method of and apparatus for ——. H. A. Humphrey, London, and W. J. Rusdell, Dudley. Eng. Pat. 15,585, July 3, 1912.

An explosive mixture enters the combustion chamber, 1, through the valves, 8, and the products of combustion are discharged through the exhaust valves, 9. The compound piston, 2, 3, 4, 6, is forced downwards by the explosion into the water in the chamber, 36. The water enters this chamber through the valves, 28, and is discharged through the valves, 29. The lower part of the piston, 6, is filled with air and weighted by water in the chamber, 4, 5, so that the pressure of the water on the float piston, 6, helps to cause the return stroke, or in case of stopping the pump, causes the piston to return to its upper position, so that the pump can be readily restarted. The return of the piston is further assisted by the air cushions under the bell, 15, and in the chamber, 7, the latter being twice in communication with the air through the valve, 19, 20, during each cycle. Cooling water enters the cylinder through the pipe and valve, 10, 11, and is discharged through the exhaust ports, 9. One or more discs, 42, are arranged above the piston to prevent splashing. —W. H. C.



Drying kilns. Soc. de Constructions Mécaniques d'Alais, Alais, France. Eng. Pat. 16,262, July 11, 1912. Under Int. Conv., June 21, 1912.

The kiln comprises a cylindro-conical casing provided with horizontal sector-shaped shelves and a vertical shaft to which horizontal sector-shaped blades are attached. Hot air is blown into the bottom of the casing by a fan and the material which is fed into the top of the casing, is swept from shelf to shelf by the blades, which are so shaped that as they pass round, they temporarily close the openings between the fixed shelves.—W. H. C.

Drying oven [for moulds]. E. C. Wiley, Assignor to Lynchburg Foundry Co., Lynchburg, Va. U.S. Pat. 1,067,087, July 8, 1913.

The gases from a furnace pass into a distributing chamber, the top of which serves as a support for the mould to be dried. There is a free passage from the distributing chamber through the mould, which thus acts as a chimney or flue for the furnace.—W. H. C.

Drying kiln. E. A., Assignor to M. B. Hallam, Portland, Oreg. U.S. Pat. 1,067,110, July 8, 1913.

The material to be dried passes through the drying kiln on trucks. By means of shields or baffles the air is made to pass down through a tubular heater arranged below the trucks, and to be evenly distributed over the material as it rises from the heater.—W. H. C.

Drying of materials, especially those in the form of small lumps or of powder agglomerated into small lumps; Process and apparatus for the ——. F. C. W. Timm. Ger. Pat. 258,230, Nov. 24, 1911.

The material is carried through the drying chamber on a support similar to a chain grate, which divides the chamber into an upper and a lower compartment. The lower compartment projects at one end some distance beyond the upper one, and the extension is connected with a suction device. The wet material travels continuously through the chamber, and is dried by hot gases passing downwards through it. When the material enters the extension, it is not completely dry on the under side, in contact with the support, and the drying is completed by air, which is sucked through the charge at a moderate velocity.—A. S.

Steam boilers; Means for preventing pitting or corrosion in ——. [*Composite boiler plates.*] B. Rose, Birmingham. Eng. Pat. 16,455, July 15, 1912.

The boiler plates are rolled from a composite ingot, formed by casting steel around a slab of iron or other metal capable of resisting corrosion. The ingot is divided into two parts, the line of section passing through the embedded slab and dividing it in two. Each half of the composite ingot is rolled separately.—W. H. C.

Measuring gases, vapours and liquids; Apparatus for ——. H. Liese, Hamburg, Germany. Eng. Pat. 23,656, Oct. 16, 1912. Under Int. Conv., Oct. 16, 1911. Addition to Eng. Pat. 27,467 of 1911, dated Dec. 9, 1910.

In using the apparatus described in the chief patent (this J., 1912, 761), when it is desired that the quantity of fluid delivered shall not exceed a certain amount, the inlet or outlet valve connected with the expansion chamber, is throttled as soon as the movement of the expansion chamber exceeds a predetermined amount. Two measuring apparatus of different capacities are so connected that when the quantity of fluid passing is greater than the capacity of the smaller or less than the capacity of the larger, one of them is automatically shut off and the other opened. By arranging a flange and a baffle in the expansion chamber, the supply of steam to an engine connected with the apparatus is throttled whenever the revolutions of the engine exceed a predetermined number per minute.—W. H. C.

Liquids and gases or vapours; Apparatus for producing interaction between ——. J. A. Hart, Blackburn. Eng. Pat. 27,654, Nov. 30, 1912. Under Int. Conv., Dec. 4, 1911. Addition to Eng. Pat. 29,391, Dec. 17, 1910 (this J., 1912, 177).

The stream of gas which enters the tangential ports in the casing as described in the chief patent, is caused to have a component motion parallel to the axis, and serves to spread the washing liquid, which is fed into the casing near the bottom, over the interior surface. The excess of liquid is discharged through a series of ports formed in the upper part of the casing, but facing in the opposite direction to those by which the gas enters.
—W. H. C.

Filter presses; Apparatus for closing ——. H. H. Davis, Ilford, A. J. S. Hooton, Romford, and S. H. Johnson and Co., Ltd., London. Eng. Pat. 28,985, Dec. 16, 1912.

Two co-axial screw rams or a screw ram and a hydraulic ram are combined so that the press is first closed by a screw ram and then a final closing pressure is applied by the second screw ram or the hydraulic ram.—W. H. C.

Filtering apparatus for removing foreign bodies from liquids. E. Babrowski, Grünberg, Silesia. Eng. Pat. 2118, Jan. 27, 1913.

The liquid is fed into a trough in which a finely perforated drum is rotated. A portion of the liquid passes through the perforations leaving the foreign bodies behind. The latter are carried forward by the flow of the liquid and are removed by a comb conveyor.—W. H. C.

Filtering gaseous fluids; Apparatus for ——. O. Happel, Bochum, Westphalia. Eng. Pat. 3948, Feb. 15, 1913.

In filters which consist of a number of separate pockets of canvas or other fabric inserted into a common chamber frame, a better joint between the pocket and the frame is secured by providing the mouth of each pocket with a separate stretching frame.—W. H. C.

Evaporator. J. E. Dunn, Santiago, Cuba, Assignor to American Evaporator Co., Philadelphia, Pa. U.S. Pat. 1,067,010, July 8, 1913.

In a tubular evaporator the space below the lower tube-plate is used as a pressure chamber and is provided with a perforated distributing plate. The liquid is delivered into this space and is forced by steam pressure up the vertical tubes. The space above the upper tube-plate forms a separating chamber into which the upper ends of the tubes project a short distance. The upper ends of the tubes are all at the same level and the level of the liquid separated is maintained below the upper ends of the tubes.
—W. H. C.

Evaporation of brine, sugar solutions, etc.; Vertical apparatus for the ——. Maschinenbau-Akt.-Ges. vorm. Breitfeld, Danek und Co. Ger. Pat. 260,801, Sept. 19, 1912.

The evaporator has vertical tubes, and above the upper-tube plate, mounted on a central shaft, is a perforated plate. As this plate rotates, its perforations come intermittently into and out of register with the openings of the tubes, whereby, it is claimed, the circulation of the liquid is so modified that formation of incrustations on the tubes is avoided. Above the rotating plate are fixed scrapers, disposed tangentially to the central space around which the tubes are arranged. These scrapers remove any deposit from the upper surface of the rotating plate and guide it to the central space.—A. S.

Lubricants; Process and apparatus for testing —— *during the working of the machine.* Allgemeine Petroleum-Industrie-A.-G. Ger. Pat. 261,544, Oct. 24, 1911.

The steam or other working fluid, mixed with the lubricant, issuing from the machine, is led through a receptacle, *e.g.* a glass tube packed with filtering material, which retains the oil, etc., and thus allows of the quality of the lubricant being judged. The oil can afterwards be extracted from the filtering material and examined.—A. S.

Drying fragmentary, pulverulent, or like materials; Automatic and continuous apparatus for ——. A. Huillard, Suresnes, France. Eng. Pat. 1961, Jan. 24, 1913.

See Fr. Pat. 442,341 of 1912; this J., 1912, 909.—T. F. B.

Separation of solids; Apparatus for gravity liquid ——. F. I. du Pont, Wilmington, Del. U.S. Pat. 1,067,410, July 15, 1913.

See Fr. Pat. 419,072 of 1910: this J., 1911, 120.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

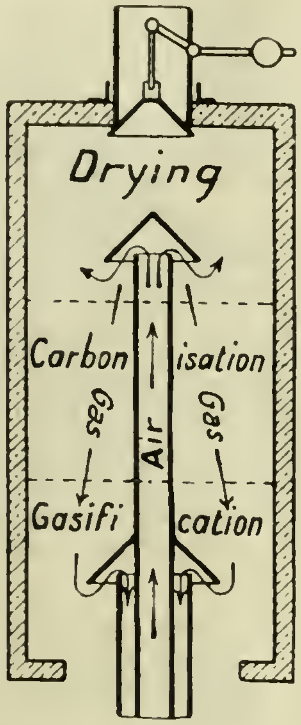
Methane; Formation of —— *from water vapour and carbon monoxide, by catalysis.* L. Vignon. Comptes rend., 1913, **157**, 131—134. (See also this J., 1913, 742.)

When carbon monoxide and water vapour are heated together to temperatures ranging from 500° C to 1200° C.

with various catalysts—iron, nickel, copper, silica, alumina, magnesia—there is always formation of methane: sometimes in considerable quantity. In some cases there is intermediate formation of carbides, which react with the steam; in others, hydrogen is produced, which in presence of the catalyst reacts with the carbon monoxide.—J, T. D.

Peat; Gasification of moist —— in gas producers. A. Wihtol. Feuerungstechnik, 1913, **1**, 374—377.

THE best heat efficiency is attained by using a producer of the kind shown diagrammatically, in which an upper zone serves for drying the peat, and the air together with the steam and volatile products from the peat pass downwards through zones in which the peat undergoes carbonisation and then gasification, with formation of carbon monoxide and hydrogen, the heat absorbed in forming steam in the drying zone thus being recovered. In two producers of this type, of 223·5 and 300 H.P. the air supply was heated by the gas leaving the producer, and also by passing through a jacket surrounding the body of the producer. Tested over a period of 8 hours, the following results were obtained:—



		223·5 H.P.	300 H.P.
Composition of the peat:—C	per cent.	29·06	41·65
H	,,	3·06	4·10
O	,,	19·56	26·35
H_2O	,,	45·54	23·80
Ash	,,	2·51	4·10
Calorific power (lower value), cals. per kilo		2360	3585
Composition of the gas:—CH_4	per cent.	0·86	1·35
C_nH_{2n}	,,	0·18	0·11
H	,,	19·25	17·13
CO	,,	14·96	15·85
O	,,	0·28	1·02
CO_2	,,	14·74	12·34
N	,,	49·73	52·20
Calorific power (lower value), cals. per cb. m.		1028	1120
Yield of gas, cb. m. at 0° C. and 760 mm. per kilo. of peat		1·73	2·59
Heat efficiency of the producer, per cent.		75·3	80·9

On certain assumptions as to the proportion of fixed carbon in the peat, and the heat losses by conduction, radiation, and through the sensible heat of the gas produced, it is calculated that the efficiencies should be 74·5 and 82·3 per cent., and the quantities of steam decomposed per kilo. of dry peat, 0·233 and 0·316 kilo. respectively. The remainder of the moisture in the peat is not decomposed, and an outlet is therefore provided at the upper part of the producer for leading away part of the steam.—A. T. L.

Methane; Preparation and analysis of ——. C. Campbell and A. Parker. Chem. Soc. Trans., 1913, **103**, 1292—1297.

ABOUT 100 grms. of aluminium carbide are covered with about 350 c.c. of previously boiled water at 90° C. The impure gas evolved is passed through an ammoniacal solution of cuprous chloride to remove acetylene, and through dilute sulphuric acid to remove ammonia. The gas thus prepared contains about 6·3 per cent. of hydrogen; this impurity is determined and rather more than the equivalent quantity of pure oxygen is added. The mixture is passed at the rate of 1 litre per hour through two wash-bottles containing sulphuric acid, then through a series of bulbs containing palladium black heated to 100° C., finally through potassium hydroxide and alkaline pyrogallol solutions. The apparatus employed for the analysis of methane is essentially that of Bone and Wheeler (see this J., 1908, 10). The hydrogen is burnt by means of palladium black contained in a small bulb heated to 100° C. The bulb is connected with a small laboratory vessel and with the measuring vessel, a second bulb being interposed to trap any mercury splashed over from the measuring vessel. Previous to the analysis, the apparatus containing the palladium must be completely exhausted; the gas to be analysed is measured, mixed with a small quantity of oxygen and passed slowly over the palladium two or three times. The hydrogen is calculated from the contraction. The method is said to afford very satisfactory results.—J. F. B.

Acetylene; Solubility of —— in acetone and acetone-water mixtures. R. Kremann and H. Hönel. Monatsh. Chem., 1913, **34**, 1089—1094.

THE saturated solutions prepared from various mixtures of water and acetone by passing in acetylene at a constant temperature, can be analysed by adding in excess a known volume of 5 per cent. alcoholic silver nitrate. The precipitate settles readily and nitric acid is formed, which can be determined by titration with alkali: $C_2H_2+3AgNO_3 = C_2Ag_2.AgNO_3+2HNO_3$. The authors' results at 0° and 25° C., for various mixtures are given in tables and curves, and by interpolation the following table is obtained for atmospheric temperature (18° C.).

Percentage of water in solvent.	Grms. of acetylene per litre of saturated soluton.
0	21
5	18·2
10	15·0
20	9·5
35	5·5
100	0·125

—W. H. P.

Acetylene hydrocarbons; Action of sodammonium on the true ——; formation of ethylene hydrocarbons. P. Lebeau and M. Picon. Comptes rend., 1913, **157**, 137—139.

IN general, sodammonium reacts with hydrocarbons of the acetylene series, forming 2 molecules of the sodium derivative of the hydrocarbon together with one molecule of the corresponding ethylene hydrocarbon. There is no secondary reaction and the products are of a high degree of purity.—J. T. D.

Carbon bisulphide; Removal of —— from gases. Knoevenagel. J. Gasbeleucht., 1913, **56**, 757—760, and J. Gas Lighting, 1913, **123**, 111—112. (See also this J., 1913, 743.)

IN laboratory experiments, the quantity of sulphur in lighting gas (free from hydrogen sulphide) was reduced from 99—115 grms. (432—502 grains per 1000 cb. ft.) to 20—24 grms. per 100 cub. m. (87—105 grains per 1000 cb. ft.) by passing the gas, freed from carbon dioxide, through a column of alkali-cellulose 32 cm. in length at the rate of 0·7 sec./mm. at the ordinary temperature. When the gas was passed through lime-water for the removal of carbon dioxide, and then through the same column of alkali-cellulose for a month, the latter remained porous except at the lower part, and retained its activity until saturated with carbon bisulphide, although the cellulose xanthate first formed undergoes further change, polycellulose xanthates, cellulose hydrate and sodium thiocarbonate being formed.—A. T. L.

Petroleum; Fractionation of California —— by diffusion through fuller's earth. J. E. Gilpin and P. Schneeberger. Amer. Chem. J., 1913, **50**, 59—100.

THE present paper contains the results of experiments with a very heavy petroleum from California. It was found that with oil of as high a sp. gr. as 0·912 at 20° C., no fractionation could be effected at the ordinary temperature by diffusion through fine-grained fuller's earth, but satisfactory results were obtained at 70° C. The results agreed generally with those obtained previously (this J., 1908, 1105; 1909, 831; 1910, 1146), and they can be explained by regarding petroleum as a colloid of the emulsion type. The fuller's earth acts as a dialysing septum, permitting the free passage of the paraffin oils, but adsorbing and coagulating the bituminous constituents, and with them the sulphur and nitrogen compounds and the benzene and olefine hydrocarbons. The determining factor in the fractionation is the amount of earth (*i.e.*, the surface) with which the oil comes in contact, the time of contact being of little or no importance. The bituminous material undergoes a change of condition when it is adsorbed by the fuller's earth, for it cannot afterwards be completely recovered by extraction with ether and carbon tetrachloride.—A. S.

Petrol substitutes. B. Redwood and V. B. Lewes. Times Eng. Suppl., July 23, 1913.

Increased supplies of petrol are now obtained by compressing natural gas so as to condense pentane and hexane, a very light spirit being produced which is suitable for mixing with heavier spirit to render it sufficiently volatile for use in carburettors. Oils of sp. gr. 0·8 or a mixture of such oil with 40 to 60 per cent. of petrol can now be used in special carburettors fitted with a supplementary feed tank containing petrol for starting. The heavier fractions of crude petroleum are converted into motor spirit by "cracking" in contact with iron, and an increase of 39 per cent. in the yield is obtained. The quantity of benzene available for motor spirit from gas-works tar in this country is only 50,000 galls. per annum, and it is doubtful whether motor spirit can be obtained profitably by distilling coal at low temperatures and "cracking" the naphtha distillates obtained from the tar. The maximum yield obtained at present is 3 galls. of motor spirit per ton of coal carbonised in coke-ovens. Scottish shale oil yields some petrol, and the amount could be increased by "cracking" the heavier fractions. The only motor spirit obtainable in unlimited quantities is alcohol, which could be made for the purpose and sold at 1s. per gallon.—A. T. L.

Hydrocarbon motor fuels. W. J. A. Butterfield. Times Eng. Suppl., July 23, 1913. (See also this J., 1913, 416.)

Possible sources of supply within the British Empire are discussed. Very little crude petroleum is available, and the chief sources are oil shale and bituminous coal or cannel. Oil shale is worked on a large scale in New South Wales and in Scotland, for the production of kerosene, lubricating oil, heavy fuel oil, paraffin wax and ammonia. In order to obtain motor spirit profitably from shale, the yield must be increased by "cracking," and ammonia must be produced so as to reduce sufficiently the cost of production of the crude oil. Motor spirit could also be obtained by "cracking" the native petroleum residues in Canada, the East Indies, and Egypt. From 1½ to 3 galls. of motor spirit per ton of coal could be recovered from the gas and tar made in coke-ovens and gas-works. Processes for distilling coal under conditions which would yield a greater amount of motor spirit depend for their success on finding a market for the semi-coke obtained at the same time, at a price not less than 75 per cent. of that of coal, and 25 lb. of ammonium sulphate per ton of coal must also be obtained. The annual consumption of motor spirit in the United Kingdom is about 100 million galls. The possible supply from coke-ovens is 30, from coal-gas 30, and from the present output of shale, 30 million galls. —A. T. L.

Asphaltum; Determination of paraffin in ——. J. Marek. Z. anal. Chem., 1913, 52, 553—556.

Richardson's method of purifying the fraction soluble in petroleum ether by means of concentrated sulphuric acid (this J., 1902, 690) is tedious, and the use of animal charcoal is recommended. 1 grm. of asphaltum is dissolved in 2 c.c. of chloroform, and 50 c.c. of petroleum ether (b. p. 70° C.) are added. After digesting for one hour the liquid is filtered through 40—60 grms. of the dry pulverised charcoal resting on cotton wool moistened with petroleum ether, suction being applied. Washing is done with 3 to 4 portions of 30 c.c. of petroleum ether. The bulk of the solvent is distilled off, the remainder expelled in the oven, and paraffin determined in the residue by the method of Engler-Böhm-Holde (solution in ether and precipitation with absolute alcohol at −20° C.). A detailed description of the filter used in this last operation is given. —W. R. S.

Determination of ammonia and nitrogen [*in gasworks products*]. Knublauch. *See* VII.

Patents.

Coal-dust and fire-damp explosions; Method of, and apparatus for preventing the spreading, and reducing the effect of ——. G. Kahler and F. Junker, Gelsenkirchen, Germany. Eng. Pat. 16,441, July 13, 1912. Under Int. Conv., Nov. 16, 1911. Addition to Eng. Pat. 16,440 of 1912, dated Aug. 17, 1911 (this J., 1913, 526).

To ensure the working of the sprinklers at every blasting operation, the drop block described in the main patent is released by an electromagnet when the circuit is closed for firing the blasting charge. The vane, actuated by the air wave of the explosion, serves for setting the sprinklers in action if the electrical device fails, or in case of an explosion other than the result of a shot.—A. T. L.

[*Coal.*] *Fuel; Method of and apparatus for making or treating* ——. W. Smith, Langley-on-Tyne. Eng. Pat. 25,698, Nov. 8, 1912.

By means of a series of screw conveyors of different diameters, small coal—alone or mixed with adhesive material—is caused to traverse the surface of a bath of molten lead contained in a horizontal, cylindrical vessel and is then compressed (while hot and plastic) into a coherent mass.—W. E. F. P.

Vertical retorts for the continuous carbonisation of coal. A. M. Duckham, Ashtead, Surrey. Eng. Pat. 25,342, Nov. 5, 1912.

The patent relates to the type of retort in which a vertical partition, which may be adjustable (see Eng. Pat. 28,388 of 1910; this J., 1911, 481), divides the upper part into two chambers one of which is left free of fuel and serves for the exit of the gases. Separate flues are provided around this free space, with dampers for regulating the temperature so that the liquid (condensable) hydrocarbons can be converted into gases by "cracking."—A. T. L.

Coke; Process for the desulphurisation of ——. H. C. Woltereck. Ger. Pat. 261,361, May 2, 1912.

The coke is treated with a mixture of air and steam at a temperature not exceeding 400° C. The operation is complete when the escaping gases no longer contain sulphur dioxide.—A. S.

Gas producers. C. H. T. Alston and P. T. Houston, London. Eng. Pat. 8056, April 3, 1912.

The producer, which is suitable for bituminous coal, wood or peat, comprises two superposed chambers connected by a part of reduced diameter. Air is admitted just above this constricted part, so as to work the upper chamber with an up-draught, thus forming producer gas of poor quality charged with tarry vapours, and at the same time coking the fresh fuel. The coked fuel descends automatically into the lower part of the producer as the fuel therein is consumed. The gases from the upper part of the producer pass downwards behind an arched or inclined wall in the upper chamber, and together with air or air and steam, are drawn downwards through the coked fuel to a gas outlet at the base of the producer. The lower part of the arched or inclined wall may consist of a hollow chamber with openings for admitting air downwards to the lower part of the producer and also in some cases, upwards to the upper part.—A. T. L.

Gas-producer. H. L. Doherty, New York. U.S. Pat. 1,066,717, July 8, 1913.

Coal is supplied continuously to the producer chamber through the upper part of which several tiers of horizontal flues extend, the upper surfaces of the latter being adapted to retain portions of the coal. The flues of one tier communicate at one end with those of the tier above and at the other with those of the tier below, the flues of the uppermost tier discharging into a common channel communicating with a gas off-take; the inlet ends of the lowermost tier are connected by means of a flue communicating with channels through which gas is withdrawn from the chamber. The lower part of the latter communicates with a draught-producing apparatus from which connections also extend to the upper part of the chamber and to a source of products of combustion. —W. E. F. P.

Gas-producer plant. C. O. Nordensson, Elkhorn, Wis., Assignor to G. A. Southwell, Chicago, Ill. U.S. Pat. 1,066,837, July 8, 1913.

In a gas-producing system, communication between the generator and the scrubber is effected by means of a chamber disposed at the lower end of the latter and in which the gas is caused to traverse a zig-zag channel the sides of which are sprayed with water. The chamber extends into a seal-well provided with vertical partitions by means of which separate water seals are formed between the chamber and the atmosphere and between the generator and the scrubber.—W. E. F. P.

Purification of gases; Apparatus for the ——. L. J. R. Bouhon, Anvers, Belgium. Eng. Pat. 15,209, June 29, 1912. Under Int. Conv., June 30, 1911.

The apparatus has a rotatable, vertical, hollow shaft provided with hollow perforated blades, through which the gas enters the apparatus. The reaction of the gas issuing from the perforations against a fixed screen provides a portion or all of the power required to rotate the shaft. The lower portion of the shaft is provided with spiral blades to raise the washing fluid against the fixed screen. —W. H. C.

Coal and other gas; Purification of ——. The Manchester Paint and Varnish Co., Ltd., and T. W. Jordan, Manchester Eng. Pat. 1384, Jan. 17, 1913.

For preventing the deposition of naphthalene from coal gas the latter is brought into intimate contact with "saponified solvent naphtha" prepared by dissolving 15 lb. of soft soap in 2½ galls. of water and mixing the solution with 5 galls. of solvent naphtha.—W. E. F. P.

Gas; Apparatus for cleaning ——. H. A. Brassert, Chicago, Ill. U.S. Pat. 1,066,704, July 8, 1913.

The gas is introduced tangentially into the upper part of a vertical conduit to the lower end of which an expansion chamber and a dust-collecting chamber are successively attached. A vertical outlet pipe extends through the conduit almost to the expansion chamber, which latter is separated from the dust-collecting chamber by a grid upon which is disposed an upright, perforated cone having its axis in line with that of the outlet pipe. The cone is provided externally with baffles or other dust-catching means and internally with means for preventing whirling of the gas.—W. E. F. P.

Gas; Apparatus for extracting tar from ——. F. H. Wagner, Assignor to The Bartlett Hayward Co., Baltimore, Md. U.S. Pat. 1,067,774, July 15, 1913.

A horizontal cylindrical casing contains two concentric perforated drums which are rotated in opposite directions. The gas enters the inner drum by a dip pipe so as to pass through the washing liquor. The perforated wall of the inner drum passes through this liquor, and liquor is also supplied to the wall of the outer drum, so that both the perforated walls through which the gas passes are kept wetted with the liquor.—A. T. L.

Mineral, tar, and resinous oils; Method of obtaining refined ——. M. Melamid, Freiburg, Germany. Eng. Pat. 9856, Sept. 24, 1912.

A crude mineral, tar, or rosin oil is mixed with phosphoric acid and heated to a temperature at which not only pyrophosphoric acid, but also metaphosphoric acid is produced. For example, 1000 kilos. of crude mineral oil or residue is mixed with 100 kilos. of phosphoric acid and heated with continual stirring at 350°—400° C. The duration of heating depends on the quantity of oil treated; thus, 10 to 15 hours is sufficient for 100 to 200 litres, whilst two days may be necessary for 20,000 kilos. (Compare Fr. Pat. 443,650 of 1912 and Addition thereto; this J., 1912, 977; 1913, 415.)—T. F. B.

Lubricant. W. Coath, Birkenhead Eng. Pat. 20,387, Sept. 7, 1912.

A lubricant which will neither explode nor burn is made by dissolving 6 oz. of starch in ½ gall. of boiling water and mixing, when cold, with ½ gall. of mineral lubricating oil.—A. T. L.

Producer-gas; Method of and apparatus for generating —— *for power and heating purposes.* E. Servais, Luxemburg. Eng. Pat. 1854, Jan. 22, 1913.

See Fr. Pat. 453,409 of 1913; this J., 1913, 781.—T. F. B.

Gases; Centrifugal apparatus for purifying, cooling, and washing ——. H. E. Theisen, Munich, Germany. Eng. Pat. 27,417, Nov. 28, 1912.

See U.S. Pat. 1,049,317 of 1912; this J., 1913, 127.—T.F.B.

Recovery of sulphuric acid from waste acids [of petroleum refining, etc.]. Eng. Pat. 2695. *See* VII.

Preparation of a pigment from desulphurised spent oxide from gas purification. Ger. Pat. 261,000. *See* XIII.

Apparatus for automatic analysis and indication of gases. Eng. Pat. 16,300. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Peat, Treatment and utilisation of ——. J. W. Leadbeater, Doncaster, Yorks. Eng. Pats. 18,587 and 28,293, Aug. 13 and Dec. 7, 1912.

The moist or air-dried peat is mixed with dry peat, peat dust, or sawdust in sufficient quantity to reduce the moisture content of the mixture to say 10 to 12 per cent. The mixture is compressed and carbonised. The tar is distilled to obtain crude oil, gas oil, creosote oil, pitch and crude paraffin. The coke is mixed with pitch and briquetted, and the blocks are heated in a retort so as to remove all tar and leave a pure carbon or charcoal coke. In order to obtain a dense hard coke suitable for steel-smelting, the peat before being carbonised is briquetted with 5 to 6 per cent. of a special binder made by re-distilling the tar obtained from the peat, and mixing with it 1 per cent. of anthracene and 3 to 5 per cent. of sulphuric acid.—A. T. L.

Gas mantles; Preparation to clean, renovate and strengthen ——. A. Lang, London. Eng. Pat. 19,668, Aug. 28, 1912.

The mantles are sprayed with a liquid prepared by dissolving ¼ lb. of naphthalene in 1 gall. of methylated

spirit, adding ½ lb. of sodium chloride dissolved in 1 pint of water, and colouring the mixture with cochineal.
—W. E. F. P.

Carbonaceous substances; Treatment of ——. F. W. Burstall and W. G. Moore, Birmingham. U.S. Pat. 1,068,314, July 22, 1913.

See Eng. Pat. 18,148 of 1910; this J., 1911, 410.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Pyrogenic decomposition of butadiene hydrocarbons. Staudinger and others. *See* XIV.

Patents.

Tar acids; Manufacture of ——. I. and S. McDougall and F. Howles, Manchester. Eng. Pat. 8323, April 6, 1912.

In place of the usual process for recovering tar acids from tar distillates by aid of caustic soda, it is proposed to extract the acids by means of alcohol mixed with a suitable proportion of water. When treating a distillate of high boiling point, commercial alcohol to which 23 to 25 per cent. of water is added may be used, whilst for low-boiling distillates, such as carbolic oil, the alcohol may be mixed with up to 40 per cent. of water. Excess of water prevents extraction of some of the acids, whilst excess of alcohol results in some of the hydrocarbons being extracted with the acids. Two gallons of the mixture of alcohol and water may be added to each gallon of the distillate, or the mixture may be added gradually as the extraction proceeds. After distilling off the alcohol from the extracts, the tar acids may be separated mechanically from the water.—T. F. B.

Nitrobenzene-diazonium compounds; Manufacture of stable ——. O. N. Witt, Berlin-Westend, Germany. Eng. Pat. 11,290, May 14, 1913. Under Int. Conv., Aug. 2, 1912.

Pure *p*-nitrobenzene-diazonium naphthalene-*β*-sulphonate, though somewhat more stable than the corresponding salts of mineral acids, is explosive in the solid state, easily soluble in water, and unstable in solution; it cannot be salted out of its solutions. It has now been found that non-explosive, stable compounds may be obtained by adding two mols. of naphthalene-*β*-sulphonic acid to a freshly prepared acid solution of one mol. of an ordinary nitrobenzene-diazonium salt, or by diazotising a *p*-nitraniline solution containing two mols. of naphthalene-*β*-sulphonic acid, and allowing the double salt to crystallise spontaneously. The sodium salt, obtained by diazotisation by means of sodium nitrite, has the composition, $NO_2.C_6H_4.N_2.SO_3C_{10}H_7,NaSO_3C_{10}H_7,H_2O$: it forms lemon-yellow silky needles, soluble to the extent of 5 per cent. in cold water; its aqueous solutions are neutral, and can be heated to 80° C. without decomposition. It is a true diazonium salt, and combines readily with *β*-naphthol. The potassium and ammonium salts are more easily soluble than the sodium salt. Solutions of these salts are stated to be indifferent towards the metallic copper of printing rollers.—T. F. B.

Indole substituted in the α-position; Process for preparing ——. W. Madelung. Ger. Pat. 262,327, Feb. 9, 1912.

N-Monoacidyl derivatives of *o*-methyl substituted aromatic amines (excepting the formyl derivatives) are treated with alkaline condensing agents which do not saponify, such as alkaline-earth oxides or alkali alcoholates, at high temperatures (*e.g.*, 340°—380° C.) and preferably with exclusion of air. The free base is obtained by decomposing the resulting metallic compound with water. It is stated that good yields are obtained of *α*-methylindole from *o*-acetaminotoluene, *α*-phenylindole from benzoyl-*o*-toluidine, etc.—T. F. B.

Anthraquinone-acridinecarboxylic acids; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 262,469, March 30, 1912.

Carboxylic acids of anthraquinone-acridine are obtained by treating 1-arylaminoanthraquinonecarboxylic acids with dehydrating agents which do not possess sulphonating properties. When 1-arylamino-anthraquinone-2-carboxylic acids are used, the resulting anthraquinone-acridinecarboxylic acids should be separated from the acridones, which are formed at the same time. The products may be used for the preparation of dyestuffs.—T. F. B.

β-Nitramines of the anthraquinone series; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 25,854, Nov. 11, 1912.

See Fr. Pat. 450,865 of 1912; this J., 1913, 592.—T. F. B.

Nitroamino-derivatives of the anthraquinone series; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 25,855, Nov. 11, 1912.

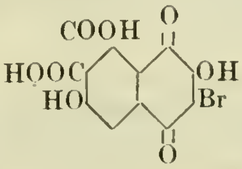
See Fr. Pat. 450,171 of 1912; this J., 1913, 479.—T. F. B.

Obtaining refined mineral, tar, and resinous oils. Eng. Pat. 9856. *See* IIa.

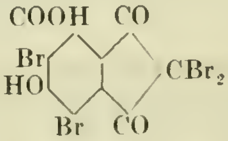
IV.—COLOURING MATTERS AND DYES.

Stick-lac; The colouring matter of ——. O. Dimroth and S. Goldschmidt. Annalen, 1913, **399**, 62—90.

Pure laccainic acid obtained from stick-lac (0·50—0·75 per cent. yield) was found to have the empirical formula $C_{20}H_{14}O_{10}$. By oxidation with hydrogen peroxide in the presence of a metallic catalyst, 2½ to 3 atoms of oxygen are taken up with the formation of calainic acid, $C_{18}H_{14}O_{11}$, a yellow substance, containing three carboxyl groups and one ketone group. Calainic acid gives with bromine a yellow substance, *β*-bromolaccain, and a colourless substance, *α*-bromolaccain. *β*-Bromolaccain appears to be analogous to the *β*-bromocarmine obtained in the same way from carminic acid, and, like the latter, it gives the reactions of a 2·6-dihydroxynaphthalene and oxidises to an *α*-ketonic acid. When acted upon by sulphuric acid and acetic anhydride it give a diacetyl compound and undergoes anhydride formation, all of which points to the formula (1).



(1)



(2)

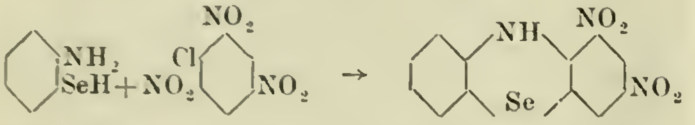
The colourless acid, *α*-bromolaccain, is formed by the further action of bromine on *β*-bromolaccain, analogous to the formation of *α*-bromocarmine and it has the formula (2). It has similar properties to those of *α*-bromocarmine, and by the action of hypobromite is converted into dibromophenoltricarboxylic acid.—J. B.

Carbomethoxy-derivatives of phenolcarboxylic acids and their use for syntheses. Fischer and Rapaport. *See* XV.

Patents.

Dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 5710, March 7, 1913. Under Int. Conv., April 12, 1912.

When *o*-nitrodiazobenzene is treated with potassium selenocyanide, *o*-nitrobenzene-selenocyanide is obtained, which, when treated with alkalis, is converted into *o*-nitroselenophenol ; by reducing the latter, *o*-aminoselenophenol may be obtained. The interaction of this *o*-aminoselenophenol or a derivative thereof with trinitrochlorobenzene, preferably in presence of a substance capable of combining with acids, results in the production of nitro-derivatives of the seleno-azine, thus :—



Reduction and subsequent oxidation of such nitroselenoazines leads to the production of dyestuffs which may be called "phenazselenonium" dyestuffs, and which are stated to be of value for therapeutic purposes.—T. F. B.

Vat [anthracene] dyestuffs ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,252, Dec. 29, 1911. Addition to Ger. Pat. 244,705 (see Eng. Pat. 29,031 of 1911 ; this J., 1912, 223).

Dyestuffs identical with those described in the principal patent may be obtained by heating the anthraquinoneacridones derived from dianthraquinonylamines, with metallic halides or acid condensing agents.—T. F. B.

Vat dyestuff ; Process for preparing a green ——. Ges. f. Chem. Industrie in Basle. Ger. Pat. 261,557, June 14, 1912.

The greenish-blue dyestuff obtained according to Ger. Pat. 243,751 from 2-methylbenzanthrone (see Eng. Pat. 11,422 of 1911 ; this J., 1911, 1204), is treated with nitric acid, whereupon a product is obtained which dyes textile fibres pure green shades from alkaline vats.—T. F. B.

Vat dyestuffs ; Process for preparing grey to black ——. Ges. f. Chem. Industrie in Basel. Ger. Pat. 262,478, April 25, 1912.

Nitro-2-methylbenzanthrone is treated with alkaline condensing agents. For example, when it is melted with caustic potash, and the product converted into a vat by means of caustic soda and hydrosulphite, a violet-red vat is obtained, in which cotton is dyed grey to black shades fast to washing and chlorine.—T. F. B.

Vat dyestuffs ; Process for preparing ——. Kalle und Co., A.-G. Ger. Pat. 261,930, April 19, 1912.

When highly brominated 2-indole-2-thionaphtheneindigo, or its derivatives or analogues, are treated with amines, new dyestuffs are obtained which are stated to produce fast dyeings, the shade of which is not altered by soap or soda.—T. F. B.

Diazotisable cotton dyestuffs ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 22,838, Oct. 7, 1912. Under Int. Conv., Nov. 29, 1911.

See Fr. Pat. 449,012 of 1912 ; this J., 1913, 480.—T. F. B.

Disazo dyestuffs for cotton ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 22,839, Oct. 7, 1912. Under Int. Conv., Dec. 1, 1911.

See Fr. Pat. 448,581 of 1912 ; this J., 1913, 418.—T. F. B.

Anthracene dyes and making the same. H. Wolff, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,063,000, May 27, 1913.

See Addition of Oct. 12, 1910, to Fr. Pat. 349,531 of 1904 ; this J., 1911, 412.—T. F. B.

Azo dye. B. Richard, Assignor to Aniline Color and Extract Works, formerly John R. Geigy, Basle. U.S. Pat. 1,067,881, July 22, 1913.

See Fr. Pat. 450,866 of 1912 ; this J., 1913, 593.—T. F. B.

Preparing azo dyestuff compounds for therapeutic use. Ger. Pat. 262,476. *See* XX.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cellulose and other products from resinous waste wood. A. Luttringer. Papierfabr., 1913, **11**, 884—886.

A process has been worked in France on a semi-industrial scale for the manufacture of turpentine oil, resin products and cellulose from waste wood, *e.g.*, larch stumps yielding 30 per cent. of ether-extract, the digestion being performed in a single operation. The digestion lye is composed of sodium hydroxide and sulphide, 60—100 kilos. ; carbonate, 30 kilos. ; sulphate, 50—200 kilos. ; water, 1500—1800 kilos. The pressure in the digester is gradually increased up to 5—7 atmospheres, the whole treatment occupying 6—12 hours. During the digestion a slight escape of steam is permitted from the top of the digester through a cooling coil, so that the oil of turpentine distils over and is condensed. When the oil ceases to pass over, the valve is closed and the digestion of the wood is continued until complete. The spent lye, containing saponified and unsaponifiable resins, is concentrated and calcined, the volatile products of the destructive distillation being condensed, whilst the residue is lixiviated for the recovery of sodium salts. The condensed liquid consists of an aqueous layer from which methyl alcohol and acetone may be recovered. The tarry layer contains resin oils, phenols, etc. Working with larch stumps on a scale of 500 kilos. per charge, the following quantities of products were obtained per 1000 kilos. of wood : Cellulose, 315 kilos. ; oil of turpentine, 59·9 ; pine oil, 11·3 ; pinolin (rosin spirit), 13·8 ; light rosin oil, 8·7 ; ordinary rosin oil, 60 ; oil containing retene, 9·2 ; solid retene, 24 ; alcohol and acetone, 5·8 ; phenols, 15·7 kilos. The value of the oleo-resin products exceeds that of the cellulose and products of a total value of about £6 8s. are obtained from a ton of stumps.—J. F. B.

Cellulose ; Hydrolysis of ——. *I.* R. Willstätter and L. Zechmeister. Ber., 1913, **46**, 2401—2412.

Whilst ordinary concentrated hydrochloric acid (sp. gr. 1·19) and even acid of sp. gr. 1·196 are not capable of dissolving cellulose, complete solution can be effected rapidly in fuming hydrochloric acid of sp. gr. above 1·2 ; acid of about 41 per cent. concentration (sp. gr. 1·209—1·212 at 15° C.) is preferably used. Cotton or filter paper dissolves in about 10 seconds to a clear solution in acid of sp. gr. 1·209. In order to obtain concentrated solutions, the cotton is immersed in and kneaded with the acid. Solutions containing 7, 12—13, and about 15 per cent. of cellulose were obtained with acid of sp. gr. 1·204, 1·209 and 1·212 respectively. The solutions are colourless and clear at first, but after 1 day a slight flocculent precipitate frequently appears, and after several days the liquid acquires a yellow colour, and a dark brown substance begins to separate. Solutions of dextrose in hydrochloric acid behave in a similar manner. If the solution be diluted within 30—45 minutes after preparation, a form of cellulose is precipitated quantitatively, and the solution has no cupric-reducing power even after prolonged boiling. The cellulose precipitated by water is plastic and becomes horny on drying. With iodine solution it gives a dark coloration which is less characteristic than that obtained with cellulose hydrate, but resists washing better than that obtained with Girard's hydrocellulose (this J., 1882, 159, 316). On more prolonged standing of the hydrochloric acid solution, the cellulose is hydrolysed and the solution acquires reducing properties. Hydrochloric acid presents a great advantage over sulphuric acid as an agent for hydrolysing cellulose in that hydrolysis is complete in 1—2 days in the cold and can be followed from beginning to end with the polarimeter. A yield of 95—96 per cent. of the theoretical quantity of dextrose (determined with the polarimeter and by reduction of Fehling's solution) is obtained, and the problem of the quantitative saccharification of cellulose (and of wood) can hence be regarded as solved. The hydrochloric acid solutions of cellulose are optically inactive at first. With a solution containing 1 grm. of cellulose in 100 c.c., optical activity was first observed after 1 hour and then increased up to the rotatory power of dextrose in the course of 24—48 hours according to the acid concentration. Direct experiments showed that the rotatory power of dextrose is enormously increased when it is dissolved in concentrated hydrochloric acid; an increase of $[\alpha]_D$ from 53° to 180° was observed. The rotatory power of the hydrochloric acid cellulose solution does not increase uniformly throughout the hydrolysis; after a time it increases less rapidly, then remains practically constant, and finally again increases steadily. This indicates that an intermediate compound, probably cellobiose, is formed at first and is subsequently hydrolysed to dextrose.

In addition to cotton and filter-paper, pine wood also dissolves rapidly in fuming hydrochloric acid, leaving an insoluble residue (30 per cent.) of lignin-substances, which are in a purer form than when sulphuric acid is used. Concentrated hydriodic acid does not dissolve cotton in the cold, but 66 per cent. hydrobromic acid (sp. gr. 1·78) dissolves it readily and completely even at 0° C. Hydrofluoric acid of 70—75 per cent. concentration gelatinises cotton and rapidly dissolves it.—A. S.

Cellulose; The benzoyl esters of ——. H. Ost and F. Klein. Z. angew. Chem., 1913, **26**, 437—440.

The authors have investigated the benzoylation of cellulose by the Schotten-Baumann reaction, employing finely chopped cotton. A maximum yield of 218 per cent. of product was obtained with sodium hydroxide of 22·4 per cent. concentration in the molecular proportions of 30 of sodium hydroxide to 1 of cellulose, while 3 molecules of benzoyl chloride were taken to 4 of sodium hydroxide. With potassium hydroxide, a maximum yield of 211 per cent. of product was obtained with a lye of 31·4 per cent. concentration, the molecular proportions being the same as above. Up to the alkali concentrations mentioned, the yields of product regularly increased, without any sudden rise such as Vieweg has observed (see this J., 1907, 1157), and with higher concentrations the yields gradually decreased. By a second treatment similar to the first the yield of product may be increased, for instance a yield of 210 per cent. was increased to 224 per cent. after a second benzoylation. Fractional separation of the constituents of the products by solvents showed them to be highly complex mixtures. A mixture of aniline and phenol dissolves the esters containing 59 per cent. and over of combined benzoic acid; aniline alone dissolves those containing 61—65 per cent., whilst chloroform dissolves only the higher esters containing 68—70 per cent. of benzoic acid. The highest benzoic ester obtained by the Schotten-Baumann method with repeated benzoylation contained 72·6 per cent. of benzoic acid, corresponding to a pentabenzoate on the C_{12} cellulose molecule. Esters containing up to 77 per cent. of benzoic acid, corresponding to a tribenzoate on the C_6 basis, were obtained by the Wohl method, by heating cellulose and pyridine with benzoyl chloride. The highest esters were obtained by working with a slight excess of the benzoyl chloride, *e.g.* in the molecular proportions $1C_6H_{10}O_5+8C_5H_5N+4{\cdot}8C_6H_5COCl$, whereby the mixture became slightly acid. The materials were heated for 3 hours at 120°—130° C. Such esters, however, gave brittle films, indicating incipient hydrolysis of the cellulose-molecule.—J. F. B.

Patents.

Fibrous product from red beech wood, analogous to brown mechanical wood pulp, and suitable for paper-making; Process for producing a ——. C. Braun. Ger. Pat. 261,848, Sept. 15, 1912.

Comminuted red-beech wood is heated under pressure to about 150° C. in a digester, with a solution of calcium bisulphite, to which may be added about 30 per cent. of liquor which has already been used for the process. The temperature is kept at 150° C. until the whole of the sulphurous acid has been used, when by reducing the pressure it is allowed to fall to 125° C., the whole process taking about six hours. The amount of free sulphurous acid used is only sufficient to ensure complete decomposition of the calcium monosulphite by the sulphuric acid formed; for example, 8, or at most 10 kilos. of sulphur dioxide is used for each 100 kilos. of wood. By this means, sufficient of the incrustating substances is removed to produce a brown fibrous mass of specific gravity not greater than that of brown conifer-wood-pulp.—T. F. B.

Wool, skins, textiles, and other materials; Method of the extraction of grease and similar matter from ——. C. R. Mayo, London. U.S. Pat. 1,067,357, July 15, 1913.

See Eng. Pat. 13,340 of 1910; this J., 1912, 636.—T.F.B.

Acetylcellulose insoluble in acetic acid and in chloroform; Process for the preparation of ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 8990, April 16, 1912. Under Int. Conv.. April 28, 1911.

See Fr. Pat. 442,512 of 1912; this J., 1912, 917.—T.F.B.

Cellulose esters; Manufacture of ——. A. Wohl, Danzig-Langfuhr, Germany. Eng. Pat. 20,527, Sept. 9, 1912. Under Int. Conv., Sept. 11, 1911.

See Fr. Pat. 448,072 of 1912; this J., 1913, 420.—T.F.B.

Artificial silk and other nitrocellulose products; Manufacture of ——. J. Duclaux, Paris. Eng. Pat. 2465, Jan. 30, 1913. Under Int. Conv., Feb. 5, 1912.

See Fr. Pat. 439,721 of 1912; this J., 1912, 714.—T.F.B.

Cellulose compound; Non-inflammable —— and method of making same. W. G. Lindsay, New York, Assignor to The Celluloid Co. U.S. Pat. 1,067,785, July 15, 1913.

See Fr. Pat. 415,518 of 1910; this J., 1910, 1299.—T.F.B.

Sulphite cellulose; Process for purifying lyes from the manufacture of ——. M. Platsch, Frankfort on Maine, Germany. Eng. Pat. 19,600, Aug. 27, 1912.

See Fr Pat. 447,578 of 1912; this J., 1913, 284.—T.F.B.

Impregnating material from viscose and rubber. Ger. Pat. 262,552. *See* VI.

Obtaining sulphur from sulphite-cellulose waste lyes. Ger. Pat. 262,468. *See* VII.

Road bed construction. [*Use of sulphite cellulose waste lye.*] U.S. Pat. 1,068,048. *See* IX.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Indigo; Report on the testing of —— on woollen cloth and other materials. A. G. Green, W. M. Gardner, L. L. Lloyd and G. H. Frank. J. Soc. Dyers and Col., 1913, **29**, 226—241.

The problem is to determine (1) the amount of indigo present on the cloth; (2) what percentage of the total colour effect is due to indigo. All the known methods of indigo analysis were examined and rejected and the solvent method relied on exclusively, the indigo being recovered from the solvent and determined gravimetrically. Pyridine, glacial acetic acid and a cresol-hydrocarbon mixture were found to be the most suitable solvents, and a special form of extraction apparatus was devised in which the condensed solvent is prevented from cooling before it reaches the cloth, as happens with an ordinary Soxhlet extractor. If glacial acetic acid be used, the extract is simply cooled and the crystallised indigo filtered off and weighed after washing with alkali and acid to remove wool substance or other impurities. When pyridine is the solvent, the extract is boiled down somewhat, cooled and precipitation completed by diluting with 50 per cent. alcohol. The solvent used has to be selected with regard to the top or bottom dyestuffs present, *e.g.*, pyridine decomposes iron-tannin lakes fairly easily. Pyridine is recommended for dense or heavily milled cloths. A table shows the action of the different solvents on the dyestuffs commonly used in conjunction with indigo. Benzaldehyde was found to have a rapid solvent action on indigo, converting it at the same time into a yellow condensation product, whilst only a very few of the other colours were attacked. It is recommended for qualitative work. When it is necessary to estimate the concomitant dyestuff, and this is attacked by both pyridine and glacial acetic acid, the cresol-hydrocarbon mixture (*e.g.*, 100 parts of cresylic acid and 30 parts of solvent naphtha, b.p. 125°—140° C., or, 75 parts of cresol and 25 parts of turpentine substitute or heavy petrol of b.p. 155°—170° C.) has to be used. The extraction in this case is carried out in an ordinary Soxhlet apparatus, the temperature around the cloth being kept at 100°—105° C. The residual colour is estimated by means of Lovibond's tintometer and the total colour units (red+yellow+blue) are translated into terms of indigo, the indigo equivalent of a given number of colour units having been previously determined by measuring the tintometric value of indigo patterns of known strength. The proportion of the total depth of shade which is due to indigo alone is now deducted, the percentage of pure indigo being known and also the indigo equivalent of the concomitant dyestuff. In the case of light shades it is sufficient to measure the total colour value of the shade in tintometer units and subtract the value of the amount of pure indigo found gravimetrically. The difference gives the proportion of the total depth due to concomitant dyestuffs.—J. B.

Patents.

Bleaching highly incrusted fibrous substances by means of air or oxygen in alkaline baths ; Process for ——. Luftbleiche G. m. b. H., and R. Müller. Ger. Pat. 262,047, May 26, 1912.

The alkali necessary for the bleaching is not added at once at the beginning of the process, but in small portions at a time, either continuously or intermittently. In the continuous process, the alkali may be added in an auxiliary apparatus, connected with the bleaching bath in such a manner that the liquor can circulate through both vessels ; in this case, an oxide or hydroxide of an alkaline earth metal, lead, manganese, zinc, etc., may replace the alkali. The air or oxygen is not allowed to come in direct contact with the goods.—T. F. B.

Dyeing, bleaching and washing machine for artificial silk, cotton, or other yarns or fibres ; Hank ——. W. H. Duckworth and W. Royle, Macclesfield. Eng. Pat. 20,718, Sept. 11, 1912.

The hanks hang from poles which are rotated by means of an endless chain running taut beneath them, and fitting into toothed wheels at the ends of the yarn poles. —J. B.

Dyeing plant. J. Dickie, Ayr. Eng. Pat. 21,344, Sept. 19, 1912.

A common, reversible shaft drives the agitating mechanism of a battery of vats, the mechanism in each vat being connected with the shaft through an independent clutch. —J. B.

Dyeing machine. J. M. Payne, Summerville, Ala., Assignor to Perfection Dyeing Machine Co., Columbus, Ga. U.S. Pat. 1,067,132, July 8, 1913.

A hollow warp-beam, with its periphery composed of slats, " alternately adjacent slats " being given a radial to-and-fro motion by means of spiders and cams acting from the axis of the beam.—J. B.

Dyeing : Process of ——. J. H. Skitt, Assignor to Smith, Drum and Co., Philadelphia, Pa. U.S. Pat. 1,067,380, July 15, 1913.

The goods are enclosed in a drum which rotates, half immersed, in the dye-bath, the dye-liquor being agitated so as to cause it to move to and fro between the axis of the drum and its outer perforated casing.—J. B.

Dyeings on wool ; Process for producing fast ——. Farbwerk Mühlheim vorm. A. Leonhardt und Co. Ger. Pat. 261,541, April 26, 1911.

Wool is dyed with the dyestuffs obtained from *o*-hydroxyarylhydrazines and dihydroxytartaric acid, and is subsequently treated with a metallic salt, especially a chromate. This after-treatment renders the dyeings fast to light and to fulling.—T. F. B.

Dyeings on cotton ; Process for producing fast ——. R. Wedekind und Co. G. m. b. H. Ger. Pats. 261,872 and 261,873, May 29 and Oct. 5, 1912.

(1) Cotton goods prepared in the usual manner with α- or β-naphthol, are treated with a neutral or feebly alkaline solution of a diazo-diaminoanthraquinone. The dyeings from diazo-diamino-1·5-anthraquinone and α-naphthol are brown and with β-naphthol red. Their fastness to light and other agencies is good. (2) The combination may also be effected in feebly acid diazo solutions.—T. F. B.

Dyeings on fibres ; Process for producing —— *fast to washing and rubbing.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,693, April 18, 1912.

The fibres are impregnated with an aminobenzoyl derivative of an aminonaphtholsulphonic acid, diazotised, and developed by means of alkali. Full orange to claret shades, very fast to washing and friction, are produced. —T. F. B.

Disazo dyestuffs on the fibre ; Process for producing blue ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 262,694, Nov. 17, 1912. Addition to Ger. Pat. 251,233 (see this J., 1912, 1117).

The dyestuffs described in the principal patent may be produced on cotton yarn by impregnating the yarn with a solution of an arylide of 2.3-hydroxynaphthoic acid, and then treating the yarn, without drying, with the solution of the tetrazo compound of a diaminodiphenyl dialkyl ether. The shades are rendered faster to rubbing and somewhat redder by treating the washed yarn with hot copper sulphate solution. Very level shades are said to be produced by this process.—T. F. B.

Bistre-brown shades in dyeing and printing ; Production of fast —— *which can be reserved.* H. Schmid. Ger. Pat. 261,871, July 6, 1912. Addition to Ger. Pat. 250,466 (see this J., 1912, 1122).

A small quantity of a catalytic agent, such as a salt of iron or other metal, may be introduced into the dyebath or printing paste described in the principal patent.—T.F.B.

Printing textile and other fabrics ; Appliances for scraping and cleaning proof covered bowls, fabrics and the like used in ——. The Calico Printers' Assoc., Ltd., and C. Roberts, Manchester. Eng. Pats. 18,224, Aug. 8, 1912, and 2853, Feb. 4, 1913.

A suitable form of scraper is caused to act upon the surface to be cleaned in conjunction with humid air, wet steam, or other suitable liquid or gas which will loosen the waste material, which is then conveyed away by either an air blast or a vacuum or both.—J. B.

Impregnating material from viscose and rubber ; Preparation of an ——. C. Pose. Ger. Pat. 262,552, Jan. 12, 1912.

The formation of viscose from cellulose, alkali, and carbon bisulphide, is allowed to proceed in presence of rubber and sulphur, and the product is emulsified. A metallic salt which forms an insoluble compound with the viscose (*e.g.*, zinc or aluminium sulphate) may be added to the resulting solution. The goods to be impregnated are immersed in the solutions obtained as described, and then heated and submitted to pressure, and finally raised to the vulcanising temperature.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitrogen pentoxide; Preparation and melting point of ——. F. Russ and E. Pokorny. Monatsh. Chem., 1913, **34**, 1051—1060.

Nitrogen pentoxide can be obtained in a single operation, by fractional distillation of concentrated nitric acid and phosphorus pentoxide, in a current of ozonised oxygen. The ozone prevents decomposition into oxygen and lower oxides, while to remove the last traces of moisture, the gases are passed through a long phosphorus pentoxide tube before condensing. The nitrogen pentoxide is almost completely condensed at —80° C. The vapour pressure of nitrogen pentoxide reaches one atmosphere in the neighbourhood of 34° C., while the oxide is still solid. It is not possible to fix a definite melting point or boiling point owing to dissociation, and the data usually quoted in text-books are not reliable.—W. H. P.

Baryta; Technical preparation of ——. *IV. Preparation of baryta by electrolysis of aqueous solutions of barium sulphide.* L. Marino and U. Gigli. Gaz. chim. ital., 1913, **43**, II., 1—25. (See this J., 1913, 655.)

The present communication deals with the effect of varying conditions on the production of barium hydroxide by the electrolysis of barium sulphide solutions (Brochet and Ransom, this J., 1902, 54, 352; 1903, 748). The experimental data, which are given in detail, show that the best results are obtained with copper electrodes in a solution containing about 20 per cent. BaS, using a current density of 1—3 ampères per sq. dm. at the anode and continuing the electrolysis for about two-thirds of the time necessary theoretically for the decomposition of the sulphide. Under such conditions nearly theoretical yields (90—95 per cent.) of barium hydroxide are obtained, with not more than 4—5 per cent. of oxidation products of the sulphide. The concentration of baryta at the anode increases continuously so long as the sulphide concentration of the electrolyte does not fall below 5 per cent. The formation of baryta is due mainly to a chemical reaction between hydroxyl ions and barium sulphide.—A. S.

Sodium cyanide; Manufacture of —— *from vinasse.* A. Vasseur. Bull. Soc. Ind. Nord de la France, 1913, **41**, 445—467.

Details are given of a process which has been employed successfully in Germany. The vinasse is rendered alkaline, concentrated to 40°—41° B. (sp. gr. 1·383—1·397), and submitted to destructive distillation. The evolved gases, which contain ammonia, are heated to 1000° C. in special superheaters. Hydrogen cyanide is formed in accordance with the equation $CO+NH_3=HCN+H_2O$. Any excess of ammonia is subsequently removed by sulphuric acid, and the hydrogen cyanide is absorbed by water in suitable columns. The solution thus obtained is distilled and the gas absorbed by sodium hydroxide solution, which when almost saturated is filtered and concentrated. The by-products are: (1) the saline mixture obtained by atmospheric oxidation of the residue left in the retorts, (2) ammonium sulphate and (3) Prussian blue obtained from cyanides and ferrocyanides present in the aqueous liquor from which the free hydrogen cyanide has been distilled. After absorption of ammonia and hydrogen cyanide, the gases from the superheaters are used for heating the retorts.—J. H. L.

Phosphoric acid, Quantitative volatilisation and separation of —— *from the metals of the copper group, and from aluminium, zinc, and the alkali metals.* P. Jannasch and R. Leiste. J. prakt. Chem., 1913, **88**, 129—167.

The method described by Jannasch and Jilke (this J., 1909, 961) for the quantitative decomposition of phosphates in a current of carbon tetrachloride has been extended and made generally applicable to all metallic phosphates. The apparatus has been somewhat modified so that the current of carbon tetrachloride can be immediately replaced by one of carbon dioxide. The reason for this is that it is found that intermittent distillation leads to more satisfactory decomposition and prevents a re-formation of phosphoric acid which is otherwise often noted in the cooler part of the tube. In the case of aluminium and zinc volatile compounds containing both phosphoric acid and the metal are formed, so that it is found necessary to add excess of potassium chloride which forms non-volatile double salts with aluminium and zinc chlorides and so retains them in the quartz boat. By heating for at most 2½ hours at red heat it is now possible quantitatively to decompose any of the metallic phosphates.—W. H. P.

Hypophosphites; Determination of ——, *with notes on commercial samples.* T. T. Cocking and J. D. Kettle. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 20—22.

2·5 grms. of the salt are dissolved in 40 c.c. of water and an excess of lead acetate solution added to precipitate phosphites (5 c.c. of 10 per cent. lead acetate solution is usually sufficient). The solution is made up to 50 c.c. and allowed to stand. 10 c.c. of the clear liquid are mixed with 50 c.c. of $N/1$ potassium bichromate solution and 10 c.c. of sulphuric acid. The mixture is heated for an hour on the water bath, cooled and made up to 250 c.c. The unused bichromate is determined by adding excess of potassium iodide to 50 c.c. and titrating the free iodine with thiosulphate solution. The hypophosphorous radical is completely oxidised to phosphate by the absorption of two atoms of oxygen. Phosphites can be determined by repeating the above process without the addition of lead acetate. One atom of oxygen is required for the complete oxidation of the phosphite radical. In removing phosphite from hypophosphorous acid, the acid must be neutralised with soda before adding the lead acetate. There is no satisfactory method of removing phosphite from ferric hypophosphite. Commercial ferrous hypophosphite consists of varying quantities of ferrous and ferric salts.—F. Shdn.

Ammonia and nitrogen; Determination of —— [*in gas-works products*]. Knublauch. Z. angew. Chem., 1913, **26**, 425—431.

Convenient forms of apparatus are described for the determination of ammonia and total nitrogen in such products as spent oxide, etc. In cases where the substance is digested with sulphuric acid for the determination of total nitrogen, the addition of mercury is not always necessary, and it must not be added when thiocyanates, ferrocyanides, and double cyanides, such as $Fe_7(CN)_{18}$, are present. The mercury may, however, be introduced after the thiocyanates have been decomposed by the sulphuric acid. One grm. of the sample, dried at 50° C., is treated with 10 c.c. of concentrated sulphuric acid, allowed to stand cold for 5 minutes, then heated gently for 20 minutes, and afterwards boiled for 10 minutes. About 0·25 grm. of mercury or 0·05 grm. of copper oxide is now added and the mixture boiled for 1 hour. It is necessary, in the subsequent distillation of the ammonia, to decompose the ammonium-mercury compounds by the addition of a sulphide or zinc dust, but when the latter is used a distinct excess of sodium hydroxide must be added. The soda-lime combustion process yields trustworthy results in the determination of nitrogen in thiocyanates and ferrocyanides.—W. P. S.

Iron and manganese silicates; Heats of formation of ——. S. Wologdine. Comptes rend., 1913, **157**, 121—123.

The molecular heats of formation from FeO or MnO and SiO_2 of ferrous and manganous silicates were determined to be: FeO,SiO_2, 5905; and MnO,SiO_2, 7725 cals.

—J. T. D.

Selenious acid; Detection of small quantities of ——. J. Meyer and J. Jannek. Z. anal. Chem., 1913, **52**, 534—538.

Sodium hydrosulphite reduces selenious acid with formation of colloidal selenium; the solution is coloured deep red. 0·1 grm. of hydrosulphite is added to 1 c.c. of the weakly acid solution, the colour showing after a few seconds, The solution is then neutralised with solid sodium carbonate to avoid liberation of yellow hydrosulphurous acid. Neutral salts do not interfere; the limit of sensitiveness is 1 : 160,000. The reaction can also be used for colorimetric determinations. When hydrosulphite is added to concentrated sulphuric acid a milky precipitate of sulphur is produced; in presence of 0·002 per cent. SeO_2 the precipitate appears yellow. The authors confirm the observations of Schulz (this J., 1911, 1242) according to which refined paraffin shaken with concentrated sulphuric acid containing selenium acquires a reddish to dark brown colour.—W. R. S.

Formates; Composition of certain ——. C. H. Hampshire and W. R. Pratt. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 26—30.

Sodium formate as found in commerce sometimes consists of the anhydrous salt and sometimes of crystals of the dihydrate. The anhydrous salt is of more constant composition and keeps better than the hydrated forms. Ferric formate has the composition $Fe_3(OH)_2,(HCO_2)_7 4H_2O$, and not $Fe_2(HCO_2)_6,H_2O$ as stated in the Codex. The commercial salt has the composition of the first formula. Magnesium formate has the composition $Mg(HCO_2)_2,H_2O$, to which the commercial salts correspond. Calcium formate has the formula $Ca(HCO_2)_2$, as stated in the Codex. Contrary to the Codex, quinine formate is not anhydrous, but is represented by the formula $C_{20}H_{24}N_2O_2,HCOOH,H_2O$. Commercial specimens were found to agree very well with this. Strychnine formate when freshly prepared has the composition $C_{21}H_{22}N_2O_2,HCOOH,2H_2O$, but it quickly effloresces. Some commercial samples contained an excessive amount of formic acid. The anhydrous salt is readily prepared and keeps well.—F. Sodn.

Carbon monoxide; Additive reactions between ——, *and other gases under the influence of ultra-violet rays.* D. Berthelot and H. Gaudechon. Comptes rend., 1913, **157**, 129—131.

The tendency of carbon monoxide to form compounds under the influence of light is most pronounced with the lowest terms of series; thus it combines with chlorine, not with bromine or iodine—with oxygen or water, not with sulphur or hydrogen sulphide—with ammonia, not with phosphine or arsine.—J. T. D.

Sulphur liberated by the reaction between sulphurous acid and water. E. Jungfleisch and L. Brunel. Comptes rend., 1913, **157**, 257—262. (See this J., 1913, 697.)

In the decomposition of hydrosulphurous acid, the sulphur appears to be first liberated in the plastic form, but this may undergo further transformations, the nature and rapidity of which depend upon the temperature at which separation occurs. The particular cases are described. —J. H. L.

Determination of tungstic and silicic acids. Hermann. *See* XXIII.

Patents.

Sulphuric acid from waste acids [*of petroleum refining, etc.*]; *Recovery of* ——. F. Bräunlich, Meuselbach, Germany. Eng. Pat. 2695, Feb. 1, 1913.

Waste sulphuric acid containing organic matter (*e.g.*, "black acid") is slowly poured into a molten mass (preferably agitated) of anhydrous alkali acid sulphate, at a temperature above the boiling point of sulphuric acid, the acid being added in the same proportion as the pure acid distils off, and a catalyst, such as copper sulphate, being present, if desired, to increase the oxidising action. Diluted acid may be directly treated by the process. —F. Sodn.

Sulphuric acid; Purification of waste ——. E. Natho. Ger. Pat. 262,466, Sept. 7, 1912.

Waste sulphuric acid contaminated with inorganic salts is treated with equivalent quantities of calcium carbonate and sand or the like, and the precipitate of calcium sulphate thus produced, together with the sand, etc., is heated in an autoclave with a small quantity of water so as to obtain calcium silicate and sulphuric acid or anhydride.—A. S.

Hydrochloric acid gas and potassium bisulphate; Process for the continuous preparation of dry —— *from potassium chloride and sulphuric acid.* Saccharinfabrik A.-G. vorm. Fahlberg, List und Co. Ger. Pat. 261,411, Oct. 20, 1911. Addition to Ger. Pat. 186,398.

The process described in the chief patent (see Fr. Pat. 384,727 of 1907; this J., 1908, 502) and earlier addition thereto (Ger. Pat. 238,570; this J., 1911, 1312) for the manufacture of sodium bisulphate and hydrochloric acid can also be used for the manufacture of potassium bisulphate from potassium chloride.—A. S.

Volatile acids; Apparatus for the continuous preparation of —— *from salts and stronger acids.* A.-G. der Chemischen Produktenfabrik Pommerensdorf and G. Schüler. Ger. Pat. 261,634, Sept. 19, 1911.

The apparatus consists of a cylindrical retort divided into compartments by rotating, knife-like screw surfaces, which force the charge from the cool to the hot end of the retort.—A. S.

Perchloric acid; Purification of crude ——. Bergbauges. Teutonia A.-G. Ger. Pat. 262,465, Nov. 13, 1912.

The crude acid, containing iron as an impurity, is treated with excess of an alkaline-earth sulphide, *e.g.* barium sulphide, the precipitate (ferrous sulphide, etc.) filtered off, and the excess of barium separated in an insoluble form, *e.g.* as sulphate.—A. S.

Caustic soda boiler of nickel-steel or similar high-grade steel. A.-G. "Weser." Ger. Pat. 261,103, July 4, 1912.

In order to prevent, as far as possible, corrosion of the nickel steel, an easily replaceable device of wrought iron, *e.g.* a tube provided with slots along its length, is disposed within the boiler, and the caustic lye is caused to come into intimate contact with this device before coming into contact with the nickel steel. In this way the constituents of the lye capable of attacking iron act on the wrought iron and action on the nickel-steel is largely prevented.—A. S.

Electrolysis of alkali chlorides; Apparatus for the —— *with a mercury cathode moved by means of compressed air.* Bosnische Elektrizitäts-Akt.-Ges. Ger. Pat. 261,397, March 19, 1912.

In apparatus of the Kellner type each cathode chamber is divided into two or more compartments by one or more partitions extending across the full width of the chamber, and projecting downwards into depressions in the floor of the chamber so as to form mercury seals. By this means the cathode chambers proper are separated from the mercury reservoirs and sealed air-tight.—A. S.

Salt blocks; Production of commercial ——. Gewerkschaft Martashall. Ger. Pat. 262,697, Dec. 22, 1912.

Cubes or prisms are cut from the blocks of rock salt as obtained from the mine, and these are then heated for a short time in a kiln in order to decompose the magnesium chloride contained therein.—A. S.

Potash salts and the like; Process and apparatus for the continuous decomposition, dissolving, and refining of ——. E. Thie. Ger. Pat. 262,235, Jan. 31, 1912. Addition to Ger. Pat. 261,210 (this J., 1913, 752).

In order to obtain directly a solution of potassium chloride of high concentration, without the need of allowing the solution issuing from the apparatus to settle and then re-dissolving the deposited material, *e.g.* potassium chloride sludge, in a separate vessel, the space between the inner and outer drums of the apparatus is utilised for dissolving the solid material carried mechanically by the liquid. The inner drum, which serves mainly for the mechanical disintegration of the material, rotates inside a fixed outer drum provided with inlets for the introduction of water or dilute solution. Any suspended salt in the liquor issuing from the inner drum is caused to dissolve in the annular space between the two drums by the aid of heat supplied from long straight steam pipes disposed in the lower part of the outer drum.—A. S.

Lime, Process of hydrating ——, and utilising heat of hydration. H. L. Doherty, New York. U.S. Pats. 1,066,718 and 1,066,719, July 8, 1913.

(1) The process is continuous. The quicklime is transmitted through the slaking chamber at a rate greater than that at which hydration is effected, the unchanged material being continuously separated and re-treated. The hot air leaving the slaking chamber, passes into a chamber containing water, where its heat is utilised in evaporating water, and the moisture-laden air from this chamber passes again to the slaking chamber, the lime being slaked by a current of air laden with water-vapour. (2) Part of the hot air issuing from the hydrating chamber is utilised for the combustion of the fuel employed for "burning" the lime, the portion so diverted from the circuit being replaced by an equal weight of atmospheric air.—W. E. F. P.

Barium and strontium compounds; Process of manufacturing ——. A. W. Ekstrom, Los Angeles, Cal. U.S. Pat. 1,067,595, July 15, 1913.

Barium and strontium compounds are reduced, without being previously mixed with carbonaceous materials, by heating them in the presence of hydrocarbon gases, generated from oil injected above the compounds, air being excluded from the containing receptacle.—W. C. H.

Perborate preparations; Production of easily soluble, stable ——. Vereinigte Fabriken für Laboratoriumsbedarf Ges. m. b. H. Ger. Pat. 261,633, Jan. 4, 1911.

Perborates are mixed with neutral salts of organic acids capable of forming complex salts with borates and of which the bases have no catalytic action on peroxides or persalts, or they are mixed with the ready formed complex salts. Special claim is made for mixtures of sodium perborate with aluminium tartrate, aluminium sodium tartrate, sodium borotartrate, sodium borocitrate, magnesium borocitrate, or aluminium borotartrate, and of magnesium perborate with sodium or magnesium borocitrate. The mixtures are much more stable than the pure perborates.—A. S.

Mercuric chloride, Process for obtaining —— from mercury and chlorine. E. Trutzer. Ger. Pat. 262,184, Oct. 12, 1912.

Chlorine is introduced under pressure into a closed vessel in which mercury is kept in motion in a gaseous or liquid medium, the temperature being kept below the volatilisation point of mercuric chloride. By continuous agitation the formation of a coating of mercuric chloride on the unattacked mercury is prevented. For example: 200 grms. of mercury are agitated with 100 c.c. of water in a closed vessel at 20° C., and gaseous chlorine is introduced under slight pressure. In a short time, the whole of the mercury is converted into chloride.—A. S.

Sulphur and selenium; Production of colloidal —— by interaction of sulphur dioxide or selenium dioxide and hydrogen sulphide or hydrogen selenide. L. Sarason. Ger. Pat. 262,467, July 31, 1912.

The reaction is effected in the presence of volatile solvents immiscible with water.—A. S.

Sulphur; Process for obtaining —— from sulphite-cellulose waste lyes. R. von Walther. Ger. Pat. 262,468, Jan. 7, 1912.

The lye is treated with a quantity of hydrogen sulphide sufficient to decompose the sulphurous acid and its compounds present therein.—A. S.

Sulphuric acid; Manufacture of ——. A. Taraud and P. Truchot, Paris. U.S. Pat. 1,068,021, July 22, 1913.

See Addition of Aug. 20, 1910, to Fr. Pat. 425,913 of 1910; this J., 1911, 1381.—T. F. B.

Ammonia from gases of dry distillation; Process for increasing the yield of ——. K. Burkheiser, Hamburg, Germany. Eng. Pat. 15,977, July 8, 1912. Under Int. Conv., Sept. 26, 1911.

See Fr. Pat. 445,556 of 1912; this J., 1913, 23.—T. F. B.

Ammonia from coal-gases and the like; Method of recovering ——. H. Rotermund, Assignor to Act.-Ges. f. Kohlendestillation, Dusseldorf, Germany. U.S. Pat. 1,067,843, July 22, 1913.

See Eng. Pat. 21,409 of 1910; this J., 1911, 1201.—T.F.B.

Lime; Method for slaking ——. W. Schulthess, Paris. U.S. Pat. 1,067,686, July 15, 1913.

See Eng. Pat. 2525 of 1911; this J., 1912, 229.—T. F. B.

Gaseous mixtures [air]; Process for separation of the constituents of ——. G. Claude, Assignor to Soc. l'Air Liquide, Paris. U.S. Pat. 1,068,219, July 22, 1913.

See Eng. Pat. 3226 of 1911; this J., 1912, 335.—T. F. B.

VIII.—GLASS; CERAMICS.

Clay; Properties of ——. G. Keppeler. Sprechsaal, 1913, **46**, 445—447.

Besides humic acid (this J., 1912, 775) fineness of subdivision is also a factor affecting plasticity. The author measures this by hygroscopicity, the finer clay having a greater superficial area. If clays, after being dried at 110° C. and weighed, be exposed to damp air in an exhausted chamber over weak sulphuric acid till they arrive at constant weight, the figures for hygroscopicity so obtained are found to be in the same order as the relative plasticities. The quantities of heat produced by moistening the clays, as measured by Bunsen's ice calorimeter, are also in the same order.

An attempt to fractionate clay-substance by mechanical analysis was not completely satisfactory. The author then proceeds to the reactions which take place during the firing of clay, and refers to the work of Le Chatelier (Z. physik. Chem., 1887, **1**, 396), Rieke (this J., 1911, 1383), Mellor and Holdcroft (this J., 1911, 804), and Sokoloff (this J., 1912. 723). Le Chatelier's heating curves for halloysite, allophane, kaolinite, pyrophyllite and montmorillonite and for various clays are given, and also some of the author's in which it is apparent that artificial mixtures of silica and alumina follow the allophane curve.—H. H. S.

Clays; Burning of ——. P. Braesco. Comptes. rend., 1913, **157**, 123—125.

Test-pieces of the clays and similar substances, gauged with water and then air-dried, were gradually heated to 1000° C., and measured at intervals. In all cases there was first expansion (to very different extents with different clays), followed, above a certain temperature, by contraction. The temperature at which contraction began was for kaolin 590° C., for mica 630° C., for various French clays 630° C. to 840° C., for glauconite 520° C. This temperature shows no relation to the temperature of dehydration of the aluminium silicates.—J. T. D.

Claywares; Magnetic materials in ——. A. Hopwood. Roy. Soc. Proc., 1913, A **89**, 21—30.

It is shown that white, cream, grey, yellow, buff, red or brown claywares are feebly or moderately magnetic owing to the presence of black unfused grains of unchanged magnetic minerals and bluish-black fused globules of ferruginous silicates, whilst flashed, brindled or blue claywares are strongly magnetic owing to the presence of ferruginous silicates and magnetic iron oxide. The magnetic oxide appears to be derived mainly from the precipitated or colloidal oxides, hydroxides, or carbonates of iron disseminated throughout the clay, these being reduced by the kiln gases. The fused globules of ferruginous silicates, on the other hand, are probably derived from granules or concretions of ferruginous minerals, which are always present in clays. Easy-fired white, cream, grey, yellow, buff, red or brown wares are less magnetic than hard-fired wares and considerably less magnetic than over-fired wares made from the same clay. Black, blue, or brindled clay wares and also badly-fired grey, yellow, buff, red or brown wares having black interiors, speckled bodies, or flashed surfaces are almost invariably strongly magnetic. Clay wares having speckled bodies, flashed surfaces, or black cores are always much more magnetic than corresponding ones free or relatively free from these defects. The need for great care in the choice of materials for the construction of magnetic observatories and physical laboratories is emphasised. —A. S.

Examination of medicine glasses. Richter. *See* XX.

Patents.

Material [*boro-silicate glass*] *for the mirrors of projectors.* Siemens-Schuckertwerke Ges. m. b. H., Berlin. Eng. Pat. 25,238, Nov. 4, 1912. Under Int. Conv., Nov. 3, 1911.

Transparent glass having a coefficient of cubical expansion smaller than "2·5×5/10," especially boro-silicate glass, is employed for the manufacture of concave mirrors of projectors.—F. Sodn.

Abrasive materials and process for producing them. Soc. Anon. des Produits Abrasifs et Alumineux de Provence, Marseilles, France. Eng. Pat. 2021, Jan. 24, 1913. Under Int. Conv., Jan. 26, 1912.

See Fr. Pat. 453,138 of 1913; this J., 1913, 753.—T. F. B.

Enamel; Manufacture of white ——. Verein. Chem. Fabr. Landau, Kreidl, Heller, und Co., Vienna. Eng. Pat. 11,754, May 17, 1912. Under Int. Conv., June 8, 1911. Addition to Eng. Pat. 10,418 of 1911, dated June 8, 1910.

See Addition of June 6, 1912, to Fr. Pat. 429,665 of 1911; this J., 1912, 1181.—T. F. B.

Enamel; Manufacture of white —— and the like. Verein. Chem. Fabriken, Landau, Kreidl, Heller, und Co., Vienna. Eng. Pat. 16,787, July 18, 1912. Under Int. Conv., Sept. 30, 1911.

See Fr. Pat. 450,228 of 1912; this J., 1913, 489.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement; New process for the examination and study of ——. B. Grünwald. Chem.-Zeit., 1913, 37, 885—886.

When Portland cement is subjected to the action of water and carbon dioxide under pressure, all its free magnesia and part of its lime are dissolved. After titrating an aliquot portion of the solution, and estimating the lime gravimetrically, the magnesia can be determined by difference and controlled gravimetrically. Of the lime which exists in combination in various brands of Portland cement, about two-thirds can be extracted by the above method, and a proportional quantity of silica is invariably dissolved with the lime, the ratio of 1 grm.-mol. of silica to 10 grm.-mols. of lime being observed in the case of three different samples. The experiments were carried out in a gold- or platinum-coated Atwater calorimetric bomb, in which the materials were treated at 13°—18° C. with carbon dioxide at 25—28 atmospheres pressure, the treatment lasting for 6—12 hours with continuous shaking. —O. R.

Puzzuolana; Diatomaceous earth as ——. A. Poulsen. Tonind.-Zeit., 1913, 37, 1132—1134.

The author describes a Danish deposit of diatomaceous earth, the composition of which, after drying, is approximately: soluble silica, 50; insoluble silica, 20; alumina, 10; combined water, 10; and other constituents, 10 per cent. respectively. The material goes by the name of "Moler," and is particularly suitable for replacing puzzuolana, such as trass, blast-furnace slag, and the like, as an addition to Portland cement in sea-water foundations. The best results are obtained by mixing 300 parts by weight of "Moler" with 700 parts by weight of cement clinker and grinding the mixture together. Mortars composed of 1 part by weight of Moler-cement and 3 parts by weight of standard sand are only slightly inferior to the corresponding, pure, cement-sand mortars after 28 days, are practically of the same strength after 6 months, and are superior after 12 months and onwards.—O. R.

Plaster; Chemical examination of ——. A. Cavazzi. Gaz. chim. ital., 1913, 43, II., 71—86.

Simple methods are given for the determination of: the active quick-setting plaster; hygroscopic moisture of raw gypsum; total water in raw gypsum and plaster; water absorbed by plaster; insoluble impurities in raw gypsum and plaster; calcium sulphate in raw gypsum and plaster; calcium sulphide in plaster, and organic matter in raw gypsum. Hygroscopic moisture is determined by drying *in vacuo*, or in a water oven between 55° and 60° C., and the total water by drying for 1 hour at 150° C., and then for 1 hour at 300° C. in a current of air. For the determination of calcium sulphate and of insoluble impurities, use is made of the solubility of calcium sulphate in a half-saturated solution of sodium chloride. The organic matter is determined by dissolving in dilute sulphuric acid and then proceeding as in the determination of organic matter in potable waters with permanganate. Calcium sulphide is determined by treating the sample, mixed with water, with a solution of arsenic trioxide in hydrochloric acid, dissolving the arsenic sulphide from the precipitate in ammonia, and then re-precipitating it. For the determination of the active quick-setting plaster, 1½ grms. of the very finely powdered material are added to 1½ litres of a solution of hydrated calcium sulphate saturated at a definite temperature, the mixture is shaken continuously for 20 mins. at this temperature, filtered through a filter of at least 1 litre capacity, and the calcium in 1 litre of the filtrate and in 1 litre of the original saturated solution determined as oxalate. It is stated that the difference between the two quantities, expressed as calcium sulphate, represents the quantity of active quick-setting plaster in 1 grm. of the material.—A. S.

Flooring-plaster. M. Stoermer. Tonind.-Zeit., 1913, 37, 1094—1096.

The addition of small quantities of calcium hydroxide to flooring-plaster of inferior quality, *i.e.*, plaster which has been calcined at too low a temperature, is accompanied by an increase in strength, especially the 28-days crushing strength, so long as the proportion of added lime does not exceed 5 per cent. The observed increase, however, is far inferior to the increase which is obtainable by calcining the flooring-plaster at the highest permissible temperature, the limit in the case of the raw material examined by the author being near Seger cone 10. The plaster so prepared contained 3·1 per cent. of free lime and possessed tensile and crushing strengths after 28 days of 33 and 345 kilos. per sq. cm. respectively, the corresponding figures for the underburnt plaster, and for the underburnt plaster with 5 per cent. of added calcium hydroxide, being 17·8 and 97, and 25 and 188 kilos. per sq. cm. respectively.—O. R.

The scoria process for the manufacture of fine ore briquettes, flue-dust briquettes, and slag bricks for building purposes. Stütz. *See* X.

Patents.

Hydrating various substances [*mixtures of sand or clinker and lime, etc.*]; *Apparatus for* ——. E. R. Sutcliffe, Leigh, Lancs. Eng. Pat. 17,936, Aug. 2, 1912.

A horizontal cylinder, which can be rotated about a central axis, is divided into compartments by vertical partitions with central apertures provided with conical flanges. A pipe for the supply of steam or water may be arranged along the horizontal axis of the cylinder. The inlet end of the cylinder is provided with a flat spiral feed device by which the substances are removed into the first compartment; when their level is high enough they pass into the second compartment through the central aperture in the partition.—W. C. H.

Road making and binding materials therefor. E. A. Paterson, Port Arthur, Ont., Canada. Eng. Pat. 23,879, Oct. 18, 1912.

See U.S. Pat. 1,042,474 of 1912; this J., 1912, 1130. The calcium carbonate may be replaced by barium or strontium carbonate.—T. F. B.

Road-bed construction. [*Use of sulphite cellulose waste lye.*] C. Ellis, Montclair, N.J. U.S. Pat. 1,068,048, July 22, 1913.

The road material is incorporated with a binder consisting of dry sulphite waste liquor solids and a weighting material. The binder may also be dusted over the road surface.
—J. H. J.

Artificial stone [*from peat*]; *Process for manufacturing* ——. W. Weiler, Munich, Germany. Eng. Pat. 3720, Feb. 13, 1913.

Powdered soluble glass and magnesia are added to an intimate mixture of cement with dried and cleaned fibrous peat, and the whole is soaked with lime-water, until a moist felt-like substance is produced and the cement sets. The material may then be placed in moulds and a considerable portion of the moisture expelled by pressure, after which it is allowed to dry. The stone produced is fireproof and non-hygroscopic. An insulating medium having greater elasticity (suitable for dishes, pipes, etc.) is prepared by adding animal glue and kieselguhr to the mixture.
—F. Sodn.

Stone and like material; Process for treating ——. H. Hemingway, Hampstead. U.S. Pat. 1,067,426, July 15, 1913.

See Eng. Pat. 28,284 of 1910; this J., 1912, 74.—T. F. B.

Bricks of blast-furnace slag; Process of making light ——. C. H. Schol, Allendorf, Germany. U.S. Pat. 1,068,396, July 22, 1913.

See Fr. Pat. 437,595 of 1911; this J., 1912, 538.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel; Intercrystalline fracture of ——. J. C. W. Humfrey. Carnegie Scholarship Mem., Iron and Steel Inst., 1912. Vol. 4. Collected Researches Nat. Phys. Lab., 1913, 10, 113—135.

Intercrystalline fracture in a defective boiler plate, in pure electrolytic iron, in a specimen prepared by melting *ferrum reductum* in a high vacuum in an electric furnace, and in a mild steel transformer sheet, suggested experiments with a pure Swedish iron, which showed a typical cleavage fracture through the crystals. These experiments indicated that intercrystalline brittleness can arise in pure iron through annealing above the Ar_1 point (670° C.) in an atmosphere containing a small quantity of oxygen or carbon dioxide. The brittleness is prevented if the oxidising gases are present in sufficient quantity to form a continuous coating of oxide upon the surface of the metal, or if such a coating be previously formed on the metal by heating in air. The brittle specimens may be restored to their original condition by: (1) heating above the Ar_3 point and quenching, (2) re-annealing for a sufficient length of time in hydrogen above the Ar_3 point. The brittleness is attributed to the formation of very small quantities of an unknown oxide of iron, which is soluble in γ-iron but insoluble or much less soluble in α-iron, and is hence separated in the boundaries between the α-crystals when these are formed on cooling, and causes lack of cohesion by preventing the formation of the usual strong amorphous cement between the crystals (see Bengough, this J., 1912, 134). The production of intercrystalline brittleness under the conditions described may afford an explanation of many cases of failure, under stamping and similar processes, of iron and mild steel sheets which have been subjected to close annealing. The paper is accompanied by photomicrographs and an appendix containing descriptions of three small electric furnaces used in the experiments. (See also this J., 1906, 538; 1910, 157; 1913, 536).—A. S.

[*Nickel-chrome*] *Steels; Discrepancies between the structure and composition of* ——. M. Brès. Rev. Mét., 1913, **10**, 797—807.

Belaïew (Rev. Mét., 1912, **9**, 647) has shown that the macrostructure of a steel, in its broad lines, cannot be modified by the ordinary thermal and mechanical treatments after solidification: hot working causes only deformation of crystals, etc., whilst heat treatment produces only local changes in the structural constituents. The author now shows from tests on four medium hard nickel-chrome steels, that these conclusions apply also to the microstructure. The steels had the following composition: (A) C 0·190, Si 0·185, Mn 0·440, S 0·022, P 0·012, Ni 2·53, Cr 0·63 per cent.; (B) C 0·190, Si 0·180, Mn 0·430, S 0·024, P 0·013, Ni 2·67, Cr 0·55 per cent.; (C) C 0·190, Si 0·175, Mn 0·530, S 0·022, P 0·009, Ni 2·69, Cr 0·64 per cent.; (D) C 0·210, Si 0·180, Mn 0·605, S 0·020, P 0·010, Ni 2·71, Cr 0·74 per cent. Steel A (tensile strength 58 kilos. per sq. cm.) had the characteristic pearlitic structure of medium-hard nickel-chrome steels. In B (tensile strength 74 kilos. per sq. cm.) the pearlite was slightly granular, the structure resembling that of a hard nickel-chrome steel such as is used in motor car construction (tensile strength 75 kilos. per sq. cm.). Steel C (tensile strength 100 kilos. per sq. cm.) had a still more abnormal microstructure, the pearlite being entirely granular like that of a very hard nickel-chrome steel such as is used in the manufacture of certain projectiles (strength about 100 kilos. per sq. cm.). Steel D had a structure similar to that of B. These differences persisted after various thermal and mechanical treatments, the steels behaving like steels of similar microstructure but normal chemical composition. The positions of the transformation points on cooling in the case of steels A (640° C.), B (600° C.) and C (490° C.) corresponded with those of normal medium-hard, hard, and very hard nickel-chrome steels, and were thus in agreement with the microstructure. These results show that it is not sufficient to rely upon chemical methods for controlling steel manufacture, and that metallographic methods are indispensable. The lack of correlation between the chemical composition and microstructure may be due to: (1) the temperature to which the molten metal is heated and the length of time it is kept at a high temperature, (2) the temperature of pouring, and (3) the rate of cooling before solidification.—A. S.

Nickel-chrome steels; [*Electrical resistance and microstructure of*] *two* ——. A. Portevin. Rev. Mét., 1913, **10**, 808—810.

The author determined the electrical resistance of two of the steels (A and C) mentioned in the preceding abstract, and found differences greater than could be accounted for by the slight differences in chemical composition.—A. S.

Steel; Gravimetric determination of tungsten, chromium, silicon, nickel, molybdenum and vanadium in ——. S. Zinberg. Z. anal. Chem., 1913, **52**, 529—534.

Nickel is determined separately, all the other constituents being estimated in the same portion: 1 grm. is dissolved in 60 c.c. of hot hydrochloric acid (1 : 4): this leaves a residue of chromium carbides and tungsten. The liquor is heated nearly to boiling and 2—3 c.c. of strong nitric acid added. All the tungsten is precipitated, whilst chromium and iron dissolve. The solution is diluted and filtered, the precipitate well washed with hydrochloric acid (1 : 10), ignited in platinum and weighed as WO_3; it is free from chromium and silicon. The filtrate is evaporated to fumes with 6 c.c. of strong sulphuric acid. After cooling the mass is treated with water, heated and filtered, the residue washed with hot water, ignited and weighed as SiO_2. The filtrate is concentrated and treated for 45 minutes with hydrogen sulphide under pressure, after which the flask is stoppered and warmed on a water-bath for half an hour. The precipitate is filtered off at once, washed with hydrogen sulphide water, incinerated at a very low temperature in porcelain and weighed as MoO_3. The filtrate is concentrated, oxidised with a few drops of nitric acid and poured drop by drop into 200 c.c. of boiling 5 per cent. caustic soda solution; the solution containing vanadium and traces of chromate is filtered and the precipitate of iron, nickel, and chromium hydroxides washed with hot water. The solution is acidified with nitric acid and precipitated with barium nitrate while boiling. The precipitate may be filtered off at once, and washed by decantation with boiling water; it is free from vanadium. The filtrate is evaporated nearly to dryness after adding a few drops of alcohol to reduce traces of chromic acid, treated with water, made ammoniacal, boiled and filtered, and the chromium hydroxide thus recovered added to the bulk of the iron-nickel-chromium precipitate in which the chromium is determined by solution in nitric acid and potassium chlorate and precipitation with mercurous nitrate. The vanadium-filtrate is freed from ammonia by evaporation and precipitated with faintly acid mercurous nitrate solution; a few drops of ammonia are then added, the yellow precipitate changing into black and settling well. It is filtered off and washed with water containing a little mercurous nitrate. Filter and precipitate are ignited separately in platinum and the residue weighed as V_2O_5. To determine nickel, 1 grm. is treated as before until tungstic acid has been separated. The filtrate is concentrated, 2 grms. of tartaric acid and a slight excess of ammonia added, and nickel is precipitated with dimethylglyoxime.—W. R. S.

[*Gold ores.*] *Mine samples; Notes on the assay of* ——. R. Dures. J. Chem., Met., and Min. Soc., S. Africa, 1913, **13**, 608—611.

In duplicate analyses of 20 different samples the average percentage difference between the results was 4·38. The average loss on the cupels of inquarted beads was 3·1 per cent., the loss being practically all silver. It was found that inquartation with silver up to 8 times the weight of gold did not cause the flattened beads to break up during parting, and with very small gold beads, as much as 20 times could be added. The silver present in Rand ores is too variable to permit of a universal allowance of 10 per cent. being made.—T. St.

Lead refinery; Electrolytic —— *at Trail, B.C.* J. F. Miller and A. J. McNab. Min. and Eng. World, July 12, 1913, 57—59.

Recent practice does not differ materially from that previously described (this J., 1909, 529). Wooden tanks are in use, each holding 20 anodes and 21 cathodes. The electrolyte contains 12 per cent. H_2SiF_6 and 6 per cent. $PbSiF_6$. Addition of glue is considered essential to prevent spongy deposits. 15 per cent. of the weight of the anodes is not dissolved, but is re-cast after removing the slime which contains the precious metals from the base bullion. Antimony can be recovered from the latter if required, by treatment with sodium sulphide and electrolysis with steel cathodes.—W. R. S.

Copper and lead; The temperature of certain operations in the metallurgy of ——. G. H. Clevenger. Met. and Chem. Eng., 1913, **11**, 447—449.

The intermittent operation of reverberatory furnaces observed by a Le Chatelier thermo-couple showed greater variations in temperature than blast-furnace work. Data relating to roasting and refining are also given.—W. R. S.

Fine-ore briquettes, flue-dust briquettes, and slag brick for building purposes; The scoria process for the manufacture of ——. E. Stütz. Trans. Amer. Inst. Min. Eng., 1913, **46**, 1257—1265.

Fine iron ore and flue dust are mixed in rotating steaming drums with 4 per cent. of blast-furnace slag and 4 per cent. of lime, pressed into bricks and hardened in cylindrical kilns by high-pressure steam for 8 to 10 hours. The use of such briquettes is stated to allow of the blast pressure being considerably reduced. Combustion is more complete, and working results have shown a saving of from 15 to 20 per cent. of coke. The plant can also be used for the manufacture, on similar lines, of slag bricks. A table is given showing the manufacturing costs of various briquetting agglomeration processes.—T. St.

Metallic oxides; The reducibility of —— *as affected by heat treatment.* W. McA. Johnson. Trans. Amer. Inst. Min. Eng., 1913, **46**, 1137—1145.

It is considered probable that a double oxide, analogous to zinc ferrite, that is, a zinc zincate, may be formed when zinc oxide is strongly heated, and that sufficient energy must be supplied to break up this compound before the reaction involving reduction, by carbon, can proceed.—T. St.

Melting points of the refractory elements. I. Elements of atomic weight from 48—59 [*metals of the iron group, vanadium, and titanium*]. G. K. Burgess and R. G. Waltenberg. J. Washington Acad. Sci., 1913, **3**, 371—378.

The determinations were made mainly with the micropyrometer (this J., 1913, 162), the metals being melted in hydrogen usually on platinum strips (manganese also on nickel strips, and titanium on iridium strips). In some cases the metals were melted in crucibles in an Arsem electric furnace (this J., 1906, 854), and the melting point determined by the method of optical heating and cooling curves (Kanolt, Tech. Paper 10, Bureau of Standards, U.S.A., 1912). The results are summarised in the following table:—

Metal.	M.pt. with micropyrometer	Purity of metal.	Probable m.pt. of pure metal.
	° C.	per cent.	° C.
Nickel	1452[*] 1449[†]	$99{\cdot}83_6$	1452 ± 3
Cobalt	1477 ± 2 1478 ± 1[‡]	$99{\cdot}95_1$	1478 ± 5
Iron	1533 ± 1[§] 1528[†]	99·98 ± ·01	1530 ± 5
Manganese ..	1255	97–98	1260 ± 20
Chromium ..	1520	98–99	1520 to > Fe
Vanadium ..	1720	97–98	1720 ± 20
Titanium ..	1794 ± 12	99·9 +	1795 ± 15

[*] Assumed value on platinum strip; observed value on iridium strip.

[†] Crucible melts in Arsem furnace.

[‡] Crucible melts in Arsem furnace; also on iridium strip with micropyrometer.

[§] Five samples all agreeing to within 3°.

—A. S.

Metals; Sublimation of —— *at low pressures.* G. W. C. Kaye and D. Ewen. Roy. Soc. Proc., 1913, A **89**, 58—67.

Experiments were made with iridium (in nitrogen at 20 mm. pressure), copper (in nitrogen at 1 mm.), iron and tungsten (in a high vacuum, about 0·004 mm. at the beginning), and sensible volatilisation was observed in all cases at temperatures considerably below the melting points. In addition to volatilisation as ordinarily understood, there was evidence of straight-line emission of particles of metal (see also this J., 1913, 754). The data for a number of metals, for which information is available, are collected in the following table: the volatilisation was detected mostly at low pressures.

Metal.	Boiling point.		Volatilisation detectable at:	M.pt. at 1 atmos.
	At 1 atmos.	*In vacuo.*		
	° C.	° C.	° C.	° C.
Mercury	357	160	—39	—39
Potassium	760	370	63	63
Sodium	880	420	97	97
Cadmium	778	450	160	321
Zinc	918	550	180	419
Bismuth	1420	1000	269	269
Lead	1525	1150	360	327
Silver	1955	1400 ?	680	961
Copper	2310	1600 ?	400	1084
Tin	2270	1700 ?	360	232
Gold	2530 ?	1800 ?	1370	1064
Iron	2450	—	950	1500
Platinum	2500 ?	--	1200	1750

—A. S.

Heats of formation of iron and manganese silicates. Wologdine. *See* VII.

Separation of chromium and aluminium. Analysis of chromite. Bourion. *See* XXIII.

Determination of tungstic and silicic acids. Hermann. *See* XXIII.

Patents.

Pig iron; Method of improving the physical nature of ——. V. Stobie, Sheffield. Eng. Pat. 16,001, July 9, 1912.

The metal is subjected, in an electric furnace, to the action of a flux free from iron (calcium silicate) with which it is agitated by means of the carbon dioxide evolved from lumps of added limestone.—W. E. F. P.

Steel; Tempering ——. F. O. Bynoe, London, and H. Edwards, Harrow. Eng. Pat. 17,014, July 22, 1912.

Superheated steam of low pressure is caused to impinge directly upon the article to be tempered or to flow around a chamber enclosing the latter, the steam exhausting into the atmosphere or into a condenser giving only slight back pressure.—W. E. F. P.

[*Aluminiferous*] *Iron ores; Method of smelting* ——. F. M. McClenahan, Maryville, Tenn. U.S. Pat. 1,066,833, July 8, 1913.

In smelting aluminiferous iron ores a fluxing agent, such as sodium chloride, which is volatile at the heat of the furnace, is used. An amount of flux equal to one-fifth to one-seventh of the alumina present is used. —T. St.

Wrought iron; Method for making a material having the general properties of ——. B. C. Lauth, Pittsburgh, Pa., Assignor to T. S. Blair, jun., Chicago, Ill. U.S. Pats. 1,067,528 and 1,067,529, July 15, 1913.

Impure (blast-furnace) iron is treated by the acid Bessemer process until the resulting slag contains sufficient iron oxide to eliminate the carbon and part of the phosphorus, from the remaining metal; the purification of the latter is then completed by agitating the molten charge in a basic-lined receptacle, after the addition of sufficient lime to render the slag slightly basic.—W. E. F. P.

Electro-plating; Apparatus for ——. G. P. M. Lee and W. A. Brame, London. Eng. Pat. 13,746, June 12, 1912.

An apparatus of the rotary type in which the containing vessel is lined with non-conducting material, except at the points constituting the cathode connection, the latter being in the form of a ring built into the vessel and having its inner portion in contact with the solution and its outer part in contact with the brush of the negative lead. The interior of the vessel is provided with sloping surfaces so that the articles may be continuously turned over during rotation.—W. E. F. P.

Furnaces for heating copper ingots and for other like uses. G. B. A. Gibbons, Lower Gornal, and R. Masters, Dudley. Eng. Pat. 15,283, July 1, 1912.

The furnace is heated with producer gas and consists of a circular chamber and a central downcast shaft leading through the revolving floor into a regenerator below. The producer is built at one side, or in the base, of the furnace.—W. R. S.

Furnaces; Crucible and similar ——. S. N. and E. R. Brayshaw, Manchester. Eng. Pat. 6847, March 20, 1913.

The furnace has a lateral hollow pillar forming a flue to which an arm is attached supporting the furnace lid, which it allows to be tilted vertically and swivelled horizontally. This arm is hollow and forms a short flue leading through the lid into the lateral pillar.—W. R. S.

Furnaces; Forging, hardening, tempering, annealing and similar ——. Fletcher Russell and Co., Ltd., and C. W. Fletcher, Warrington. Eng. Pat. 11,094, May 10, 1913.

A circular rotatable furnace heated by a central blast burner projecting into the furnace either from above or below.—W. R. S.

Furnace; Tilting metallurgical ——. W. W. Case, jun., Denver, Colo. U.S. Pat. 1,066,995, July 8, 1913.

The furnace consists of a crucible chamber with a communicating combustion chamber directly beneath. The latter is in communication with an oil burner supplied with air at approximately 6 oz. pressure. The lining of the crucible chamber is provided with a number of closely spaced refractory projections which hold the crucible in place. The contents of the crucible are discharged into a mould which is carried by a framework mounted by adjustable bearings on a bracket which is secured to the furnace, so that when the furnace is tilted, the mould will come beneath the pouring lip. The furnace cover is carried by a swivelled bracket supported on a rod which is mounted in a sleeve attached to the furnace. Means are provided for raising and lowering the rod in the sleeve. —T. St.

Furnace; Smelting ——. C. A. Kuenzel, Buena Vista, Colo., Assignor to The Kuenzel Gas Producer & Smelter Construction Co. U.S. Pat. 1,067,481, July 15, 1913.

A gas-fired furnace of the reverberatory type consisting of one long hearth having a sloping roof upon which are disposed a number of smaller hearths, the latter communicating with each other and arranged in a series of steps. The smaller hearths are provided with separate heating and charging means and are adapted to discharge into the large hearth by means of a series of vertical shoots.—W. E. F. P.

Zinc-lead ore; Removal of zinc from the ore, particularly ——. H. C. Woltereck and J. Moeller, London. Eng. Pat. 16,218, July 11, 1912.

A process for removing zinc from roasted ores by means of hot ferrous sulphate solution, zinc sulphate and ferrous hydroxide being formed.—W. R. S.

Zinc; Process of producing —— from blue powder. W. F. Bleecker, Canonsburg, Pa. U.S. Pat. 1,066,787, July 8, 1913.

The blue powder is immersed in a suitable fused electrolyte and subjected to electrolysis. The coating of the particles of blue powder is thus removed, and the uncovered zinc particles then fuse.—T. St.

Zinc and other volatile metals; Process for the distillation of ——. W. Troeller. Ger. Pat. 260,749, Dec. 11, 1909.

The ore is mixed with fuel and moistened with water or other suitable liquid, then charged into the furnace to such a height that the air blast, which is forced through the charge from above downwards, is composed essentially only of carbon monoxide and nitrogen when it issues from the furnace. The furnace is narrower at the bottom than at the top. Under these conditions, it is stated, oxidation of the zinc vapour does not occur and the residue is sintered. If the ore contains two volatile metals, *e.g.*, zinc and lead, the process may be so regulated that the zinc and lead vapours are collected separately, or the zinc may be volatilised and the lead retained in the residue. —A. S.

Zinc; [Electrolytic] Manufacture of —— *with the aid of a bath of liquid slag.* F. Tharaldsen. Ger. Pat. 261,188, March 12, 1912.

In order to prevent, as far as possible, the formation of dust (fume), the ore is fed into the furnace below the surface of the molten slag.—A. S.

Alloys, compounds, or mixtures; New metallic ——. H. A. Warneck, Margate. Eng. Pat. 17,534, July 29, 1912.

The addition of asbestos or hornblende to molten iron or steel is stated to give various desirable properties to the resulting metal, which can be made hard and tough, or non-rusting, or white and ductile, according to the temperature of the operation.—W. R. S.

Tin from waste tinned metal and alloys; Cold electrolytic process for the recovery of ——. A. L. C. Nodon, Bordeaux, France. Eng. Pat. 24,203, Oct. 23, 1912.

For the recovery of the tin, the electrolytic bath is composed approximately of water, 87·5 kilos., sodium fluoride, 6·0 kilos., sodium pyrophosphate, 0·5 kilo., and hydrochloric acid (1 to 2° B., sp. gr. 1·007—1·014), 6·0 kilos. The sodium fluoride may be replaced by the potassium compound, and the pyrophosphate by sodium or potassium fluo-phosphate, fluo-borate or fluo-silicate.—B. N.

Metals; Process of extracting —— *from their ores.* H. B. Slater, Assignor to R. B. Shelden, Riverside, Cal. U.S. Pat. 1,066,855, July 8, 1913.

A solution of sodium and ferrous chlorides is treated electrolytically, and to the anode solution is added sodium hydroxide and ferrous hydroxide obtained from the cathode solution. The resulting solution is used for lixiviating the ores. It is stated that oxidising compounds (hypochlorites, etc.), are formed in the solution, and that these oxidise the ore, and liberate any sulphur present.—T. St.

Copper; Apparatus for recovering —— *from its ores.* H. M. Wilcox, Chicago, Ill. U.S. Pat. 1,066,968, July 8, 1913.

An absorption tank and a measuring tank for a chemical agent, are connected together at the top and bottom by conduits supplied with controlling valves, and similar conduits connect the absorption tank and a precipitating boiler. The latter consists of a vertical cylinder closed at the ends with sheets. Open-ended tubes extend between and are secured to the sheets. A dome is fitted to the upper end of the cylinder, forming, with the upper sheet, a gas chamber. A double-walled chamber is secured to the lower end of the cylinder, the space between the walls being in communication with the space between the vertical tubes. Circulating tubes arranged outside the cylinder communicate at their upper and lower ends with the dome and the double-walled chamber respectively. —T. St.

Copper; Process for obtaining —— *from sulphide ores, especially ores containing much carbonate and low percentages of copper sulphide.* P. Schmidt und Desgraz Ges. m.b.H. Ger. Pat. 261,799, May 29, 1912.

The ore is roasted at a low temperature with restricted access of air, then treated with a solution of alkali persulphate (preferably ammonium persulphate) rendered alkaline with ammonia or ammonium carbonate, and the copper recovered from the resulting solution by electrolysis, the solution being simultaneously or subsequently enriched in persulphate by electrolysis.—A. S.

Precious metals; Extraction of ——. *Amalgamator.* W. W. Guest, Alameda, Cal. U.S. Pats. 1,067,022 and 1,067,023, July 8, 1913.

(1). The sands or ores are reduced to a watery slime by grinding with a solution containing, in approximately equal proportions, a nitrate, a chlorate, a hypochlorite and a hydroxide of an alkali metal. The precious metals are then recovered by agitating and circulating the slime in contact with mercury. Alternative solutions contain a nitrate and a hydroxide, together with a chlorate, or a hypochlorite or a thiosulphate of an alkali metal. (2). The amalgamator consists of a tub-like receiver into which the slime is brought through a vertical pipe provided at the bottom with radial arms, the slime being discharged tangentially through discharge nozzles. The pipe is supported in ball bearings by a flanged tube which rests on a beam fixed across the top of the receiver, and is thus able to revolve.—T. St.

Nickel; Electrolytically recovering ——. H. L. Wells, New Haven, Conn., and T. C. King, East Orange, N.J. U.S. Pat. 1,067,698, July 15, 1913.

Finely-divided nickel matte is treated with hydrochloric acid, and the solution electrolysed to recover the nickel. The chlorine gas, which is also evolved, is treated with hydrogen sulphide, and the hydrochloric acid produced is absorbed in water.—B. N.

Aluminium; Process for the manufacture of pure ——. L. Devaucelle. Fr. Pat. 453,501, April 4, 1912.

The process consists of two stages, viz., the production of crude aluminium from the ore and the refining of the crude metal. The crude aluminium is obtained by electrolysis of a fused electrolyte which is continuously renewed during the process by addition of the ore, *e.g.*, bauxite. The electrolyte consists of a double fluo-sulphide and chloro-sulphide of aluminium and an alkali metal. It may be prepared in various ways, *e.g.*, by adding sulphur to a boiling solution of sodium aluminate, chloride and fluoride, and evaporating to dryness. The crude aluminium containing compounds of iron, silicon, and aluminium as impurities, is refined by an electrolytic process in cells provided with variable adjustable resistances so that the temperature can be kept slightly above but as near as possible the melting point of the aluminium. The resistances may take the form of perforated refractory partitions arranged in pairs, one fixed and the other movable; by suitable relative adjustment of these the resistance offered to the current can be varied. Or, the resistance may be constituted by a fused salt or mixture of salts of higher specific gravity than the molten aluminium. It is stated that by reason of: (1) the difference in the velocity of migration of iron, silicon, and aluminium ions, (2) the electronegative properties of iron and silicon in relation to aluminium, and (3) the higher melting points of silicon and iron, the iron and silicon are separated from their compounds and deposited on the cathode in a solid state, whilst the aluminium remains fused and serves as a vehicle. It is preferred to make the process continuous, the crude aluminium entering at one end and the refined metal leaving at the other. It is stated that this refining process may be used for recovering pure aluminium from scrap.—A. S.

[*Metals.*] *Heterogeneous materials; Process for separating —— by melting the more easily fusible constituent.* W. Buess. Ger. Pat. 260,770, Feb. 22, 1912.

Above the hearth of the melting chamber are a number of arms which move the material gradually from the centre to the periphery. The more easily fusible metal melts, whilst the metal of higher melting point is swept over the edge of the hearth by the arms.—A. S.

"*Red metal*" (*copper-rich alloys*) *and white metal; Apparatus for separating —— by melting the more easily fusible white metal.* Schaefer und Schael, Metall-Hüttenwerk. Ger. Pat. 261,262, April 27, 1911.

The material is distributed on a sieve or grating which is moved to and fro on rails in a furnace chamber. At the ends of the grating, hinge-like projections, which can be displaced from the vertical position only in one direction, extend downwards. Projecting from the walls of the furnace chamber, on either side, are pieces of similar shape to the catches employed for door-latches and the hinge-like projections engaging with these catches impart a vibratory motion to the grating, whereby the separation between the melted and unmelted metal is facilitated. —A. S.

Cementing (*carburising*) *material from animal and vegetable refuse; Preparation of a ——.* E. Fochtenberger. Ger. Pat. 260,806, June 20, 1912.

Dried fine sharp river sand or quartz sand is impregnated with jelly-like meat refuse and then mixed with the skins of earth nuts obtained as a waste product in the manufacture of arachis oil. The product may be dried, powdered, and mixed with other carburising agents.—A. S.

Cerium and cerium alloys for pyrophoric purposes; Process for hardening ——. C. Dreymann. Ger. Pat. 260,843, Dec. 20, 1911.

The metal is heated in an inert or reducing atmosphere or while embedded in an inert substance and is then more or less rapidly cooled according to the degree of hardness required.—A. S.

Mill-scale; Process for melting out —— from heating furnaces with basic hearths. F. Siemens. Ger. Pat. 261,830, Dec. 8, 1912.

The claim is for the use of a material, *e.g.*, a calcium iron silicate slag, which at a high temperature acts as a solvent for the mill-scale but is without appreciable action on the basic hearth.—A. S.

Iron; Process of converting —— into steel F. F. Palli, Antwerp. Eng. Pat. 26,203, Nov. 14, 1912.

See Fr. Pat. 450,638 of 1912; this J., 1913, 608.—T. F. B.

Tin; Method and apparatus for electrolytically recovering and refining ——. G. Michaud and E. Delasson, Montreuil, France. Eng. Pat. 20,557, Sept. 9, 1912.

See Fr. Pat. 435,936 of 1911; this J., 1912, 395.—T. F. B.

Ore concentration. E. H. Nutter, Berkeley, Cal., and H. Lavers, Broken Hill, N.S.W., Assignors to Minerals Separation, Ltd., London. U.S. Pat 1,067,485, July 15, 1913.

See Eng. Pat. 23,870 of 1910; this J., 1912, 31.—T. F. B.

Means for preventing pitting or corrosion in steam boilers. [*Composite boiler plates.*] Eng. Pat. 16,455. *See* I.

XI.—ELECTRO-CHEMISTRY.

Tantalum as a cathode material. G. Oesterheld. Z. Elektrochem., 1913, 19, 585—587. (See also Brunck, this J., 1912, 1135.)

Tantalum electrodes have a potential difference against sulphuric acid about midway between those of copper and lead. They possess the disadvantage for many electrolytic purposes, of readily absorbing cathodic hydrogen, which produces a considerable change of structure even when less than 0·1 per cent. is absorbed. The hardness and elasticity of the metal disappear, and it becomes useless as an electrode material. The paper contains measurements relative to the velocity of absorption of hydrogen and to its influence on the overvoltage.—W. H. P.

Technical preparation of baryta. V. Preparation of baryta by electrolysis of aqueous solutions of barium sulphide. Marino and Gigli. *See* VII.

Testing of ebonite for electrical purposes. Paterson and others. *See* XIV.

Patents.

Anodes for use in electrolytic apparatus. G. P. M. Lee and W. A. Brame, London. Eng. Pat. 16,475, July 15, 1912.

The anode, for use in non-rotary electrolytic apparatus, is made partially or completely hollow, and is provided, on the surface facing the cathode, with perforations which may be furnished with insoluble bushes. The electrode may be supported in a non-perforated insulating insoluble frame, which forms a hollow compartment behind the anode, the inner portion of the anode or the hollow compartment being connected with a pump for circulating the electrolyte.—B. N.

Cells; Electrolytic ——. E. A. Allen, Rumford Falls, Me., and H. I. Allen, Portland, Me., U.S.A. Eng. Pat. 26,169, Nov. 14, 1912.

The anode comprises separated parallel plates, spaced from the top, bottom and sides of the chamber, with an open space between them for the circulation of the electrolyte. Each plate may be divided into vertically separated sections, cross-bars being provided for connecting together the sections and the plates, and one or more vertical stems located in apertures in the cross-bars for leading in the electric current. The electrolytic chamber is provided with a cover, and a tube, supported by and depending from the cover and closed above by a luted cap, is attached at its lower end to a salt receptacle of a longitudinally-extended form, disposed between the anode plates in the path of the electrolyte for the continuous saturation of the latter. The sides of the chamber are closed by one or more diaphragms located opposite to the outer surfaces of the anode plates, and one or more cathode chambers containing cathodes are clamped to the outside of the diaphragms, with insulating material on one or both sides of the diaphragms. The cathode chambers, together with the cathodes, are each removable as a separate unit for replacement of the diaphragms. The edges of each cathode, consisting of wire gauze or similar material, are turned outwards and secured to a casing constituting the cathode chamber. One or more braces, the middle portions of which are adapted to bear against each cathode and the end portions connected to a plate forming the outside of each cathode chamber, are provided for the purpose of supporting the cathodes.—B. N.

Electro-osmotic extraction of water from substances: Apparatus for ——. Ges. für Elektro-Osmose m. b. H., and G. B. Schwerin, Frankfort-on-Maine, Germany. Eng. Pat. 10,873, May 8, 1913. Addition to Eng. Pat. 23,545, July 17, 1912 (this J., 1913, 200).

A series of vertical filter chambers each containing two perforated hard-lead electrodes of the same polarity, between which a third electrode is disposed. The material is supplied to the spaces between the perforated electrodes, the inner sides of the latter being provided with filter-cloths.—W. E. F. P.

Storage batteries; Negative-pole plate for ——. W. Morrison, Des Moines, Iowa. U.S. Pat. 1,067,437, July 15, 1913.

The material, which is to become active, is applied to a grid, and the plate is then electro-chemically formed in a suitable electrolyte. A reagent, capable of electro-chemically dissolving matter from the grid, is added to the pasted plate, the dissolved matter is precipitated and electro-chemically oxidised, thereby forming between the grid and the active material a binder. The plate is then employed as an electrode in a suitable electrolyte, and an electric current passed in order to reduce it.—B. N.

Electrolytic gases; Apparatus for the purification of ——. A. E. Knowles, Wolverhampton. U.S. Pat. 1,067,822, July 22, 1913.

SEE Eng. Pat. 21,600 of 1911; this J., 1911, 1458.—T. F. B.

Apparatus for electrolysis of alkali chlorides with a mercury cathode moved by compressed air. Ger. Pat. 261,397, *See* VII.

XII.—FATS; OILS; WAXES.

Oils; Polenske and Reichert values of some ——. G. D. Elsdon and H. Hawley. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 33.

Oil.	Reichert value.	Polenske value.
Apricot kernel	0·3	0·3
Colza	0·1—0·5	0·3
Castor	0·1—2·3	0·2
Linseed	0·0	0·1
Soya bean	0·1—0·4	0·3
Almond	0·2—0·5	0·2
Cotton seed	0·2—1·0	0·4
Sesame	0·1—0·4	0·4
Cod liver (Newfoundland)	0·1—0·2	0·6
Olive	0·2—0·8	—
Arachis	0·4—0·5	—
Croton	12·7	1·2
Various fish oils	0·1—0·8	0·2—0·7

The corresponding values for some oils which had been kept for several years were:—

Oil.	Acidity % KOH.	Reichert value.	Polenske value.
Cotton seed	4·04	11·1	0·6
Menhaden	5·04	11·0	0·9
Cod liver	1·02	4·6	0·6
Brusmer	2·63	8·2	0·6

—F. SHDN.

Rosin; Determination of —— *in blown oils.* W. Fahrion. Chem. Rev. Fett Ind., 1913, 150—152, 177—179.

THE hydroxy-acids in blown oils are only partially esterified in Twitchell's method of determining rosin (this J., 1891, 804), and the error thus produced is greater than in the author's modified method (this J., 1911, 1266). In such cases about 5 grms. of the oil (previously freed from metals) may be dissolved in 50 c.c. of petroleum spirit, and the solution treated with 20 c.c. of 96 per cent. alcohol and neutralised with $N/1$ alkali solution, with phenolphthalein as indicator. It is next diluted to an alcoholic strength of about 60 per cent., shaken, and allowed to stand over night, after which the soap solution is diluted to at least 200 c.c., acidified with hydrochloric acid, and extracted twice with petroleum spirit. The united extracts are esterified with absolute alcohol and hydrochloric acid, and the rosin determined as described (this J., 1911, 1266), with the addition that traces of soap are removed from the solution of esters by washing with 10 c.c. of 60 per cent. alcohol, and the washings added to the solution of the rosin soap. The fatty acids insoluble in petroleum spirit are more difficult to esterify in the case of oxidised than of unoxidised oils. For example, a sample of rosin-free blown linseed oil yielded 0·86 per cent. of apparent rosin by this method. On the other hand, colophony contains from 10 to 25 per cent. (average 14 to 15 per cent.) of neutral substances and hydroxyabietic acids which escape determination. The ratio between the fatty and resin acids has also some influence upon the esterification. In the author's test experiments good results were obtained by the use of the following corrections. Amounts below 1 per cent. were ignored; those between 1 and 4 per cent. were taken directly as rosin; whilst amounts above 4 per cent. were multiplied by 1·17, the factor corresponding to the average loss of 14 to 15 per cent. of neutral substances and hydroxyabietic acids.—C. A. M.

Chemical examination of wheat germ. Power and Salway. *See* XIXA.

PATENTS.

Wood oil; Process for preventing the coagulation of —— *when heated.* A. Beringer. Ger. Pat. 261,403, Sept. 27, 1912.

WHEN wood oil is heated, it tends to coagulate, rendering its use for making varnishes, etc., somewhat limited. It is now found that by adding to the oil sulphur, a sulphide, selenium, or a selenide, either alone or in mixtures, this coagulation may be prevented.—T. F. B.

Hydrogenating fatty materials. C. Ellis, Montclair, N.Y., U.S.A. Eng. Pat. 24,084, Oct. 22, 1912. Under Int. Conv., Oct. 23, 1911.

SEE Fr. Pat. 449,668 of 1912; this J., 1913, 497.—T. F. B.

Grease; Method of extracting —— *from grease-bearing materials.* C. R. Mayo, London. U.S. Pat. 1,068,354, July 22, 1913.

SEE Eng. Pats. 8600, 17,125, and 22,615 of 1909; this J., 1910, 941.—T. F. B.

Soap; Process for the manufacture of [hard] ——. J. Leimdorfer, Budapest. Eng. Pat. 8332, April 6, 1912. Under Int. Conv., April 6, 1911.

SEE Fr. Pat. 442,248 of 1912; this J., 1912, 936.—T. F. B.

Soap in the form of tablets or the like; Process of making ——. M. Castenholz, Cologne, Germany. Eng. Pat. 25,221, Nov. 4, 1912.

SEE U.S. Pat. 1,057,931 of 1913; this J., 1913, 498.—T.F.B.

Hydrogenated fatty food product. U.S. Pat. 1,067,978. *See* XIXA.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

The colouring matter of stick-lac. Dimroth and Goldschmidt. *See* IV.

Cellulose and other products from resinous waste wood. Luttringer. *See* V.

Determination of rosin in blown oils. Fahrion. *See* XII.

PATENTS.

Carbon or lampblack; Method of producing ——. G. Fernekes, Pittsburgh, Assignor to J. A. Snee, West Elizabeth, Pa. U.S. Pat. 1,066,894, July 8, 1913.

A STREAM of methane at atmospheric pressure is passed into a chamber maintained at a temperature of not less than 1300° C., whereby, it is claimed, the gas is immediately and completely dissociated into carbon and hydrogen.
—W. E. F. P.

Pigment from desulphurised spent oxide from gas purification; Preparation of a ——. C. J. H. Madsen. Ger. Pat. 261,000, June 11, 1912.

THE desulphurised spent oxide, without any chemical treatment, is worked up into a homogeneous pigment by mechanical means (fine wet or dry grinding or the like). According to the nature and origin of the spent oxide, the pigment obtained may have a deep blue, olive-green, or brown colour.—A. S.

Shellac and its allied lacs ; Process of refining ——. H. Cassard, Baltimore, Md. U.S. Pat. 1,066,794, July 8, 1913.

Shellac and its allied lacs are refined by subjecting them to the combined action of two solvents, an alcoholic solvent for the lac, and a hydrocarbon solvent for the wax, at a temperature above the melting point of the wax, *i.e.*, from 57° to 84° C. The vapours of the solvents are condensed and returned to the mixture being heated. The mixture on standing at the above-named temperature separates into layers which can be run off separately, and the two constituents of the lac recovered from them.—E. W. L.

Resin-like condensation products ; Process for the production of ——. F. Pollak, Berlin. Eng. Pat. 13,431, June 7, 1912. Under Int. Conv., June 7, 1911.

See Fr. Pat. 447,969 of 1912 ; this J., 1913, 436. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 1921 of 1908. —T. F. B.

Gluten ; Process for the solution of —— *in formic acid.* G. G. Diesser, Zürich, Switzerland. Eng. Pat. 16,615, July 16, 1912.

See Fr. Pat. 446,349 of 1912 ; this J., 1913, 151.—T. F. B.

Bodies obtained from solutions of albumin in formic acid ; Process for increasing the elasticity of ——. G. G. Diesser, Zürich, Switzerland. Eng. Pat. 16,616, July 16, 1912.

See Fr. Pat. 446,348 of 1912 ; this J., 1913, 151.—T. F. B.

Varnishes ; Manufacture of ——. L. Meunier, Lyons, France. U.S. Pat. 1,067,536, July 15, 1913.

See Fr. Pat. 448,529 of 1911 ; this J., 1913, 436.—T. F. B.

Pine-oil, turpentine-oil, and the like ; Process for refining raw unrefined ——. J. Schindelmeiser, Dorpat, Russia. U.S. Pat. 1,068,174, July 22, 1913.

See Eng. Pat. 4775 of 1912 ; this J., 1912, 784.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Plantation rubber ; Sodium bisulphite in the manufacture of ——. C. Beadle, H. P. Stevens and S. Morgan. India Rubber J., 1913, **46**, 222—223.

Pale crêpe rubber can be and is prepared by inhibiting surface darkening through the addition of from 1 to 6 parts of sodium bisulphite to 2400 parts of the latex. The authors state that physical tests on vulcanised samples show very little difference between rubbers prepared with and without bisulphite, the former being perhaps slightly superior. This may be due to the fact that bisulphite tends to make the rubber dry rather more slowly. It is concluded that bisulphite preserves the pale colour without damaging quality but rather the reverse.—H. E. P.

Kickxia elastica rubber ; Valuation of ——. D. Spence and W. F. Russell. Kolloid-Zeits., 1913, **13**, 41—46.

Authenticated specimens of *Kickxia elastica* latex from Cameroon were coagulated by means of tannin and also by formalin, both alone and in presence of "kalaitin" and hydroxylamine hydrochloride. The resulting rubbers all appeared to be of very high grade, the loss on washing varying between 0·65 and 1·3 per cent., whilst the amount soluble in acetone was from 9·18 to 10·6 per cent., calculated on the washed and dried rubber. Ash was found to the extent of 0·38 to 0·69 per cent., whilst the nitrogen varied from 1·0 to 1·17 per cent., except in one case, when 0·48 per cent. only was found, in the sample coagulated with formalin and hydroxylamine ; this sample also differed from the remainder in colour, being yellow, whilst the others were brown, and it vulcanised less rapidly than the other specimens ; with all the *Kickxia* rubbers vulcanisation proceeds less rapidly than in the case of Hevea rubber. A number of vulcanisation tests were made at 141° C., using 6 per cent. of sulphur, on the rubber, alone or mixed with an equal weight of zinc oxide, and for different periods ; the physical properties of the products differed considerably amongst themselves, but, in general, the best of the products compared very favourably with high-grade plantation *Hevea* rubbers (see also this J., 1911, 436 ; 1913, 204).—T. F. B.

Ebonite ; Notes on the testing of —— *for electrical purposes.* C. C. Paterson, E. H. Rayner, and A. Kinnes. J. Inst. Elect. Eng., 1913, **50**, Pt. 217. Collected Researches, Nat. Phys. Lab., 1913, **10**, 175—187.

From the results of tests made at the request of the Admiralty the following specification has been drawn up for sheet ebonite used in the Navy. The ebonite should be made from the best Para rubber without adulteration. *Specific gravity* should not exceed 1·21. *Yield test.* A cantilever of the ebonite 25 mm. (1 in.) wide and 10 mm. ($\frac{3}{8}$ in.) thick, supporting a 1 lb. weight 152 mm. (6 in.) from the support shall be placed in an oven kept at 70° C. The point of support of the weight should not drop more than 15 mm. (about $\frac{5}{8}$ in.) in 2 hours, the distance dropped being measured before and after the test with the weight removed. *Electric strength.* The electric strength measured under the conditions described shall not be less than 125,000 volts per mm. (R.M.S.). For the test metal spheres 51 mm. (2 in.) diam., are fitted exactly into machined spherical recesses on opposite sides of the material so that the thickness of ebonite between the spheres is about 0·5 mm. An alternating potential difference with an approximately sine-wave distribution is put across the spheres, and the voltage gradually raised over a period of 1 minute until breakdown occurs. If the test be carried out under oil, a specimen 100 mm. (4 in.) diam. will suffice to prevent sparking round the edges. At least two specimens must be tested, and if one passes the test, the material shall not be rejected. The authors' tests showed that no other ebonite is equal in electric strength to that made from pure Para rubber and sulphur only. Plantation Para (obtained in 1909) did not give such good results as Brazilian Para rubber. Of the common adulterants, the only one which did not greatly diminish the electric strength was French chalk (powdered steatite). Whilst the test of electric strength is the only real criterion of quality for ebonite to be used for high-tension insulation, the sp. gr. and yield tests are very useful, as they will serve to eliminate nearly all but the best grades of ebonite. —A. S.

Butadiene hydrocarbons ; Pyrogenic decomposition of ——. H. Staudinger, R. Endle, and J. Herold. Ber., 1913, **46**, 2466—2477.

When isoprene is led through a tube heated to 750° C., it is converted to the extent of 45—55 per cent. into a tar, similar to coal tar, in which benzene, toluene, naphthalene, α-methylnaphthalene, anthracene, chrysene, etc., can be detected ; butadiene, hydrogen, methane, ethylene, and retort carbon are also formed. At 400°—500° C. isoprene is only partly decomposed, yielding terpene hydrocarbons similar to those formed as by-products in the polymerisation of isoprene to caoutchouc ; amylene is among the products. At 600°—700° C. a mixture of unsaturated hydrocarbons resembling a crude petroleum is obtained, together with gases (ethylene, propylene, butadiene). At 750° C. aromatic compounds are formed almost exclusively. The stability of isoprene is increased by dilution, *e.g.*, by diminishing the pressure ; at 20—25 mm. the decomposition at 700° C. is practically the same as that at about 500° C. at atmospheric pressure. At 15 mm. pressure isoprene can be distilled several times over a platinum spiral heated to bright redness (see this J., 1911, 1023) without being notably decomposed. These results show that in the preparation of isoprene or butadiene by pyrogenic reactions, favourable yields can be obtained only if strongly diluted vapours be used, and these be exposed to a high temperature for as short a time as possible. Butadiene, dimethylbutadiene, and amylene give somewhat similar results to isoprene on pyrogenic decomposition. Amyl and butyl alcohols yield no tar, but both yield small quantities of butadiene; among the products from amyl alcohol, ethylene and propylene were detected.—A. S.

Patents.

Caoutchouc and the like: Process and apparatus for coagulating the milk juice of plants furnishing ——. W. Pahl, Dortmund, Prussia. Eng. Pat. 24,156, Oct. 22, 1912.

Carbon dioxide from a bottle containing it in the liquid state is caused to pass through an injector-like atomising apparatus which is fed with latex. The latex is atomised and complete coagulation is stated to be effected. (Cf. this J., 1911, 225.)—E. W. L.

Impregnating material from viscose and rubber. Ger. Pat. 262,552. *See* VI.

Treatment of hides and manufacture of rubberised leather. Eng. Pat. 4488. *See* XV.

Manufacture of unsaturated hydrocarbons and intermediate products. Eng. Pat. 13,923. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Phenolcarboxylic acids; Carbomethoxy-derivatives of —— and their use for syntheses. IX. E. Fischer and M. Rapaport. Ber., 1913, **46**, 2389—2401.

Pyrogallolcarboxylic acid can be converted into its tricarbomethoxy-derivative, in good yield, by treatment several times in succession with methyl chlorocarbonate and alkali. The corresponding chloride, obtained from the carbomethoxy-derivative by means of phosphorus pentachloride, interacts with benzene and aluminium chloride to give a product, which on hydrolysis, yields 2.3.4-trihydroxybenzophenone (Alizarin Yellow A.). With *p*-hydroxybenzoic acid in alkaline solution, the chloride gives a product from which by elimination of the carbomethoxy-groups, the didepside, pyrogallol-carboyl-*p*-hydroxybenzoic acid, $(HO)_3C_6H_2.CO.O.C_6H_4(COOH)$, is obtained. (Carboyl is proposed as a name for the acyl group corresponding to carbonic acid.) By treatment of the chloride of the carbomethoxy-derivative with dextrose and quinoline in chloroform solution, in a similar manner to that previously described for the corresponding gallic acid derivative (this J., 1912, 503), penta-[tricarbomethoxypyrogallolcarboyl]-dextrose was obtained, and this on hydrolysis yielded a tannin-substance, pentapyrogallolcarboyldextrose, $C_6H_7O_6.[(HO)_3C_6H_2.CO]_5$, which is regarded as a structural isomeride of pentagalloyldextrose (*loc. cit.*). The pyrogallol derivative begins to sinter at about 160° C. and melts at about 200° C. with evolution of gas and slight discolouration. It differs from the gallic acid derivative chiefly by its very sparing solubility in cold water. It dissolves somewhat more easily in hot water, and the solution gives the ordinary tannin reactions. It is considered that the difference between the pyrogallol and gallic acid derivatives is in the power of forming colloidal solutions with water rather than in true solubility. This difference extends to the iron compounds of the tannins, hence unlike the iron compounds of the tannin from gallic acid, the iron compounds of the tannin from pyrogallol cannot be used for making inks. Two determinations of the optical activity of the tannin from pyrogallol in alcoholic solution at 18° C. gave $[a]_D = +69{\cdot}01°$ and $+69{\cdot}25°$ respectively.—A. S.

Gelatin: Swelling of —— in aqueous solutions. R. Ehrenberg. Biochem. Zeits., 1913, **53**, 356—390.

The author has carried out and tabulated the results of a large number of experiments upon the swelling of 10 and 20 per cent. gelatin jellies in water and in various aqueous solutions. The relative effect of different electrolytes on the swelling varies according to the concentration, *e.g.*, in concentrated solutions sodium sulphate is less active than sodium chloride and may even produce contraction, but in dilute solutions (less than 0·2 *N*) it is more active. If the salts are dissolved with the gelatin in making the original jelly, they diffuse out and behave in the same way as they would if originally dissolved in the outer solution. On the basis of these and other results the author believes that the swelling is not caused by a single process, but by two or more, and that a particular effect may preponderate according to circumstances. The whole process certainly cannot be explained on osmotic grounds, though osmotic phenomena are not excluded. Probably electroendosmose may play a part, the gelatin being enclosed by a polarisable membrane, and the electromotive force coming from diffusion or membrane potentials.—W. H. P.

Patents.

Belting; Composition for treating ——. A. Vacheron, Lyons, France. Eng. Pat. 20,554, Sept. 9, 1912.

A mixture of pine oleoresin (15 parts), clarified cod liver oil (30), petroleum oil (53), and nitrobenzene (2 parts by weight).—J. R. B.

Rubberised leather; Treatment of hides and manufacture of ——. J. Herbert, London. Eng. Pat. 4488, Feb. 21, 1913.

Raw hides are soaked in a solution of borax, then "blubbered," depilated after liming, treated with alum and placed in consecutive baths of (1) sulphuric acid, red arsenic, borax, asbestos dissolved in sulphuric acid, rubber solution, naphtha and benzine; (2) naphtha, borax and rubber solution.—J. R. B.

Tanning process for the preparation of sole-leather. P. Castiau, Renaix, Belgium. U.S. Pat. 1,067,796, July 22, 1913.

See Fr. Pat. 440,736 of 1912; this J., 1912, 830.—T. F. B.

XVI.—SOILS; FERTILISERS.

Patent.

Fertilizer; Process of making ——. O. K. Slater, Chicago, Ill. U.S. Pat. 1,067,224, July 8, 1913.

A mixture of slag and phosphatic material is disintegrated by the action of steam, and treated, while still moist, with sulphurous fumes. The product may then be subjected to the action of ammoniacal vapours.—E. W. L.

XVII.—SUGARS; STARCHES; GUMS.

Sucrose; Determination of —— by double polarisation in [beet] molasses. E. Saillard, A. Wehrung, and M. Ruby. Circ. hebd. Syndic. Fabric. Sucre France. Nos. 1260—1262, May, 1913.

In the case of beet molasses the usual double polarisation method of determining sucrose gives too low results (cf. this J., 1911, 62—64), owing to the influence of optically active nitrogenous substances and also to certain salts, which are always present. The error arising from the optically active nitrogenous substances may be avoided by the hydrochloric acid and urea process of acid direct polarisation, but that originating from the salts still remains, and the acidity after inversion of the pure sucrose solution used for determining the constant cannot be the same as that of the molasses analysed. The sulphurous acid polarisation (this J., 1912, 1195) is subject to the same disadvantages, and, moreover, gives results which are uncertain compared with the true hydrochloric acid polarisation, differences as high as 20 per cent., it is stated, being possible. Experiments on the action of the salts and optically active nitrogenous substances present in molasses, and of hydrochloric, sulphurous, and acetic acids on sucrose and invert sugar, have led the author to devise the following double polarisation process of determining the sucrose in beet molasses: 52 grms. of the sample are defecated with 20 c.c. of basic lead acetate, made up to 200 c.c., and filtered. 100 c.c. of the filtrate are treated with sulphurous or oxalic acid to precipitate the lead, the excess of the precipitant neutralised by dry calcium or barium carbonate, some decolourising carbon added if necessary, and the liquid filtered. For the direct reading, 50 c.c. of the solution are treated with sodium or potassium chloride containing the equivalent of the chlorine present in the hydrochloric acid used for inversion (6·5 c.c. of solution of sp. gr. 1·188), made up to 100 c.c., and polarised at 20° C. For the inversion reading. 50 c.c. of the solution are hydrolysed with 6·5 c.c. of hydrochloric acid (sp. gr. 1·188) in the usual manner, neutralised with sodium or potassium hydroxide, cooled, and polarised at 20° C. Finally, the constant to be used in the calculation of the percentage result is established under similar conditions to those of the actual determination.—J. P. O.

Hydrolysis of cellulose. I. Willstätter and Zechmeister. *See* V.

Patents.

Sugar crystals; Process and apparatus for separating syrup from —— or for liquoring sugar. W. Ritter von Proskowetz. Ger. Pat. 261,169, March 1, 1912.

The massecuite is placed in an upright, fixed cylindrical vessel with perforated wall, being kept as near the periphery as possible, and is subjected to the action of radial jets of compressed air issuing from the rotating axis of the cylinder. The massecuite is thrown against the wall of the cylinder by the jets of air, and the syrup passes through the perforations. By reason of the rotary motion imparted to the jets of air, fresh portions of the massecuite are continually exposed and stoppage of the perforations is avoided.—A. S.

Starch; Continuous drying apparatus, especially for ——. Sudenburger Maschinenfabrik und Eisengiesserei-A.-G. zu Magdeburg. Ger. Pat. 261,259, April 23, 1912.

The drying chamber is divided into a number of compartments, *e.g.*, sixteen, through which the starch, on suitable supports, is conveyed by means of an endless chain. A current of air is introduced into the last compartment, *e.g.*, the sixteenth, and after passing through say the next two compartments, and cooling the dried starch therein, is led out of the drying chamber to a heater, after which it is returned, say at the eleventh compartment, and passes through and dries the starch in the compartments up to No. 4, from which it is discharged.—A. S.

Beetroots; Treatment of ——. L. Dautrebande, Daussoulx, Belgium. U.S. Pat. 1,067,976, July 22, 1913.

See Fr. Pat. 414,329 of 1910; this J., 1910, 1222.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Hops; The constituents of ——. F. B. Power, F. Tutin and H. Rogerson. Chem. Soc. Trans., 1913, **103**, 1267—1292.

Kentish hops were extracted with hot alcohol and the extract distilled in a current of steam to remove the essential oil. From the portion of the extract soluble in water were isolated small quantities of choline and *l*-asparagine. The aqueous liquid also contained, besides tannin, a quantity of potassium nitrate and a sugar yielding *d*-phenylglucosazone, together with an amorphous substance with an intensely bitter taste. The portion of the alcoholic extract insoluble in water consisted of a dark-green oily resin equivalent to 14·1 per cent. of the hops. From this were isolated: ceryl alcohol, hentriacontane, a phytosterol, a phytosterol glucoside, a mixture of volatile fatty acids, saturated and unsaturated non-volatile acids, comprising palmitic, stearic and cerotic acids, a compound isomeric with arachidic acid, cluytinic and linolic acids; a new phenolic substance *humulol*, $C_{17}H_{18}O_4$, m. p. 196° C., yielding on hydrolysis *p*-hydroxybenzaldehyde; a new crystalline phenolic substance, *xanthohumol*, $C_{13}H_{14}O_3$, m.p. 172° C., tasteless and orange-yellow in colour. The authors conclude that the bitterness of hops is not due to any single substance, such as "hop bitter acid" or "lupulic acid," but is to be attributed to a number of products most of which are amorphous. Some of these substances are soluble in water, whilst others are constituents of the resin. The crystalline phenolic substance, humulol, possesses a bitter taste. The custom of differentiating the constituents as α-, β-, γ-resins is misleading, as the resinous material is far more complex in character than the methods employed for separating these three resin-fractions would indicate. The various products obtained from hops by ordinary processes of separation, and supposed to represent the bitter principles, are evidently of very indefinite nature. The resinous material contains a large proportion of the ordinary fatty acids and their esters; consequently methods of valuation based on the titration of extracts obtained by means of petroleum spirit, etc., must be of very doubtful utility.—J. F. B.

Hops; The nitrogenous constituents of ——. (Preliminary note.) A. C. Chapman. Chem. Soc. Proc., 1913, **29**, 182—184.

In 1910 the author (see Proc. Intern. Congress of Brewing, **1**, 93) succeeded in obtaining certain crystalline bases from hops. In view of the recently published paper of Power and others (see preceding abstract) an account of the author's further investigation so far as it has now gone is given.

In the first method of working the concentrated aqueous extract of hops was precipitated with basic lead acetate, and the filtrate, after the removal of the excess of lead, was precipitated with phosphotungstic acid and ammoniacal silver solution used for the precipitation of purines. Histidine, betaine, choline, and asparagine were isolated, together with other substances not, at present, identified.

In the second method the hops were mixed with lime, boiled with water, and the resulting mixture evaporated, dried, powdered, and extracted with alcohol. This extract was freed from alcohol, and precipitated with phosphotungstic acid. The solution of the bases thus obtained was precipitated with an ammoniacal solution of silver chloride, and from the resulting precipitate adenine and hypoxanthine were isolated. In the filtrate from the purine precipitate, betaine and choline were again obtained.

In the third method the hops were extracted with ammoniacal amyl alcohol, which was in turn extracted with water acidified with hydrochloric acid and the extract was treated with phosphotungstic acid.

In order to obtain confirmatory evidence as to the nitrogenous constituents present, a concentrated aqueous extract of hops was treated with a mixture of alcohol and acetic acid, filtered, the filtrate freed from alcohol, and the residue extracted with water. This aqueous extract was then treated systematically with various immiscible solvents.

Diastase modified by heat; Action of hydrochloric acid gas on ——. IX. T. Panzer. Z. physiol. Chem., 1913, **86**, 322—339. (See also this J., 1913, 41, 441, 547, 620, 669, 707, 708.)

The experiments on the action of dry hydrogen chloride upon diastase have been repeated, under comparative conditions, upon diastase previously rendered inactive by boiling its aqueous solution for 5 minutes, then precipitating with alcohol and drying. As regards the absorption of hydrogen chloride and the gradual removal of a portion of the latter on prolonged exposure to reduced pressure, the two kinds of diastase behaved very similarly. But, whereas active diastase contains an atomic grouping which absorbs hydrogen chloride without an equivalent increase in acidity, the modified diastase shows an increase in acidity equivalent to the hydrogen chloride absorbed. In ordinary diastase this is the group upon which its enzymic activity depends; by absorption of hydrogen chloride the diastase loses its activity but regains it when exposed to reduced pressure, whereby the hydrogen chloride is partially removed. On heating, this particular group is changed, so that the heated diastase is no longer active and no longer combines with hydrogen chloride in the special manner indicated. The heated diastase, however, is still capable of giving up a portion of its hydrogen chloride under reduced pressure, though more slowly than the original diastase, and in so doing it recovers a slight degree of enzymic activity which had been totally suppressed by the heating. It is probable that the hydrogen chloride attacks certain other groups of the inactive heated diastase, so modifying them that they give up a portion of the acid under reduced pressure and are converted into active groups.—J. F. B.

Diastase rendered inactive by heating; Action of ammonia on ——. X. T. Panzer. Z. physiol. Chem., 1913, **86**, 401—406.

The experiments were similar to those carried out with active diastase (this J., 1913, 441) and the results obtained were practically the same. The enzyme remained inactive, and the conclusions previously drawn (*loc. cit.*) are confirmed.—J. H. L.

Invertase. I. Purification by treatment with acids. J. Meisenheimer, St. Gambarjan and L. Semper. Biochem. Zeits., 1913, **54**, 108—121.

The preparation of invertase from Buchner's pressed yeast juice is more expeditious and yields a purer product than the use of yeast extract or autolysed yeast juice. A still purer product is obtained if, before the precipitation of the enzyme by acetone or alcohol, the pressed yeast juice is treated with acids (hydrochloric, or better still oxalic or sulphuric acid) to precipitate protein matter. A large excess of acid must be avoided, but the amount necessary to remove all the precipitable protein is usually not sufficient to injure the enzyme. The optimum amount of acid depends on the character of the yeast, and is best determined in each case by preliminary tests. The precipitate thrown down by acids is practically free from invertase, and the hydrolytic power of the enzyme subsequently precipitated by acetone or alcohol is 50—100 per cent. greater than when the acid treatment is omitted. The invertase may be further purified by the kaolin-treatment of Michaelis (this J., 1908, 416).—J. H. L.

Invertase. II. Raising the invertase-content of living yeast. J. Meisenheimer, St. Gambarjan and L. Semper. Biochem. Zeits., 1913, **54**, 122—154.

Pressed beer yeast was mixed with 5—10 times its weight of pure sucrose solution (10—20 per cent.), and after 1—2 days fermentation was arrested by addition of ice. The yeast was allowed to subside for several hours, then separated from the liquid, and a portion was withdrawn for investigation whilst the remainder was again mixed with sucrose solution and left for a few more days, and so on. The yeast withdrawn each time was tested by preparing pressed juice from it, precipitating the invertase by acetone, and determining the hydrolytic power of the precipitate. The invertase-content of the yeast stored in the sucrose solution increased fairly uniformly to far above the normal value (in one case an eight-fold increase was observed), and finally appeared to fluctuate about an upper limit. At the same time there was a falling off in zymase activity, and the yeast eventually became autolysed. The substitution of invert sugar or lævulose for sucrose in these experiments gave equally good results, whereas the influence of dextrose on the production of invertase was less by about 20 per cent. The treatment described by Euler and Johansson (this J., 1912, 245), appears to produce a more rapid increase in the invertase-content of yeast than the one now described, but the latter is more convenient for the purpose of obtaining invertase preparations of great activity.—J. H. L.

Bacillus lactis fermentens, a spore-forming organism producing butyleneglycol from lactose. Ruot. Comptes rend., 1913, **157**, 297—299.

This organism, of which the cells measure 3—5 μ by 0·5 μ, and the spores 1·5—2 μ by 0·9 μ, is a facultative anærobe and occurs fairly frequently in milk, especially in the summer. The spores resemble those of *B. subtilis*, and withstand heating for 5 mins. at 90° C. or for half a minute at 100° C. The organism forms greyish white, watery colonies on agar-agar, and in broth cultures it produces a mucilaginous mass at the bottom of the vessel, whilst the liquid remains clear but becomes viscous. The bacillus reduces nitrates to nitrites, liquefies gelatin, and coagulates milk with production of gas. It ferments dextrose, sucrose, lactose, mannitol and glycerol, forming in all cases carbon dioxide, hydrogen, alcohol, 2·3-butyleneglycol, acetylmethylcarbinol, and formic and acetic acids (see also this J., 1912, 247).—J. H. L

Wines; Influence of the yeast on the variations of dry extract and glycerol-content of ——. J. Ventre. Comptes rend., 1913, **157**, 304—307.

Wine yeasts show considerable differences in their effect on the dry extract of must. Yeast of champagne, *e.g.*, appears to produce a diminution comparable with the attenuation produced by certain yeasts in brewery worts. Yeast of Médoc, on the other hand, effects practically no change in the amount of dry extract present. Addition of sulphurous acid to must diminishes the attenuation produced by certain yeasts, notably by that of champagne. These differences are largely due to variations in the amount of glycerol formed by different yeasts, which in white wines may range from 3·2 to 4·1 per 100 parts of sugar originally present, or in the case of red wines from 3·6 to 4·2 parts. In musts treated with sulphurous acid the quantity of glycerol produced is practically the same in all cases (3·5—3·7 parts).—J. H. L.

Manufacture of sodium cyanide from vinasse. Vasseur. *See* VII.

Patents.

Water for brewing and malting purposes; Process for improving ——. E. Jalowetz, E. Richter, and A. Schückher, Vienna. Eng. Pat. 25,582, Nov. 7, 1912. Under Int. Conv., Nov. 13, 1911.

The water is heated in an open tank and stirred vigorously in order to cause precipitation of calcium and magnesium carbonates, which are then removed by decantation or filtration.—W. P. S.

Malting drums. F. Knüttel, and Berliner Act.-Ges. f. Eisengiesserei u. Maschinenfabr., Charlottenburg, Germany. Eng. Pat. 17,502, July 27, 1912.

See U.S. Pat. 1,064,490 of 1913; this J., 1913, 804.—T.F.B.

Preparation of yeast for food preparations. Eng. Pat. 26,697. *See* XIXa.

XIXa.—FOODS.

Wheat germ; Chemical examination of ——. F. B. Power and A. H. Salway. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 5—8.

In addition to sitosterol, the presence of the following substances in wheat germ has been confirmed: choline, betaine, allantoin, sucrose, dextrose, and raffinose. No evidence was obtained of the presence of asparagine. The fatty oil separated from the alcoholic extract amounted to 7 per cent. of the material used. The fatty acids consist of palmitic, stearic and linolic acids. Sinapic acid, $C_{11}H_{12}O_5$, is present in wheat germ in very small amount.
—F. Shdn.

Bacillus lactis fermentens, a spore-forming organism producing butyleneglycol from lactose. Ruot. *See* XVIII.

Patents.

Yeast for food preparations; Preparation of ——. E. Krause, Steglitz, Germany. Eng. Pat. 26,697, Nov. 20, 1912.

A mixture of washed yeast and sugar solution is allowed to ferment, and when fermentation is complete, the yeast is killed and is then subjected to further treatment in order to produce a food preparation in the usual manner. If desired, an excess of sugar may be employed so that the finished product shall contain a small quantity of sugar. —W. P. S.

Coffee substitute; Compound or beverage suitable as a ——. C. F. Erikson, Linköping, Sweden. Eng. Pat. 1824, Jan. 22, 1913.

Suitable grains, such as rye, are mixed with about 15 per cent. of their weight of juniper berries, the mixture is roasted and ground, and a decoction is prepared from the powder.—W. P. S.

Food product consisting of a jelly base. P. R. Boyles, Seattle, Wash. U.S. Pat. 1,067,714, July 15, 1913.

Two parts by weight of pectin are mixed with 1 part of tartaric acid so as to form a dry granular product.—W. P. S.

Beverage extract. W. H. Post, Assignor to Postum Cereal Co., Ltd., Battle Creek, Mich. U.S. Pat. 1,067,938, July 22, 1913.

Prunes are roasted sufficiently to caramelise the sugar, pulped and extracted, and the extract converted into a solid form, which can be dissolved to prepare beverages. —J. H. J.

Food product; Hydrogenated fatty ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,067,978, July 22, 1913.

Hydrogenated corn [maize] oil is combined with hydrogenated cottonseed oil or other fatty material so as to form a compound of lard-like consistence which is stable and free from tendency to spontaneous coagulation. —J. H. J.

Fruit product; Process of making a ——. C. Ellis, Montclair, N.J., Assignor to Ellis Foster Co. U.S. Pat. 1,068,047, July 22, 1913.

"Citrus fruit culls" are expressed and the juice clarified, sterilised and partially neutralised. At least half the water is then removed under diminished pressure at a low temperature, and the remainder by evaporation in thin layers in contact with dry air. The product is obtained in a lamellar form.—J. H. J.

Butter; Process for the manufacture of ——. Friwi-Butterungsverfahren Ges. m. b. H. Ger. Pat. 261,035, June 17, 1910.

The cream is strongly cooled, but without freezing, for 24 hours, then warmed to about 18°—20° C., treated with about 10 per cent. of an acid "starter," and after keeping for 4—6 hours at 18°—20° C., a further 10 per cent. of acid "starter" is added; the mixture is then cooled to about 10°—13° C. and allowed to ripen for 18—20 hours at this temperature, after which conversion into butter is effected in the usual manner.—A. S.

Animal carcases, slaughterhouse refuse, and the like; Process and apparatus for the treatment of ——. A. Sommermeyer. Ger. Pat. 261,146, Jan. 6, 1912. Addition to Ger. Pat. 258,689 (see Eng. Pat. 8898 of 1911; this J., 1912, 200).

The material, preferably cut up, is introduced continuously into the cylinder described in the chief patent (*loc. cit.*), through a pipe provided with a tapering portion, in which works a screw of similar shape. By this means the material itself forms a vapour-tight seal and prevents a lowering of the pressure in the cylinder.—A. S.

Egg albumin; Process for increasing the froth-forming properties of ——. P. Meyersberg. Ger. Pats. 261,435 and 261,436, Nov. 23 and Dec. 21, 1912.

(1). The albumin is mixed with pectin substances or gluten or with collagen or products of hydrolysis of proteins. (2). Starch or starch paste is added to the albumin, in addition to the products of hydrolysis of proteins. These additions increase the value of albumin for the manufacture of confectionery.—A. S.

Confectionery [from molasses]; Manufacture of ——. M. F. Hahn, Hamburg, Germany. Eng. Pat. 21,284, Sept. 18, 1912.

See Fr. Pat. 451,352 of 1912; this J., 1913, 619.—T. F. B.

Coffee substitute from soya beans; Process and apparatus for the preparation of a ——. H. Buer, Cologne, Germany. Eng. Pat. 24,535, Oct. 26, 1912.

See Fr. Pat. 446,237 of 1912; this J., 1913, 157.—T. F. B.

Butter and cream; Process of manufacturing sterile ——. E. W. Kuhn, London. U.S. Pat. 1,067,743, July 15, 1913.

See Eng. Pat. 19,298 of 1911; this J., 1912, 554.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Micro-organisms capable of producing arsine. H. Husz. Svensk Farmaceutisk Tidskrift, 1913, No. 16. Apoth.-Zeit., 1913, **28**, 605—606.

Of 90 different moulds investigated, the following were found to produce arsine from arsenical compounds:—*Penicillium brevicaule* (two forms), *Aspergillus candidus* and *clavatus* and three other *Aspergillus* forms, termed provisionally A, D and T, two of which constituted the chief flora on oil paint taken from the damp walls of a room. On the same paint was found an active *Actinomyces* form which appears to be widely distributed; when grown in lactose- or maltose-agar cultures the colonies assumed a chalky white appearance after some time, owing to spore-formation. Another active organism, not fully characterised, was probably related to *Penicillium brevicaule*, and possessed a chocolate brown colour. —J. H. L.

Patents.

Sewage and other liquids; Centrifugal treatment of ——. J. Bromet, Tadcaster, F. Thorman, Newton Kyme, and H. C. Wood, Tadcaster, Yorks. Eng. Pats. 22,836, Oct. 7, and 25,578, Nov. 7, 1912.

The centrifuge consists of three concentric pans with vertical sides and flat tops and bottoms. The outer and intermediate pans differ only slightly in diameter but the inner pan is much smaller. The outer and inner pans are driven from a central shaft, and the intermediate pan independently from a sleeve on the shaft. The screened sewage, with or without a precipitant, is added through a central funnel and passes to the periphery of the intermediate pan on which the solids are deposited, while the liquid passes to the open bottom of the inner pan and flows upwards through it, and escapes at the top by pipes rigidly connected to the top of the outer pan. When it is required to discharge the collected solids, the machine is stopped or not as desired, and valves in the bottom of the outer pan are opened by link motions, worked by a hand lever, to allow the water held up to escape; then the intermediate pan is fixed, and scrapers on the outside of the inner pan remove the solids from the face of the intermediate pan through the open valves on to a travelling belt below.—J. H. J.

Water and other liquids; Apparatus for the purification of ——. M. D. Avery, Kansas City, Mo. U.S. Pat. 1,066,570, July 8, 1913.

A vertical rotatable rod is fitted in a closed tank which contains the water to be treated; plates having central openings and separated by insulators are attached to the central rod and are clamped together. A current of electricity is supplied to the plates, which act as electrodes. —W. P. S.

Water sterilised by means of halogens or hypohalogenites; Process for rendering —— odourless and potable. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 260,653, March 15, 1912.

The sterilised water is treated with hydrogen peroxide or similar peroxides or per-compounds.—A. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Opium for pharmaceutical purposes; Standardisation of ——. "Normal opium." P. van der Wielen. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 2—3.

For the standardisation of morphine in opium the lime method of the British and Dutch Pharmacopœias is to be preferred to those in which ammonia is used. Meconic acid can be determined by a modification of a method proposed in 1830 by Ure. 1 grm. of opium is macerated for 24 hours with 100 c.c. of water with frequent shaking. The liquid is filtered and 25 c.c. of the filtrate mixed with 5 c.c. of Goulard's extract [basic lead acetate solution]. After standing for 15 minutes the precipitate is filtered off, washed with water till colourless and dissolved in warm *N*/10 hydrochloric acid, the volume being made up to 100 c.c. This solution has a yellowish colour. 50 mgrms. of meconic acid are dissolved in *N*/10 hydrochloric acid and a 0·1 per cent. solution of Orange G is added in such a quantity that when the whole is made up to 250 c.c. the colour is the same as that of the meconic acid solution from the opium. 5 c.c. of each of the two solutions are placed in a small flask with parallel sides about 1 cm. apart and divided into two parts of about 10 c.c. capacity. One drop of ferric chloride solution is added to each liquid. Water is then added from a burette to the darker of the two liquids so as to make the colours of both the same. The quantity of meconic acid can then be calculated. The author suggests that the morphine, narcotine, codeine and meconic acid should be determined in a large number of samples of opium. By choosing suitable proportions of these and mixing them, it should be possible to prepare an opium containing standard amounts of the above active principles. There is more likelihood of obtaining opium with a uniform therapeutic activity by this method. It is to be preferred to dilution of opium with starch or milk sugar added in amounts sufficient to reduce the morphine content to 10 per cent.—F. Shdn.

Strychnine and brucine. [Action of bromine on isostrychnine.] R. Ciusa and G. Scagliarini. Gaz. chim. ital., 1913, **43**, II., 59—62. (See this J., 1912, 201.)

Isostrychnine (this J., 1905, 1123) when treated with bromine in glacial acetic acid solution yields a perbromide, $C_{20}H_{24}NBr_3(:NH)COOH$. When this is treated with boiling alcohol for purification, the corresponding ethyl ester is produced. When tested physiologically the perbromide shows a stronger curare-like action than isostrychnine itself, and none of the characteristic action of strychnine.—A. S.

Isoquinicine, a transformation product of isoquinidine (isoconquinine) analogous to quinicine. M. Pfannl and E. Wölfel. Monatsh. Chem., 1913, **34**, 963—972.

Quinicine is a product isomeric with, and obtained from quinidine by heating its disulphate to 140° or 150° C. As one of the authors has shown (this J., 1911, 709), quinidine is converted, on treating with concentrated sulphuric acid, into isoquinidine, and it is now shown that isoquinidine yields a product similar to but not identical with quinicine. Both are red brown oily substances giving crystalline salts. Their difference is best shown by the specific rotatory powers of their oxalates, quinicine oxalate giving $[\alpha]_D = +10°$, isoquinicine oxalate $[\alpha]_D = -9°$. The fact that isoquinicine is a single substance was shown by a fractionation of the oxalate, which did not affect the specific rotatory power.—W. H. P.

"Jambulol"; Identification of —— as ellagic acid. F. B. Power and T. Callan. Pharm. J., 1913, **91**, 245.

The phenolic substance isolated from jambul seeds (this J., 1912, 1051), which was named "jambulol," and which has also been detected in Chinese rhubarb (Chem. Soc. Trans., 1911, **99**, 962, and Proc., 1912, **28**, 96) and in *Euphorbia pilulifera* (this J., 1913, 505), has since been identified as ellagic acid, $C_{14}H_2O_4(OH)_4$.—A. S.

Essential oils; Constituents of ——. Reduction in the sesquiterpene series. F. W. Semmler and F. Risse. Ber., 1913, **46**, 2303—2308.

When eudesmene dihydrochloride (this J., 1913, 766) is boiled with alcoholic potassium hydroxide solution, eudesmene is produced. This was reduced in glacial acetic acid by means of hydrogen and finely divided platinum. In this way tetrahydroeudesmene, $C_{15}H_{28}$, was produced. After distilling over sodium, it boils at 122°—122·5° C. at 7·5 mm., and has the sp. gr. 0·8893 at 20° C., $n_D = 1·48278$, and $[\alpha]_D = +10° 12'$. When eudesmol has been carefully purified it can be reduced under the same conditions with the formation of the same hydrocarbon. If the reduction is carried out in ether instead of acetic acid, dihydroeudesmol is produced (*loc. cit.*). Purified guaiol is reduced in acetic acid by hydrogen and platinum to tetrahydroguaiene, $C_{15}H_{28}$, which boils at 118°—119° C. at 7 mm., has the sp. gr. 0·8806 at 20° C., $n_D = 1·47840$, and $[\alpha]_D = +10° 36'$. Tricyclic santalol (b. pt. 147°—148° C. at 4·5 mm.) was reduced in the same way with the production of tetrahydrosantalene, $C_{15}H_{28}$, which is bicyclic. Its characters are: b.pt. 115°—116° C. at 9 mm., sp. gr. 0·8655 at 20° C., $n_D = 1·46908$, $[\alpha]_D = +5° 36'$. When bicyclic santalol (b. pt. 158°—158·5° C. at 5 mm.) was reduced, a hydrocarbon and an alcohol were obtained. The hydrocarbon had the composition, $C_{15}H_{28}$, and the following characters: b. pt. 119° C. at 10 mm., sp. gr. 0·8550, $n_D = 1·46612$, $[\alpha]_D = +2° 48'$. The composition of the alcohol was $C_{15}H_{28}O$ and the characters were b.pt. 155°—160° C. at 10 mm., sp. gr. 0·9380, $n_D = 1·48471$, $[\alpha]_D = +4° 24'$.—F. Shdn.

Geranium oils: Proportion and composition of the alcohols in ——. W. H. Simmons. Brit. Pharm. Conf., 1913, Pharm. J., Special Issue, 31—32.

When citronellol is boiled with twice its volume of 98—100 per cent. formic acid for an hour in a reflux apparatus, it is not completely converted into the formyl ester. When geraniol is subjected to the same treatment the conversion into terpene is likewise incomplete. The addition of anhydrous sodium formate does not affect the result. However, useful results can be obtained with regard to geranium oils by determining the total alcohols by acetylation and then estimating the citronellol by the above formylation process. Examined in this way, the alcohols from African geranium oil contain from 42 to 61 per cent. of citronellol, whilst those from Bourbon geranium oil contain 61 to 73 per cent.—F. Shdn.

Reduction with colloidal platinum or palladium; Suitable apparatus for ——. O. Stark. Ber., 1913, **46**, 2335—2336.

In order to avoid the accidental introduction of air or mercury when reducing by means of hydrogen and colloidal platinum a special apparatus has been constructed. It consists of a glass vessel with two necks, each provided with a glass stopcock. A small funnel with a stopcock is fused into the upper part of the vessel between the two necks. One neck is connected with the source of hydrogen, the other with a graduated gas burette and mercury reservoir. The substance to be reduced is placed in the glass vessel and a current of hydrogen passed through. At this stage the burette and reservoir contain no mercury. The hydrogen supply is then cut off and mercury poured into the reservoir from which it flows and partly fills the burette. By lowering the reservoir, a solution of platinum or palladium can be introduced through the funnel with the stopcock without admitting any air.—F. Shdn.

Absolute alcohol; Application of Young's method for preparing ——. G. Chavanne. Bull. Soc. Chim. Belg., 1913, **27**, 205.

The author suggests that the benzene used by Young (this J., 1902, 721) should be replaced by acetylene dichloride. Both of the isomeric dichlorides form binary mixtures with alcohol, and ternary mixtures with alcohol and water, with minimum boiling points. The loss of alcohol in the ternary mixture is about the same as it would be with benzene, but the great advantage is that the boiling point of absolute alcohol is 20·6° C. higher than that of the less volatile binary mixture. It is not likely, however, that this method will in practice prove superior to dehydration by lime.—W. H. P.

Medicine glasses; Examination of ——. E. Richter. Apoth.-Zeit., **28**, 1913, 588—589.

The results are given of the examination of a number of glasses used in pharmaceutical work, in regard to the alkali loss. The glasses were rinsed with hydrochloric acid and distilled water, and tested for varying times with a 0·1 per cent. solution of narcotine hydrochloride, specially prepared in a Jena apparatus glass bottle. The quality of the glasses was judged by the time during which the liquid remained clear and did not become cloudy. An ampulla, and Jena normal-glass 16 III. remained clear more than 24 hours. Suprarenin is also very sensitive to the alkali given up by glass to liquids, but it was found that bottles in which synthetic *l*-suprarenin is supplied do not withstand the narcotine test best. Suprarenin, however, by itself has an acid reaction, which tends to neutralise the alkali given up by the glass. The testing of glass for pharmaceutical work is important, for when some of the litre flasks examined were filled with distilled water, and heated for 1 hour in steam, needles and scales of hydrated silicic acid separated from the glass, and the contained water gave an alkaline reaction. The scales could be distinctly observed under the microscope against a dark background, and if present in a sterilised liquid, prepared for injection into the human frame, would be very dangerous in the blood system owing to the tearing effect of the sharp angles.—W. C. H.

Determination of hypophosphites, with notes on commercial samples. Cocking and Kettle. *See* VII.

Composition of certain formates. Hampshire and Pratt. *See* VII.

Patents.

Unsaturated hydrocarbons and intermediate compounds; Manufacture of ——. F. E. Matthews, Blackheath, and H. J. W. Bliss, Stockwell. Eng. Pat. 13,923, June 15, 1912.

In the manufacture of hydrocarbons with two double linkages from dihalogen-hydrocarbons, the halogen atoms are, in some cases, in a position favourable to the formation of allene or acetylene derivatives rather than those with conjugated double linkages. It is now found that the dichloro-compounds of hydrocarbons may be made to undergo an intramolecular rearrangement by heating to temperatures below the decomposition point. The process is especially applicable to the treatment of the 1.2-dichlorohydrocarbons, with a primary carbon atom in the 1-position, which can only yield allenes or acetylenes; when treated by the process described, isomeric dihalogen compounds, convertible into compounds with conjugated double linkages, are formed. For example, 1.2-dichloro-3-methylbutane (b. pt. 144° C.) is passed in the state of vapour through a silica tube heated to 324°—336° C., the product is condensed and run back to the boiling flask, and the circulation is continued for about four hours; by fractionating the product, nearly 50 per cent. of fractions of b. pt. 130°—140° C., and consisting chiefly of 2.3-dichloro-3-methylbutane (b. pt. 137° C.) is obtained. The 2.3-dichloro-compound may be readily converted into isoprene.—T. F. B.

Dinitrophenylarsinic acid; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,667, Oct. 28, 1912. Under Int. Conv., Nov. 16, 1911.

2.4-Dinitrophenylarsinic acid may be obtained in good yield by treating diazotised 2.4-dinitraniline with an arsenite or its equivalent in presence of excess of acid. The reaction does not take place in neutral or alkaline solutions. The new compound is readily soluble in hot water and in alkali solutions, also in acetic acid, methyl alcohol, and ethyl alcohol, but insoluble in ether. Its aqueous solutions colour Congo-paper violet. It melts at 199°—200° C.—T. F. B.

Nitro-aminophenylarsinic acid; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,668, Oct. 28, 1912. Under Int. Conv., Nov. 16, 1911.

Nitro-acidylaminophenylarsinic acids ($AsO_3H_2 : NO_2 : NHAc = 1 : 2 : 4$), obtained by the action of arsenious acid on the diazo compound of the acidylnitro-*p*-phenylenediamine, can be converted into a new *o*-nitro-*p*-aminophenylarsinic acid by heating them with acid or alkaline saponifying agents. When heated, the product becomes dark at 240° C. and melts at about 258° C., with decomposition.—T. F. B.

4.4′-Dihydroxy-3.3′-diaminoarsenobenzene; Preparation of soluble, stable compounds of ——. A. Dering. Ger. Pat. 261,542, Oct. 19, 1912.

The salts of the dihydroxydiaminoarsenobenzene with acids are treated with the alkali salts of lysalbinic or protalbinic acid, or other albumin decomposition product, or of nucleinic acid or casein; the insoluble addition products are dissolved in alkali hydroxide solution, and the alkali salts are separated from the solutions either by precipitation with ether-alcohol or by evaporation *in vacuo*.—T. F. B.

Nitro-3-aminobenzene-1-arsinic acid; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 261,643, Dec. 23, 1911.

3-Oxalylaminobenzene-1-arsinic acid is treated with a nitrating agent, and the oxalyl group is subsequently eliminated (compare Ger. Pat. 256,343 of 1911; this J., 1913, 380).—T. F. B.

Aromatic stibinic acids; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 261,825, Aug. 6, 1912. Addition to Ger. Pat. 254,421 (see Eng. Pat. 16,350 of 1912; this J., 1913, 109).

An aromatic amine is diazotised in presence of an acid salt of antimony, or a double compound of a halogen compound of antimony with the diazo compound of an aromatic amine, whether isolated or not, is decomposed by means of alkali.—T. F. B.

Pharmaceutical preparations; Process of manufacturing ——. E. Scheitlin, Basle, and E. Kunz, Geneva, Assignors to L. Givaudan, Geneva, and E. Scheitlin, Basle. U.S. Pat. 1,068,083, July 22, 1913.

1-Phenyl-2.3-dimethyl-5-pyrazolone and acetyl-*p*-phenetidine are crystallised together. A new article is claimed, consisting of crystals of 1-phenyl-2.3-dimethyl-5-pyrazolone, 1-phenyl-2.3-dimethyl-4-sulphamino-5-pyrazolone, and acetyl-*p*-phenetidine.—T. F. B.

Mercury substituted aryloxy-fatty acids and their salts; Process for preparing nucleus ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 261,229, March 26, 1912.

Nucleus substituted mercury derivatives of aryloxy-fatty acids are obtained by heating the acids with mercuric oxide or a mercuric salt, or by heating a mercuric salt of an aryloxy-fatty acid, with or without addition of a diluent or solvent, and subsequently converting the mercury-anhydride compound into the salt of the acid. The new products are said to be applicable to medicine.—T. F. B.

Mercury compounds of aminosulphonic acid soluble in water and stable to alkalis; Process for preparing ——. K. Hofmann. Ger. Pat. 261,460, May 8, 1912.

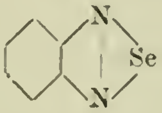
The alkali salts of aminosulphonic acid are treated with mercuric oxide or a mercuric salt in alkaline solution. The products are soluble in water and are not decomposed by alkalis or soaps: the constitution of the sodium salt, for example, is represented by the formula, $HgN.SO_3Na$. —T. F. B.

Silver salts of mercury-carbon compounds; Process for preparing soluble ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 261.875, April 28, 1912.

The silver salts of mercury-carbon compounds are allowed to react with the alkali salts of amphoteric or feebly acid carbon-nitrogen compounds. The products are soluble in water, and appear to be addition compounds.—T. F. B.

Piaselenol; Process for preparing derivatives of —— *soluble in alkali.* F. Heinemann. Ger. Pat. 261,412, Feb. 28, 1912.

By treating derivatives of aromatic *o*-diamines containing acidic groups (hydroxy-, carboxy-, sulphonic) with selenious acid or its salts, derivatives of piaselenol,



are obtained, which are soluble in alkalis. They may be used for medicinal purposes.—T. F. B.

a-Bromo-isovaleric acid derivatives; Process for preparing ——. A. Liebrecht. Ger. Pat. 261,877, Aug. 30, 1912.

When an acid halogenide of a-bromo-isovaleric acid is allowed to react with a primary aliphatic amine, products are obtained which are said to possess powerful sedative and soporific properties.—T. F. B.

Curative agent for cancer; Process for preparing a ——. E. Merck. Ger. Pat. 262,157, May 15, 1912. Addition to Ger. Pat. 257,473.

As a variation of the process described in the principal patent and in Ger. Pat. 257,474 (see this J., 1913, 507), the internal organs of animals which have been treated with gaseous or dissolved radioactive substances, either by subcutaneous injection or by internal administration, are extracted with the serum drawn from the animals.—T. F. B.

Azo dyestuff compounds for therapeutic use; Process for preparing ——. R. J. Zink. Ger. Pat. 262,476, March 14, 1912.

Diazotised aminoazotoluene is allowed to react with an ester of *p*-aminobenzoic acid or of *p*-hydroxybenzoic acid. The products are stated to possess anæsthetic properties, as well as being applicable to the treatment of skin complaints.—T. F. B.

Dichlorethylene; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 16,620, July 16, 1912.

See Ger. Pat. 254,069 of 1911; this J., 1913, 212.—T. F. B.

Pharmaceutical compound [from apocynaceae]; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,414, Aug. 10, 1912.

See Ger. Pat. 255,537 of 1911; this J., 1913, 450.—T. F. B.

Isopentenes and homologues thereof; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 18,653, Aug. 14, 1912.

See Fr. Pat. 450,461 of 1912; this J., 1913, 624.—T. F. B.

Remedies for beri-beri; Process for preparing ——. J. Tsuzuki, Suginami, Japan. Eng. Pat. 25,322, Nov. 5, 1912.

See U.S. Pat. 1,058,927 of 1913; this J., 1913, 550.—T. F. B.

Bromide preparations for alimentary purposes; Manufacture of ——. F. Hoffmann-La Roche und Co., Grenzach, Germany. Eng. Pat. 26,365, Nov. 16, 1912. Under Int. Conv., April 2, 1912.

See U.S. Pat. 1,054,258 of 1913; this J., 1913, 380.—T. F. B.

Metal adsorptions; Method of producing ——. Ges. f. Elektro-Osmose m. b. H., Frankfort, Germany. Eng. Pat. 29,049, Dec. 17, 1912. Under Int. Conv., Jan. 8, 1912.

See Ger. Pat. 252,372 of 1912; this J., 1912, 1201.—T. F. B.

Formaldehyde; Process for the manufacture of ——. M. J. Kusnezow, Charkow, Russia, Assignor to Perth Amboy Chemical Works. U.S. Pat. 1,067,665, July 15, 1913.

See Fr. Pat. 412,501 of 1910; this J., 1910, 1033.—T. F. B.

Ether; Apparatus for producing ——. D. Annaratone, Settimo Torinese, Italy. U.S. Pat. 1,067,709, July 15, 1913.

See Fr. Pat. 408,089 of 1909; this J., 1910, 592.—T. F. B.

Preparation of mercury; Process for producing an effective ——. E. Scheitlin, Basle, Switzerland. U.S. Pat. 1,068,172, July 22, 1913.

See Ger. Pat. 261,081 of 1911; this J., 1913, 768.—T. F. B.

Manufacture of dyestuffs. Eng. Pat. 5710. *See* IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Photographic reproduction of colours. E. C. G. Caille, Paris. Eng. Pat. 15,935, July 8, 1912. Under Int. Conv., July 6, 1911.

See Fr. Pat. 445,787 of 1912; this J., 1912, 1202.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosion; Circumstances attending an —— *which destroyed a guncotton stove in the factory of the British Explosives Syndicate, Ltd., at Pitsea, Essex, on March* 28, 1913. Captain R. A. Thomas, H.M. Inspector of Explosives. [Cd. 6949.]

Three men were killed as the result of this explosion. There were 2300 lb. of dried guncotton in the stove, which was lightly constructed of wood, with brick foundations set in concrete. The roof was made of sheet zinc, and the close-joined wooden floor was covered with lead. The interior was lined with sheet zinc, and all lining joints, joints with hot air pipes, and heads of tacks were soldered to prevent dust from getting behind the lining. A substantial clay mound 3 ft. thick at the top and 9 ft. at the bottom, revetted with corrugated iron sheets, surrounded the building to the height of the eaves. The stove was heated by hot air which entered the building through large gauze-covered pipes at intervals round three sides, and on

the fourth passed out through ventilators fitted with traps for catching dust. There were no steam pipes in the building. Loose wet guncotton was spread on trays (2 ft. 10 in. by 2 ft. 3 in.) made of brass wire gauze framed in wood. The trays were placed in wooden racks and arranged two abreast in six tiers. The racks, 6 ft. by 2 ft. by 6 ft. high, were not fixed to the floor or walls. The temperature of the stove was kept as nearly as possible at 110° F. (43° C.). The time taken for drying was about 40 hours. A large crater 18 ft. by 20 ft. by 4 ft. 6 in. deep was formed near the site of the door, its centre being the position where filled bags of dry guncotton were usually placed. A small crater was formed on the opposite side of the building at what would have been the position of the end of one of the passages between the racks. Many of the factory buildings were seriously damaged—in almost all cases by the force of the explosion, and not by projected *débris*. In the mixing house, 93 yards away, the mixing machines were at work on nitroglycerin and nitrocotton paste. Windows were shattered and paraffin oil lamps and broken glass were thrown into the building, glass falling into all the pans. The machines were injured and the mixing blades were twisted and brought into contact with the bottom of the pans. They continued to run, mixing the broken glass with the explosive. Captain Thomas considers that the most probable cause of the accident was some act on the part of one of the workmen in unloading the stove. The following recommendations and suggestions are made:—In buildings of the nature of guncotton stoves a "use-list" of all implements should be kept, and the implements systematically inspected. The possibility of lamps being blown into danger buildings from the outside, and of glass falling into machines, should be guarded against. Buildings of such light construction as was the case in this accident are considered not to be entirely satisfactory, since they are neither proof against the danger of projecting *débris* in the case of an explosion in the building, nor are they strong enough to resist heavy projected *débris*, distortion or fracture, from the force of an explosion in their vicinity. (See also this J., 1913, 626.)
—G. W. McD.

Patents.

Explosives; Composition for use with —— for neutralising noxious fumes therefrom, after explosion. W. H. Mawdsley, Mount Morgan, Queensland. Eng. Pat. 16,484, July 15, 1912.

Lime is slaked with a solution of an alkali hydroxide, and the product is mixed with kieselguhr, potassium permanganate or chlorate and sodium chloride, made into cartridges and placed in the borehole on top of the charge.
—G. W. McD.

Explosives; Waterproof and damp-proof coating material especially applicable to ——. C. W. Hunter, Barrow-in-Furness. Eng. Pat. 17,155, July 23, 1912.

Collodion varnish mixed with 5—20 per cent. of its weight of tung oil.—W. E. F. P.

Explosives. O. Silberrad, Buckhurst Hill, Essex. Eng. Pat. 19,381, Aug. 24, 1912.

Claim is made for the use of any nitrated alkyl derivative of naphthalene or derivative thereof. The following compositions are given. Nitromethylnaphthalene (20—25 parts) oxygen-bearing salts (50—60), collodion cotton (0—5) and wood meal (0—5 parts). Nitromethylnaphthalene (20—25 parts), potassium perchlorate (50—60), nitroglycerin (15—25), collodion cotton (0·5—4) and wood meal (0—10 parts). Cordite mark I. (50—95 parts) and nitromethylnaphthalene (50—5 parts). Mercury fulminate (90—95 parts) and trinitromethylnaphthalene (5—10 parts) (see also this J., 1912, 978, 1055).—G. W. McD.

Sifting device for priming and detonating compositions highly sensitive to friction. Westfälisch-Anhaltische Sprengstoff-A.-G. Ger. Pat. 260,405, Oct. 22, 1912.

An upper coarse-mesh horsehair sieve rests dust-tight on a lower horsehair sieve of closer mesh, the bottom of which is inclined. At the lowest part of this sieve is an opening from which a rubber tube leads to a box. Below the inclined bottom of the sieve and fixed dust-tight thereto is a rubber funnel the stem of which extends downwards into a receptacle containing water, opening below the level of the water. A charge of the explosive composition is placed in the upper sieve, which is then covered, and the device is given a vibratory motion. The material falls through into the lower sieve. Here the granular material rolls downwards along the inclined bottom and is discharged through the rubber tube, whilst the dust passes through the sieve into the rubber funnel and is discharged into the receptacle below the water level.—A. S.

Smokeless powders; Process for the preparation of porous ——. W. Eberlein. Ger. Pat. 260,604, Feb. 12, 1911.

Nitrohydrocarbons are added to the powder during the gelatinisation process, and are subsequently partially or completely removed from the finished powder by means of a suitable solvent.—A. S.

Explosive compositions for blasting; Use of ——. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. Eng. Pat. 3245, Feb. 7, 1913. Under Int. Conv., March 19, 1912 Addition to Eng. Pat. 3102 of 1913, dated Feb. 8, 1912.

See Addition of March 19, 1912, to Fr. Pat. 451,265 of 1912; this J., 1913, 768.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Volumetric analysis; Mercuric oxide as a standard for ——. L. Rosenthaler and A. Abelmann. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 32—33.

Mercuric oxide in the presence of sodium chloride dissolves in the equivalent quantity of hydrochloric acid to form the neutral compound, $HgCl_2,2NaCl$. For iodometry, the oxide is dissolved in hydrochloric acid and a slight excess of potassium iodide added. The whole is made alkaline and formaldehyde solution added, causing the liberation of metallic mercury. The mixture is acidified with acetic acid and excess of standard iodine solution added. After shaking, the unused iodine can be titrated with thiosulphate. The metallic mercury reduced as above can be used to standardise permanganate. For this purpose the mercury is filtered off, washed well and shaken with the permanganate solution in the presence of excess of sulphuric acid.—F. Shdn.

Sodium thiosulphate solutions. C. H. Hampshire and W. R. Pratt. Brit. Pharm. Conf., 1913. Pharm. J., Special Issue, 30—31.

The authors found that $N/10$ solutions of sodium thiosulphate remained unaltered in strength for many weeks even when exposed to daylight in white glass bottles. It is immaterial whether the pure re-crystallised or the ordinary salt be used.—F. Shdn.

Iodine-ions; A reaction of ——. R. Ciusa and A. Terni. Gaz. chim. ital., 1913, **43**, II., 86—90.

The production of the reddish-brown substance formed in the Nessler test for ammonia may be used for the detection of iodides. The reagent is prepared by dissolving 10 grms. of mercuric nitrate in 50 c.c. of water acidulated with 5 c.c. of nitric acid, and then adding 60 c.c. of concentrated ammonia solution. 1 c.c. or more of this solution is added to the solution under examination. The reaction is more delicate than any of those hitherto used for the detection of iodides. Chlorides give a white precipitate which does not interfere with the test. Bromides may give a white or yellow precipitate according to the concentration, but if the mixture of the solution and the reagent be heated, the yellowish- or brownish-red colour due to iodide becomes apparent.—A. S.

Chromium ; Detection of ——. A. Terni. Gaz. chim. ital., 1913, **43**, II., 63—65.

THE solution containing the chromium salt is treated with concentrated nitric acid and a small quantity of lead dioxide, heated to boiling, then diluted with water, and allowed to settle ; the presence of chromium is indicated by a yellow colour due to lead chromate. In the case of very small quantities of chromium, the solution is decanted from the excess of lead dioxide and treated with hydrogen peroxide and ether in the known manner, a blue coloration indicating the presence of chromium. The test is very sensitive. In presence of iron the yellow colour may be masked : in such cases the chromium may be detected by means of hydrogen peroxide and ether, or the lead chromate may be precipitated by addition of excess of sodium acetate. In presence of manganese, after boiling with nitric acid and lead dioxide, a small quantity of hydrochloric acid is added to the hot solution : the violet colour due to permanganic acid is destroyed and the yellow colour due to lead chromate becomes apparent.—A. S.

Chromium and aluminium ; Quantitative separation of ——. *Analysis of chromite.* F. Bourion and A. Deshayes. Comptes rend., 1913, **157**, 287—289.

THE method described for the separation of chromium and iron (this J., 1913, 713) may be applied also to mixtures of chromic oxide and alumina. If the mixture contains more than 20 per cent. of chromic oxide it is necessary to add ammonium sulphate (*loc. cit.*). The method was successfully applied to the analysis of a sample of chromite containing oxides of chromium, iron, aluminium and magnesium, and a little lime and silica. It was found necessary first to mix the chromite with mercuric sulphate and heat gradually to redness. The metals were thus converted into sulphates which were again partially decomposed, but after this treatment a complete conversion of the metals into chlorides was attained in five hours. The residue in the boat consisted of the chlorides of magnesium and calcium and unaltered silica, whilst the chlorides of chromium (insoluble in water) and of iron and aluminium (soluble) were volatilised.—J. H. L.

Copper ; Determination of ——, [*in small quantities*] *by methanal-sulphurous acid.* P. Malvezin. Bull. Soc. Chim., 1913, **13**, 721—722.

THE process depends upon the decoloration of ammoniacal solutions of copper by an aqueous solution of methanal-sulphurous acid (prepared by saturating a 40 per cent. solution of formaldehyde with sulphurous anhydride) ; the latter is standardised against pure copper, 1 grm. of which is dissolved in nitric acid and diluted to 100 c.c. ; the titration is made upon 1 c.c. of this solution after the addition of 1 c.c. of water and 2 c.c. of ammonia solution. For the determination of copper, 0·1 grm. of the substance is calcined, the residue heated with nitric acid, the solution diluted to 20 c.c. and filtered ; to 10 c.c. of the filtrate 2 c.c. of ammonia solution are added, the liquid diluted to 20 c.c. and filtered again ; 10 c.c. of the last filtrate, after the addition of 1 c.c. of ammonia solution, are titrated as in standardising. —W. E. F. P.

Molybdenum ; Sensitive reaction for ——. A. Komarowsky. Chem.-Zeit., 1913, **37**, 957.

IT is possible to detect molybdenum in 1 c.c. of a solution of ammonium molybdate containing 0·00544 grm. Mo per litre by the test described by Melikoff (this J., 1912, 1077), depending on the formation of ammonium permolybdate. The test is less sensitive but more reliable than the usual one with concentrated sulphuric acid, and possesses the further advantage that the ammonium permolybdate can be decomposed by heat, and the substance used for the qualitative test thus made available for quantitative determination.—A. S.

Tungstic and silicic acids ; Determination of ——. H. Hermann. Z. anal. Chem., 1913, **52**, 557—568.

TUNGSTIC acid is quantitatively precipitated from solutions of normal tungstates by nitric acid in the cold. Para- and meta-tungstates must be converted into normal tungstates by rendering the solution alkaline ; on adding nitric acid to the cold liquor and evaporating on the water-bath, the whole of the tungstic acid separates. To avoid the formation of soluble silico-tungstic acid in a solution containing silicate and tungstate (such as is obtained in the carbonate fusion of tungsten ores), it is acidified, freed from carbonic acid by boiling, and digested hot with excess of caustic soda ; this decomposes the complex acid radical. A large excess of nitric acid is then added all at once and after one hour the solution is evaporated to dryness ; the evaporation is repeated twice and the precipitate filtered off after treatment with nitric acid and ammonium nitrate as usual. Reference is made to an earlier paper on the estimation of silicic acid by conversion into silico-tungstic acid. (Z. anal. Chem., 1912, **51**, 736.)

Luteocobaltic nitrate gives a characteristic precipitate with silico-tungstic acid, which may be used as a microchemical test for the detection of silica.—W. R. S.

Tungsten ; Separation of —— *from thorium, lanthanum, cerium, erbium, didymium, and silica.* M. Wunder and A. Schapira. Ann. Chim. Analyt., 1913, **18**, 257—260.

IN continuation of a previous investigation (this J., 1912, 920), it has been found that tungstic and thorium oxides may be separated by fusing for an hour with sodium carbonate, boiling with water containing sodium carbonate for 20 minutes, and filtering ; the residual thorium oxide is ignited and the tungstic anhydride precipitated from the filtrate by mercurous nitrate, in weak nitric acid solution, after neutralising with ammonia. The separation of lanthanum and cerium oxides from tungstic acid is effected similarly, but with erbium or didymium oxide, the mixture is filtered cold, the residue, in this case, being completely soluble in hot 5 per cent. hydrochloric acid, from which it is reprecipitated by ammonia. Silica and tungstic acid are separated by fusing with sodium carbonate, treating with water, slightly acidifying with nitric acid, boiling off carbon dioxide, and adding mercurous nitrate ; this precipitates the tungsten as mercurous tungstate, and the filtrate is evaporated to dryness, the residue dried at 110° C., treated with acid, filtered, dried, ignited, and weighed as silica. To a solution containing tungstic acid, silica, and alumina, an excess of ammonium nitrate is added to precipitate the alumina, and the precipitate, which contains part of the silica, is ignited and weighed ; it is then treated with hydrogen fluoride and a little sulphuric acid, ignited again, and weighed as Al_2O_3, the co-precipitated silica being obtained by difference. Tungsten is precipitated in the filtrate by mercurous nitrate, and this precipitate also is treated with hydrogen fluoride and sulphuric acid, which gives by difference a further quantity of silica. The rest of the silica is determined by evaporating the filtrate to dryness, drying the residue at 110° C., treating with water and nitric acid, filtering, washing, and igniting.—F. Sodn.

Preparation and analysis of methane. Campbell and Parker. *See* IIA.

Determination of paraffin in asphaltum. Marek. *See* IIA.

Testing of indigo on woollen cloth and other materials. Green and others. *See* VI.

Quantitative volatilisation and separation of phosphoric acid from the metals of the copper group and from aluminium, zinc, and the alkali metals. Jannasch and Leiste. *See* VII.

Determination of hypophosphites. Cocking and Kettle. *See* VII.

Determination of ammonia and nitrogen [in gasworks products]. Knublauch. *See* VII.

Detection of small quantities of selenious acid. Meyer and Jannek. *See* VII.

Chemical examination of plaster. Cavazzi. *See* IX.

Gravimetric determination of tungsten, chromium, silicon, nickel, molybdenum, and vanadium in steel. Zinberg. *See* X.

[Gold ores.] Notes on the assay of mine samples. Dures. *See* X.

Determination of rosin in blown oils. Fahrion. *See* XII.

Testing of ebonite for electrical purposes. Paterson and others. *See* XIV.

Determination of sucrose by double polarisation in [beet] molasses. Saillard and others. *See* XVII.

Standardisation of opium for pharmaceutical purposes. "Normal opium." Van der Wielen. *See* XX.

PATENTS.

Pyrometers, gas-analysing apparatus and the like; Means for compensating for changes in barometric pressure in ——. M. Arndt, Aachen, Germany. Eng. Pat. 15,384, July 1, 1912. Under Int. Conv., June 30, 1911.

THE indicating or registering apparatus is provided with a barometric compensating arrangement, the pen-carrier being released from its actuating mechanism during the intervals between the measuring operations and supported in an independent bearing; this bearing is displaced by means of a device actuated by the changes of atmospheric pressure, for instance, a barometer and float or an elastic aneroid barometer. Before the registration again commences, the actuating mechanism on coming into contact with the pen-carrier carries the latter with it at distances from the fulcrum varying according to the barometric pressure.—W. P. S.

Automatic analysis and indication of gases; Apparatus for ——. P. R. Boulton, Birmingham. Eng. Pat. 16,300, July 12, 1912.

THE apparatus comprises a measuring pump which delivers flue gases to a vessel containing an absorbent, a gas discharge valve from this vessel being closed for a predetermined period so that the pressure attained in the absorption vessel depends upon the proportion of gas absorbed. The discharge valve then opens the absorption vessel to a second vessel from which the gases pass to the atmosphere, and the operation is repeated automatically. A pressure gauge is connected with the absorption vessel, and works a pointer or the pen of a recording device. The pressure gauge may be provided with an arrangement for compensating for the effect of variations of pressure in the flue. —A. T. L.

Calorimetric bomb. C. Féry, Paris. U.S. Pat. 1,067,908, July 22, 1913.

SEE Fr. Pat. 436,330 of 1911; this J., 1912, 461.—T. F. B.

Books Received.

GAS ANALYSIS. By L. M. DENNIS, Professor of Inorganic Chemistry in Cornell University. The Macmillan Company, New York. 1913. Price 9s.

VOLUME (7⅝ by 5¼ in.), containing 404 pages of subject matter, 8 of tables, and alphabetical indexes of names and subjects. There are 110 illustrations. The subject matter is classified as follows:—I. Collection and storage of gases. II. Measurement of large samples of gas. III. Measurement of gases. IV. Determination of the specific gravity of a gas. V. Arrangement and fittings of the laboratory. VI. Apparatus using water as the confining liquid. VII. Hempel apparatus with mercury as confining liquid. VIII. Construction and connection of apparatus. IX. Purification of mercury. X. Absorption apparatus for use with large volumes of gas. XI. Combustion of gases. XII. Determination of gases by combustion. XIII. Properties and methods of determining various gases. XIV. Flue gas analysis. XV. Illuminating gas. Fuel gas. XVI. Heating value of fuel. XVII. Acetylene. XVIII. Atmospheric air. XIX. Analysis of saltpetre and nitric acid esters (nitroglycerin, guncotton), with the nitrometer. XX. The Lunge nitrometer.

INDUSTRIAL POISONING FROM FUMES, GASES AND POISONS OF MANUFACTURING PROCESSES. By Dr. J. RAMBOUSEK, Prof. of Factory Hygiene, and Chief State Health Officer, Prague. Translated and edited by T. M. Legge, M.D., D.P.H., H.M. Medical Inspector of Factories. London, E. Arnold. 1913. Price 12s. 6d. net.

THIS volume (8⅝ by 6 ins.) contains 354 pages of subject matter, an alphabetical index, and 59 illustrations. The main portion of the work is divided into three parts, followed by an appendix containing bibliographic references. Part I. Description of the industries and processes attended with risk of poisoning; incidence of such poisoning. (1) Chemical industry. (2) Recovery and use of metals. (3) Other industries. Part II. Pathology and treatment of industrial poisoning. (1) Industrial poisons in general. (2) Industrial poisons in particular. Part III. Preventive measures against industrial poisoning. (1) General preventive measures. (2). Preventive measures in particular industries.

JAHRESBERICHT UEBER DIE LEISTUNGEN DER CHEMISCHEN TECHNOLOGIE FÜR DAS JAHR 1912. 58. Jahrgang. Bearbeitet von Dr. P. F. SCHMIDT und Prof. Dr. B. RASSOW. I. Abteilung: Unorganischer Teil. Verlag von J. A. Barth. Leipzig. 1913. Price M. 17·50.

THIS volume (9½ by 6 ins.) contains 681 pages of subject matter, with 268 illustrations, alphabetical indexes of authors' names and of subjects, and a list of the numbers of German patents referred to in the text. The classification adopted is as follows:—I. Fuels. II. Recovery of metals. III. Chemical manufacturing industries. IV. Glass, ceramics, cement, lime. V. Apparatus.

CHEMISTRY IN DAILY LIFE. Popular lectures. By Dr. LASSAR-COHN. Translated by M. M. Pattison Muir, M.A. Fifth Edition, revised and augmented. H. Grevel and Co., London. 1913. Price 6s.

A VOLUME, 8¾ by 5¾ ins., containing 309 pages of subject matter, with 24 woodcuts, and an alphabetical index. The general scheme of the book is the same as in the fourth edition (see this J., 1909, 1172), but there are numerous omissions and additions.

MANUALE DEL CONCIATORE. Dott. A. GANSSER. U. Hoepli. Milan. 1913. Price L. 4·50.

SMALL volume (6 by 4½ ins.), containing 367 pages of subject matter, with 22 illustrations and 2 coloured plates, and a series of tables. The headings of the chapters are:— I. Leather. II. The hide and its properties. III. Defects and diseases of the hide. IV. Water for tanning. V. Preparation of the hide for tanning. VI. Tanning materials. VII. Conversion of the hide into leather. VIII. Substances used after the tanning. IX. Treatment of the leather after tanning. X. Various treatments of the tanned hide. XI. Finishing of leather. XII. Adulteration (loading) of leather. XIII. Bleaching leather and hide. XIV. Dyeing leather. XV. Vegetable tanning. XVI. Tanning with alum. XVII. Tanning with oils. XVIII. Combined tanning with alum and vegetable tannins. XIX. Tanning with formaldehyde and with quinone. XX.

Mineral tanning. XXI. Chrome tanning. XXII. Combined mineral and vegetable tanning. XXIII. Tanning action of various substances. XXIV. Purification of waste tannery liquors. XXV. Analysis of tanning materials. XXVI. Analysis of leather. XXVII. Yields.

Grundriss der Fermentmethoden. Ein Lehrbuch für Mediziner, Chemiker, und Botaniker. Von Prof. Dr. J. Wohlgemuth. J. Springer. Berlin. 1913. Price M. 10; bound M. 10·80.

The volume measures 8⅝ by 5¾ ins., and contains 351 pages, in addition to an alphabetical index. The subject matter is arranged as follows:—General part. (1) Nature and properties of enzymes. (2) General principles in investigations on enzymes. (3) Preparation of solutions of and isolation of enzymes. (4) Filtration, dialysis. Special part. A. Enzymes which decompose carbohydrates. B. Lipolytic enzymes (lipases, esterases). C. Enzymes which decompose proteins. D. Enzymes which decompose nuclein and nuclein bases. E. Oxydases. F. Catalase. G. Coagulation of blood.

Abwehrfermente des tierischen Organismus gegen körper-, blutplasma- und zellfremde Stoffe, ihr Nachweis und ihre diagnostische Bedeutung zur Prüfung der Funktion der einzelnen Organe. Von E. Abderhalden, 2. vermehrte Auflage. J. Springer. Berlin. 1913. Price M. 5·60; bound M. 6·40.

This volume (8⅝ by 5¾ ins.) contains 183 pages of subject matter, with 11 figures and 1 plate, and also lists of references to investigations by the author and by other workers. The book treats of the enzymes developed in the animal organism as a means of defence against foreign substances. (See also this J., 1912, 610.)

Cyanamid. Manufacture, Chemistry and Uses. By E. J. Pranke, B.Sc. The Chemical Publishing Co., Easton, Pa., U.S.A. Williams and Norgate, London. 1913. Price $1·25.

Volume (9 by 6 ins.) containing 106 pages of subject matter and an alphabetical index. It comprises chapters on:—I. Discovery and manufacture of cyanamide. II. Preparation and properties of cyanamide. Dicyandiamide. III. Analytical methods. IV. Storage of cyanamide. V. Decomposition of cyanamide in the soil. VI. Retention of cyanamide nitrogen in the soil. VII. Nitrification of cyanamide nitrogen. VIII. Toxicity of fertilisers. IX. Agricultural use of cyanamide. X. Fertiliser mixtures with cyanamide. XI. Permanganate availability of cyanamide. XII. Fire and water hazard of cyanamide.

Quantitative Metallurgical Analysis. Selected methods for chemical analysis of ores, slags, coal, iron, and steel. Arranged by C. F. Sidener, B.S. The H. W. Wilson Co., Minneapolis, U.S.A. The American Book Supply Co., Ltd., London. 1912. Price 5s. net.

Volume (7¾ by 5½ ins.) containing 110 pages of subject matter, an alphabetical index, and the table of international atomic weights (1912). Descriptions are given of what the author considers to be the best technical methods for the analysis of ores of the common metals, furnace products, coal and coke.

Einführung in die Thermodynamik. Von R. Blondlot. Autorisierte Deutsche Ausgabe der zweiten französischen Auflage. Besorgt von C. Schorr und F. Platschek. T. Steinkopff. Dresden and Leipzig. 1913. Price M. 4.

This volume (9¼ by 6¼ ins.) contains 102 pages and 39 illustrations. The subject matter is arranged as follows:—I. The principle of equivalence. (First law of thermodynamics.) II. Special study of gases. III. Carnot's principle. (Second law of thermodynamics.) IV. Application of the laws of thermodynamics. V. Energy.

National Physical Laboratory. Report for the year 1912. W. F. Parrott. Teddington. 1913. 123 pages.

Collected Researches. The National Physical Laboratory. Vols. IX. and X. 1913.

These volumes each measure 12 by 9⅛ ins. Vol. IX. (245 pages) contains 12 papers including:—"Emission of electricity from carbon at high temperatures," by J. A. Harker and G. W. C. Kaye (pp. 17—35); "Coefficients of expansion of fused silica and mercury," by H. Donaldson (pp. 181—190); "Experiments on the strength and fatigue properties of welded joints in iron and steel," by T. E. Stanton and J. R. Pannell (pp. 191—217). Vol. X. (253 pages) contains 11 papers including:—"Alloys of aluminium and zinc," by W. Rosenhain and S. L. Archbutt (pp. 1—90; see this J., 1912, 493); "Intercrystalline cohesion in metals," by W. Rosenhain and D. Ewen (pp. 91—111); "Intercrystalline fracture of iron and steel," by J. C. W. Humfrey (pp. 113—135; see also under X., page 829); "Testing ebonite for electrical purposes," by C. C. Paterson, E. H. Rayner, and A. Kinnes (pp. 175—187; see also under XIV., page 835); "Inflammability of flake charcoal, decayed wood, and insulating papers," by W. Rosenhain and W. Gemmell (pp. 207—228; see also this J., 1912, 322).

Colloids and their Viscosity. Reprinted from Transactions of the Faraday Society, 1913. Price 7s. 6d.

This volume (9¾ by 6¼ ins.) contains a series of papers on viscosity especially in relation to colloidal systems and also a general discussion on the subject. The papers are by Wo. Ostwald, V Henri, W. Pauli, H. Freundlich and C. Ishizake, and E. Hatschek, and occupy altogether 75 pages.

Bericht ueber die Tätigkeit der technischen Aufsichtsbeamten der Berufsgenossenschaft der chemischen Industrie (Deutschlands) im Jahre 1912.

This report, occupying 55 pages, with 52 illustrations, forms a supplement to the issue of "Die Chemische Industrie" of July 15, 1913. It is similar in general character and arrangement to the corresponding report for 1911 (see this J., 1912, 849).

Mellon Institute of Industrial Research and School of Specific Industries. Smoke Investigation. Bulletin No. 2.

Bibliography of Smoke and Smoke Prevention. Compiled by Ellwood H. McClelland. Technology Librarian, Carnegie Library of Pittsburgh. University of Pittsburgh. Pittsburgh, Pa., U.S.A. 1913. Price 50 cents.

Volume (9 by 6 ins.) containing 164 pages of subject matter, referring to the bibliography of the entire subject under the following heads:—I. Patents. II. History. III. Serial publications. IV. Combustion of smoke. V. Sources of smoke. VI. Composition and properties of smoke and soot. VII. Effects of smoke. VIII. Smoke prevention. IX. Work of organisations. Exhibitions. X. Inspection. XI. Smoke problem in special localities. XII. Legal aspects in general. Unofficial publications. X. Laws and ordinances of special localities. Official publications.

The Volatile Oils. By E. Gildemeister and Fr. Hoffmann. Second edition, by E. Gildemeister. Written under the auspices of the firm of Schimmel & Co., Miltitz, near Leipzig. Authorised translation by Edward Kremers. First Volume. Longmans, Green & Co., 39, Paternoster Row, London, Bombay, and Calcutta. 1913. Price 20s. net.

Volume (9⅜ by 6¾ ins.), contains 641 pages of subject matter with 75 illustrations, numerous tables, and two maps. The matter is classified according to the following plan:—I. Historical introduction. II. Production of flower perfumes by extraction, enfleurage and maceration. III. Principal constituents of volatile oils, natural and artificial perfumes:—(i), Hydrocarbons. (ii), Alcohols. (iii), Aldehydes. (iv), Ketones. (v), Phenols and phenol ethers, acids, esters, lactones, oxides, compounds containing nitrogen and sulphur. IV. Examination of volatile oils (i), Determination of physical properties. (ii), Chemical methods of examination.

Journal of the Society of Chemical Industry.

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Manchester Section.

CONTRIBUTION TO THE STUDY OF THE ACTIONS OF VARIOUS WATERS UPON LEAD.

BY HARRI HEAP, M.SC.

(Concluded from August 30th issue, p. 815.)

PART III.

Experiments using Lead Foil.

Action of pure water free from gases.

The laboratory distilled water was re-distilled four times, only the distillates free from ammonia being collected. Precautions were taken to prevent contamination by dust. Of this pure water 120 c.c. were placed in the flask of the modified Adeney's apparatus which had been previously washed out with a portion of the same water. A strip of lead was then placed supported in the flask by the glass rods, attached to the stopper used for closing the flask. The stopper was pressed tightly home and sealed with mercury. The flask was pumped free from air and the water boiled under reduced pressure for a time, the gases evolved being removed. Boiling and exhausting were continued until the apparatus was quite free from gases, this being detected by observing the temperature and the pressure recorded on the barometer tube. When the apparatus is vacuous a characteristic metallic click is heard on allowing the mercury to rise fairly quickly in the barometer tube by raising the reservor of mercury. Although by this method of exhaustion the last traces of gas would not be removed from the surface of the glass, yet for the purposes of the investigation deductions could be made quite within the limits of the pretensions of this work. The apparatus being freed from gases, the lead strip was immersed in the water and allowed to remain for 24 hours, the lead was then removed, and the water tested.

Other experiments were conducted in similar fashion, excepting that instead of being made *in vacuo* certain gases were admitted at definite pressures.

The distilled water used had an alkalinity of 0·5 c.c. $N/100$ tested with methyl orange and of 0·1 c.c. with lacmoid, and an acidity of 0·2 c.c. $N/100$ against phenolphthalein. The duration of exposure in each case was 24 hours, and the initial and final temperatures 24° C. The results are shown in Table XI. :—

Table XI.

Nature of water.	Lead found parts per 100,000.	Appearance of	
		Strip.	Water.
Distilled water free from gases	0·01	Unchanged	Clear
Pure distilled water under one atm. pressure of oxygen	12·0	Unchanged	Slightly silky
Pure distilled water under one atm. pressure of carbon dioxide	1·6	Unchanged	Clear
Pure distilled water under one atm. pressure of hydrogen ..	1·6	Unchanged	Slightly silky
Pure distilled water under one atm. pressure of air	8·5	Crystalline markings	Silky

Action of pure water exposed to the air during the progress of the experiment.

In a very short time the water assumes a cloudy appearance and a little later becomes what we have termed "silky." This precipitate gradually increases and collects at the bottom of the vessel as a mass of lamellar crystals. The amount of lead in the liquid, as soluble lead, is practically constant. Part of the lead in solution is precipitated by the carbon dioxide of the atmosphere and then more lead from the strip dissolves, only to be afterwards precipitated by combination with more carbon dioxide. The action under these conditions is progressive.

Action of ordinary distilled water out of contact with air.

Although the experiment was made out of contact with air, the water had previously been exposed to the air and so a certain amount of dissolved air was present. Alkalinity of water to methyl orange, 0·6 c.c. $N/100$; to lacmoid, 0·2 c.c.; acidity to phenolphthalein, 0·1 c.c. per 100 c.c.

Table XII.

Nature of water.	Initial and final temperatures, °C.	Exposure in hours.	Lead found parts per 100,000.
Ordinary distilled water	18—18	1	1·5
	18—18	2	2·2
	18—18	3	2·0
		4	4·0
		5	6·0
		24	8·0

In each case the strip had crystalline markings, and the water was silky.

Action of pure water containing dissolved atmospheric gases and various chemical products.

These experiments were made in the bottles. The initial and final temperatures were 25° C. Exposure 24 hours.

Table XIII.

Pure distilled water containing 1 grm. per litre of :—	Lead found expressed in parts per 100,000.	Appearance of	
		Strip.	Water.
Magnesium carbonate	0·06	Protective coating	Clear
Sodium carbonate	0·08	Protective coating	Clear
Calcium carbonate ..	0·04	Protective coating	Clear
Ammonium nitrate....	50·00	Crystalline markings	Clear
Potassium nitrate	6·00	Unchanged	Slightly silky
Calcium nitrate	6·00	Unchanged	Slightly silky
Sodium nitrite........	6·00	Unchanged	Slightly silky
Ammonium chloride ..	1·20	Glistening surface	Clear
Calcium chloride......	0·80	Glistening surface	Clear
Magnesium chloride ..	0·16	Glistening surface	Clear
Aluminium sulphate ..	0·60	Unchanged	Clear
Sodium sulphate	0·50	Unchanged	Clear
Ammonium sulphate	0·24	Unchanged	Clear
Calcium sulphate	0·7	Slightly coated	Clear
Magnesium sulphate ..	1·00	Unchanged	Clear
Calcium acetate	0·10	Protective coating	Clear
Ammonium acetate ..	6·00	Unchanged	Clear
Sodium acetate	0·40	Unchanged	Clear
Sodium phosphate	None	Unchanged	Clear
Calcium oxide	8·00	Crystalline markings	Clear

Thus phosphates seem to have the greatest protective action and carbonates next. Nitrates seem to attack lead very vigorously and sulphates, chlorides, and acetates only slightly with certain exceptions. Certain ammonium compounds had a very marked action, especially ammonium nitrate. Ammonium chloride exerts a very much less action and ammonium sulphate still less. Calcium oxide also has a very marked action.

Action of pure water which has percolated through peat.

A. The water was allowed to percolate through six inches depth of peat just as removed from the ground. The water collected required six days to percolate and had a volume of 500 c.c., and was of a dark brown colour; Acidity per 100 c.c. :—methyl orange, 0·8 c.c. ; lacmoid, 2·0 c.c. ; phenolphthalein, 2·4 c.c. *N*/100.

B. The water was allowed to percolate through a six-inch layer of peat which had been made by pressing together smaller pieces of peat. 500 c.c. of the water was collected after percolating through the peat which required a period of four days. The water percolating had a brownish colour. Acidity per 100 c.c. :—methyl orange 0·4 c.c. ; lacmoid, 1·0 c.c. ; phenolphthalein, 1·7 c.c. *N*/100.

Table XIV.

Nature of water.	Exposure in hours.	Lead found parts per 100,000.
Water from peat A.	24	1·2
	48	1·5
	72	1·8
	96	2·0
Water from peat B.	24	1·0
	48	1·1
	72	1·2
	96	1·4

In each case the strip had a brownish coating, but the water remained clear. The action is most vigorous in the initial stages of the reaction.

Action of pure water which has stood for 1 or 3 days in artificial peat bogs.

In each case the initial and final temperatures were 24° C.

The following abbreviations are used for indicators in the subsequent tables :—M.O., Methyl orange, L., Lacmoid, P.P., Phenolphthalein.

Table XV.

Nature of water.	Reaction of 100 c.c. in centinormal terms.			Duration of exposure in hours.	Lead found parts per 100,000.
	Indicator.	Alkalinity.	Acidity.		
A.	M.O.	0·2	—	24	0·70
	L.	—	1·2	48	0·70
	P.P.	—	1·5	72	0·80
B.	M.O.	—	0·4	24	0·80
	L.	—	1·3	48	0·90
	P.P.	—	2·2	72	1·00
				96	1·10
C.	M.O.	0·1	—	24	0·9
	L.	—	0·9	48	1·3
	P.P.	—	1·8	72	1·3
D.	M.O.	—	0·5	24	1·2
	L.	—	1·4	48	1·4
	P.P.	—	2·2	72	1·6
				96	1·8

A. Pure water in deep bog 1 day.
B. Pure water in deep bog 3 days.
C. Pure water in shallow bog 1 day.
D. Pure water in shallow bog 3 days.

In each case the lead had a brownish coating, but the water was clear. Contact of a pure water with peat is rendered less active or the action is delayed up to 96 hours' exposure; carbon dioxide does not precipitate the lead in such waters.

Action of rain water.

Pure rain water has an action approaching very nearly to that of distilled water, but the less pure rain waters are greatly modified according to the nature of the atmosphere in the neighbourhood of the place in which they are gathered. Rain waters gathered in localities where macadam roads are common contain calcareous dust, and so this water has very little action on lead, the lead becoming covered with a protective coating, but rain water gathered in the neighbourhood of manufacturing cities contains fairly large amounts of sulphates, nitrates, chlorides, and ammonium compounds, and these rain waters exert marked actions upon lead. This is illustrated in the following table :—

Table XVI.

Nature of rain water.	Reaction of 100 c.c. in centinormal terms.			Chlorine, parts per 100,000.	Initial and final temperatures °C.	Exposure in hours.	Lead found, parts per 100,000.	Appearance of	
	Indicator.	Alkalinity.	Acidity.					Strip.	Water.
A.	M.O.	—	0·3	0·7	14—14	24	2·40	Crystalline markings	Cloudy
	L.	—	1·2		14—14	48	3·00	Crystalline markings	Cloudy
	P.P.	—	2·0		14—14	72	3·50	Crystalline markings	Cloudy
B.	M.O.	0·5	—	1·0	22—22	24	2·80	Crystalline markings	Cloudy
	L.	—	0·4		22—22	48	3·40	Crystalline markings	Cloudy
	P.P.	—	1·0		22—22	72	4·0	Crystalline markings	Cloudy
C.	M.O.	0·2	—	0·4	20—20	24	7·0	Crystalline markings	Silky
	L.	—	0·2		20—20	48	7·0	Crystalline markings	Silky
	P.P.	—	0·2		20—20	72	7·5	Crystalline markings	Silky.
D.	M.O.	—	0·3	0·4	16—16	2	2·0	Crystalline markings	Slightly silky
	L.	—	1·3		16—16	4	3·5	Crystalline markings	Slightly silky
	P.P.	—	1·5		16—16	24	6·0	Crystalline markings	Silky
					16—16	48	8·0	Crystalline markings	Silky
					16—16	72	10·0	Crystalline markings	Silky.

A. Rain water collected in the garden of the University Laboratory during continuous rainy weather.
B. Collected in the garden of the Laboratory in one hour during a thunderstorm. Previously a long spell of dry weather had prevailed
C. Collected in a downpour during one hour during continuous rainy weather on the summit of Pendle Hill, Lancashire.
D. Collected on an open moorland bordering on Lancashire and Yorkshire. (Extwistle Moor.)

Thus the rain water of Manchester either in fine or wet weather shows no very marked difference in its action on lead, although the acidity of the water varies very much. Both the Manchester rain waters show a much less action than ordinary distilled water. The moorland rain waters show actions very similar to distilled water, but the acidities of the two waters were very different.

Action of rain water percolated through peat.

The acidity of 100 c.c. of the rain water used expressed in centinormal terms was as follows:—Methyl orange, 0·5; lacmoid, 1·1; phenolphthalein, 1·5. After percolating through the peat, the water was alkaline (0·5) to methyl orange, and its acidity to lacmoid was 1·0 and to phenolphthalein 1·5. Initial and final temperatures were 20° C.

Exposure in hours.	Lead found, parts per 100,000.
24	0·7
48	0·8
72	0·8

The strip had a brownish coating after treatment; the water was clear.

Action of raw upland lake water.

Reaction of 100 c.c. of water:—Methyl orange, alkalinity 0·8 c.c. *N*/100; lacmoid, alkalinity 0·4; phenolphthalein, acidity 0·2.

TABLE XVII.

Exposure in hours.	Lead found, parts per 100,000.
24	0·12
48	0·18
72	0·28
96	0·28
120	0·30
144	0·30

The initial and final temperatures were 14° and 15° C. respectively. Although the water is what is generally termed an alkaline water, yet it has quite an appreciable action on lead. The maximum amount of lead which the water will take up seems to be attained by an exposure of about 72 hours. After this very little more lead is dissolved. The strip was unchanged in appearance after the experiment but the water was cloudy.

Action of raw upland lake water to which has been added various salts.

In the following series of experiments lake water was modified by adding to it 1, 2, and 3 parts per 100,000 of various chemical substances.

The action of the modified waters on lead was then observed and the results tabulated as follows. The last column gives the appearance of the lead strip. The water remained clear in every case.

TABLE XVIII.

Substance added, parts per 100,000.	Reaction of 100 c.c.s expressed in centinormal terms.			Initial and final temperatures. °C.	Exposure in hours.	Lead found, parts per 100,000.	Strip.
	Indicator.	Alkalinity.	Acidity.				
Magnesium carbonate							Protective coating.
1	M.O.	3·1	—	18—18	24	0·04	
	L.	2·0	—	18—18	48	0·06	
	P.P.	0·40	—	18—18	72	0·10	
				18—18	96	0·10	
2	M.O.	4·3	—	18—18	24	0·02	
	L.	3·0	—	18—18	48	0·04	
	P.P.	1·3	—	18—18	72	0·04	
				18—18	96	0·06	
3	M.O.	7·0	—	18—18	24	0·02	
	L.	6·0	—	18—18	48	0·02	
	P.P.	2·8	—	18—18	72	0·04	
				18—18	96	0·04	
Sodium carbonate							Protective coating.
1	M.O.	3·0	—	16—16	24	0·04	
	L.	2·0	—	16—16	48	0·08	
	P.P.	—	0·2	16—16	72	0·08	
				16—16	96	0·12	
2	M.O.	4·5	—	16—17	24	0·02	
	L.	4·0	—	16—17	48	0·04	
	P.P.	0·1	—	16—17	72	0·04	
				16—17	96	0·04	
3	M.O.	6·5	—	17—17	24	0·01	
	L.	5·5	—	17—17	48	0·01	
	P.P.	0·8	—	17—17	72	0·02	
				17—17	96	0·02	
Calcium carbonate							Protective coating.
1	M.O.	1·4	—	16—16	24	0·03	
	L.	0·6	—	16—16	48	0·04	
	P.P.	—	0·2	16—16	72	0·04	
				16—16	96	0·04	
2	M.O.	2·0	—	16—16	24	0·01	
	L.	0·5	—	16—16	48	0·04	
	P.P.	—	0·4	16—16	72	0·04	
				16—16	96	0·04	
3	M.O.	2·5	—	16—16	24	0·01	
	L.	0·8	—	16—16	48	0·01	
	P.P.	—	0·4	16—16	72	0·01	
				16—16	96	0·02	
Ammonium nitrate							Unchanged.
1	M.O.	1·0	—	16—16	24	0·16	
	L.	0·4	—	16—16	48	0·24	
	P.P.	—	0·3	16—16	72	0·3	
				16 - 16	96	0·30	
2	M.O.	1·2	—	16—16	24	0·16	
	L.	0·5	—	16—16	48	0·24	
	P.P.	—	0·3	16—16	72	0·32	
				16—16	96	0·34	
3	M.O.	1·0	—	16—16	24	0·26	
	L.	0·5	—	16—16	48	0·30	
	P.P.	—	0·4	16—16	72	0·32	
				16—16	96	0·36	
Potassium nitrate							Unchanged.
1	M.O.	1·2	—	17—18	24	0·06	
	L.	0·2	—	17—18	48	0·12	
	P.P.	—	0·2	17—18	72	0·16	
				17—18	96	0·20	
2	M.O.	1·2	—	17—18	24	0·10	
	L.	0·2	—	17—18	48	0·16	
	P.P.	—	0·2	17—18	72	0·20	
				17—18	96	0·24	
3	M.O.	1·2	—	17—18	24	0·10	
	L.	0·3	—	17—18	48	0·18	
	P.P.	—	0·3	17—18	72	0·24	
				17—18	96	0·26	
Calcium nitrate							Slightly coated.
1	M.O.	1·5	—	18—18	24	0·08	
	L.	0·2	—	18—18	48	0·10	
	P.P.	—	0·2	18—18	72	0·2	
				18—18	96	0·20	
2	M.O.	1·5	—	18—18	24	0·12	
	L.	0·3	—	18—18	48	0·14	
	P.P.	—	0·3	18—18	72	0·22	
				18—18	96	0·30	
3	M.O.	1·5	—	18—18	24	0·08	
	L.	0·2	—	18—18	48	0·16	
	P.P.	0·2	0·2	18—18	72	0·22	
				18—18	96	0·32	
Sodium nitrite							Glistening surface.
1	M.O.	1·2	—	17—18	24	0·10	
	L.	0·3	—	17—18	48	0·10	
	P.P.	—	0·3	17—18	72	0·12	
				17—18	96	0·12	
2	M.O.	1·2	—	17—18	24	0·08	
	L.	0·3	—	17—18	48	0·16	
	P.P.	—	0·3	17—18	72	0·18	
				17—18	96	0·20	
3	M.O.	1·2	—	17—18	24	0·18	
	L.	0·2	—	17—18	48	0·26	
	P.P.	—	0·3	17—18	72	0·26	
				17—18	96	0·28	
Ammonium chloride							Unchanged.
1	M.O.	1·2	—	18—18	24	0·20	
	L.	0·2	—	18—18	48	0·20	
	P.P.	—	0·2	18—18	72	0·30	
				18—18	96	0·40	
2	M.O.	1·2	—	18—18	24	0·30	
	L.	0·2	—	18—18	48	0·34	
	P.P.	—	0·4	18—18	72	0·40	
				18—18	96	0·40	
3	M.O.	1·2	—	18—18	24	0·40	
	L.	0·2	—	18—18	48	0·46	
	P.P.	—	0·6	18—18	72	0·52	
				18—18	96	0·56	

Table XVIII.—*continued.*

Substance added, parts per 100,000.	Reaction of 100 c.c.s expressed in centinormal terms.			Initial and final temperatures. °C.	Exposure in hours.	Lead found, parts per 100,000.	Strip.
	Indicator.	Alkalinity.	Acidity.				
Calcium chloride							
1	M.O.	1·2	—	18—18	24	0·08	Glistening surface.
	L.	0·2	—	18—18	48	0·16	
	P.P.	—	0·2	18—18	72	0·26	
				18—18	96	0·26	
2	M.O.	1·5	—	18—18	24	0·12	
	L.	0·6	—	18—18	48	0·16	
	P.P.	—	0·3	18—18	72	0·24	
				18—18	96	0·30	
3	M.O.	1·5	—	18—18	24	0·12	
	L.	0·6	—	18—18	48	0·20	
	P.P.	—	0·3	18—18	72	0·28	
				18—18	96	0·30	
Magnesium chloride							
1	M.O.	1·4	—	17—18	24	0·16	Glistening surface.
	L.	0·5	—	17—18	48	0·24	
	P.P.	—	0·3	17—18	72	0·28	
				17—18	96	0·28	
2	M.O.	1·5	—	17—18	24	0·16	
	L.	0·3	—	17—18	48	0·22	
	P.P.	—	0·3	17—18	72	0·28	
				17—18	96	0·28	
3	M.O.	2·0	—	17—18	24	0·20	
	L.	0·3	—	17—18	48	0·28	
	P.P.	—	0·2	17—18	72	0·28	
				17—18	96	0·36	
Aluminium sulphate							
1	M.O.	0·6	—	18—18	24	0·8	Loose flocculent coating.
	L.	—	0·2	18—18	48	0·8	
	P.P.	—	1·3	18—18	72	1·0	
				18—18	96	1·0	
2	M.O.	0·6	—	18—18	24	1·4	
	L.	—	0·6	18—18	48	1·6	
	P.P.	—	2·4	18—18	72	2·0	
				18—18	96	2·2	
3	M.O.	0·6	—	18—18	24	2·0	
	L.	—	1·2	18—18	48	2·6	
	P.P.	—	3·4	18—18	72	3·0	
				18—18	96	3·0	
Calcium sulphate							
1	M.O.	1·4	—	18—18	24	0·08	Slightly coated.
	L.	0·2	—	18—18	48	0·10	
	P.P.	—	0·2	18—18	72	0·14	
				18—18	96	0·16	
2	M.O.	1·7	—	18—18	24	0·06	
	L.	0·3	—	18—18	48	0·14	
	P.P.	—	0·4	18—18	72	0·18	
				18—18	96	0·20	
3	M.O.	2·0	—	18—18	24	0·08	
	L.	0·3	—	18—18	48	0·16	
	P.P.	—	0·4	18—18	72	0·20	
				18—18	96	0·30	
Sodium sulphate							
1	M.O.	1·2	—	17—17	24	0·06	Glistening surface.
	L.	0·3	—	17—17	48	0·14	
	P.P.	—	0·3	17—17	72	0·14	
				17—17	96	0·18	
2	M.O.	2·0	—	17—17	24	0·06	
	L.	0·3	—	17—17	48	0·20	
	P.P.	—	0·3	17—17	72	0·20	
				17—17	96	0·22	
3	M.O.	2·0	—	17—17	24	0·12	
	L.	0·3	—	17—17	48	0·16	
	P.P.	—	0·3	17—17	72	0·16	
				17—17	96	0·20	
Ammonium sulphate							
1	M.O.	1·5	—	18—18	24	0·10	Crystalline markings.
	L.	—	0·1	18—18	48	0·32	
	P.P.	—	0·4	18—18	72	0·35	
				18—18	96	0·35	
2	M.O.	1·5	—	18—18	24	0·16	
	L.	0·4	—	18—18	48	0·24	
	P.P.	—	0·6	18—18	72	0·32	
				18—18	96	0·32	
3	M.O.	1·5	—	18—18	24	0·18	
	L.	0·4	—	18—18	48	0·18	
	P.P.	—	0·8	18—18	72	0·34	
				18—18	96	0·34	
Magnesium sulphate							
1	M.O.	1·2	—	18—18	24	0·14	Slightly coated.
	L.	0·2	—	18—18	48	0·14	
	P.P.	—	0·3	18—18	72	0·18	
				18—18	96	0·32	
2	M.O.	1·2	—	18—18	24	0·10	
	L.	0·2	—	18—18	48	0·30	
	P.P.	—	0·3	18—18	72	0·32	
				18—18	96	0·36	
3	M.O.	0·8	—	18—18	24	0·11	
	L.	0·2	—	18—18	48	0·32	
	P.P.	—	0·3	18—18	72	0·36	
				18—18	96	0·40	

Table XVIII.—*continued.*

Substance added, parts per 100,000.	Reaction of 100 c.c.s expressed in centinormal terms.			Initial and final temperatures. °C.	Exposure in hours.	Lead found, parts per 100,000.	Strip.
	Indicator.	Alkalinity.	Acidity.				
Calcium acetate							
1	M.O.	3·0	—	18—18	24	0·10	Slightly coated.
	L.	0·8	—	18—18	48	0·20	
	P.P.	—	0·3	18—18	72	0·22	
				18—18	96	0·30	
2	M.O.	3·2	—	18—18	24	0·10	
	L.	1·4	—	18—18	48	0·20	
	P.P.	—	0·3	18—18	72	0·24	
				18—18	96	0·30	
3	M.O.	4·0	—	18—18	24	0·08	
	L.	2·0	—	18—18	48	0·12	
	P.P.	—	0·4	18—18	72	0·16	
				18—18	96	0·24	
Sodium acetate							
1	M.O.	1·7	—	18—18	24	0·14	Unchanged.
	L.	0·5	—	18—18	48	0·16	
	P.P.	—	0·3	18—18	72	0·16	
				18—18	96	0·20	
2	M.O.	2·7	—	18—18	24	0·16	
	L.	0·5	—	18—18	48	0·20	
	P.P.	—	0·3	18—18	72	0·20	
				18—18	96	0·20	
3	M.O.	3·0	—	18—18	24	0·12	
	L.	0·5	—	18—18	48	0·16	
	P.P.	—	0·3	18—18	72	0·16	
				18—18	96	0·16	
Ammonium acetate							
1	M.O.	1·5	—	18—18	24	0·20*	Crystalline markings.
	L.	—	0·2	18—18	48	0·50	
	P.P.	—	0·7	18—18	72	0·50	
				18—18	96	0·50	
2	M.O.	2·2	—	18—18	24	0·70	
	L.	—	0·5	18—18	28	0·80	
	P.P.	—	1·1	18—18	72	1·30	
				18—18	96	1·30	
3	M.O.	2·3	—	18—18	24	1·4	
	L.	—	0·8	18—18	48	1·4	
	P.P.	—	1·3	18—18	72	1·4	
				18—18	96	1·6	
Sodium phosphate							
1	M.O.	1·5	—	18—18	24	0·02	Slightly coated.
	L.	0·4	—	18—18	48	0·02	
	P.P.	—	0·5	18—18	72	0·02	
				18—18	96	0·02	
2	M.O.	2·0	—	18—18	24	0·02	
	L.	0·5	—	18—18	48	0·02	
	P.P.	—	0·6	18—18	72	0·02	
				18—18	96	0·02	
3	M.O.	2·0	—	18—18	24	0·01	
	L.	0·6	—	18—18	48	0·01	
	P.P.	—	0·7	18—18	72	0·02	
				18—18	96	0·02	
Calcium oxide							
1	M.O.	4·4	—	18—18	24	0·01	Unchanged.
	L.	3·2	—	18—18	48	0·04	
	P.P.	2·3	—	18—18	72	0·04	
				18—18	96	0·04	
2	M.O.	7·4	—	18—18	24	0·01	
	L.	6·6	—	18—18	48	0·04	
	P.P.	5·2	—	18—18	72	0·04	
				18—18	96	0·06	
3	M.O.	10·6	—	18—18	24	0·08	
	L.	9·7	—	18—18	48	0·08	
	P.P.	8·5	—	18—18	72	0·10	
				18—18	96	0·12	

* Unchanged.

From the foregoing table it will be seen that the action of the water is greatly affected by the addition of salts. Sodium phosphate and the alkali and alkaline-earth carbonates seem to exercise the greatest inhibitive action. The acetates of the same bases only slightly diminish the action, whilst the nitrates but slightly increase the action. The sulphates and chlorides show this increased action a little more markedly, but there are certain cases worthy of special notice. Compounds of aluminium and ammonium have greater actions than the corresponding compounds of the other bases. Ammonium compounds act much more strongly than any others, excepting, of course, the free acids. Ammonium nitrate, sulphate, chloride, and acetate have a greater action than the corresponding salts of the same acids with other bases. Aluminium sulphate and calcium oxide have quite appreciable actions. This fact is of importance considering the extensive use which is made of these substances in purifying water for drinking purposes.

Action of raw upland lake water after contact with natural peat.

Five hundred grms. of natural peat from a moorland gathering ground were shaken up very thoroughly for 2 hours with 2 litres of the water. The whole mass was then filtered and the filtrate tested; 100 c.c. of the raw water had an alkalinity of 0·8 $N/100$ to methyl orange, and 0·2 to lacmoid, and an acidity of 0·2 to phenolphthalein. Reaction of 100 c.c. After shaking with peat, the alkalinity to methyl orange was 0·5 $N/100$, and the acidity to lacmoid and phenolphthalein 0·5 and 1·0 respectively.

After 24 hours' contact with lead, the prepared water had dissolved 0·6 part per 100,000; after 48 hours, 0·7 part; after 72 hours, 0·7 part per 100,000.

Action of distilled water after contact with peat.

Five hundred grms. of the peat were shaken with 2 litres of distilled water as before. 100 c.c. of the distilled water had an alkalinity of 0·5 $N/100$ to methyl orange and an acidity of 0·1 and 0·2 to lacmoid and phenolphthalein respectively. After shaking with peat the respective figures were 0·3, 1·2, and 1·8 $N/100$. The action of these waters on lead was:—24 hours, 0·6 part per 100,000; 48 hours, 0·8 part; 72 hours, 1·0 part; 96 hours, 1·2 parts per 100,000.

Action of rain water after contact with natural peat.

Five hundred grms. of the peat were shaken with 2 litres of rain water, as in the last two experiments. The rain water had an acidity of 0·5 $N/100$ to methyl orange per 100 c.c., 1·1 to lacmoid, and 1·5 to phenolphthalein. After being shaken with peat, the alkalinity to methyl orange was 0·5 $N/100$, whilst the acidity to lacmoid was 1·0 and to phenolphthalein 1·5 $N/100$. After 24 hours' contact, the prepared water had dissolved 0·7 part of lead per 100,000; after 48 and 72 hours, 0·8 part.

Action of a "naturally hard limestone drinking water" after contact with peat.

Five hundred grms. of the peat were shaken with 2 litres of the hard water as before. The water had an alkalinity of 54 $N/100$ per 100 c.c. against methyl orange. After contact with peat the alkalinity to methyl orange was 4·8 and to lacmoid 3·0, whilst the acidity to phenolphthalein was 0·4 $N/100$ per 100 c.c.

Action of the prepared water on lead:—Contact of 24 hours dissolved 0·33 part of lead per 100,000; 48 hours, 0·40 part; and 72 hours, 0·50 part. The water coats the lead strips with a protective coating and is not contaminated by lead after a contact of from one hour to 24 days.

From the foregoing experiments it will be seen that generally the result of bringing waters in contact with peat is to lessen the action of the water on lead and at the same time increase the acidity of the water.

In certain waters, especially those tending to contain a fair amount of dissolved salts in solution, the mixing with peat causes a precipitation, which increases the action of the water on lead. This is especially evidenced in the case of naturally hard waters which have no action on lead before treatment with peat, but afterwards they exert considerable action.

Action of naturally hard waters.

The action of naturally hard waters varies very much, according to whether the hardness is temporary or permanent. Waters containing carbonates or bicarbonates of calcium or magnesium exert a strong protective action.

With permanently hard waters the protective quality is generally not so marked, and in fact certain fairly hard waters attack lead with great vigour.

The following is an analysis of a drinking water, typical of this action:—

Oxygen absorbed from potassium permanganate at 27° C. in 4 hours	0·015
Ammonia, free	0·0004
Ammonia, albuminoid	0·0058
Nitrous nitrogen	None
Nitric nitrogen	0·70
Chlorides	5·00
Hardness	17·00

The water was bluish-green in colour, slightly turbid and gave a slight sediment. There was no opalescence: 24 hours' contact with lead dissolved 5·0 parts per 100,000.

Action of upland peaty moorland rivers.

Initial and final temperatures, 18° C.

TABLE XIX.

River.	Reaction of 100 c.c. in centinormal terms.			Exposure in hours.	Lead found, parts per 100,000.	Strip.
	Indicator.	Alkalinity.	Acidity.			
I.	M.O.	15·5	—	24	0·08	Unchanged
	L.	11·0	—	48	0·10	
	P.P.	—	0·4	72	0·12	
				96	0·16	
II.	M.O.	6·1	—	24	0·08	Slightly coated
	L.	5·5	—	48	0·10	
	P.P.	0·3	—	72	0·14	
				96	0·20	
III.	M.O.	2·8	—	6	0·14	Loose flocculent coating
	L.	1·8	—	24	0·24	
	P.P.	—	0·2	48	1·00	
				72	2·50	
IV.	M.O.	6·5	—	24	0·12	Slightly coated
	L.	6·0	—	48	0·12	
	P.P.	0·1	—	72	0·14	
				96	0·20	
V.	M.O.	11·5	—	6	0·08	
	L.	10·2	—	24	0·10	
	P.P.	—	0·1	48	0·20	
VI.	M.O.	5·5	—	24	0·16	
	L.	4·0	—	48	0·18	
	P.P.	—	0·2	72	0·22	
				96	0·50	
VII.	M.O.	1·0	—	24	0·28	Loose flocculent coating
	L.	—	0·1	48	4·00	
	P.P.	—	0·3	72	5·00	
VIII.	M.O.	2·0	—	24	0·30	
	L.	1·3	—	48	4·00	
	P.P.	—	0·3	72	5·00	
				96	5·00	
IX.	M.O.	4·3	—	24	0·18	Protective coating
	L.	3·7	—	48	0·25	
	P.P.	—	0·2	72	0·25	
				96	0·30	
X.	M.O.	0·5	—	24	0·3	Loose flocculent coating
	L.	—	0·1	48	6·0	
	P.P.	—	0·5	72	7·0	
				96	7·0	
XI.	M.O.	1·0	—	24	0·34	
	L.	0·4	—	48	6·00	
	P.P.	—	0·4	72	7·00	
				96	8·00	

The water remained clear in each case.

The rivers I. and II. in Table XIX. are situated in Lancashire, Yorkshire, and Westmorland. The rivers all flow through many miles of moorland in their early courses and yet at the points where collected all showed alkaline reactions. Although the waters were alkaline in reaction they showed great lead-dissolving capacities, due to the purity of the waters and their extremely low saline content. In some cases where the saline matter increases the lead solvent action is diminished, as is illustrated in the cases of the rivers I., II., IV., V., VI., and IX.

Action of water from peaty moorland streams.

The waters in these cases are from small streams flowing through channels in the peat-moorlands and collected near the sources of the streams whilst the beds of the streams are still in the peat layers. The waters are for the most part acid in reaction and from the nature of the places from which they were drawn would contain little saline matter. Their plumbo-solvent effects are somewhat variable but not approaching to that of pure distilled water. Initial and final temperatures, 18° C. Exposure, 24 hours.

TABLE XX.

Stream.	Reaction of 100 c.c. in centinormal terms.			Lead found expressed in parts per 100,000.	Strip.
	Indicator	Alkalinity	Acidity		
I.	M.O.	—	0·3	1·6	Loose flocculent coating
	L.	—	1·6		
	P.P.	—	3·2		
II.	M.O.	—	2·2	5·0	
	L.	—	4·2		
	P.P.	—	5·8		
III.	M.O.	2·3	—	0·12	Slightly coated
	L.	1·8	—		
	P.P.	—	1·7		
IV.	M.O.	—	0·5	1·6	Loose flocculent coating
	L.	—	1·5		
	P.P.	—	2·2		
V.	M.O.	0·5	—	1·0	
	L.	—	0·7		
	P.P.	—	1·2		
VI.	M.O.	0·5	—	0·6	Unchanged
	L.	—	0·3		
	P.P.	—	0·6		

The water remained clear in each case.

Action of water from the same peaty moorland streams upon lead pipes.

The lead figure was determined by Frankland's method. The lead was estimated in the water used to prepare the pipe, as well as in the water placed in the pipe later. Exposure, 24 hours.

TABLE XXI.

Stream.	First filling.	Second filling.
I.	1·8	1·4
II.	5·0	3·5
III.	0·14	0·12
IV.	1·40	1·60
V.	0·80	1·0
VI.	0·60	0·08

From Tables XX. and XXI. it will be seen that the amounts of lead dissolved as determined by Frankland's method and by my method are comparable and the results are of the same order.

Influence of temperature on the action of raw upland lake water.

Exposure, 24 hours.

TABLE XXII.

Temperature of water, ° C.	Lead found, parts per 100,000.	Appearance of water.
5	0·20	Clear
25	0·60	Cloudy
50	0·70	Cloudy
75	0·80	Cloudy
100	1·00	Cloudy

In each case the water was gradually raised to the desired temperature by placing the bottle which contained it in a water-oven, until the temperature was reached. In one case the water had to be slightly cooled, but excepting in this case none of the waters had ever had a higher temperature than that acquired in the particular experiment. When the water was at the required temperature the lead strip was inserted and the stopper pressed home in the bottle. The whole apparatus was left in the oven for the required time, and then removed and the lead dissolved in the water estimated.

Influence of temperature on the action of distilled water.

These experiments were made just as were those in the case of lake water in Table XXII.

TABLE XXIII.

Temperature of water ° C.	Lead found, parts per 100,000.
5	3·0
25	7·0
50	9·0
75	3·0
100	2·0

NOTE —Exposure, two hours. The water was "silky" in each case.

Action of raw upland lake water and distilled water at 100° *C.*

The waters were allowed to boil in open Jena flasks and after boiling for fifteen minutes the lead strip was dropped in. The waters were kept boiling for one hour, and the amount of lead was then estimated. The initial volume of the water was 120 c.c. When boiling commenced distilled water was added to both flasks drop by drop so as to keep the water level constant. The drops were allowed to drain on the upper part of the neck of the flask so as to be free from air on entering the water. The amounts of lead found were 0·08 part per 100,000 in the distilled water and 0·60 part in the lake water.

From Tables XXII. and XXIII. it will be seen that in the case of lake water the action increases with the temperature from 5° C. up to 100° C., when the time of exposure is constant; in the case of distilled water under the same experimental conditions the action increases with increase of temperature from 5° C. up to 50° C., but at temperatures above 50° C. and up to 100° C. the action diminishes.

PART IV.

GENERAL SUMMARY.

The results of the various experiments described in this paper show that pure distilled water specially prepared and free from dissolved gases, exerts but a very slight action upon lead. The amount of lead dissolved by such water is in fact so small as to be only just recognisable by the method used.

Its action is, however, greatly modified when certain gases are dissolved in it. Hydrogen, carbon dioxide, oxygen, and air may play a part in causing the lead to dissolve, the most potent being oxygen. When both oxygen and carbon dioxide are present a very interesting reaction takes place, comparable with the actions of many pure natural waters. This action has been termed the "erosive power" of such waters, and is not to be explained by the assumption that a "scaling" of the lead takes place and that actual particles of lead are "pitted" off. It is undoubtedly due to the fact that the lead passes into solution and is afterwards precipitated by carbon dioxide. It is this suspension of the precipitated lead carbonate which has been termed "eroded lead." If to this "suspension of precipitate" an excess of carbon dioxide is added, the precipitate will gradually dissolve and a clear liquid will result. The lead can again be precipitated from this clear liquid by the passing of a stream of air free from carbon dioxide through it. This solution will then have the "silky appearance," as it is termed in this paper, characteristic of liquids containing the so-called "eroded lead."

The reactions are expressed as follows:—

$$
\begin{array}{rcl}
Pb_2 + O_2 & = & 2PbO \\
2PbO + 2H_2O & = & 2Pb(OH)_2 \\
2Pb(OH)_2 + CO_2 & = & HO.Pb.CO_3Pb.OH + H_2O \\
2Pb(OH)_2 + 2CO_2 & = & 2PbCO_3 + 2H_2O \\
2PbCO_3 + 2CO_2 + 2H_2O & \rightleftarrows & 2PbH_2(CO_3)_2
\end{array}
$$

Distilled water made slightly acid and then allowed to act on lead produced a liquid which could not be rendered "silky" by the admission of carbon dioxide. Two facts explain this:—1. Lead carbonate cannot exist as an insoluble suspension in acid solutions. 2. Carbonic acid does not replace other acid radicles in lead salts under such conditions. The lead dissolved in waters of this class is probably present as a salt of the type, PbR_2, where R represents the radicle of the acid present. Under other conditions basic salts can be produced of the type, Pb.OH.R, or polybasic salts of the type, R.Pb.O.Pb.O.Pb.R.

The experiments made with ordinary distilled water gave approximately the same results as those made with very pure distilled water. The greatest difference —and that but slight—was that ordinary distilled water took more lead into solution than did the very pure distilled water. This was probably due to the presence in the ordinary distilled water of small quantities of ammonia or of acids.

Distilled waters containing dissolved atmospheric gases attacked lead with increased activity as the temperature was raised from 5° C. to between 50° C. and 60° C. but at higher temperatures the action diminished, until at boiling temperature its intensity was no more than it had been at 5° C.

When distilled water in which a piece of lead foil was suspended was left exposed to the atmosphere, the precipitation of lead carbonate proceeded as long as any lead foil remained. The explanation of this is that the lead hydroxide, formed by the action of the water and the oxygen upon the lead, is precipitated as lead carbonate by the atmospheric carbon dioxide; thus more lead hydroxide is formed, and this in its turn is precipitated and so the action continues (other conditions remaining constant) so long as the lead and carbon dioxide are in excess.

The presence of free acids prevents this action, and in such cases the lead salts of the particular acids present are found dissolved in the water. When the reaction between the lead and the acid has reached its maximum it resolves itself into the solubility of lead in a solution of the lead salt of that acid, of a particular concentration, depending upon the amount of acid which was originally present. This partially accounts for the fact that in certain acid solutions more lead is dissolved than theoretical calculations would admit.

The phosphates of calcium and sodium when dissolved in waters seem to prevent entirely any lead from going into solution; ranking next to the phosphates, as regards this preventive action, are the carbonates and bicarbonates of the alkali metals and the alkaline earths. These salts seem to exert remarkable protective actions upon lead. Solutions of certain chlorides, sulphates, and acetates possess this preventive action in a slight degree only, and the nitrates exhibit this power in a still less marked degree.

Considering the solvent effect of the various solutions upon lead, from the point of view of the acids present, it is found that salts of phosphoric acid exert the least action, and very slightly removed from them in the scale of activity are the carbonates and the bicarbonates.

The sulphates, chlorides, and acetates cause increased actions which are fairly similar, but the nitrates are conspicuous by a marked tendency to increase the action upon lead of the waters in which they are dissolved. Ammonium chloride, ammonium acetate, and ammonium nitrate in solution have very marked actions, especially the last named, which has an action greater than that of distilled water containing a limited amount of dissolved air, for equal durations of exposure. Here the amounts of oxygen and ammonium nitrate present are by no means comparable, the ammonium nitrate being present in much greater quantity.

Aluminium sulphate and especially calcium oxide dissolve quite large amounts of lead.

The purer natural waters, such as rain water and the waters from streams (before they have had the opportunity of dissolving much mineral or organic matter or received material amounts of spring waters), exert actions which are comparable with the action of ordinary distilled water. Rain waters containing large quantities of acids react like distilled water containing acids.

Moorland waters are generally very free from dissolved mineral matter, but contain varying amounts of organic matter and are usually very soft. Moorland waters may have alkaline, neutral, or acid reactions: they generally attack lead rather vigorously but seldom more actively than distilled water. The waters gathered from peaty moorlands exhibit at certain seasons an increased acidity, but this cannot account for the amount of lead with which they become contaminated.

In seeking an explanation of the action of these peaty waters, various types of water were subjected to the action of fresh peat. Distilled water after undergoing the above treatments, whilst showing in some cases increased acidity, yet exerted less action on lead than did the pure distilled water. This was also the case with rain water. Distilled water and rain water showed diminished actions upon lead after contact with peat, but the reverse was the case with a soft upland lake water and with a hard spring water.

Distilled water, rain water, lake water, and hard spring water after treatment with peat all manifested actions upon lead considerably weaker than the action of untreated distilled water. By contact with the peat the content of soluble organic matter in the soft waters is increased, and the amount of soluble saline contents of hard waters is reduced. This is probably why soft waters are rendered less and the hard waters more active by this treatment. Certain hard waters, and especially those in which the hardness is permanent, are not rendered more active by treatment with peat.

Lake waters, which are naturally very pure and contain only small amounts of saline matter, exert a much weaker action than either rain water or distilled water. Their action, though generally of a low degree, is liable to variation during different seasons.

In the case of distilled water it was found that increases of temperature up to 50°—60° C. increased the amount of lead passing into solution in a definite time, but that above these temperatures the amount of lead diminished gradually as the boiling point was approached. With lake water the action was different, the amount of lead passing into solution gradually increasing as the temperature was raised to the boiling point. The amounts of lead found in experiments made with lake water were much smaller than the amounts found when distilled water was used.

The action of lake water is markedly modified by the addition of various substances. The modifications are very similar to those which were found in the distilled water experiments. In those experiments larger quantities of the various substances were dissolved in the waters than in the lake water experiments. In these latter experiments the amounts of substance dissolved would interfere only to a slight extent with the amount of dissolved oxygen in the water, and in some cases it would be more than in others, depending upon the nature of the substance dissolved.

When lead is exposed to solutions containing electrolytes, probably a certain proportion of the lead will pass into solution in the form of the lead salt of the acid present. The solution of this lead salt will decrease the amount of dissolved oxygen, and as the concentration of the lead salt increases the amount of dissolved oxygen will decrease; thus the action will tend to increase up to a certain maximum rate, afterwards gradually diminishing until equilibrium is established. This accounts to some extent for the very slight effect observed when sodium carbonate and calcium carbonate are used and the greater effect of the chlorides, sulphates, and nitrates, in these dilute solutions.

The carbonates and bicarbonates after a very short time produce coatings on the surface of the lead, which is thus rendered out of contact with the water, so that any further solution of the lead is prevented. The chlorides and sulphates after long periods of exposure also tend to produce slight protective coatings upon the lead. Waters containing certain forms of organic matter show, after a short period of contact with lead, a peculiar cloudiness which, after a time, develops into a flocculent precipitate consisting of a compound of the organic matter with lead. This precipitate tends to deposit upon the lead surface as a loosely attached protective coating.

The remarkable way in which the ammonium salts and especially ammonium nitrate attack lead is no doubt due to the fact that these salts become largely hydrolysed in aqueous solution, and thus exhibit the properties of acids rather than of neutral salts. It is to the oxygen available in the nitrates (for oxidising purposes) to which I would ascribe their increased action. This affords a ready explanation of the intense action of ammonium nitrate. Ammonium compounds are very generally present in the atmosphere and in the soil, and of all compounds present in natural waters those of ammonia are the most common. Ammonium compounds are very easily oxidised to nitrates by various agencies, and it is practically impossible to procure a natural water which does not contain some trace of ammonium nitrate. Even should the water contain no ammonia either mineral or organic, almost without exception it would contain some nitrate. The action of many natural waters is to be explained by the presence of varying amounts of ammonium nitrate.

Moorland streams are generally very pure waters and contain small amounts of saline matter, thus approaching in character very nearly to distilled water. Thus, as one would expect, the amounts of lead they dissolve are very similar; but river waters, having traversed stretches of rocky beds and dissolved appreciable amounts of mineral matter, behave more like dilute saline solutions and exert a very much milder action upon lead than the purer waters.

Thus one would expect to find that spring waters and hard waters had but a slight action on lead. Generally this is the case, but there are exceptions, and some very hard waters attack lead quite vigorously. Of the waters characterised by the possession of large amounts of saline matter, those exhibiting practically no solvent effect upon lead, are those possessed of temporary hardness, but waters devoid of this quality, at least certain of them which contain much permanent hardness, show that they are capable of attacking lead, in some cases to a very appreciable extent.

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DISCUSSION.

Mr. H. L. TERRY observed that nothing had been said about lead ore as a possible source of contamination of water supplies. In his opinion this was right, as despite the actions of various eminent geologists in condemning certain gathering grounds because of contiguity to lead mines he thought there was no satisfactory evidence of lead poisoning arising from lead ore—in limestone areas at any rate. He might instance the small town of Middleton-in-Teesdale where the water supply came direct, after gravel filtration, from the adit of a disused lead mine about two miles away, and where both cerussite and galena had been mined. This water had always been found free from lead. Other instances could be given as well as the fact that lead miners commonly drank water from the lodes without ill effect. The reference to pyrites was important as in the absence of limestone the acidity produced by oxidation might easily prove dangerous. In Swaledale he had found crystals of pure copperas in very old lead mine adits in the Yoredale beds. The great purity (softness) of moorland water was a frequent source of trouble in mining operations owing to its corrosive action on steel reservoir pipes, and he was quite inclined after his experience of some such waters to agree with the author that the dangerous element was the dissolved oxygen rather than the small amount of vegetable matter usually found in solution.

Mr. C. RAWSON said that about 25 years ago there was a good deal of trouble in Bradford owing to the action of water on lead, and he had made a number of experiments and tested the waters from several of the reservoirs feeding the town; the results were recorded in the Journal of the Society of Dyers and Colourists for April, 1889. He came to the conclusion that the action of water upon lead was due to the presence of free carbon dioxide, and the author of the paper had in a great measure confirmed that opinion. From the figures put before them oxygen seemed to have a very great effect upon the amount of lead dissolved, but he had not taken that factor into consideration. Viewing the subject from a practical standpoint, however, he was of opinion that the action was chiefly if not entirely due to free carbon dioxide. He made his experiments in leaden water piping with distilled water and with ordinary water supplied to the town. He took new lead pipes and old lead service pipes. Each working pipe, sealed at one end, was a yard in length and after pouring in the water to be tested, the upper end was firmly closed by a cork so that the water was practically under the same conditions as when standing in the service pipe. In the case of distilled water, ⅓ grain of lead per gallon was dissolved after being in the tube 24 hours. When the water was boiled and cooled (without access of air), in the old lead pipe there were traces of lead found, but in the new lead pipe not a trace. When the water was saturated with carbon dioxide at the ordinary pressure, and put into the tubes, as much as 4½ grains per gallon dissolved in the case of new lead, and about half that amount in the old pipes. All the other waters were treated in a similar manner with like results. He found the addition of calcium phosphate to be the best means of preventing the action of water on lead, though sodium carbonate was nearly as good. In the former case no trace of lead dissolved either in the case of an old pipe or a new one. He made tests with regard to the solubility of lead phosphate which showed it to be less than one part in 3,000,000. Referring to the hard water where five parts of lead dissolved in 100,000 he presumed the hardness was due to sulphates.

Mr. W. THOMSON said that the silky looking lead precipitate shown might probably occur in and be carried by the drinking water. If it were filtered out or allowed to settle it would probably show comparatively little lead in solution. He was not aware whether experiments had been made with regard to nitrites as compared with nitrates, but as some waters contain a good deal of nitrites they might have more or less action upon the lead than the nitrates. Phosphates had a distinctly deterrent effect on the action of water upon lead, and it was recognised that an ordinary animal charcoal filter would easily remove traces of lead from water. Mr. Heap's experiment of heating the water to 20° C. did not seem quite natural.

Mr. E. ARDERN asked whether the author had entirely discarded the electrolytic theory of corrosion or solubility of lead. He was under the impression that Mr. Heap, as a result of his experiments, had concluded that the solution of lead by water was due jointly to biological and chemical action, that is to say, the primary action was a biological one, where carbonates and nitrates were produced by the fermentation and oxidation of organic matter, and that the actual solution of the metal was purely chemical due to the dissociation or ionisation of the salts thus produced. In a paper before the last meeting of the Section Mr. Lambert had noted the effect of the presence of dissolved oxygen on the corrosion of iron and according to his explanation the effect was purely electrolytic, the oxygen acting as a depolariser in oxidising the film of hydrogen formed on the surface of the metal, and which in the absence of oxygen was sufficient to cause polarisation and thus prevent corrosion. Did Mr. Heap accept this theory or did he base the secondary action upon a purely chemical theory?

The Chairman understood that the experiments lead to the result that the whole question of the solution or otherwise of lead in water was a matter of the balance of constituents which might be present. The small amount of saline matter made a very great difference by altering the balance of the reaction which took place at the surface of the lead. It appeared to him that the great merit of Mr. Heap's work was to correlate a great amount of work which had been done before into one fairly consistent whole. One or two practical points had arisen which it was well that the citizens generally should know something about. One important point was the smoke problem, where one found carelessness in one direction caused trouble in another. Smoke poured into the atmosphere of one district may be carried into other districts, and more or less poison the water of those districts; and apparently, from Mr. Heap's observations, peat instead of being an enemy was really a friend by protecting the water supply. It appeared to be a point of very great importance which would add increased force to the agitation for the suppression of smoke. There was also the very important question in regard to the effect of aluminium sulphate being present in water in small quantities. A very small mistake in the mixing of the chemicals might apparently result in giving a water which attacked lead to a much greater extent than would otherwise be the case. This fact emphasised the need for a rigid control of waterworks filters, not only the ordinary slow sand filter, but also the mechanical waterworks filter. The corrosion of lead under certain circumstances might be extraordinarily rapid. He had seen a lead pipe used for insulating an electrical wire, not actually immersed in sewage but just a few inches above the surface of the sewage carrier, and in the space of about six months it was reduced to a mass of lead carbonate owing to the simultaneous attack of ammonia and carbonic acid.

Mr. S. E. Melling said he thought it had been generally assumed in the past that water containing four to five parts of temporary hardness in 100,000 acted as a protective of lead. Had Mr. Heap carried out any experiments to show the minimum quantity of calcium carbonate or magnesium carbonate which checked the plumbo-solvent action of a water, and had he tried to show any relationship between temporary hardness and permanent hardness in connection with this action? Mr. Heap had shown in one of the tables a very remarkable difference in the amount of lead dissolved by waters containing equal quantities of calcium sulphate and calcium chloride. It would be interesting to know in the case of water containing, say, 10 degrees of temporary hardness and four degrees of permanent hardness, whether that, or any similar other proportion, would be in the direction of minimising the action of water upon lead.

Dr. S. Wolff stated that both Mr. Heap and himself had had the opportunity of examining the same kind of waters, invariably finding similar results in their examinations. A point upon which he wished to lay particular stress was not to attach too much value to the result of a single examination of a water for lead solvency, because a slight alteration in the condition of experiment might introduce errors causing the water to be condemned. Three to six experiments should be done on different samples of the same water before a definite conclusion was reached that the method was right and the water was wrong. He himself had worked at a temperature of about 18° C.

Mr. H. J. Bailey asked if the author inferred that the main action was due to dissolved oxygen, and whether the carbon dioxide appeared to play merely the part of a precipitant, so clearing the liquor of dissolved lead. Did the saline solutions form a protective coating to the lead which hindered the action of the oxygen? The very high comparative results obtained with distilled water seemed to point to the conclusion that corrosion must be due to something different to bacteriological action or decomposition of organic matter.

Mr. Heap, in reply, quite agreed that waters drawn from lead mines as a rule did not show much contamination with lead. There was the popular instance in the Isle of Man. As a rule lead mines did not offer lead to the water collecting round the various strata in which the pockets were placed because the insoluble lead carbonate was produced rather quickly, and at that depth there was not much carbonic fermentation going on, consequently there was no tendency to produce the bicarbonate, and of course the insoluble parts were left. He agreed with the remarks made about pyrites. He did not suggest that peat was the medium by which the particular acids under discussion were generated. It might be that in peat the two bacilli of Houston did live and propagate and produce certain amounts of acid; it might be that the acids attack lead, but that the amount of acid produced did not account for the action of those waters upon lead. He did not agree that carbon dioxide was the causative agent concerning the solution of the lead. He would not like to support the carbonic acid theory of corrosion, or the electrolytic or ionic theory, because he was not in a position to come to a proper decision. Probably both shared in the action. He believed oxygen to be the chief causative agent. Carbon dioxide had a secondary action, to his mind, in precipitating a part of the lead, although in the initial stage of the reaction the atom of lead, or the ions of lead, and the ions of hydroxyl or hydrogen were all acting. In his opinion oxygen had a greater effect than carbon dioxide. So far as the pipes used in the experiments were concerned the experiments were anaerobic with the exception of the gas dissolving in the water. He did not know why distilled water should not dissolve any lead. It was not his experience. Sodium carbonate and sodium phosphate were good preventives. With regard to the hard water the hardness was chiefly permanent. Professor Carnelly had estimated that aerated water was four times more active than water deprived of air. Professor Frankland had said that carbon dioxide had no action, but Professor Patterson Muir, whilst working at Owen's College, showed that carbon dioxide had an action which increased with increase of pressure, working with seltzer waters or syphon carbonated waters. Dealing with charcoal and phosphate filters he agreed that lead easily combined with phosphate salts to form lead phosphate, the insoluble compound, of course, being retained on the surface of the charcoal. The filters, however, had not a very long life, and if there was a great amount of lead in the water they soon became saturated with it and lost their action. The reason he, himself, had experimented with water at 20° C. was because the incubator was at the same temperature. Incidentally the effect of sunlight had an increased action upon the waters. He did not think that the cause of the solution of lead was biological. As far as possible the solutions employed were sterile. In referring to the organic matter of fermentation he was really dealing with the production of nitrates. He agreed that depolarisation and overvoltage played quite a considerable part in the reaction. By taking an ordinary cell and making a lead plate the anode, and then adopting a plate of any other metal desired as the cathode, the lead would always disappear. If the lead pipe was kept sufficiently charged the lead would not go into solution, but if overvoltage and polarisation occurred then it began to go into solution owing to the current reversing and the lead becoming the cathode. The same principle applied to the corrosion of iron pipes. With respect to Dr. Fowler's remarks, of all waters the purest non-aerated water had the least action. Pure distilled water free from gases had the least action. Next came pure water containing oxygen which showed the greatest action. Carbon dioxide had a slight action. If water was saturated to a certain extent with sodium sulphate it would not dissolve the same amount of lead sulphate that it would have done were the sodium sulphate not present, because of the equilibrium between the two. It was all a matter of equilibrium between the lead salt formed and the salts present. In the case of rain the amount of lead found was less than with distilled water. Water containing temporary hardness and no permanent hardness would certainly not attack lead, or rather the lead would not pass into solution, but a protective coating would be produced on lead. Water containing permanent hardness alone attacked lead vigorously, and broke up the acid salts present, with the result that one got a lot of lead, especially with waters containing a large amount of nitrates. It was not possible to make any rule as everything depended upon the particular nature of the acids going into the water, whether nitrates or sulphates. Each water had to be judged on its merits. He was of opinion that dissolved oxygen had a great action upon lead. Taking a water with oxygen alone the water quickly became saturated with lead hydrate, and the figure was not high in comparison with what took place if the water was allowed to be in contact with air, or carbon dioxide was always coming in contact with the water, when, of course, the reaction was progressive, and the lead foil entirely disappeared. From that point of view carbon dioxide had the greater action, though under anaerobic conditions he considered it had the smaller action.

Communication.

NOTES ON ALCOHOLOMETRY.

BY A. F. JOSEPH AND W. N. RAE.

(Ceylon Medical College, Colombo.)

The following observations relate to the determination of the strength of alcoholic liquids by the distillation method, with special reference to work in a warm atmosphere. Considering the simplicity and frequency with which the determination is made, it is curious that so little definite information is given in the ordinary works dealing with organic analysis (and especially with alcoholometry) as to the conditions under which satisfactory results can be obtained. Thus, for example, while it is probably well known to analysts, that the usual tables accompanying Sikes' hydrometer are inaccurate to the extent of several per cent. when used at high atmospheric temperatures (80—100° F.) this fact is never mentioned. Again, the different tables connecting the specific gravity of the solution with its alcoholic content differ considerably, so that it becomes a matter of considerable diffculty to interpret accurately the specific gravity determinations: the same holds good for the reduction of percentage of alcohol by weight to percentage of proof spirit. This latter is due to the fact that there is no authoritative statement as to the exact percentage of alcohol in proof spirit, different observers having obtained different results.

Works on analysis sometimes give the specific gravity tables to five places of decimals without pointing out that to obtain a result correct to the fifth place, requires that the temperature should be adjusted to 0·01° C.: it is unlikely that many analytical laboratories maintain a thermostat with that degree of accuracy, indeed the tables themselves are drawn for 60° F., which is taken by some workers as 15·5° and others as 15·6° C. It is not necessary to be correct to the fifth place in which one figure only corresponds to about 0·01 per cent. of proof spirit, but we do consider it advisable to keep within five figures in the fifth place, which requires maintaining a constant temperature to 0·05° C.

Our attention has recently been drawn to two points: first the conditions as to time of distillation and temperature of condenser water necessary to obtain satisfactory results, and, secondly the probable errors caused by the use of Sikes' hydrometer, and the methods of reducing them. The maximum permissible temperature of the condenser water is a point of practical importance in the tropics, as, if it is necessary that it should be below about 85° F., ice must be used, and this causes much trouble and expense.

The experiments now described were carried out in Colombo during the hot weather (March to May) of this year: during this time, the usual temperature of the laboratory was about 88° F.—somewhat lower than usual for the time of year.

Mixtures of pure ethyl alcohol and water were prepared and the alcoholic strength was found either by the hydrometer or by direct density determination. The sample was then treated as if it were an alcoholic liquid of unknown strength: 300 c.c. were measured out in a graduated flask, placed in the distilling flask and distilled: after distillation, the volume of the distillate was made up to 300 c.c. and its strength determined by the same method as before. The apparatus used by which the temperature of the inlet water to the condenser could conveniently be controlled is shown in the figure and requires no explanation. In some of the experiments the bath was filled with ice-water. Solutions of three different strengths were used—about 90 under proof, 30 under proof, and a little over proof. The results obtained by altering the temperature of the inlet water show that between 60° and 120° F. there is very little difference in the accuracy obtained. In determining the densities, a large thermostat was used adjusted to 32·5° C. ± 0·02, the solutions being weighed in quartz specific gravity bottles. These, although not so suitable for work of the highest accuracy, as, *e.g.*, Bousfield pyknometers, offered great advantages for our purposes, owing to the ease with which they are cleaned, dried, and filled. The probable error in our determinations is not more than two units in the fifth place.

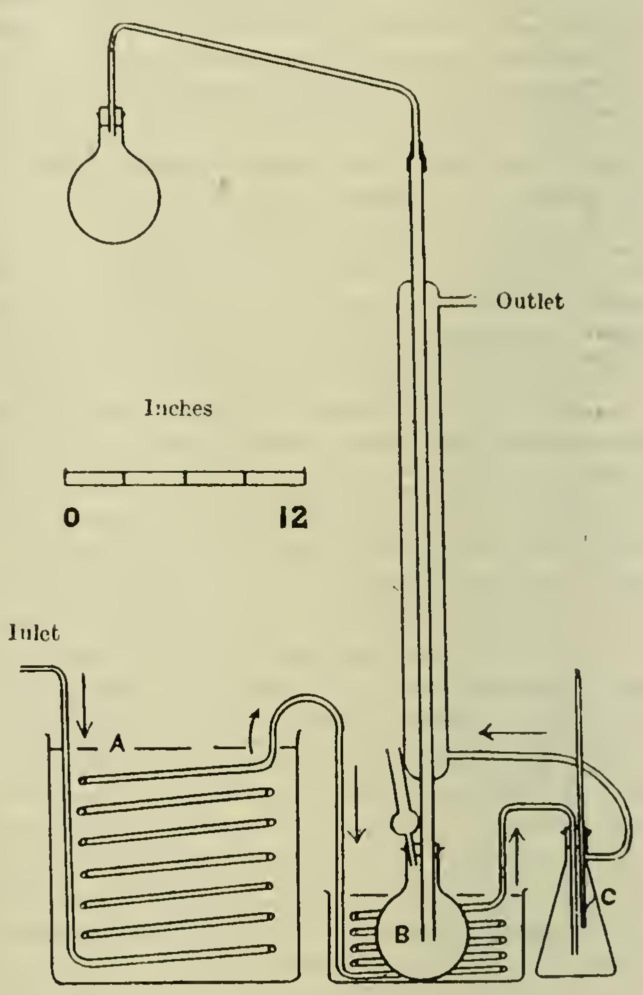

Fig. 1.

A. Tank containing long spiral for heating or cooling inlet water.
B. Receiver fitted with guard tube containing a little moist cotton wool.
C. Small flask with thermometer for observing temperature of inlet water.

The percentage of alcohol was calculated from the densities by careful interpolation of the tables of Osborne, McKelvy, and Bearce (this J., 1913, 304). These do not differ to any important extent from those in current use and have the advantage (in addition to greater accuracy) of allowing the determinations to be made at any temperature between 10° and 40° C.

In making the observations with the hydrometers, we were specially careful respecting the removal of air-bubbles, sometimes a matter of some difficulty with the brass instrument with the more dilute solutions.

Temperatures were read with an Anschutz thermometer to 0·1° C. and the hydrometer read to 0·05 (a division being 0·2): as for weak solutions 1 division makes a difference of 0·5 per cent. proof spirit, it is necessary to sub-divide to this extent. As will be seen, the condenser was of the ordinary Liebig pattern, the jacketed part of the inner tube being 2 feet long, and as the internal diameter was half an inch, the condensing area was about 38 sq. in. A Davies condenser with a 1 ft. jacket would have given almost double this area, but we preferred to use the simplest apparatus possible. The water was passed at the rate of 25 litres per hour, and during its passage through the condenser was raised only a few degrees in temperature. As stated above, 300 c.c. were taken for the distillation, this being the smallest quantity which can conveniently be used with the brass hydrometer. The distillation was carried out fairly slowly until most of the alcohol had passed over, which is roughly indicated by the size of the drops, and also by the way in which the distillate flows down the condenser tube.*

The operation was then hastened and completed in 45 to 50 minutes for pure alcohol-water mixtures: for fermented liquids which are apt to froth, we found it necessary to extend the time to 60 minutes. The volume of the liquid distilled varied according to the strength from 150 to 250 c.c.—this quantity can be passed over in the time stated.

The results are shown in the table below; the densities (grams per c.c.) are given to the nearest half unit in the 4th place.

(H = Hydrometer; D = Density-grams per c.c.)

Temp. of condenser water.	Method.	D at 32·5° C. or H reading before distillation.	Ditto after distillation.	% proof spirit before.	Ditto after.
		° F.	° F.		
60° F.	H	51·6 @ 82·8	51·55 @ 83·7	102·5	102·2
60° F.	D	0·9014	0·9018	102·3	102·0
60° F.	H	94·05 @ 84·9	94·4 @ 83·5	10·7	10·1
60° F.	D	0·98335	0·98405	14·3	13·4
68° F.	H	92·45 @ 85·6	92·9 @ 81·4	14·9	14·5
86° F.	H	51·35 @ 84·9	50·1 @ 91	102·0	101·5
86° F.	D	0·9017	0·9017	102·1	102·1
86° F.	H	71·2 @ 86·7	70·95 @ 88·2	67·3	67·2
86° F.	D	0·93995	0·94015	69·6	69·3
86° F.	H	93·3 @ 84·4	93·4 @ 85·8	12·9	12·3
86° F.	D	0·98385	0·98385	13·7	13·7
104° F.	H	51·15 @ 84·6	50·45 @ 88·2	102·4	102·0
104° F.	D	0·9440	0·9440	65·3	65·3
104° F.	H	73·05 @ 86·7	73·2 @ 86	63·3	63·3
104° F.	D	0·98715	0·98725	9·3	9·2
104° F.	H	94·45 @ 92·4	95·0 @ 85·6	8·5	8·2
122° F.	H	72·2 @ 86·4	71·5 @ 91·4	65·3	64·5
122° F.	D	0·9421	0·9424	67·3	67·0
122° F.	H	95·0 @ 86·5	94·85 @ 86·9	8·1	8·1
122° F.	D	0·98715	0·98725	9·3	9·2

It therefore appears that condensation is equally efficient at the various temperatures between 60° and 120° F.

The second point which occupied us was that a comparison between the strengths found by density determinations and by the Sikes hydrometer, using the ordinary tables, showed that there is a very large error in using the latter. A great improvement is made if the tables compiled by C. H. Bedford (late Director of the Indian Central Excise Laboratory) are used in conjunction with Oertling's glass Sikes hydrometer, or even with the ordinary brass instrument, which, however, is not so good. The difference in the two sets of figures is shown in the following diagram, in which difference is plotted against hydrometer reading. Except with very dilute solutions at 100° F. (the points for which are not shown), the strength as obtained from Bedford's tables is always higher than that from the ordinary ones. It will be noticed that the greatest differences are for the highest temperatures and when the hydrometer reading is about 80 (corresponding to about 50 under proof). At 100° F. it is as much as 6 per cent. of proof spirit.

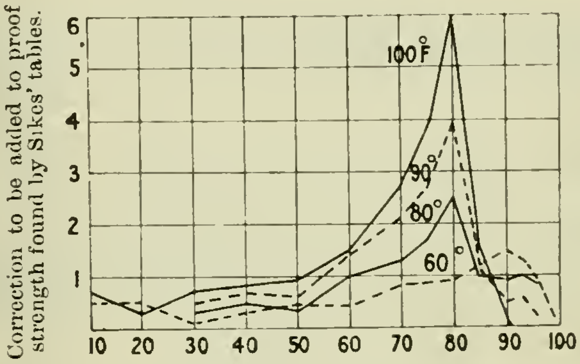

FIG. 2.

The following table shows the results obtained by determining the strengths of nine solutions by density and by the glass hydrometers, the reading of the glass instrument being interpreted by both the ordinary and Bedford's tables.

Percentage of proof spirit.

True strength by density.	By brass hydrometer.	Glass, ordinary tables.	Glass. Bedford's tables.
102·2	101·8	101·8	102·5
83·6	81·9	82·3	83·5
67·5	65·3	65·7	67·8
56·7	53·5	54·2	57·0
49·2	45·1	45·9	49·5
45·2	42·5	42·3	44·9
34·5	33·1	33·0	34·0
22·1	21·6	21·4	22·0
11·1	9·7	9·8	10·6

The results show how much more satisfactory Bedford's tables are than those in ordinary use, at any rate within the limits of the above concentrations. For the nine determinations, the average error with the former is 0·3 per cent., with the latter 1·7 per cent.

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* The addition of even a very small quantity of alcohol has a marked effect on the surface tension of water (*cf.* Duclaux, Ann. Chim. Phys., [**5**], ii, 233—253). It is possible that interesting quantitative results might be obtained from a study of this, and experiments have been commenced on the subject.

Journal and Patent Literature.

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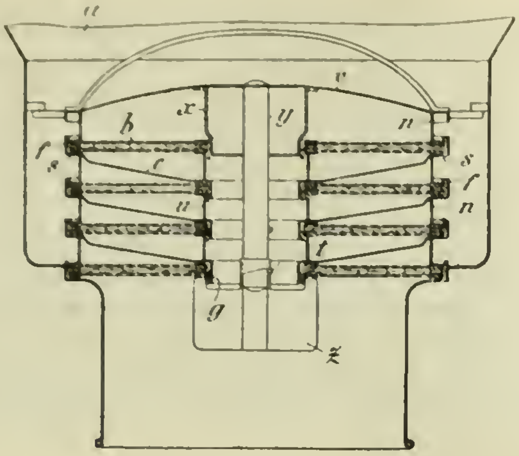
I.—GENERAL PLANT; MACHINERY.

Patents.

Filters. A. J. Ericsson, Stocksund, Sweden. Eng. Pat. 24,027, Oct. 21, 1912.

The superposed filter frames, *b*, are spaced apart by conical partition frames, *c*, both being provided with central openings. The outer edges, *f*, and inner edges, *g*, of the partition frames, *c*, are turned respectively over the outer edges, *s*, and the inner edges of the filter frames. The frames are further supported by perforated bands, *n* and *u*, and the whole is provided with a cover, *v*, and keyed together by the rod, *y*, and the key, *z*. The filter is placed in the outer vessel, *a*, and the liquid to be filtered is poured into the vessel and passes through the filters, along the



upper side of the partition frames, *c*, into the central opening. A sleeve, *x*, fits into the upper end of the central opening and prevents access of the unfiltered liquid.
—W. H. C.

Filtering apparatus. W. Paterson, London. Eng. Pat. 2574, Jan. 31, 1913.

HORIZONTAL filters of the drum pressure type are provided with a by-pass valve between the impure water main and the filtered water main, and also with means for admitting compressed air to the filtering material for the purpose of cleansing it.—W. H. C.

Separators; Centrifugal ——. W. Mauss, Johannesburg, South Africa. Eng. Pat. 6478, March 15, 1913.

Two or more drums open below and provided with a flanged lip above, are mounted in a frame so that they are rotated about a central axis, and also about their own axes. The material to be treated is fed against the inside of the drums; the liquid rises up and is discharged over the lip and the solids are carried round and discharged by a scraper fixed at the side near the central axis.—W. H. C.

Centrifugal separators; Discharge of liquid from ——. Separator Aktiebolaget Fama. Fr. Pat. 454,010, Feb. 5, 1913. Under Int. Conv., Feb. 6, 1912.

THE tubes through which the skimmed milk or other heavier liquid is discharged are arranged parallel with, or slightly inclined to, the axis of the drum, in order that the points of discharge may be as near as possible to the axis of the separator.—W. H. C.

Packing material for stuffing boxes and the like. J. Sucich, Vienna. Eng. Pat. 8802, April 15, 1913. Under Int. Conv., April 16, 1912.

A MIXTURE of 100 parts by weight of grains (not less than 1 mm. diam.) of "bearing metal," 20 parts of whiting, 5 parts of graphite flakes and 5 parts of acid-free rape-seed or linseed oil, with or without the addition of 1 or 2 parts of pine or like soot.—W. H. C.

Furnace. J. W. Brown, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,067,795, July 22, 1913.

A CENTRAL chamber containing material which is heated by suitable means is surrounded by a number of concentric annular chambers through which the material to be treated is passed, and in which it is preheated by the heat radiated from the wall of the central chamber.—W. H. C.

Shaft-kilns; Producer-gas-fired ——. E. Schmatolla, New York. U.S. Pat. 1,068,175, July 22, 1913.

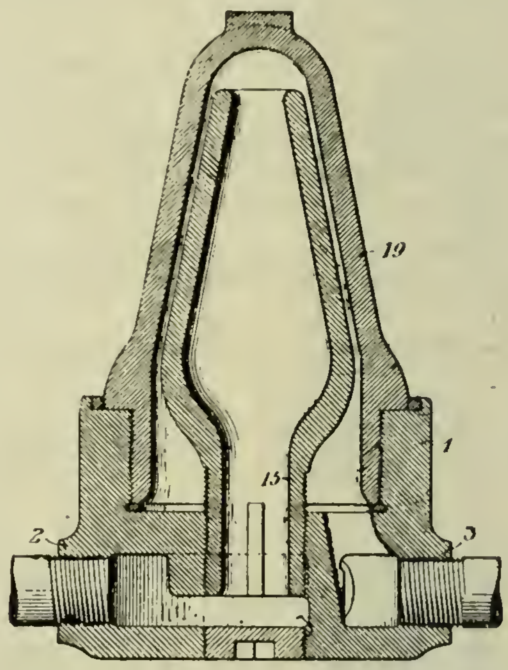
Two vertical shaft-kilns are arranged within a chamber and separated by a division wall provided with openings for the introduction of a gaseous fuel. The shaft-kilns are surmounted by a calcining shaft of greater area of cross-section than that of the former together, this latter being again surmounted by a preheating shaft of still greater cross-section.—W. H. C.

Reverberatory furnace; Regenerative ——. H. Rehmann and H. Bangert. Fr. Pat. 455,094, Mar. 5, 1913.

THE gas conduit is directed obliquely downwards towards the hearth of the furnace, and the air inlets, on either side of the gas inlet, are directed at right angles or obliquely to the direction of the gas inlet. Cooling channels are formed in the furnace walls between the air and gas conduits.—A. T. L.

Retort. D. Townsend, Philadelphia, Pa. U.S. Pat. 1,068,610, July 29, 1913.

THE "retort," which is intended for superheating liquids, consists of a base, 1, provided with inlet, 2, and, outlet 3, openings, and into which two concentric members, 15, 19, are screwed so that the size of the annular space between them may be varied at will.—W. H. C.



Evaporator; Mechanical —— Soc. d'Exploitation des Procédés Evaporatoires (Système Prache et Bouillon). Fr. Pat. 453,995, Feb. 5, 1913.

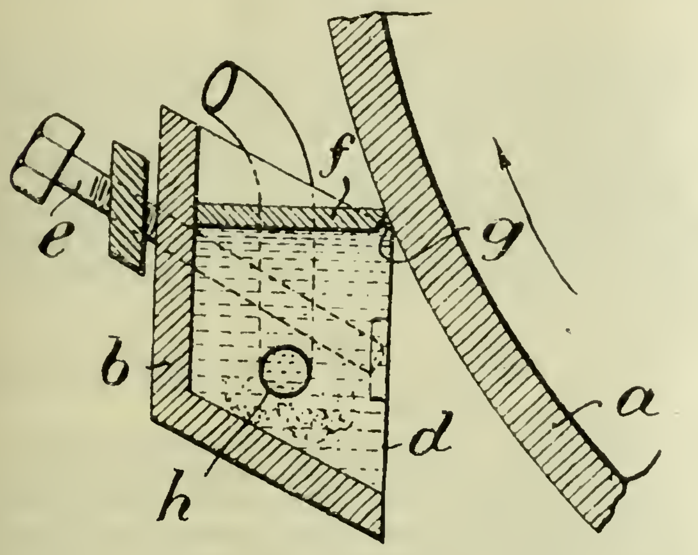
LIQUID or gaseous fuel is utilised in an explosion motor and the power developed is used to withdraw and compress the steam given off from the evaporator. The steam is then passed round the tubes of the evaporator and serves to evaporate the liquid under the diminished pressure produced in the evaporator. The liquid to be evaporated passes first through a heat interchanger where it is heated by the condensed water from the heating chamber, then through a second heat interchanger where it is further heated by the waste gases from the explosion motor and then through the jacket of the motor where it is still further heated by the heat of the explosions. It then enters the evaporator at a temperature nearly equal to that at which evaporation takes place.—W. H. C.

Dryer; Tunnel —— for mineral white or other substances in the form of sludge. L. Hertenbein. Fr. Pat. 454,377, Feb. 15, 1913.

THE long drying chamber is divided into two compartments by a horizontal partition, and the material travels first through the upper and then through the lower one in the opposite direction to a current of hot gases. The material, in the form of sludge, is charged into buckets carried on an endless conveyer in the upper compartment, and the buckets discharge cakes of partially dried material on to an endless band conveyer in the lower compartment, where the drying is completed.—A. S.

Dryers; Process and apparatus for applying liquids to single drum ——. W. Stieler. Fr. Pat. 454,468, Feb. 17, 1913. Under Int. Conv., Feb. 17, 1912.

THE liquid is fed into the distributing box, *b*, through the pipe, *h*, which extends the full length of the box and has discharge openings on its lower side. The side, *d*, of the box which is next the drying drum, *a*, is made of thin flexible metal and is pressed against the drum by a series of screws, *e*. A cover, *f*, provided with projections, *g*, floats on the surface of the liquid in the box, *b*, and ensures an even distribution of the liquid upon the surface of the drum.—W. H. C.



Drying chamber with special device for the removal of the products of evaporation. J. J. F. Balès. Fr. Pat. 455,223, March 7, 1913.

The air is discharged from the drying chamber by fans which also serve to mix the gases and equalise the temperature. The openings of the discharge pipes are placed near the bottom of the chamber so that only the denser portion of the air, *i.e.*, the portion more heavily charged with moisture, is withdrawn.—W. H. C.

Converter for transforming saturated steam into a dry gas. P. Boute. Fr. Pat. 454,401, Feb. 15, 1913.

Steam from a boiler is passed through a series of horizontal pipes which are progressively heated in a furnace. The pipes are of such dimensions that the pressure is the same as that in the boiler. The superheating causes a partial dissociation of the steam into hydrogen and oxygen. The former diffuses through the walls of the tubes leaving behind a gas having strongly oxidising properties. The tubes may be provided with longitudinal porous diaphragms so that the hydrogen which passes through may be collected.—W. H. C.

Drying materials with a circulation of hot air; Method of and means for ——. W. Kützleb, Lennep, Germany. Eng. Pat. 1479, Jan. 18, 1913. Under Int. Conv., Jan. 23, 1912.

See Fr. Pat. 453,278 of 1913; this J., 1913, 780.—W. H. C.

Drying, sifting, or filtering substances; Centrifugal process and apparatus for ——. J. Leigh. Fr. Pat. 454,392, Feb. 15, 1913.

See Eng. Pat. 4830 of 1912; this J., 1913, 11.—T. F. B.

Concentration of syrupy liquids. J. MacGregor, Glasgow. U.S. Pat. 1,068,789, July 29, 1913.

See Eng. Pat. 6866 of 1911; this J., 1912, 421.—T. F. B.

Washing or separating coal, ore, and other granular or like materials; Machine for ——. R. S. Benson, Middleton St. George. U.S. Pat. 1,069,223, Aug. 5, 1913.

See Eng. Pat. 22,813 of 1911; this J., 1912, 1071.—T. F. B.

Air; Apparatus for producing dry heated ——. G. Erlwein, Charlottenburg, Germany. U.S. Pat. 1,069,241, Aug. 5, 1913.

See Eng. Pat. 13,613 of 1911; this J., 1912, 109.—T. F. B.

High vacuums; Method and apparatus for producing ——. W. Gaede, Freiburg, Germany. U.S. Pat. 1,069,408, Aug. 5, 1913.

See Eng. Pat. 27,457 of 1909; this J., 1910, 1145.—T. F. B.

Raising or forcing liquids; Apparatus for ——. H. A. Humphrey. Fr. Pat. 454.915, March 2, 1912. Under Int. Conv., May 12 and 23, 1911.

See Eng. Pats. 11,527 and 12,449 of 1911; this J., 1912, 626, 707.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Microscopic examination of ——. A. Wahl and P. Bagard. Comptes rend., 1913, **157**, 380—381.

If the polished surface of a piece of coal be immersed in pyridine and heated on the water-bath for some time, it is attacked, and the degree of the corrosion, as observed under the microscope, affords some indication of the homogeneity of the coal. A similar method has been proposed by Roush (this J., 1911, 811) for the examination of carbon, the process also (pyridine extraction) described by Bedson (this J., 1908, 147) for the analysis of coal is referred to.—W. P. S.

Gas manufacture; South African coals for ——. J. W. Brown. J. Gas Lighting, 1913, **123**, 367—368.

The best South African coals for gas making are those found in Natal, no good gas-making coal being yet obtainable in bulk in the Transvaal. Of the Natal coals, that from the Burnside colliery is the best. It yielded per ton, 10,500 cb. ft. of gas of 16 candle-power, 5½ galls. of tar, and 900 lb. of excellent coke containing 86 per cent. of combustible matter. The English coal hitherto employed by the South African Lighting Association at Port Elizabeth (Aldwarke Main washed nuts) gave under similar conditions 12,400 cb. ft. of 16 candle-power gas, with 10 galls. of tar and 800 lb. of coke, but costs 38s. per ton at the works. The Natal coals were not washed or picked.—H. H.

Petroleum oil from Maikop; Characteristics of ——. K. W. Charitschkoff. Chem.-Zeit., 1913, **37**, 986.

Petroleum oil from a well near Maikop (Russia) had a sp. gr. at 15° C. of 0·855 and yielded the following fractions:—Up to 100° C., 5·12 per cent. of sp. gr. 0·7032; 100° to 150° C., 15·2 per cent. of sp. gr. 0·746; 150° to 200° C., 29·0 per cent. of sp. gr. 0·8201; and residue 50·3 per cent. of sp. gr. 0·9305. The oil would therefore be suitable for the production of benzine. When distilled with steam, and *in vacuo*, at a temperature not exceeding 295° C. the residue yielded fractions (13·98 per cent.) which made a good machine oil, and other fractions (19·17 per cent.) suitable for cylinder oil.—C. A. M.

Oil fuel; Admiralty Specification for ——. [Cd. 7010.] Price ½d.

The following is the text of the Revised Admiralty Specification (1912) for oil fuel:—

Quality.—The oil fuel supplied shall consist of liquid hydrocarbons, and may be either (*a*) shale oil; or (*b*) petroleum, as may be required; or (*c*) a distillate or a residual product of petroleum; and shall comply with the Admiralty requirements as regards flash-point, fluidity at low temperatures, percentage of sulphur, presence of water, acidity, and freedom from impurities.

The flash-point shall not be lower than 175° F., close test, Abel or Pensky-Martens. (In the case of oils of exceptionally low viscosity, such as distillates from shale, the flash-point must not be less than 200° F.) The proportion of sulphur contained in the oil shall not exceed 3·00 per cent. The oil fuel supplied shall be as free as possible from acid, and in any case the quantity of acid must not exceed 0·05 per cent., calculated as oleic acid when tested by shaking up the oil with distilled water, and determining by titration with deci-normal alkali the amount of acid extracted by the water, methyl orange being used as indicator. The quantity of water delivered with the oil shall not exceed 0·5 per cent.

The viscosity of the oil supplied shall not exceed 2000 seconds for an outflow of 50 cubic centimetres at a temperature of 32° F., as determined by Sir Boverton Redwood's standard viscometer (Admiralty type for testing oil fuel). (Pending settlement of this specification a viscosity of 1000 seconds was provisionally adopted in 1912.) The oil supplied shall be free from earthy, carbonaceous, or fibrous matter, or other impurities which are likely to choke the burners. The oil shall, if required by the inspecting officer, be strained by being pumped on discharge from the tanks, or tank steamer, through filters of wire gauze having sixteen meshes to the inch.

The quality and kind of oil supplied shall be fully described. The original source from which the oil has been obtained shall be stated in detail, as well as the treatment to which it has been subjected, and the place at which it has been treated. The ratio which the oil supplied bears to the original crude oil should also be stated as a percentage.

Mineral production of the United Kingdom. *See under* X.

Patents.

Coal ; Process for drying the waste from the washing of —— by the warm gases from steam boilers. J. Prégardien. Fr. Pat. 454,649, Feb. 21, 1913.

Wet powdered coal from coal washing is spread upon gratings and dried by flue gases from steam boilers. The temperature of the flue gases is lowered by the admission of air, which may be injected on to the layers of waste by a fan driven by the current of air supplied to the furnaces of the boilers. The dried waste may be burned in the furnaces without any addition of coal of good quality. —H. H.

Fuel blocks ; Treatment of coal or carbonaceous waste materials for the manufacture of briquettes or ——. J. Wetter, London. From Naamlooze Vennootschap Briquet Co. (Briket Maatschappy), Amsterdam, Holland. Eng. Pat. 5416, Mar. 4, 1913.

A mixture of coal with from 7½ to 12½ per cent. of tar is treated in a heavy edge-runner mill until it becomes sufficiently dry to enable it to be pressed and moulded into briquettes.—H. H.

Combustibles ; Protective waterproof covering for agglomerated —— such as briquettes, etc. E. Commelin and R. Viau. Fr. Pat. 453,921, April, 16, 1912.

The briquettes, etc., are either powdered with a coloured metallic oxide, such as iron or manganese oxides, or immersed in a bath of sodium silicate admixed with the metallic oxide.—H. H.

Fuel ; Process for expelling gases from ——. F. C. W. Timm. Fr. Pat. 454,797, Feb. 26, 1913. Under Int. Conv., Feb. 27, 1912.

The fuel, powdered or in small pieces, is heated on a grid in a retort by passing a current of hot gases downwards through it. The water or tar which collects beneath the grid in the early stages of the process is drawn off through a sealed pipe. The heating gases may be producer gas at 900° C., or the gases may be first at a lower temperature which is gradually raised so as to effect the distillation in stages. Gases or heated air at 100° to 120° C. may be passed first of all in order to dry the fuel. The residue of coke at the end of the process may be cooled by passing through it the gases which are being led to a freshly charged retort. The heating gases may be raised to the temperature required by partial combustion.—A. T. L.

Retorts ; Discharging vertical ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 29,371, Dec. 20, 1912.

A water-cooled, rocking wedge is arranged at the lower end of the vertical retort to split the column of coke vertically into two parts which are then deflected sideways into the discharge chamber by rollers.—W. H. C.

Retort furnaces. C. M. Stein et Cie. Fr. Pat. 455,255, May 18, 1912.

The furnace comprises a battery of inclined or horizontal retorts, and is divided into two compartments by a central partition transverse to the length of the retorts. The gas is led to two separate sets of burners for heating the two compartments, and the heating gases in each compartment pass upwards through a series of vertical flues and then downwards through one vertical flue. The regenerator is divided into four sections, two of which serve for heating the primary air, one for the secondary air and one for the gas.—A. T. L.

Combustion products ; Production of a mixture of steam and ——. O. Kraus, New York, U.S.A. Eng. Pat. 14,710, June 24, 1912.

An apparatus for the production of a working fluid for use in motors comprises a horizontal combustion chamber for burning a hydrocarbon and communicating with a vertical steam-generating chamber containing small pieces of metal into the centre of which a regulated stream of water is introduced. The water becomes vapourised in contact with the heated metal surfaces in the upper part of the steam chamber ; any excess remaining unvapourised flows to the bottom of the steam chamber and is led into the passage connecting the two chambers, so that the combustion gases become laden with moisture before entering the steam chamber.—H. H.

Gas producers ; Suction ——. M. F. Derrick, Coatbridge, Scotland. Eng. Pat. 14,153, June 17, 1912.

In a suction gas producer of the underfeed type, the whole of the fuel is forced continuously from the lower to the upper end of the producer body by a helical conveyer extending to the full diameter of the producer and projecting below into a feed chamber. The ashes are discharged over the top edge of the inner annular wall of the producer through water seals formed by a dome-shaped cover dipping into an annular trough surrounding the outer wall of the producer. Air is supplied through the spindle of the helical conveyer, and also through openings in the producer walls if necessary. The blades of the conveyer are preferably made of increasing pitch, and the inner walls of the producer are tapered, with the widest diameter at the top.—H. H.

Gas generators. H. Wade, London. From Ehrhardt und Sehmer, Ges. m. b. H., Saarbrücken, Germany. Eng. Pat. 4294, Feb. 19, 1913.

A gas generator is fitted with a rotary grate in the form of an inverted truncated cone revolving about a fixed ash-discharge pipe arranged eccentrically to the axis of rotation of the grate and projecting vertically into the lower central opening thereof. To ensure an even blast of air over the whole area of the charge of fuel, a number of slots are formed in the ash-discharge pipe communicating with the air chamber surrounding the grate, so that air enters equally between the bars of the grate and through the clinkers in the ash-discharge pipe.—H. H.

Fuel ; Process and apparatus for gasifying ——. F. C. W. Timm. Fr. Pats. 454,655 and 454,656, Feb. 21, 1913, Under Int. Conv., Feb. 22, 1912.

(1). The producer works with a downdraught and is suitable for burning fine charcoal, charcoal dust, sawdust, small peat, etc. The working is intermittent, the producer being filled with fresh fuel and worked until the charge is burned away. The gas is led off from a lateral outlet beneath the grate, and water and tar which condense in the space below the grate are drawn off through a hydraulic seal. The gas formed from each charge of fuel is collected in two or more stages, so as to obtain first a gas rich in ammonia and volatile substances, and then a gas of good quality free from condensable substances. The process may be interrupted before the charge is burned away, so as to obtain coke as one of the products. (2). The producer works with a downdraught and is tapered inwards towards the lower end. A bed of small coke is placed upon the grate and the producer is charged with small or powdery fuel (charcoal, sawdust, etc.). Gas is made until the depth of the fuel column is insufficient for the reduction of the carbon dioxide first formed. The gases may then be led to the upper end of another producer which is freshly charged so as to obtain a uniform ignition of the charge. Finally, the producer is emptied and the process is repeated. The grate is formed of water-cooled bars, and the producer is mounted on trunnions so that it can be inverted for discharging. The air inlet, gas outlet and water connections are made at the trunnions. Valves in the air and gas pipes may be controlled by the difference in pressure at the inlet and outlet of the producer, so that gas is made at a uniform rate and the process is stopped when the fuel burns down to a certain point.—A. T. L.

Gases from coke-ovens and like gases; Treatment of —— and recovery of products therefrom. W. H. Coleman, Manchester. Eng. Pat. 20,900, Sept. 13, 1912.

The gases are treated in a scrubber with neutral ferrous sulphate solution when ammonium sulphate, ferrous sulphide and iron ammonium cyanides are formed. The resulting liquid is distilled and any ammonia and hydrogen sulphide are returned to the gas before it enters the scrubber along with similar gases obtained by distilling the "virgin" liquor from the condensers. In this way an excess of ammonia and of hydrogen sulphide is maintained at the gas inlet end of the scrubber. An excess of neutral ferrous sulphate is maintained at the gas outlet end of the scrubber to ensure the recovery of all the ammonia. The liquid from the scrubber is heated, filtered, and the solution of ammonium sulphate evaporated. The residue, which consists of ferrous sulphide and some cyanogen compounds, is treated with sulphuric acid whereby ferrous sulphate is regenerated which is returned to the scrubber after filtering off the insoluble cyanides. The evolved hydrogen sulphide is burned and used for the manufacture of sulphuric acid.—W. H. C.

Mixing gases of different specific gravities in gas holders; Apparatus for ——. Berlin-Anhaltische Maschinenbau Akt.-Ges., Berlin. Eng. Pat. 2281, Jan. 28, 1913. Under Int. Conv., Sept. 25, 1912.

To ensure that lighting gas supplied from a gas holder in which the gas has been stored for several days shall be of constant composition, the gas is drawn off from near the bottom of the holder by a blower and re-introduced into the holder at great speed through a pipe at a higher level.—H. H.

Oils of all kinds, for example mineral oils, wax, tar and other analogous materials; Process for treating ——. M. Melamid and L. Grötzinger. Second Addition, dated Feb. 22, 1913, to Fr. Pat. 443,650, May 10, 1912 (this J., 1912, 977; 1913, 415).

Oils are purified by passing them or their vapours over heated phosphoric acid or an equivalent phosphorus compound. *Example.* 10 kilos. of commercial phosphoric acid are heated to about 300° C. and 1000 kilos. of vapourised mineral oil, tar or resin passed over it.—H. H.

Hydrocarbons; Process and apparatus for transformation of high boiling-point —— into lower boiling-point hydrocarbons. L. G. Leffer. Fr. Pat. 454,580, Feb. 19, 1913.

The hydrocarbon is carried into a fractionating chamber in the form of spray or mist by a current of inert gas at a temperature of about 400° C., the gas being forced through a nozzle at the bottom of a reservoir which is constantly supplied with hydrocarbon. The fractionating chamber is arranged above the reservoir and is maintained at any desired temperature. The process is regulated by varying the pressure and speed of the current of inert gas, and the quantity of hydrocarbon supplied to the vaporizing chamber.—H. H.

Coke oven with vertical retorts and horizontal heating flues traversed by the heating flames in a constant direction. Stettiner Chamotte-Fabr. A.-G. vorm. Didier. Fr. Pat. 453,956, Feb. 3, 1913. Under Int. Conv., March 14, 1912.

See U.S. Pat. 1,058,744 of 1913; this J., 1913, 526.—T.F.B.

Coke oven heated alternatively by poor gas, rich gas, or a mixture of the two. Dr. C. Otto und Co. G. m. b. H. Fr. Pat. 454,172, Feb. 10, 1913. Under Int. Conv., Aug. 31, 1912.

See Ger. Pat. 258,248 of 1912; this J., 1913, 647.—T.F.B.

Gaseous fuel; Apparatus for the production of ——. A. W. Southey, Mill Hill. U.S. Pat. 1,068,708, July 29, 1913.

See Eng. Pat. 21,363 of 1911; this J., 1912, 1021.—T. F. B.

Gas-producer for generating rich gases. R. Lahoussois, Paris. U.S. Pat. 1,068,788, July 29, 1913.

See Eng. Pat. 3113 of 1912; this J., 1912, 676.—T. F. B.

Gas producer with truncated funnel-shaped hearth. Ehrhardt und Sehmer Ges. m. b. H. Fr. Pat. 455,138, Feb. 24, 1913.

See Eng. Pat. 4294 of 1913; preceding.—T. F. B.

Backward propagation of flame along a conduit conveying combustible gaseous mixtures; Means for preventing the ——. A. C. Ionides, jun., London. U.S. Pat. 1,068,904, July 29, 1913.

See Eng. Pat. 14,717 of 1912; this J., 1913, 412.—T. F. B.

Combustible gaseous mixtures; Means for preventing backward propagation of flame in ——. Bonecourt Surface Combustion, Ltd. Fr. Pat. 454,066, Feb. 7, 1913. Under Int. Conv., March 19, 1912.

See Eng. Pat. 6738 of 1912; this J., 1913, 412.—T. F. B.

Manufacture of briquettes insoluble in water by means of sulphite cellulose waste lyes. Fr. Pat. 455,099. *See* V.

Extracting sulphur and nitrogen from spent oxide and regeneration of the oxide. Fr. Pat. 454,990. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Peat; Utilisation [wet carbonisation] of ——. T. Rigby, Dumfries, and Wetcarbonizing, Ltd., London. Eng. Pat. 17,428, July 26, 1912.

The gas from the wet-carbonizing plant is burned under a steam boiler which is worked at a pressure of about 300 lb. per sq. in. The high-pressure steam is used in a steam engine and its pressure reduced to about 190 lb. per sq. in. The exhaust steam is then utilised in the jacket of the wet carbonising plant. Any excess of high-pressure exhaust steam may be used in low-pressure steam engines and the exhaust from these used in heat-interchanging apparatus. The condensed water from the different parts of the plant is returned by a pump to the steam boiler.—W. H. C.

Combustion of combustible mixtures. C. D. McCourt and Bonecourt Surface Combustion, Ltd., London. Eng. Pat. 12,696, May 31, 1913.

To enable the proportion of gas and air supplied to a surface combustion heating apparatus such as is described in Eng. Pats. 25,808 and 29,430 of 1909 (this J., 1910, 1448) to be regulated to agree with that theoretically required for complete combustion, a small supply of the mixture flowing to the main heating apparatus is abstracted and burned in or amongst granular refractory material contained in an open cup-shaped body, so that the nature of the combustion taking place therein can be observed and the mixture regulated accordingly.—H. H.

Metallic filaments : Electric furnaces for treating ——. G. Lüdecke and The Brimsdown Lamp Works, Ltd., Brimsdown. Eng. Pat. 6952, March 20, 1913.

In a furnace similar to that described in Eng. Pat. 8996 of 1911 (this J., 1911, 1264) a cage formed of tungsten or molybdenum rods is substituted for the cylinder. The filaments are hung upon hooks within the cage of rods through which the heating current is passed.—W. H. C.

Metallic filaments ; Process for rendering ductile tungsten and analogous metals for manufacture of ——. The Westinghouse Metal Filament Lamp Co. Fr. Pat. 454,083. Feb. 7, 1913. Under Int. Conv., Feb. 9, 1912.

Tungsten, molybdenum, uranium and other fragile metals are formed into thin sheets, bars, or filaments in two stages. In the first stage the metal is alloyed with 5 or 10 per cent. of nickel, copper, iron or similar metal and the alloy partially drawn or beaten out into the desired form. In the second stage, the auxiliary metal is removed by fusion or by dissolving it, and the resulting pure metal is then drawn or beaten out to the desired thickness. The liability to breakage of a fine filament during the removal of the auxiliary metal is thus avoided. The ingots of alloy may also be coated with the auxiliary metal electrolytically or otherwise.—H. H.

Heating by combustion of gaseous and other mixtures ; Method of ——. Bonecourt Surface Combustion, Ltd. Fr. Pat. 453,999, Feb. 5, 1913. Under Int. Conv., March 19, 1912.

See Eng. Pat. 6732 of 1912 ; this J., 1913, 782.—T. F. B.

Metallic filament for electric incandescence lamps ; Manufacture of ——. Dick, Kerr and Co., Ltd. Fr. Pat. 455,262, March 7, 1913. Under Int. Conv., May 14, 1912.

See Eng. Pat. 11,455 of 1912 ; this J., 1913, 527.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Phenols ; New colour reactions of di- and trihydric ——. O. Schewket. Biochem. Zeits., 1913, **54**, 282—284.

Pyrocatechol. A solution of 0·01 grm. in 1 c.c. of water, treated with 3—5 drops of 1 per cent. solution of iodine (containing potassium iodide), and then diluted with water, gives a green colour if several drops of 5 per cent. sodium hydroxide solution are added. The liquid becomes brownish on standing or boiling, but the green colour reappears after cooling, or shaking, or addition of a little hydrogen peroxide. Neither resorcinol nor quinol gives a green colouration after treatment with iodine. *Pyrogallol.* (1) A solution of 0·05 grm. in 2 c.c. of water, treated with 5—10 drops of 1 per cent. iodine solution, and then diluted with water, gives a transient violet colour on addition of a few drops of alkali. (2) If 10 c.c. of an aqueous solution are mixed with 5—10 c.c. of alcohol and then, after cooling, with several drops of alkali, a colouration resembling that of permanganate solution gradually develops. Both these tests serve to distinguish pyrogallol from phloroglucinol. *Phloroglucinol.* (1) 0·01 grm. dissolved in 5 c.c. of hot water, and treated with 5—10 drops of 0·5 per cent. iodine solution decolourizes the latter. Addition of a few drops of alkali produces a light brown colour which changes to reddish-violet on boiling. (2) A little phloroglucinol, heated with 5 c.c. of water and then treated with a few drops of alkali and 5—10 drops of hydrogen peroxide, gives a lasting blue-violet colour which changes to red and then to yellow if the liquid is acidified, but reappears on subsequent addition of alkali. This test is very characteristic.—J. H. L.

Patent.

Isatin compounds ; Process for producing [*halogenated*] ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 453,973, Feb. 4, 1913. Under Int. Conv., Feb. 7 and March 18, 1912.

See Ger. Pats. 255,772, 255,773, 255,774, and 255,775 of 1912 ; this J., 1913, 355.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Oxindole and thio-oxindole. C. Marschalk. J. prakt. Chem., 1913, **88**, 227—250.

An easy method for the preparation of oxindole from isatin, consists in reducing the latter first to dioxindole with hydrosulphite, and then to oxindole by means of sodium amalgam and carbon dioxide in dilute alcohol solution. Another promising synthesis is from the technically available thionaphthenequinone, the hydrazide of which gives thioindoxyl on heating, with evolution of nitrogen. From oxindole, thio-oxindole and isocumaranone are obtained through the intermediate stage of *o*-aminophenylacetic acid (see this J., 1912, 634 and Ber., 1912, **45**, 582). Thio-oxindole shows great analogy with oxindole in its chemical behaviour. It forms a sodium salt and appears to be tautomeric, like thioindoxyl and like its analogue isocumaranone (Annalen, **313**, 83). With nitrous acid it gives thionaphthenequinone-3-oxime and it combines with diazo compounds to give azo dyestuffs which are possibly identical with the hydrazones of thionaphthenequinone (Ber., **41**, 236). Thio-oxindole, besides giving condensation products of the indirubin type (this J., 1912, 634), can give iso-indigo products, *e.g.*, 3-thionaphthene-3-indole-indigo from isatin. This is a brown substance incapable of giving a vat with hydrosulphite. Its dichloro- and dibromo-derivatives are similar.—J. B.

Patents.

Monoazo dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,322, July 25, 1912.

The diazo compounds of *p*-aminosalicylic acid or of its homologues or their substitution products, are combined with acidylaminonaphthols or their sulphonic acids. When the products are printed on the fibre in presence of chromium salts, Bordeaux-red, violet, or blue shades fast to chlorine and soap are produced.—T. F. B.

Sulphide colouring matters ; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort, Germany. Eng. Pats. 22,453, Oct. 2, 1912, and 29,970, Dec. 30, 1912.

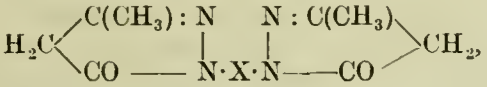
Sulphide dyestuffs distinguished by their fastness to chlorine, are produced by heating with sulphur, at a high temperature, and preferably in presence of benzidine, tolidine, etc., an acetylaminocarbazole, or an amino-N-alkylcarbazole, or an acetylated amino-N-alkyl- or -N-aralkylcarbazole. Especially valuable products are said to be obtained if the halogen derivatives of these carbazole compounds are used. The dyestuff obtained from diacetyldiaminocarbazole, benzidine, and sulphur by heating to 180°—250° C. for 10—14 hours, dyes cotton fast yellow shades.—T. F. B.

Substantive [*azo*] *dyestuffs ; Process for making* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 454,171, Feb. 10, 1913. Under Int. Conv., Feb. 13, 1912.

Soluble dyestuffs of pronounced substantive character are obtained by combining a diazosulphonic acid or a diazocarboxylic acid with aminobenzoyl-2.5.7-aminonaphtholsulphonic acid, diazotising the intermediate compound, and combining with nitro-*m*-phenylenediamine. For example, the dyestuff made by this process, starting with sulphanilic acid, dyes unmordanted cotton bright orange shades fast to acids.—T. F. B.

Disazo dyestuffs for wool; Process for producing yellow ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 454,661, Feb. 21, 1913. Under Int. Conv., Aug. 22 and Sept. 18, 1912.

Dyestuffs which dye wool from acid baths bright yellow shades, fast to washing, are obtained by combining two mols. of the diazo compounds of diaminodiphenylethersulphonic acids or their homologues or analogues with one mol. of a dipyrazolone of the formula,



$$H_2C\begin{matrix}\diagup C(CH_3):N \quad N:C(CH_3)\diagdown \\ \diagdown CO —— N{\cdot}X{\cdot}N —— CO\diagup\end{matrix}CH_2,$$

where X represents an aromatic residue. Analogous dyestuffs are also obtained by combining the diazodiphenylethersulphonic acids with acetoacetic ester and condensing two mols. of the product with one mol. of a dihydrazine (obtained from aromatic diamines by the usual process).—T. F. B.

Sulphide dyestuffs and their production. Act.-Ges. f. Anilinfabr. Fr. Pat. 454,782, Feb. 25, 1913. Under Int. Conv., March 6, 1912.

Sulphide dyestuffs which are, in general, very fast to washing and to chlorine, are obtained by heating with sulphur or a polysulphide a mixture of an aromatic amine and a *p*-hydroxydiphenylamine derivative in which the benzene nucleus not containing the hydroxy groups, contains one or several alkyl groups; the other benzene nucleus may also contain substituents. An aromatic nitro compound may be used in place of the amine, and a solvent or diluent, copper or a copper compound, or iodine or other catalytic agent may also be present. The dyestuff from *p'*-methyl-*p*-hydroxydiphenylamine and *a*-naphthylamine dyes cotton violet-brown shades, with benzidine reddish brown shades, and with 3-aminocarbazole black shades.—T. F. B.

Azo dyestuffs dyeing cotton; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 18,005, Aug. 3, 1912. Under Int. Conv., Aug. 14, 1911.

See Addition of June 29, 1912, to Fr. Pat. 376,888 of 1907; this J., 1913, 131.—T. F. B.

Vat dyestuffs of the anthraquinone series; Manufacture of ——. O. Imray, London. From Soc. of Chem. Industry in Basle, Switzerland. Eng. Pat. 12,228, May 26, 1913.

See Ger. Pat. 261,557 of 1912; this J., 1913, 822.—T. F. B.

Basic dyestuffs; Process for producing brown ——. L. Cassella und Co., G. m. b. H. Fr. Pat. 453,880, April 15, 1912.

See Ger. Pat. 258,560 of 1912; this J., 1913, 529.—T. F. B.

Thiazoles of the anthraquinone series; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 454,583, Feb. 19, 1913. Under Int. Conv., July 30 and Nov. 28, 1912.

See Eng. Pat. 21,615 of 1912; this J., 1913, 694.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton goods; Determination of small quantities of wool in ——. P. Heermann. Mitt. K. Materialprüfungsamt, 1913, **31**, 176—182.

For the determination of as little as 0·5 per cent. of wool fibre in cotton goods, the cotton, previously freed from fat, is dissolved in 80 per cent. sulphuric acid, leaving the wool intact and, within certain limits, unmodified. 5—10 grms. of the sample are extracted with boiling ether and then with 96 per cent. alcohol; the material is then placed, without fully drying, in 20—100 times its weight of 80 per cent. sulphuric acid at the ordinary temperature in a glass-stoppered bottle and thoroughly shaken at frequent intervals, particularly during the first hour. After 3 or 4 hours at the most, the cotton will be completely dissolved; the solution is poured into an excess of cold water and the undissolved wool fibre is collected on a fine copper sieve. The residue is washed, treated with dilute ammonia and, after microscopic verification, is dried and weighed. If it is weighed in the dry condition, a correction of 17 per cent. is allowed for hygroscopic moisture. Certain samples of wool show a gain in weight of 1—1·5 per cent. after the acid treatment, but with small proportions such a small alteration may be neglected.—J. F. B.

Wood cellulose; Testing the degree of bleaching of ——. B. Johnsen. Papierfabr., 1913, **11**, 979—980.

When crude wood-cellulose in a finely rasped condition is shaken for a short time with a 1 per cent. solution of nitrous acid and then treated with dilute caustic alkali, a colouration is produced, dark brown in the case of underboiled soda pulps, lighter brown with ordinary soda pulps and vivid red-brown in the case of sulphite pulps. The colouration cannot be classed definitely as a lignin reaction, although it is more or less indicative of the extent of digestion. When the pulp is bleached, the colouration produced by this test becomes weaker as bleaching proceeds, finally disappearing when bleaching is complete. In applying this test for controlling the course of bleaching, samples are withdrawn at intervals, pressed off, neutralised with sodium bisulphite and washed. The fibrous mass is shaken for 2 minutes in a test-tube with 5 c.c. of sodium nitrite solution (29·4 grms. per litre) and 5 c.c. of dilute sulphuric acid (20·8 grms. per litre); the pulp is then drained off in a Gooch crucible, without washing, and shaken in a test-tube with 10 c.c. of a 2 per cent. solution of sodium hydroxide, being then allowed to stand for 5 minutes. If the pulp, after treatment with nitrous acid, be heated with the alkali, the yellow colouration, after disappearing when the bleaching process is complete, re-appears when the action of the bleach-liquor is continued, owing to the formation of oxycellulose.—J. F. B.

Sulphite-cellulose lyes; The testing of —— *with iodine.* G. von Zweigbergk, Papierfab., 1913, **11**, 1007—1010.

The titration of the sulphur dioxide in sulphite digestion liquors, by means of iodine, may lead to erroneous results unless certain precautions be taken. The principal sources of error are loss of sulphur dioxide by volatilisation, and the reversibility of the reaction: $SO_2+H_2O+2I\rightleftarrows 2HI+SO_3$. The latter error is diminished by working at high dilutions. If iodine be added to a strong solution of sulphurous acid the reaction may also be complicated by the liberation of sulphur. Excessive stirring and exposure to air are to be avoided. The best method is to dilute the sulphite liquor to a concentration approximately equivalent to that of the iodine, and to run the sulphite solution into the iodine so that an excess of the latter is present until the end. For the separate titration of the combined and free sulphurous acid, the acid produced by the reaction with iodine must be titrated subsequently with sodium hydroxide. For the combined titration, 2 c.c. of the sulphite liquor are diluted with 20 c.c. of water and run in a fine stream into 10 c.c. of *N*/8 iodine solution; starch should only be added towards the end of the titration. When decolouration is complete, 2 drops of phenolphthalein are added and the liquid is titrated with *N*/8 sodium hydroxide. For the titration of the sulphur dioxide at the end of the boiling process, 100 c.c. of lye are made alkaline with a solution of lime and sugar, then boiled and filtered; the precipitate is dissolved in hydrochloric acid, diluted to 250 c.c., and 25 c.c. are taken for titration with iodine. Alternatively, 25 c.c. of the lye may be distilled in an atmosphere of carbon dioxide with 25 c.c. of 25 per cent. acetic acid and 250 c.c. of water and the distillate collected in *N*/10 iodine.—J. F. B.

Viscose; The commercial manufacture of ——. H. Jentgen. Papierfabr., 1913, **11**, 984—985.

THE bleached sulphite wood pulp used for the manufacture of viscose silk must be of exceptional purity and good quality. It must be as free as possible from products soluble in strong caustic lye. 100 kilos. of pulp only yield 75 kilos. of silk. Overbleached pulp is very poor in quality and yield, whilst underbleached pulp does not produce a satisfactory viscose. Freedom from calcium salts is very important. Above all, uniformity in quality and composition must be ensured, because many of the subsequent operations have to be adjusted empirically to suit the quality of pulp employed. The strength of the lye and the time of steeping for the manufacture of the alkali-cellulose depend primarily on the percentage of soluble cellulose present in the pulp. The time of steeping ranges generally from 30 minutes to 6 hours, but some mills allow as much as 24 hours. The excess of soda lye is removed either by presses or centrifugal machines; the latter are preferable as affording a more uniform product if carefully loaded, but they are less durable than presses. The quantity of soda left in the alkali-cellulose is a most important factor in the manufacture and must be adjusted to the quality of the pulp employed. The alkali-cellulose is broken up by passage through a kneading machine. The treatment with carbon bisulphide is best performed in a revolving iron drum, the temperature of the room being preferably regulated artificially. Special precautions are required in the sulphuring rooms to guard against explosions and poisoning. The process should not be carried beyond a certain well-defined limit, and the particles of xanthogenate should not be allowed to cake together. The xanthogenate is dissolved in mixing machines with condensed water containing a determined amount of soda lye, the latter having the effect of controlling the viscosity of the viscose. In the material-costs, the precipitating chemicals form the chief item, nevertheless it is advantageous to have some subsidiary manufacture in which batches of viscose unsuitable for spinning may be worked off without loss.—J. F. B.

"Normal papers"; The percentage of ash in ——. W. Herzberg. Mitt. K. Materialprüfungsamt, 1913, **31**, 182—194.

PRIOR to 1904, the Prussian official specifications for "normal papers" stipulated certain maximum limits for the percentage of ash, viz.: for stuff-class I, 3 per cent.; for class II, 5 per cent. and for class III, 15 per cent. In that year, all restrictions as to the percentage of mineral constituents were withdrawn, owing chiefly to representations to the effect that a moderate proportion of loading facilitates the operation of writing on the paper. At the same time, the specifications for breaking length were maintained, but slight concessions were made in the limits for breaking stretch for the first two classes of paper. From statistics now available it would appear that the allowances in force prior to 1904 for the different classes have in no case been exceeded on the average. The normal papers of class I have been manufactured, as before, entirely without loading, whilst only in very rare instances have papers of class II been found to contain moderate quantities of added mineral matters. It would appear that in spite of the removal of all restrictions as to ash, the rigid mechanical specifications in force as to tensile strength, stretch and resistance to folding have acted automatically as a check on the employment of mineral loadings, so that the manufacturer who wishes to take advantage of his liberty to increase the ash can only fulfil the mechanical tests by employing a better quality of fibrous material. —J. F. B.

Paper: Influence of the sizing of the —— on the resistance of the text of documents to removal by mechanical or chemical means. H. Frederking. Mitt. K. Materialprufungsamt, 1913, **31**, 195—197.

THE harder the surface-sizing and the closer the surface-texture of the paper, the more readily are written, type-written or stamped characters removed. A striking exception to this rule is found in the case of parchment papers, from which characters in writing ink can seldom be removed entirely without trace. Such papers, however, hardly fall within the range of practical application for documents. As a guard against falsification, document papers, should be relatively soft-sized; papers sized with rosin are to be preferred from this point of view to papers sized with gelatin, because certain of the chemical ink-removing agents leave stains on rosin-sized papers. The prejudice against type-writing for documents is scarcely justified, since many brands of modern type-writer ribbons give characters as difficult to remove as characters written in ink, sometimes even more resistant. The treatment of documents with a protective varnish is of little value as a safeguard against falsification; such varnishes cause the spreading of type-written or stamped characters and are only available for documents written in ink With hard tub-sized papers, the varnish remains on the surface and is easily removed by solvents, whilst with softer-sized papers the protection afforded by the varnish is so slight that it does not compensate for the unsightly appearance produced.—J. F. B.

Content of tanning substances in waste sulphite-cellulose lyes. Stutzer. *See* XV.

PATENTS.

Flax straw and the like; Drying or treatment of ——. W. J. Fernie, Newark, Notts. Eng. Pats. 17,073, July 22, and 24,638, Oct. 28, 1912.

THE material is loaded in a thinly spread condition on the supports of framework carriers, each support being first inserted in the frame, and then loaded before the next is inserted; the loaded carriers are then passed through one of a series of drying chambers through which the drying medium passes in the opposite direction. The material is transported mechanically from the retting tanks to a platform with a stepped or graded edge corresponding to the positions of loading the carriers.—J. F. B.

Wood pulp; Production and treatment of mechanical ——. A. N. Andersen, Hougsund, Norway. U.S. Pat. 1,068,092, July 22, 1913.

THE process consists in cutting the wood into chips, grinding the chips into small particles, suspending the ground particles in water, separating the fine particles and water from the coarser particles, separating the fine particles from the water, disintegrating the separated fine particles and mixing the disintegrated mass with the water separated from the fine particles.—J. F. B.

Plastic and plastic composition [from waste sulphite-cellulose lye] and process of making same. J. S. Robeson, Au Sable Forks, N.Y. U.S. Pat. 1,069,031, July 29, 1913.

As a binding material for finely divided, inert substances, claim is made for a mixture of sulphite liquor and neutral, plastic, clayey matter pulped together. (See also U.S. Pats. 1,069,029 and 1,069,030, IX., page 869.) —W. E. F. P.

Sulphite cellulose waste lyes; Manufacture of all kinds of briquettes insoluble in water by means of ——. M. Platsch and Hoesch und Co. Fr. Pat. 455,099, March 5, 1913.

THE concentrated waste lyes are treated in the cold with a slight excess of sulphuric acid and the calcium sulphate precipitated is recovered. It is sometimes necessary to cool the lyes specially, in order to avoid coagulation of the agglutinating substances liberated by the acid before the briquettes are made. The briquettes made with the purified lyes are dried at a temperature of about 100° C. and a reaction takes place whereby the agglutinating substances are fixed in an insoluble form, whilst the slight excess of sulphuric acid is decomposed and escapes as sulphur dioxide together with the volatile organic acids of the lyes. These acids, being driven off in a concentrated form, may be recovered.—J. F. B.

Artificial silk threads, etc., from cuprammonium solutions of cellulose; Alkaline precipitating baths for the manufacture of ——. E. G. Legrand. First Addition, dated Apr. 23, 1912, to Fr. Pat. 445,896, Sept. 16, 1911 (see Ger. Pat. 250,357; this J., 1912, 1120).

When diastase is employed, as described in the chief patent, the concentration of the alkali hydroxide may be considerably reduced. A dilute bath containing 16—21 per cent. of sodium hydroxide and 3·5—4·0 per cent. of diastase is mentioned.—J. F. B.

Threads, films or sheets [from viscose]; Manufacture of ——. Vereinigte Glanzstoff-fabriken Act.-Ges. Fr. Pat. 454,011, Feb. 5, 1913. Under Int. Conv., Apr. 13, 1912.

Coagulating baths for the manufacture of threads, etc., from viscose are prepared by adding lactic or glycollic acid to a solution of the sodium salt of the same acid. For instance, 140 grms. of lactic acid are added to 1 litre of a saturated solution of sodium lactate.—J. F. B.

Viscose: Process of precipitating —— for the production of threads, films, etc. L. Leduc, H. Jacquemin and Soc. Anon. des Soieries de Maransart. Fr. Pat. 454,061, Feb. 7, 1913.

For the coagulation of viscose a bath containing a metallic salt, other than an ammonium salt, and a strong mineral acid, other than sulphuric acid, is specified. Example: a bath composed of 9 litres of a concentrated solution of sodium chloride and 1 litre of concentrated commercial hydrochloric acid.—J. F. B.

Films or bands from substances dissolved in volatile solvents; Manufacture of ——. B. Borzykowski. Fr. Pat. 454,692, Feb. 22, 1913.

The arrangement for manufacturing films or bands from materials, such as celluloid, dissolved in volatile solvents, consists of an endless supporting band on which the solution is delivered in a thin layer whilst the band is driven continuously. The endless supporting band and the reeling apparatus for the film produced are placed in a closed chamber, from which the vapours of the solvent are aspirated by a pump and recovered in condensing vessels. —J. F. B.

Threads or artificial products; Manufacture of —— from cupric solutions of cellulose. Vereinigte Glanzstoff-fabriken A.-G. and E. Bronnert. Fr. Pat. 454,811, Feb. 26, 1913. Under Int. Conv., Sept. 2, 1912.

In the coagulation of cupric solutions of cellulose it is possible to employ dilute solutions of sodium hydroxide, such as would otherwise be insufficient to determine satisfactory coagulation, by saturating the bath more or less with salts of hydroxy acids or incorporating such salts with the cellulose solution. For instance, 2·5 grms. of caustic soda are dissolved in 100 c.c. of a concentrated solution of sodium lactate, and coagulation is effected with this solution at 50° C.—J. F. B.

Cellulose; Manufacture of acid esters of —— [modification of solubility]. Verein für Chem. Ind. in Mainz. Fr. Pat. 455,117, Feb. 7, 1913. Under Int. Conv., Feb. 29 and Sept. 5, 1912.

Cellulose acetate soluble in chloroform is heated in solution, in presence of small proportions of water and in the absence of substances with pronounced hydrolytic action, until the ester becomes soluble in ethyl acetate. By prolonging the treatment the ester may be converted into a modification soluble in acetone. Example: 50 parts of cellulose acetate are dissolved and heated at 100° C. with 500 parts of 95 per cent. acetic acid for about 20 hours. Similar effects are obtained with 90 per cent. acetic acid at 105°—110° C. or, in a shorter time, with 90 per cent. formic acid at 100°—110° C. If the reaction product of the acetylation be treated direct, without isolation of the ester, it is necessary to neutralise the catalytic agent, *e.g.*, by the addition of sodium acetate or ammonia, and to add sufficient water to decompose the excess of acetic anhydride.—J. F. B.

Cellulose; Treatment of —— and manufacture of paper and other substances therefrom. H. Arledter, Frodsham. Eng. Pats. 16,085, July 9, 1912, and 684, Jan. 9, 1913.

The vacuum beating apparatus described in Eng. Pat. 2018 of 1910 (this J., 1911, 205) is modified in such a way that the alternate application of vacuum and admission of air are effected automatically by suitable gearing. The cylindrical vessel serving as the body of the engine is divided into compartments by partitions extending nearly to the bottom, so that the stuff becomes uniformly distributed, and each compartment has one or more separate inlets for gas or liquid, directed in such a manner as to assist the mixing action. When a hydraulic bed-plate is employed with the beating roll, a connection is made with the interior of the vessel to compensate for variations of pressure therein. Treatment of the pulp with a solution of aluminium sulphate, with the admission of ozonised air induces a rapid conversion of the cellulose into a colloid useful for sizing.—J. F. B.

Marbled papers; Process of manufacture of ——. B. Zarnowiecki. Fr. Pat. 454,217, Feb 11, 1913. Under Int. Conv., Feb. 14, 1912.

Marbled paper is prepared by means of two or more webs of unfinished paper produced independently, one of the webs being incised with the patterns to be produced by removing groups of fibres from the web, then uniting either the removed portions or the remaining portion of the cut-out web with the other web of unfinished paper. The disturbance of the fibres is produced by jets of liquid or air directed from beneath the wire cloth on which the layer of fibres is being carried, and baffles may be placed on the other side to re-direct the sprays of fluid back against the outer side of the web.—J. F. B.

"Duplex" papers; Process and apparatus for the manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 454,421, Feb. 15, 1913. Under Int. Conv., March 6, 1912.

The wet felt of the first press of the ordinary paper machine is replaced by a wire cloth and, the web of paper being carried by guide rolls at a higher level, pulp is fed on to this wire cloth so that a second web of paper is produced thereon. The wire cloth carrying the new web of paper meets the original web of paper before entering the first press and the angle of incidence is so adjusted by a guide roll that the two webs of paper combine gradually and are then united by the pressure of the press rolls. Both top and bottom rolls should be jacketed with felt.—J. F. B.

Cellulose and its products of transformation; Process for acetylating ——. A. Loose, Hermsdorf, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,069,445, Aug. 5, 1913.

See Eng. Pat. 27,228 of 1912; this J., 1913, 530.—T. F. B.

Artificial-silk-spinning machine. L. Morane, Paris. U.S. Pat. 1,069,456, Aug. 5, 1913.

See Fr. Pat. 410,267 of 1909; this J., 1910, 810.—T. F. B.

Wood and other fibrous materials; Process and apparatus for treating —— [manufacture of cellulose]. B. Loomis. Fr. Pat. 454,137, Feb. 10, 1913.

See U.S. Pat. 1,052,675 of 1913; this J., 1913, 283.—T.F.B.

Cellulose solutions; Process for preparing —— by means of sulphuric acid, and manufacture of cellulose products from such solutions. E. Berl. Fr. Pat. 454,753, Feb. 24, 1913. Under Int. Conv., June 10, 1912.

See Ger. Pat. 259,248 of 1912; this J., 1913, 653.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing: Theory of ——. Distribution of dyestuffs between two solvents. W. Reinders. Kolloid-Zeits., 1913, **13**, 96—105.

A COMPARISON of the distribution of a number of dyestuffs between water and isobutyl alcohol on the one hand and between water and fibres or other solid materials on the other, leads the author to the conclusion that the dyeing of fibres can be explained satisfactorily in most cases, by the formation of a solid solution.—A. S.

PATENTS.

Dyeing textile materials; Apparatus for ——. W. R. Smith, Buffalo, N.Y. Eng. Pat. 294, Jan. 4, 1913.

THE apparatus comprises a closed tank and an air pump, the inlet and outlet of the latter being connected respectively with the top and bottom of the tank. Suitable pipes lead steam to the tank in proximity to the outlet ends of the air pipes for heating the dye liquor, and the vapour rising from the liquor is returned with the air to the bottom of the tank. The steam is also employed for supplying fresh dye liquor to the tank in a thoroughly mixed condition.—B. N.

Printing viscose on fabrics. Calico Printers' Assoc., Ltd., and E. A. Fourneaux. Fr. Pat. 454,826, Feb. 27, 1913. Under Int. Conv., June 28, 1912.

SEE Eng. Pat. 15,080 of 1912; this J., 1913, 284.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali carbonate solutions; Theory of causticising ——. P. P. Fedotieff. Z. anorg. Chem., 1913, **82**, 341—352.

THE available data (chiefly those of Walter: this J., 1907, 871) concerning equilibrium in the reversible reaction, $Na_2CO_3+Ca(OH)_2\rightleftarrows 2NaOH+CaCO_3$, have been studied from the standpoint of the phase rule, and the equilibrium diagram is given for the system involved, for 80° C. The Guldberg-Waage curve for this temperature, showing the concentrations of all solutions in equilibrium with both calcium hydroxide and calcium carbonate, terminates on the line of equal sodium concentrations corresponding to $\Sigma Na=5{\cdot}3$ equivalents, the point of intersection marking the concentration of the solution ($\Sigma OH=4{\cdot}3$, $\Sigma CO_3=0{\cdot}5$ grm.-mol. per litre) in equilibrium with the solid phases, $Ca(OH)_2$, $CaCO_3$, and $Na_2Ca(CO_3)_2,2H_2O$ (this J., 1907, 253). With low concentrations, the composition of the solution changes during causticising along a line of equal total sodium concentration until this line cuts the Guldberg-Waage curve, and this curve indicates, therefore, the limit to which causticising can be carried for any given concentration in this part of the diagram, explaining graphically the well-known increased yield with dilute solutions. Material is lacking for defining exactly the regions of stability of calcium hydroxide and pirssonite, $Na_2Ca(CO_3)_2,2H_2O$, but that of calcium carbonate has been determined, and it is shown that, with the usual concentrations employed in technical practice (2—3 grm.-equivalents of sodium carbonate per litre), no double salt is liable to be formed, even when considerable cooling takes place during settling and filtering.—F. SODN.

Persulphate on iodate; Action of —— and the determination of periodate in the presence of persulphate. E. Müller and W. Jacob. Z. anorg. Chem., 1913, **82**, 308—314.

PERIODATE may be determined in the presence of iodate and alkali hydroxide by adding about twice as much sodium bicarbonate as is required to transform the hydroxide into carbonate, then a measured volume of $N/10$ arsenious acid, and sufficient potassium iodide to introduce about 4 grms. per 100 c.c., warming to 50° C. for 3—5 minutes, cooling, and titrating the excess of arsenious acid with $N/10$ iodine; the periodate and iodide react in accordance with the equation, $IO_4'+2I'+2H^{\cdot}=IO_3'+H_2O+I_2$. If persulphate also be present, approximate results may be obtained by allowing the solution to stand for 24 hours in the presence of caustic alkali and iodide, before treating as above; the persulphate is decomposed according to the equation, $3S_2O_8''+I'+3H_2O=6SO_4''+IO'_3+6H^{\cdot}$ (this J., 1913, 286, 532). By warming a mixture of sodium iodate and persulphate solutions in the presence of sodium hydroxide, basic sodium periodate is precipitated, and with the corresponding potassium salts and potassium hydroxide, potassium periodate is precipitated by carefully neutralising with sulphuric acid. Persulphate and periodate are determined in a solution containing no iodate as follows:—Caustic alkali (to normal strength) and potassium iodide are added, the solution is boiled for 2 minutes, cooled, acidified with dilute sulphuric acid, and the liberated iodine titrated with $N/10$ thiosulphate. This gives the total periodate and persulphate. Another portion of the solution is made alkaline with caustic alkali, granulated zinc is added, and the mixture boiled for 1 hour, under a reflux condenser, to effect reduction to iodide and sulphate; the solution is then poured off from the zinc, cooled, acidified with dilute sulphuric acid, and the iodide determined by adding excess of iodate solution, followed by an excess of bicarbonate (the evolved carbon dioxide being passed through potassium iodide solution to prevent loss of iodine), and titrating with $N/10$ arsenious acid; 5/6 of the iodine found represents the periodate originally present. A solution containing persulphate and iodate (without periodate) may be dealt with in a similar manner.—F. SODN.

Sodium bichromate; Solubility of —— in alcohol. B. Reinitzer. Z. angew. Chem., 1913, **26**, 456.

WHILST potassium bichromate is insoluble in alcohol, the sodium and ammonium salts, and in a lesser degree the magnesium salt, are soluble. When an excess of the crystallised sodium salt was shaken with absolute alcohol for 10 mins. at 19·4° C., the filtered solution had the sp. gr. 0·8373 and contained 5·13 grms. $Na_2Cr_2O_7,2H_2O$ per 100 c.c. It became turbid after a few minutes, a brown precipitate being formed. The anhydrous salt also dissolves in absolute alcohol, forming an orange yellow solution. —A. S.

Lead sulphide and lead chromate; Solubility of ——. G. v. Hevesy and F. Paneth. Z. anorg. Chem., 1913, **82**, 323—328.

THE solubilities of lead chromate and lead sulphide, prepared so as to contain a known trace of radium D, have been determined by agitating with water at 25° C. and measuring the radioactivity of the solution, the ratio Pb/RaD being assumed to remain constant: that of the chromate is $1{\cdot}2\times10^{-5}$ and of the sulphide 3×10^{-4} grm. per litre; the solubility of the sulphide in water saturated with hydrogen sulphide is $1{\cdot}5\times10^{-4}$ grm. per litre.—F. SODN.

Mercury halides; Solubility of —— in haloid salt solutions. W. Herz and W. Paul. Z. anorg. Chem., 1913, **82**, 431—437.

TABLES are given showing the solubility, at 25° C., of mercuric chloride in solutions of the chlorides of lithium, sodium, potassium, magnesium, calcium, strontium, and barium, of mercuric bromide in solutions of the bromides of sodium, potassium, calcium, strontium, and barium, and of mercuric iodide in solutions of the iodides of sodium, potassium, calcium, strontium, and barium. —A. S.

Refractory oxides; Fusion and vaporisation of —— in the electric vacuum furnace. O. Ruff, H. Seiferheld and J. Suda. Z. anorg. Chem., 1913, **82**, 373—400.

USING a furnace of larger dimensions but similar construction to that described previously (this J., 1910, 886), the behaviour of the oxides of beryllium, magnesium, calcium, aluminium, zirconium, yttrium, tin, titanium, cerium, thorium, niobium, tantalum, chromium, and lanthanum was studied. The results are described in detail, but except in the case of aluminium oxide, the melting points observed are really those of mixtures of several oxides, or mixtures of oxide and carbide or oxycarbide. The melting point of aluminium oxide (2010°± 10° C.) may be taken as a standard temperature. For the preparation of refractory vessels for use in the electric vacuum furnace, only beryllium oxide (m.pt. about 2525° C.) and zirconium dioxide (m.pt. about 2585° C.) appear suitable, but magnesium oxide (m.pt. above 2500° C.) could also be used if precautions be taken to prevent its relatively rapid volatilisation. Amorphous titanium dioxide becomes coloured on heating to about 1000° C., and at 1450° C. becomes converted, in the course of a few hours, into an oxide, $2Ti_2O_3,3TiO_2$, which has a blue colour with a bronze reflex. (See also this J., 1911, 1066.)—A. S.

Ultra-violet light; Decompositions effected by ——. A. Kailan. Monatsh. Chem., 1913, **34**, 1209—1244.

When dilute (0·5 to $2N$-) solutions of acetic, oxalic, malonic, succinic, malic and tartaric acid are exposed in quartz cells to the light of a quartz-mercury lamp, slight decomposition takes place. The speed of decomposition of a dibasic acid was increased by the introduction of an alcoholic hydroxyl group into the molecules. No decomposition took place under similar conditions in glass vessels. The speed of decomposition increases with length of exposure, but does not increase in proportion to increasing concentration of the acid. Any dissolved oxygen only plays a subordinate part, since the acid solutions showed at most only a slight reduction in the speed of decomposition when all air had been expelled. Iodide solutions containing about 1/800 mol. per litre of hydrochloric acid were decomposed more rapidly than neutral solutions.—C. A. M.

Mineral production of the United Kingdom. See under X.

Patents.

Sulphuric acid; Process for the production of a contact material capable of serving in the manufacture of ——. P. Farup. Fr. Pat. 454,893, Feb. 28, 1913. Under Int. Conv., Feb. 29, 1912.

Ilmenite or other material containing iron and titanium is treated with concentrated sulphuric acid (*e.g.*, 1—2 parts), and the porous mass so formed is used directly as a contact substance after or first heating to decompose the sulphates produced.—F. Sodn.

Zinc sulphate; Manufacture of —— from liquors obtained by treatment of galvanised iron scrap, zinc residues, or the like, with sulphuric acid. J. W. Kynaston and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 26,895, Nov. 22, 1912.

The liquors in question are diluted, and the iron present is oxidised by means of bleaching powder, and precipitated with calcium carbonate. After settling and filtering, the solution is evaporated to dryness, with the addition of as much sulphuric acid as is equivalent to the zinc chloride present, and the residue is dissolved in water and crystallised.—O. R.

[Ammonium] sulphite; Process of oxidising ——. E. Collett, Christiania, Norway. Eng. Pat. 3124, Feb. 6, 1913. Under Int. Conv., Feb. 6, 1912.

Oxygen or a gas containing oxygen is caused to circulate through a system containing ammonium sulphite solution, so that the amount of gas passing through the oxidation system or plant in a unit of time is greater than the amount of gas supplied to or withdrawn from the system.—O. R.

Salt; Production of blocks of ——. T. Lichtenberger and G. Kassel, Heilbrunn, Germany. Eng. Pat. 8903, April 16, 1913.

Salt is fused, poured into moulds, and subjected to pressure whilst still in a molten condition.—O. R.

Cyaniding of alkali and alkaline-earth metals; Process of ——. K. Kaiser. Fr. Pats. 454,237 and 454,238, Feb. 11, 1913. Under Int. Conv., Aug. 28, 1912, and Feb. 3, 1913.

(1) An intimate mixture of carbonates or oxides of the alkali or alkaline-earth metals with carbon is heated at 900°—1400° C., for 2 hours, and then allowed to cool, in an atmosphere of nitrogen, which should be as dry as possible and preferably under pressure. The process refers particularly to barium, and the proportion of nitrogen absorbed is said to reach 90—95 per cent. of that theoretically possible. (2) The process is similar to the above, but claim is made for heating to a red heat, during a period of not more than 3 hours.—F. Sodn.

Potash; Process allowing of extracting from silicates of potassium, products richer in ——. P. Schneider. Fr. Pat. 454,632, Feb. 20, 1913. Under Int. Conv., Feb. 21, 1912.

Material containing potassium silicate (*e.g.*, felspar) is heated in a current of air or other gas to such a temperature that potassium compounds are volatilised, and condensing apparatus is provided for collecting the product. The process may be combined with existing processes, such as the production of iron in the blast-furnace, material containing potassium compounds being introduced with the charge and the volatilised product retained with the dust carried from the furnace, in separating apparatus of the usual type; the collected dust may be used directly as a fertiliser. The process may be aided by adding lime or other suitable material to the silicate and introducing acids into the gas current. —F. Sodn.

Radioactive minerals; Process for the treatment of —— and the preparation of radioactive intermediate products. E. Ebler. Fr. Pat. 455,189, March 6, 1913. Under Int. Conv., Dec. 11, 1912.

Crude sulphates from the treatment of radioactive minerals, or other radioactive materials containing salts of oxyacids, are submitted to a process of reduction and the product containing sulphides is exhausted, preferably with feebly acid solutions, especially dilute hydrochloric acid, so as to separate radium and mesothorium with barium, etc., from lead sulphide and silicic acid which remain insoluble. The reduction may be effected by intimately mixing with carbon or carbonaceous matter and heating to incandescence, in absence of air, or by mixing with dry calcium hydride (1 mol. for each atom of oxygen) and starting interaction with a suitable kindling mixture. Further purification is brought about by converting into sulphate in the usual way, or better, by saturating the solution of crude chlorides with hydrochloric or nitric acid, so as to precipitate radium and mesothorium along with barium as chloride or nitrate, in which case, by incomplete precipitation, the ratio of radioactive element to barium may be increased. Several examples are given.—F. Sodn.

Chromium formate solutions; Process for preparing basic ——. A. Wolff. Ger. Pat. 262,049, Nov. 20, 1912. Addition to Ger. Pat. 244,320 (see Fr. Pat. 435,446 of 1911; this J., 1912, 386).

Chromium chloride solution, preferably $\frac{1}{3}$ to $\frac{1}{2}$-basic, is mixed with the amount of sodium formate calculated to produce a $\frac{2}{3}$-basic chromium formate, and the excess of acid is neutralised by addition of sodium carbonate. To avoid separation of sodium chloride from the resulting solutions, it is advisable to work at a dilution corresponding to about 10 per cent. of chromium oxide.—T. F. B.

Nitrous oxide; Manufacture of ——. C. Torley, Brussels, and O. Matter, Troisdorf, Germany. Eng. Pat. 11,828, May 21, 1913.

A stream of ammonium nitrate, either in solution or in a suitable solid form, is continuously introduced into a reaction vessel, which contains a filling material, such as sand, shot, molten metal, salts, or the like; the filling material is maintained above the temperature of decomposition of ammonium nitrate and is agitated by means of a stirring apparatus.—O. R.

Carbon; Method of treating —— and apparatus therefor. W. A. Smith, Assignor to International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 1,068,707, July 29, 1913.

The carbon is subjected to the action of heat developed by induced electrical currents whilst passing downwards through an annular, electric shaft furnace provided with a bottom discharge. The lines of current flow are transverse, to the direction of travel of the carbon, and it is stated that a commercially uniform product is obtained. —W. H. C.

Sulphur and nitrogen; Process for extracting —— from spent oxide, and regeneration of the oxide. Soc. d'Eclairage, Chauffage et Force Motrice. Fr. Pat. 454,990, March 3, 1913.

The sulphur is first extracted by means of light tar oil (b. pt. 150°—190° C.) at 100° C. and is crystallised out from the solution by cooling. The oil dissolves 2 to 2·5 per cent. S at 15° C., and 35 to 40 per cent. at 100° C. Sufficient sulphur is left with the oxide to transform the ferrocyanides into thiocyanates, the necessary quantity of lime is added and the material is heated in a current of air and steam, gradually to 550° C., whereby the whole of the nitrogen is liberated as ammonia and an active iron oxide is obtained.—A. T. L.

Acetic acid from acetate of lime; Process for the continuous manufacture of ——. M. Prager, Berlin. Eng. Pat. 24,327, Oct. 24, 1912.

See Fr. Pat. 449,622 of 1912; this J., 1913, 486.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,352, Oct. 1, 1912.

See Fr. Pat. 449,010 of 1912; this J., 1913, 487.—T. F. B.

Ammonia; Production of —— and catalytic agents for use therein. C. Bosch, A. Mittasch, and H. Wolf, Ludwigshafen, and G. Stern, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,068,966, 1,068,967, 1,068,968, and 1,068,969, July 29, 1913.

See Eng. Pat. 5835 of 1911; this J., 1911, 1115.—T. F. B.

Ammonia from aluminium nitride; Process for making ——. Soc. Générale des Nitrures. Fr. Pat. 454,430, April 26, 1912.

See U.S. Pat. 1,040,439 of 1912; this J., 1912, 1078.—T. F. B.

Aluminium nitride; Process for making ——. Société Générale des Nitrures. First Addition, dated May 18, 1912, to Fr. Pat. 427,109, May 19, 1910.

See Eng. Pat. 22,435 of 1912; this J., 1913, 233.—T. F. B.

Zinc-sodium hydrosulphite; Manufacture of ——. G. Munch, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 1,068,522, July 29, 1913.

See Fr. Pat. 434,511 of 1911; this J., 1912, 335.—T. F. B.

Copper liquors; Treatment of ——. J. H. Thwaites, Peterborough. U.S. Pat. 1,069,205, Aug. 5, 1913.

See Eng. Pat. 9174 of 1911; this J., 1912, 431.—T. F. B.

Oxygen and nitrogen from liquefied air; Process and apparatus for obtaining ——. "Industriegas" Ges. f. Sauerstoff- und Stickstoff-Anlagen m. b. H., Berlin. Eng. Pat. 17,431, July 26, 1912. Under Int. Conv., Aug. 30, 1911.

See Fr. Pat. 446,560 of 1912; this J., 1913, 142.—T. F. B.

Hydrogen; Process for the manufacture of —— from metals or low metal oxides and water. F. Bergius, Hanover, Germany. Eng. Pat. 19,002, Aug. 19, 1912. Under Int. Conv., Oct. 23, 1911.

See Ger. Pat. 254,593 of 1911; this J., 1913, 195.—T. F. B.

Hydrogen; Manufacture of —— from metals and water. F. Bergius, Hanover, Germany. Eng. Pat. 19,003. Aug. 19, 1912. Under Int. Conv., July 15, 1912, Addition to Eng. Pat. 19,002 of 1912, dated Oct. 23, 1911.

See Fr. Pat. 447,080 of 1912; this J., 1913, 364.—T. F. B.

Process of electrolysis and electrolytic cell. Eng. Pats. 1420 and 1439. *See* XI.

Electric furnace for fixing nitrogen from the air. Eng. Pat. 14,871. *See* XI.

Nitrogen fixation furnace. Eng. Pat. 16,014. *See* XI.

Treatment of nightsoil and extraction of ammonia from ammoniacal solutions in the cold. Fr. Pat. 454,498, *See* XIXb.

VIII.—GLASS; CERAMICS.

Patents.

[Electric] Glass furnace and process. P. L. T. Héroult, La Praz, France. U.S. Pat. 1,069,255, Aug. 5. 1913.

Molten glass is treated in an electric furnace having non-conducting hearth and walls, and electrodes of metal electro-negative to the metals of the glass, the furnace being preferably fitted with carbon terminals on opposite sides of the hearth, with a molten metal electrode overlying each.—F. Sodn.

Articles of glass and the like; Manufacture of ——. M. Demongeot, Paris. Eng. Pat. 13,922, June 16, 1913. Under Int. Conv., July 3, 1912.

See Fr. Pat. 446,218 of 1912; this J., 1913, 142.—T. F. B.

Quartz bodies; Apparatus for producing hollow ——. A. Voelker, Beuel, and N. Meurer, Cologne, Germany. U.S. Pat. 1,068,716, July 29, 1913.

See Fr. Pat. 435,037 of 1911; this J., 1912, 336.—T. F. B.

Ceramic objects; Manufacture of porous ——. M. Grünzweig, Munich, Germany. U.S. Pat. 1,068,762, July 29, 1913.

See Eng. Pat. 22,613 of 1908; this J., 1909, 310.—T. F. B.

Refractory siliceous products; Manufacture of ——. J. Campbell. Fr. Pat. 453,944, Feb. 3, 1913.

See Eng. Pat. 1066 of 1912; this J., 1913, 235.—T. F. B.

Preventive and curative treatment of industrial lead poisoning. Oliver. *See* XIXb.

Uniting metals or other electrically conducting bodies to quartz tubes. Fr. Pat. 454,431. *See* XXIII.

IX.—BUILDING MATERIALS.

Sand-lime bricks; Specifications for ——. E. Schleler. Tonind.-Zeit., 1913, **37**, 1234—1235.

In addition to a minimum crushing strength of 140 kilos. per sq. cm., standards have been specified by certain authorities for sand-lime bricks in respect of water absorption, content of soluble silica, and coefficient of porosity, the latter being the value $1 - \frac{r}{s}$, where r is the volume-weight and s the specific gravity. The author shows that in the case of 27 different makes of sand-lime bricks, 17, which satisfied all tests, possessing crushing strengths in the dry state of 141—258, and in the water-saturated condition of 117—219 kilos. per sq. cm. respectively. The remaining 10 makes of bricks, which did not come up to specifications in one respect or another, possessed corresponding crushing strengths of 149—235, and 124—207 kilos. per sq. cm. respectively. Specifications for water absorption, porosity, and soluble silica should therefore be accepted with reserve.—O. R.

Patents.

Artificial stone ; Process of making ——, and the product produced thereby. S. Sborowitz, Berlin. Eng. Pat. 17,482, July 27, 1912.

A MIXTURE of finely divided ashes, sand, or the like and a binding medium dissolved in a volatile solvent (such as copal oil in spirit), with or without the addition of mineral fibre and mineral dyestuff, is filled into closed moulds, which are not quite gas-tight, and submitted alternately to a moderate pressure and to heating in an oven (the compression being effected outside the oven), after which it is rapidly cooled.—F. Sodn.

Furnace linings ; Process of forming ——. A. E. Wheeler and M. W. Krejci, Great Falls, Mont. U.S. Pat. 1,068,470, July 29, 1913.

A CURRENT of air or oxygen, or an oxidising agent, is delivered to a "fused composite, metallic charge" contained in the furnace, with the object of causing the separation *in situ* of suitable metallic oxides which are subsequently distributed evenly over the inner surface of the furnace.—W. E. F. P.

Roads, etc. ; Process of treating ——. J. S. Robeson, Au Sable Forks, N.Y. U.S. Pats. 1,069,029, and 1,069,030, July 29, 1913.

WITH the object of compacting the surfaces of roads containing clay or clay-forming material, and preventing the formation of dust upon the same, the roads are sprinkled with sulphite waste liquor, the latter being used either in the raw concentrated form, somewhat diluted and neutralised, or combined with alumina. (See also U.S. Pat. 1,069,031, V., page 864.)—W. E. F. P.

[Cement.] Hydraulic products ; Process of manufacturing ——. E. Duboequet. Fr. Pat. 454,506, Feb. 17, 1913.

THE argillaceous material usually employed (with limestone) in the manufacture of cement is wholly or partly replaced by fuel ash, the latter being used in the form of finely divided cinders or similar waste and thus providing a portion of the combustible required for the "burning" operation.—W. E. F. P.

Wood ; Process for destroying vegetable parasites which attack —— and for preventing their appearance. M. Leger. Fr. Pat. 454,670, Feb. 21, 1913. Under Int. Conv., Feb. 22, 1912.

SEE Ger. Pat. 256,151 of 1912 ; this J., 1913, 428.—T. F. B.

Cement or hydraulic lime from plaster ; Process for making ——. L. P. Basset. Fr. Pat. 455,062, May 11, 1912.

SEE Eng. Pat. 12,027 of 1912 ; this J., 1913, 793.—T. F. B.

Production of fertilisers [and cement]. Fr. Pat. 454,336. *See* XVI.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Mineral production in the United Kingdom in 1912. [Cd. 7025.]

PART I. of the General Report for 1912 on Mines and Quarries contains the following statistics of the output of certain minerals in the United Kingdom in 1912, as compared with 1911 :—

——	1911.	1912.
	Tons.	Tons.
Coal	271,891,899	260,416,338
Iron ore	15,519,424	13,790,391
Clays and shale	13,835,038	12,808,950
Limestone (other than chalk)	12,183,355	11,500,660
Igneous rock	6,524,696	6,638,215
Chalk	4,884,020	4,285,412
Sandstone	4,044,907	3,839,567
Gravel and sand	2,280,248	2,191,451
Oil shale	3,116,803	3,184,826
Gypsum	276,684	285,291
Fluorspar	55,231	47,246
Barium compounds	44,118	45,377
Lead ore	23,910	25,409
Strontium sulphate	5,869	19,370
Zinc ore	17,652	17,704
Ochre and umber	14,585	13,947
Alum shale	10,516	11,258
Iron pyrites	10,114	10,522
Tin ore (dressed)	7,746	8,166
Bauxite	6,007	5,790
Manganese ore	4,987	4,170
Arsenical pyrites	1,170	2,450
Arsenic	2,144	2,194
Copper ores	3,153	1,787
Tungsten ore	266	193
Uranium ore	67	42

Iron ore resources of Chili. Part II. C. Vattier and N. Echegarai. Iron and Steel Inst., Sept. 1913. [Advance proof.]

FURTHER particulars of the iron ore deposits of Chili, based on more recent prospecting, are given. (See also this J., 1912, 985.)—A. S.

Iron ; The displacement of the critical points of —— by the addition of silicon. G. Charpy and A. Cornu. Comptes. rend., 1913, **157**, 319—322. (See also this J., 1913, 537 and 660.)

THE point a_3 occurs at a slightly higher temperature and becomes less marked as the silicon content rises, and disappears at about 1·5 per cent. Si. The point a_2 occurs at a lower temperature as the silicon increases, but does not alter in intensity. In low-carbon steels the fall is 10° to 12° C. for 1 per cent. Si. The point a_1 rises slightly on the temperature scale as the silicon increases. It tends at the same time to become less marked, in consequence of the transformation of the carbon into graphite in presence of the silicon, and disappears when the silicon exceeds about 5 per cent. The extent to which the carbon is transformed into graphite, and hence the intensity of the a_1 transformation, is partly determined by the heat treatment. In steels with more than 3·2 per cent. Si, a_1 is higher than a_2 on the temperature scale.—T. St.

Ferrosilicon ; Oxidisability of ——. M. v. Schwarz. Z. anorg. Chem., 1913, **82**, 353—356.

IN the presence of air at 850°—1100° C., finely powdered ferrosilicon (50 per cent.) steadily increases in weight for many hours, but even with a current of pure oxygen, oxidation is too slow to be utilised for the purposes of analysis.—F. Sodn.

Gold ; Annealing of ——. T. K. Rose. Inst. of Metals, Aug., 1913. [Advance proof.]

ROLLED bar gold is softened by annealing ; the degree of softening varies with the temperature and time of heating. Impurities increase the hardness ; by measuring the latter with a scleroscope or Ludwik's cone, 1—2 parts of impurities in 100,000 are readily detected. Metallographical descriptions and photographs of annealed surfaces are given. —W. R. S.

Copper ; Method of improving the quality of arsenical ——. F. Johnson. Inst. of Metals, Aug., 1913. [Advance proof.]

BY addition of ferrosilicon to copper containing 0·3—0·4 per cent. As, a series of bars containing from 0·02 to 0·80 per cent. Si and 0·035 to 0·24 Fe was prepared. It was found that arsenical copper is deoxidised by ferrosilicon and, to a smaller extent, by iron alone, the resulting metal yielding sound castings and being superior to the original copper as regards cold malleability, toughness or flexibility, and resistance to the influence of hydrogen at high temperatures. Even some excess of the added elements was found to be without injurious effect upon the metal.—W. E. F. P.

Zinc ; Preparation of ore containing ——, for the recovery of other metals such as silver, gold, copper and lead, by the elimination and subsequent recovery of the zinc as a chemically pure zinc product. S. E. Bretherton. Trans. Amer. Inst. Min. Eng., 1913, **46**, 1481—1487.

In the process employed for the preparatory treatment of ores occurring in Shasta County, Cal., U.S.A., and containing up to 50 per cent. ZnS with smaller proportions of copper and lead sulphides, the material is successively crushed to 30-mesh size, subjected to a sulphating roast, "slimed," and agitated with a solution containing about 9 per cent. each of NH_3 and CO_2, the time of agitation being usually about 20 hours but much less when pressure is employed. After filtering, the copper is precipitated by sheet zinc and the liquid boiled to precipitate the zinc as basic carbonate, the ammonia and carbon dioxide evolved being recovered ; the basic carbonate is subsequently calcined, the resulting zinc oxide, it is stated, being almost chemically pure. The insoluble ore-residue, together with the copper precipitated from the solution, is smelted for the production of matte from which the precious and other metals are recovered by ordinary means. From ores containing 35, 25, 20 and 10·4 per cent. Zn as sulphide, together with some PbS and CuS, extractions of 90—95, 85—90, 80—85 and 73—80 per cent. Zn respectively are stated to be obtained. The process is not suited to fused or sintered products or to ores containing much arsenic or zinc silicate.—W. E. F. P.

Patents.

Steel process. J. Churchward, Mount Vernon, N.Y., Assignor to Churchward International Steel Co., New York. U.S. Pat. 1,069,387, Aug. 5, 1913.

Steel having a granular structure is maintained at approximately 3100° F. (1704° C.) for such a period that upon solidifying it assumes a fibrous structure.—T. St.

Iron and iron oxides ; Agglomerating the finely divided —— obtained, as waste products, from blast-furnaces, magnetic separators, etc. J. Simon. Fr. Pat. 455,165, Feb. 27, 1913.

A mixture of 10 parts of the material with 1 of Portland cement is moistened with about 10 per cent. of H_2O and made into briquettes for smelting.—W. E. F. P.

Metals ; Electro-deposition of ——. N. H. M. Dekker, Paris Eng. Pat. 7328, of 1913, date of Appl., Aug. 1., 1912.

The electrolyte consists of a saturated solution of a salt of the metal to be deposited surrounding the cathode, and, in addition, one or more salts, which do not give a metallic deposit during electrolysis, may be added. The anode, of insoluble material, dips into water in a porous pot, the latter being immersed in the electrolyte. The water thus forms an anode electrolyte, adapted to absorb the whole of the acid liberated during the deposition of the metal in the principal electrolyte, and decomposition of water in the principal electrolyte is avoided.—B. N.

Minerals ; Means for separating —— from alluvial wash. R. Hughes, Wilson's Downfall, N.S. Wales. Eng. Pat. 20,190, Sept. 4, 1912. Under Int. Conv., Sept. 4, 1911.

The alluvial wash passes along a trunk-way, the first part of which is vertical, and the second almost horizontal. The floor of the second arm is made of overlapping plates, a narrow transverse slit being left at each junction. The lowest plate, immediately below the vertical arm, is perforated. Below the bottom plate and the slits are hoppers leading to discharge pipes. Where gold is present in the wash, one side of each hopper is sloped, and riffles, in which mercury is placed, are provided. As the material to be treated is fed into the vertical arm, water under pressure is driven up through the slits and through the bottom plate. The material is thus agitated, and while the tailings pass on, the heavier mineral particles pass into the hoppers. The pipes leading from the hoppers have a glass portion, at each extremity of which is a cock. The lower cock is kept closed until the tube is full, then after an inspection of the contents has been made through the glass, the upper cock is closed, and the lower one opened, to allow the collected material to be discharged.—T. St.

Nickel ; Extraction of ——, from mixtures of nickel and other metals. H. E. Fierz, Basle, Switzerland, and E. Cahen, London. Eng. Pat. 4249, Feb. 19, 1913.

In extracting nickel, by means of carbon monoxide, from mixtures of nickel and other metals obtained by reducing the mixed oxides with gas containing carbon monoxide, the latter is displaced by hydrogen or removed by suction from the presence of the reduced metals while the temperature is maintained above that at which nickel will decompose, or combine with, carbon monoxide. The temperature is then reduced to that required for the formation of nickel carbonyl and the gas re-admitted. —W. E. F. P.

Nickel and its alloys ; Method of preparation of ——. J. B. M. E. Vuigner and P. R. Pierron. Fr. Pat. 455,253, May 18, 1912.

A nickel-iron matte is smelted in an electric furnace with alkalis (lime) and carbon or a carbide, with formation of carbon monoxide, alkali or alkaline-earth sulphide and metal. In order to avoid the carburisation of the metal, the proportion of carbon must be carefully regulated, and the hearth of the furnace should not be composed of carbon.—T. St.

[Nickel] Catalysers ; Process for the manufacture of ——. K. H. Wimmer and E. B. Higgins. Fr. Pat. 454,501, Feb. 18, 1913. Under Int. Conv., Feb. 19, 1912.

The primary material, *e.g.*, nickel formate, is mixed with some protecting material and is then reduced to the metallic condition. The protecting material which may be a suitable oil serves also to preserve the catalytic properties of the reduced substance.—W. H. C.

Separator ; Magnetic ——. F. Krupp Akt.-Ges. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 4595, Feb. 22, 1913. Under Int. Conv., March 15, 1912.

Several magnet poles, concentrically arranged, rotate beneath stationary rings, tapering downwards, which form an armature. Liquid conveying the material to be treated runs into radial channels passing over, and rotating with, the magnet poles, and discharges into a stationary concentric channel. Magnetic particles are thus attracted and lifted out of the liquid by the armature. Between the poles are rotating sprayers arranged to play on the armature, and directly under the latter are channels for the reception of the dislodged material.—T. St.

[Uranium, vanadium and radium.] Ores ; Process of extracting values from ——. W. F. Bleecker, Canonsburg, Assignor to The Standard Chemical Co., Pittsburgh, Pa. U.S. Pat. 1,068,730, July 29, 1913.

The finely powdered ore (carnotite) is successively treated with (1) a solution of sodium hydroxide and carbonate, to form partly soluble vanadates and insoluble sodium uranate ; (2) hydrochloric acid, to produce vanadyl, radium and uranyl chlorides ; (3) a solution of sodium carbonate, to form sodium vanadate (partly soluble), radium carbonate (insoluble) and sodium uranyl carbonate (soluble) ; (4) hydrochloric acid, to produce radium and vanadyl chlorides ; and (5) sulphuric acid, to form soluble vanadyl sulphate.—W. E. F. P.

Alloy ; Non-corrosive metallic ——. J. Coup, Marion, Ohio. U.S. Pat. 1,069,113, Aug. 5, 1913.

The alloy consists of Cu 69·13, Ni 14·81, Zn 8·64, Pb 0·58, Fe 0·06, phosphor-tin 3·08, and Al 3·70 per cent.—T. St.

Alloys of aluminium and magnesium; Application of —— in the manufacture of mirrors of projectors [*searchlights, etc.*]. Barbier, Bénard et Turenne. Fr. Pat. 454,028, April 18, 1912.

The alloy found to give the best results as material for projecting mirrors consists of Al 100 and Mg 20 parts. It can be worked easily and takes a high polish. After being given the desired shape and polished, the mirror is coated with colourless varnish and dried in a hot atmosphere containing a large amount of formaldehyde vapour. —T. St.

Zinc; Process of recovering ——. Process of roasting ores and recovering zinc therefrom. C. J. Reed, Philadelphia, Pa. U.S. Pats. 1,069,178 and 1,069,179, Aug. 5, 1913.

(1) Material containing zinc is treated with an excess of sulphuric acid, and the resulting solution is treated with an oxidising agent. The solution is purified by the addition successively of a zinc-containing substance and metallic zinc, and the contained zinc is then recovered from the purified solution. (2) Finely powdered sulphide ores are mixed with a previously oxidised portion of similar material, and heated in air, whereby the zinc is converted into sulphate. This is dissolved out and the zinc recovered. —T. St.

[*Zinc*] *Ores; Process of treating ——.* C. C. Titus and W. J. Barenscheer, Helena, Mont., Assignors to New England Electro-Chemical Metals Co., Boston, Mass. U.S. Pat. 1,069,498, Aug. 5, 1913.

Sulphide ores containing zinc and other metals are coarsely ground, and heated with common salt to a temperature between the fusing and volatilizing points of zinc chloride. The mixture is then subjected to the action of chlorine, whereby a fluid melt containing the chloridized metals is obtained.—T. St.

Zinc; Method and apparatus for the condensation of the vapours of volatile metals, and particularly those of ——. F. C. W. Timm. Fr. Pats. 454,399, Feb. 15, 1913, and 454,495, Feb. 18, 1913. Under Int. Conv., Feb. 17, 1912, and Feb. 20, 1912.

(1) The hot gases containing zinc vapour are passed downwards through a condensing charge consisting of small pieces of porous material resting on a grid, the condensed zinc collecting in vessels placed underneath. The condensing charge may be made up of smelting material, whereby the latter receives a preliminary heating. By suitably adjusting the temperatures of condensers, a separation of metals of different vaporizing points, such as lead and zinc, may be accomplished. It is preferable to cool the gases partially before sending them through the condensers, by passing them through a spacious chamber, where dust and and zinc oxide are deposited. (2) The vapours are passed upwards through the condensing charge, and better condensation is brought about by damping the charge with water. The hot zone thus rises, the zinc condensing in greater and greater quantities in the upper parts of the charge, and finally the zinc runs out at the bottom in streams, and is collected. Any zinc remaining in a heated condenser may be recovered by passing hot gases through from top to bottom, but if the charge is composed of smelting material, the immediate recovery of the zinc is unnecessary, as this latter merely enriches a succeeding furnace charge.—T. St.

Zinc oxide; Method and apparatus for the extraction of —— from zinciferous materials, especially from the slags obtained in the metallurgy of lead and copper. F. C. W. Timm. Fr. Pat. 455,086, March 5, 1913. Under Int. Conv., March 7, 1912.

The zinciferous substances, mixed with carbon and suitable fluxes, are heated in a shaft furnace, the lower part of which is water-cooled, as are the bars on which the charge rests. Air and gaseous, liquid, or powdered fuel are introduced above the charge, and the products of combustion, carrying with them the zinc oxide, pass through the grate at the bottom and are drawn off to filters, etc. The rest of the charge drops in the molten state between the bars of the grate into suitable receivers. In order to obtain the zinc as oxide, and to prevent the separation of copper, etc., as metal, the atmosphere is made as oxidising as possible. The charge may receive a preliminary heating in a chamber placed above the furnace, the gases issuing from the latter being led through the new charge to the condensers. —T. St.

[*Condenser*] *Metallurgical apparatus.* W. McA. Johnson, Hartford, Conn. U.S. Pat. 1,069,260, Aug. 5, 1913.

A number of inclined pipes, enclosed in a vessel, are in direct communication with a receptacle containing metallic vapours, the ends of the pipes remote from the receptacle projecting from the enclosure wall. The pipes are kept at a uniform condensing temperature by circulating around them the gases from an independent furnace. Movable covers are fitted to the free ends of the pipes to allow access to the interiors, and apertures are provided for the escape of accumulated gases. Means are provided for recovering valuable products from the escaping gases, and for withdrawing the molten metal from the condenser pipes. —T. St.

Copper; Electrolytically refining ——. G. D. Van Arsdale, East Orange, N.J. U.S. Pat. 1,069,305, Aug. 5, 1913.

Copper is dissolved from a metallic anode, and deposited upon a cathode in an electrolyte containing ammonium cuprous sulphite.—B. N.

Furnace; [*Electric*] *Smelting ——.* O. S. and O. J. D. Emberg, Chicago, Ill. U.S. Pat. 1,069,326, Aug. 5, 1913.

A crucible has a conical cover, which with the crucible forms a cup and-cone arrangement for feeding material into the crucible. The latter is supported between two platforms which carry cooled electrodes, the inner ends of which extend into the crucible, while the rear ends are exposed on the platforms. The electrodes are composed of jointed sections, and means are provided for moving them forward into the crucible.—T. St.

Furnace; Tilting Martin-Siemens ——. Ateliers de Constructions Electriques du Nord et de l'Est. Second Addition, dated May 6, 1912, to Fr. Pat. 436,020, Jan. 11, 1911 (this J., 1912, 393, and 1913, 756).

Means are provided for automatically closing the gas conduits communicating with the hearth when the furnace is tilted for pouring.—W. E. F. P.

Barytes; Method of separating —— from ores. C. J. Greenstreet, Webster Groves, Mo. U.S. Pat. 1,069,545, Aug. 5, 1913.

The ore is heated with sodium chloride until the latter melts and dissolves the barytes. The molten solution is separated from the ore, and the barytes then separated from the sodium chloride.—T. St.

Soldering; Process of ——, in which the metals forming the solder are not oxidised at the temperature employed. G. Klingberg. Fr. Pat. 454,776, Feb. 25, 1913.

An Al-Cd alloy, in the form of powder, is spread upon the previously cleaned and heated metal surfaces to be united, the joint being made by the application of heat but without the use of a soldering flux or liquid.—W. E. F. P.

Tin plate; Process of stripping ——. A. Drogo. Fr. Pat. 455,162, March 1, 1913.

The material is subjected to the action of a chlorinated hydrochloric acid solution of manganese chloride, with the object of dissolving the tin and simultaneously rendering the iron passive. The tin is recovered by electrolysis, the same apparatus being employed as that used for the chlorination of the liquid; the latter is purified from iron by means of carbonate or oxide of manganese, and is periodically strengthened by the addition of hydrochloric acid.—W. E. F. P.

Briquettes from ore or blast furnace dust and organic binding materials in solution in water; Manufacture of ——. Gewerkschaft Pionier, Walsum on Rhine, Germany. Eng. Pat. 20,952, Sept. 13, 1912. Under Int. Conv., Sept. 15, 1911.

See Fr. Pat. 448,276 of 1912; this J., 1913, 431.—T. F. B.

Pig iron; Making dephosphorised high grade ——. P. L. T. Héroult, New York City. Eng. Pat. 25,974, Nov. 12, 1912. Under Int. Conv., July 30, 1912.

See Fr. Pat. 449,160 of 1912; this J., 1913, 492.—T. F. B.

Steel; Process for making cement ——. G. H. Benjamin. Fr. Pat. 454,582, Feb. 19, 1913.

See U.S. Pat. 1,054,817 of 1913; this J., 1913, 430.—T.F.B.

Ores and metallurgical products; Process of treating ——. W. Troeller, Frankfort, Germany. U.S. Pat. 1,068,611, July 29, 1913.

See Eng. Pat. 12,198 of 1909; this J., 1910, 433.—T. F. B.

Gold and silver; Process for the recovery of —— from antimonial, arsenical, and other gold-bearing ores. J. Gitsham, Moonee Ponds. Assignor to Gitsham Gold Extraction Co., Ltd., Melbourne. U.S. Pat. 1,068,646, July 29, 1913.

See Fr. Pat. 430,852 of 1911; this J., 1911, 1392.—T. F. B.

Zinc and other volatile metals; Process of recovering ——. T. Huntington, London, and F. Heberlein, Frankfort, Germany. U.S. Pat. 1,069,085, July 29, 1913.

See Eng. Pats. 20,896 of 1910 and 8035 of 1911; this J., 1911, 1319.—T. F. B.

Roasting ores and recovering the gases therefrom; Process and apparatus for ——. F. von Schlippenbach, Stolberg, Germany. U.S. Pat. 1,069,191, Aug. 5, 1913.

See Eng. Pat. 28,755 of 1909; this J., 1910, 1165.—T. F. B.

Ores; Apparatus for roasting or sintering ——. J. E. Greenawalt. First Addition, dated Feb. 21, 1913, to Fr. Pat. 448,244, July 17, 1912.

See Eng. Pat. 28,441 of 1912; this J., 1913, 430.—T. F. B.

Copper and other metals the oxides of which are soluble in solutions of free or combined ammonia; Process for dissolving ——. P. Schmidt und Desgraz G. m. b. H. Fr. Pat. 453,941, Feb. 3, 1913. Under Int. Conv., Feb. 22, 1912.

See Ger. Pat. 255,084 of 1912; this J., 1913, 199.—T. F. B.

Metallic alloys. E. Haynes. Fr. Pat. 454,064, Feb. 7, 1913.

See U.S. Pat. 1,057,828 of 1913; this J., 1913, 493.—T.F.B.

Lead and zinc contained in ores in the form of sulphide; Process for separating ——. G. de Bechi. Fr. Pat. 454,255, Feb. 11, 1913. Under Int. Conv., April 11, 1912.

See Eng. Pat. 4246 of 1913; this J., 1913, 540.—T. F. B.

Phosphate slags; Process for the complete utilisation of basic ——. H. Naegell. Fr. Pat. 454,462, Feb. 17, 1913. Under Int. Conv., Feb. 28 and Sept. 23, 1912.

See Ger. Pats. 256,303 and 258,709 of 1912; this J., 1913, 369, 610.—T. F. B.

Extracting products richer in potash from silicates of potassium. Fr. Pat. 454,632. *See* VII.

Manganese fertilisers with a base of blast-furnace slag. Addition to Fr. Pat. 452,602. *See* XVI.

XI.—ELECTRO-CHEMISTRY.

Electrochemical indicator for oxidising agents [*in the sterilisation of water*]. Rideal and Evans. *See* XIXb.

PATENTS.

Nitrogen from the air; Electric furnace for fixing ——. E. K. Scott, Bromley, Kent. Eng. Pat. 14,871, June 26, 1912.

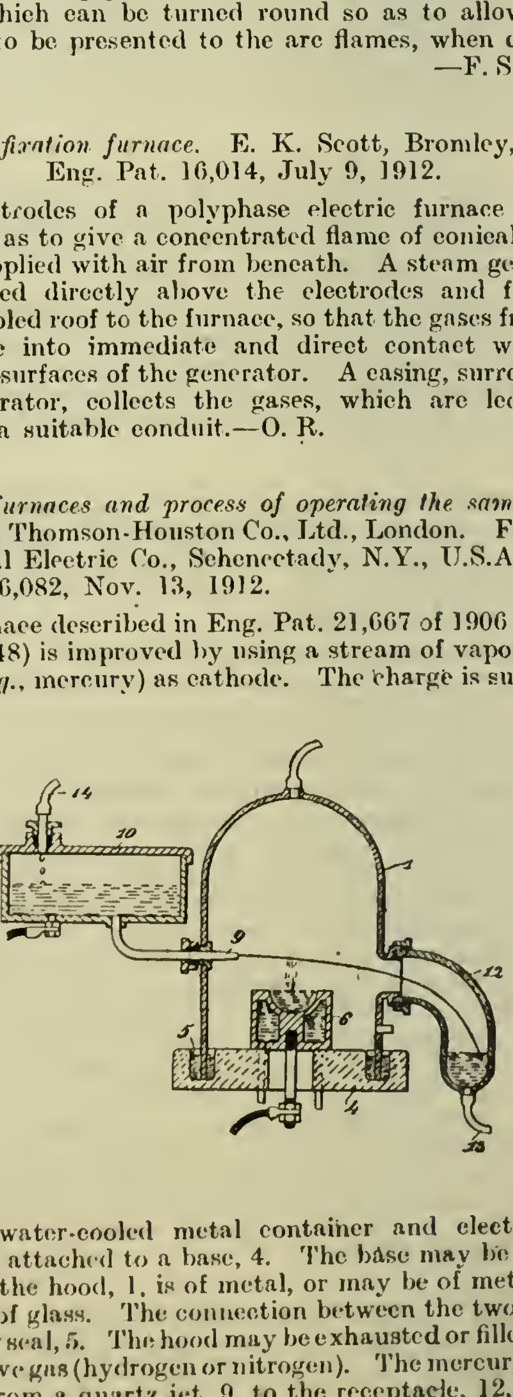
The furnace utilises three-phase alternating currents and contains 3 horn-shaped electrodes, preferably made of steel tubes, through which cooling water flows; to protect the main tubes from being burnt away, renewable metal pieces are provided, as well as wedge-shaped copped arc tips. A central metal pipe, forming the neutral point of the system, supplies air under pressure below the arc flames, and cooling air to the upper part of the flames. Air may otherwise be delivered through a duct in the floor, cool air being directed to the upper part of the arc flame through additional ducts in the floor, side, or top of the furnace. The arcs are started by temporarily pushing forward the electrodes, or by means of a metal cone, which may be raised and lowered by levers. The upper part of the central pipe is surrounded by a piece of metal tubing which can be turned round so as to allow fresh surfaces to be presented to the arc flames, when desired. —F. Sodn.

Nitrogen fixation furnace. E. K. Scott, Bromley, Kent. Eng. Pat. 16,014, July 9, 1912.

The electrodes of a polyphase electric furnace are so arranged as to give a concentrated flame of conical shape, when supplied with air from beneath. A steam generator is disposed directly above the electrodes and forms a water-cooled roof to the furnace, so that the gases from the arc come into immediate and direct contact with the adjacent surfaces of the generator. A casing, surrounding the generator, collects the gases, which are led away through a suitable conduit.—O. R.

Electric furnaces and process of operating the same. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 26,082, Nov. 13, 1912.

The furnace described in Eng. Pat. 21,667 of 1906 (this J., 1907, 1148) is improved by using a stream of vapourizable metal (*e.g.*, mercury) as cathode. The charge is supported in the water-cooled metal container and electrode, 6, which is attached to a base, 4. The base may be of soapstone if the hood, 1, is of metal, or may be of metal if the hood is of glass. The connection between the two is by a mercury seal, 5. The hood may be exhausted or filled with a protective gas (hydrogen or nitrogen). The mercury stream passes from a quartz jet, 9, to the receptacle, 12, when it can be passed *via* 13 and 14 back to the reservoir, 10. The arc may be started by a high potential discharge, or by allowing the mercury first to come in contact with the electrode, 6, and then increasing the pressure to drive it into 12. The furnace may be used for such materials as boron, silicon, tungsten, titanium, carbides, and the like without contaminating them, and impure boron products may be heated therein so as to yield chemically pure coherent boron.—W. H. P.



Furnace; Electric —— with treatment in a closed space. Helfenstein-Elektro-Ofen-G.m.b.h. Fr. Pat. 454,195, Feb. 4, 1913.

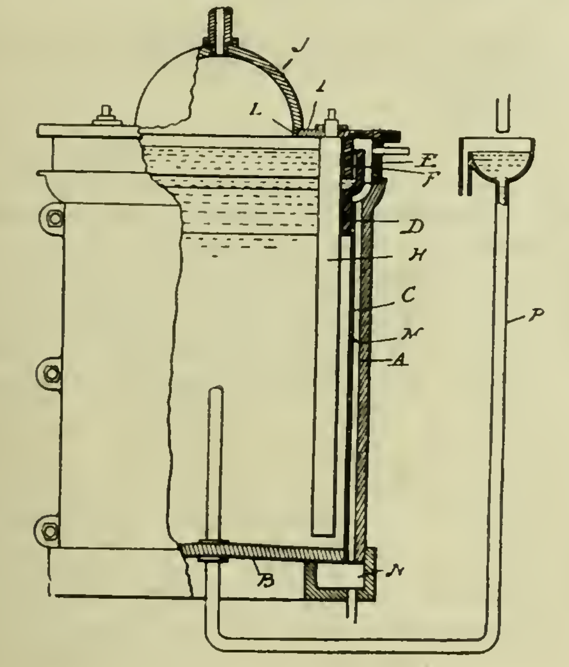
THE electrodes of the furnace traverse the hopper or charging reservoir, and at the interior of the latter are formed chambers or compartments of an annular, bell-like or other suitable form. These serve to receive the gases of the reaction, which separate in the hopper and collect in the chambers during the working of the furnace.—B. N.

Ozone generators. F. de Mare, Brussels. Eng. Pat. 20,988, Sept. 14, 1912.

THE generator is of the type in which air is drawn in at the centre of a rotating mechanism and forced towards the periphery, where it is passed through an opening across which the discharge takes place. The rotary device is a divided casing with a circular and practically peripheral slot, between the rims of which the discharge is produced. The air is discharged through the slot along an intervening diaphragm. The diaphragm may be fixed or movable, and both parts or only one part of the shell may rotate. There may be several diaphragms separated by metal rings which may be coupled electrically in series or in parallel. In a modified arrangement the rotating member is a horizontal fan, enclosed in a cylindrical drum, the air entering through a filtering arrangement at the bottom. The blades of the fan are of insulating material and they carry a dielectric diaphragm, which may be composed of a number of overlapping segments. The diaphragm rotates in a horizontal plane between two toothed rings of U-shaped cross-section, each ring being connected with a pole of a high current generator.—W. H. P.

Electrolysis; Process of —— and electrolytic cell. H. M. Du Bois, Wayne, Mich., U.S.A. Eng. Pats. 1420 and 1429, Jan. 17, 1913.

(1) THE electrolyte, such as sodium chloride, is fed continually into the anode compartment, the inflow of liquid being so regulated that it exceeds the amount passing through the porous diaphragm, and the surplus is forced upwards through a space between flanges, forming a gas-proof seal, into the cathode compartment. The liquid thus passes across the electrolytic field in a space between the cathode and diaphragm. The gases are drawn off separately on each side of the gas-proof seal, the hydrogen reducing the hypochlorite which passes through the seal. (2) The cathode, A, consisting of several cylindrical segments bolted together, forms the outer cell, which also clamps in position the bottom, B. The cathode is provided with several vertical channels, M, forming the cathode compartment between the vessel, A, and the annular diaphragm, C. An annular piece of insulating material, D, with the insulating rings, E and F, forms a gas-proof seal communicating with opposite sides of the diaphragm. The anodes, H, consist of a series of carbon rods suspended from the cover, I, and the latter is cemented to a removable cap, J, the joint being protected by a flange, L. Electrolyte is supplied to the anode compartment through the tube, P, flows through the gas-proof seal, and is discharged into the annular channel, N, at the bottom of the cathode compartment.—B. N.



Furnace; Electric resistance ——. C. R. J. Louis. Fr. Pat. 454,641, Feb. 20, 1913.

THE fused reaction products flow away through a channel in the lower part of the furnace. The electric current is brought into contact with the material to be treated at the upper portion only of the fixed electrodes, these being separated from one another by the channel forming the exit for the fused material.—B. N.

Furnace; Electric resistance ——. N. Koroleff. Fr. Pat. 455,019, May 9, 1912.

A CLOSED space is arranged in the walls of the furnace to receive a resistance in iron, nickel, or other inexpensive metal or alloy, and a gas, or mixture of reducing gases, is maintained in the space to protect the resistance against oxidation.—B. N.

Cells which are sensitive to light, and provided with aluminium electrodes, and for which acetone is used as electrolyte. C. Stille, Berlin. Eng. Pat. 9060, April 17, 1910. Under Int. Conv., April 24, 1912.

THE cell has acetone as an "electrolyte," and one pole is a bare aluminium plate and the other an aluminium plate coated with an alloy of gold and selenium. The coating is produced by covering with melted selenium and heating several times above 200° C. till the selenium becomes silver grey and crystalline. After cooling to 90° C. a layer of gold leaf is laid on and the whole is carefully heated to about 170° C. On exposure of the plate to light a chemical change is produced which is reversed when the cell is closed and the exposure stopped, and thereby an electric current is generated. The cell can be used in connection with distance photography since the reactions are proportional or nearly so to the intensity of the light and the duration of exposure.—W. H. P.

Gases; Method of discharge of electricity into ——. F. G. Cottrell, Berkeley, Cal., Assignor to International Precipitation Co., Los Angeles, Cal. U.S. Pat. 1,067,974, July 22, 1913.

ELECTRODE surfaces of different character (so as to promote a non-disruptive charge in a given direction) are exposed to the gas, the negative potential (which is made approximately as high as possible without causing "disruption of the gas") being applied at the surface whence the discharge proceeds. The difference of potential exceeds that maintained when the positive potential is applied to the same surface. In this way it is possible to separate suspended particles from the gas. C. A. M.

Coating electric conductors, wires and cables; Process of and apparatus for ——. L. W. Chubb, Wilkinsburg, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pats. 1,068,410, 1,068,411, and 1,068,413, July 29, 1913.

(1). THE conductor (*e.g.*, wire or cable) is passed progressively through a bath, and a current is simultaneously passed through the bath and the conductor. The bath is of such a character that it will co-operate with the current in producing an insulating coating on the wire or cable. (2). The wire is passed through a series of tanks containing liquid and connected together by pipes below the level of the liquid. The pipes are of materially greater diameter than the wires, and in order to prevent the liquids in the various tanks from mixing, T-connections are made in the pipes through which a gas may be passed under pressure. (3). A transformer comprising primary and secondary windings and a core member has the latter at least partially submerged. The bath is of ammonium borate or some liquid capable of producing an electrolytic valve action. The wire or cable is passed through the liquid and round the submerged portion of the core. A source of alternating current is connected with the primary winding and a secondary circuit is established through the cable and the bath. A pair of conductors may be passed through the bath so as to produce two groups of turns round the core, and sheaves or pulleys of conducting material may be severally connected with the cables, before they enter the bath, and also with the free terminals of the secondary winding.—W. H. P.

Wires and cables; Apparatus for treating [coating] ——. L. W. Chubb, Wilkinsburg, Pa., and H. R. Edgecomb, Edgewood Park, Pa., Assignors to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,068,412, July 29, 1913.

The wire is passed through a succession of tanks containing liquid, each with an open topped notch in its opposite sides sufficiently large to allow the wire to pass. The bottom of the notch is below the level of the liquid which consequently flows out continuously. Arrangements are made for automatically keeping the level of the liquid above the bottom of the notch so that the wires are always immersed.—W. H. P.

Insulating coating on conductors. Specialfabrik für Aluminium-Spulen und Leitungen G. m. b. H. Fr. Pat. 454,292, Feb. 12, 1913.

The insulating coating, such as aluminium hydroxide, is deposited electrolytically on the conductor forming the cathode from a bath containing an aluminium and a mercury salt, the anode consisting of lead with lead peroxide. During the precipitation of the hydroxide, the bath is rapidly stirred by means of a current of air blown into the liquid between the anode and cathode. The air may be passed in through a tube, which serves at the same time as a guide for the conductor of copper wire. —B. N.

Carbon electrodes with protective envelopes; Process for providing ——. Ges. für Teerverwertung m. b. H. Fr. Pat. 454,475, Feb. 17, 1913. Under Int. Conv., June 18, 1912.

Granular materials, unaffected by oxidising gases at high temperatures, are mixed with the surfaces of the electrodes by pressing, rolling, hammering, etc., before the electrodes are baked.—B. N.

Retorts for the baking of electrodes of electric furnaces. C. M. Stein et Cie. Fr. Pat. 455,256, May 18, 1912.

The retorts are formed of superposed tubular elements assembled in any convenient manner.—B. N.

Heating material by electricity; Method of ——. W. S. Franklin, South Bethlehem, Pa. U.S. Pat. 1,068,643, July 29, 1913.

The material is placed in a metal receptacle with a refractory lining, and is passed in a stream to a receiver which may have a similar lining. The metal portions of the receiver and the original receptacles are the terminals of an electrical circuit. If the material has a high melting point it may be mixed with one of lower melting point. —W. H. P.

Electrical separation of bodies in suspension from gaseous fluids; Process and apparatus for the ——. E. Möller, Brackwede, Germany. Eng. Pat. 17,840, Aug. 1, 1912.

See Fr. Pat. 449,337 of 1912; this J., 1913, 495.—T. F. B.

Electrical accumulators; Manufacture of ——. P. Marino, London. U.S. Pat. 1,068,439, July 29, 1913.

See Eng. Pat. 23,265 of 1911; this J., 1912, 396.—T. F. B.

Furnace; Electric ——. J. Bally, Grenoble, France. U.S. Pat. 1,068,558, July 29, 1913.

See Fr. Pat. 432,151 of 1911; this J., 1912, 32.—T. F. B.

Furnace; Electric —— and process of operating the same. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,068,615, July 29, 1913.

See Eng. Pat. 26,082 of 1912; preceding.—T. F. B.

Furnace; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 1,069,252, Aug. 5, 1913.

See Eng. Pat. 14,164 of 1912; this J., 1913, 432.—T. F. B.

Method of treating carbon and apparatus therefor. U.S. Pat. 1,068,707. *See* VII.

XII.—FATS; OILS; WAXES.

Paint oils; Drying rates of raw ——. *A comparison.* L. V. Redman, A. J. Weith, and F. P. Brock. J. Ind. Eng. Chem., 1913, **5**, 630—636.

Experiments were made with two samples each of linseed, soya bean, and China wood (tung) oils and four samples of fish (menhaden) oil. Films were painted on glass and these were exposed to a current of filtered air for 20 days in diffused daylight. The results are given in curve-diagrams showing (1) the gain in weight of the oils, and (2) the daily variation in weight together with the variation in temperature and relative humidity of the air. The linseed, soya bean and tung oils gave solid films in 20 days, but the fish oils remained tacky viscous liquids. The fish oils gained in weight much more rapidly, and the maximum gain in weight (average, 12·5 per cent. on the third or fourth day) was greater than with the other oils, viz., linseed (11·5 per cent. on the seventh day), soya bean oil (7·7 per cent. on the sixth day), and tung oil (10·5 per cent. on the ninth day). The increase in weight was most rapid on the fourth and seventh days for the linseed oils, in the first two or three days for the fish oils, on the fifth day for the soya bean oil, and on the fourth and fifth days for the tung oils.—A. S.

Oil of Plukenetia conophora. P. Mühle and A. Hämmelmann. Farbenzeit., 1913, **18**, 2175. Chem. Zentr., 1913, **2**, 587.

The nuts of *P. conophora* consist of about 30 per cent. of shells and 70 per cent. of kernels. The latter yield about 53·5 per cent. of oil by extraction and 35 per cent. by pressing. The yellow oil has an odour and taste resembling that of linseed oil and its characters are: sp. gr. at 15° C., 0·9388; refractometer reading at 25° C., 84·2; acid value, 34·3; saponification value, 191·7; iodine value (Wijs) 198·3; Hehner value, 95·7; unsaponifiable matter, 0·21 per cent.; hydroxy-acids insoluble in petroleum ether, 3·01 per cent. The oil yielded 47·7 per cent. of hexabromides of m.pt. 177°—178° C. by Eibner and Muggenthaler's method (this J., 1913, 242). The separated fatty acids melted at 24°—25° C., and had an iodine value (Wijs), 211·4, and mean molecular weight, 278—280. When heated the oil gelatinised in a similar manner to Chinese wood oil, setting taking place after about 6 hours at 300° C. or 35 hours at 250° C. After removing the free acids, *Plukenetia* oil dries more readily than linseed oil. The oil decomposes readily in the kernels, and hence would have to be extracted at the place of origin.—A. S.

Kapok seeds and kapok oil. H. Sprinkmeyer. Z. Unters. Nahr. Genussm., 1913, **26**, 86—101.

The kapok tree, *Eriodendron anfractuosum*, grows in almost all tropical countries and resembles the cotton plant in that it yields a fruit containing fine fibrous material in which the seeds are embedded. The East Indian tree, *Bombax malabaricum*, is also known as "kapok" and, in commerce, no distinction is made between the oils derived from these two sources. The seeds contain about 23 per cent. of oil and yield about 17 per cent. by pressing. Expressed oils yielded by kapok seeds from Java, East Africa, Ceylon, and Ecuador had the following characters: Sp. gr. at 15° C., 0·9235 to 0·9326; refractometer reading at 40° C., 51·7 to 59·7; iodine value, 85·24 to 93·78; saponif. value, 189·2 to 194·5; Reichert-Meissl value, 0·20 to 0·66; Polenske value, 0·40; acid value, 18·5 to 210·2; insoluble fatty acids, 95·60 to 95·76 per cent. The fatty acids had: iodine value, 86·8 to 98·96; saponif. value, 199·0 to 202·7; solidif. pt., 26·9° C. to 31·8°; m. pt., 32·2 to 34·2°. The expressed oil from *Bombax* seeds had: sp. gr. 0·9300; refractometer reading at 40° C., 57·0; iodine value, 73·59; saponif. value, 194·3; acid value, 3·0; insoluble fatty acids, 95·61 per cent. The fatty acids from kapok oil yield a hexabromide melting at 112° to 114° C. Kapok oil resembles cottonseed oil, and gives a strong reaction with Halphen's reagent; it is not, however, used so extensively as cottonseed oil for edible purposes.—W. P. S.

Candelilla wax. H. Meyer and W. Soyka. Monatsh. Chem., 1913, **34**, 1159—1172.

The constituent giving the Liebermann-Storch reaction, violet colouration and green fluorescence with acetic anhydride, chloroform and sulphuric acid, was separated by repeatedly boiling the powdered wax with 96 per cent. alcohol and after cooling, the residue was collected, drained and pressed. The alcoholic solution, when evaporated, left a soft yellow resinous residue, from which by distillation with zinc dust in a current of hydrogen, a colourless sesquiterpene could be obtained. The resinous constituent of the wax (18 to 20 per cent.) is probably formed in the preparation of the wax. The wax, from which the resin had been removed, consisted largely of normal dotriacontane, $C_{32}H_{66}$, m. pt. 71° C. (74 to 76 per cent. of the wax), but contained also an oxylactone, $C_{30}H_{58}O_3$, m. pt. 88° C., (5 to 6 per cent. of the wax). —C. A. M.

Patents.

Oil and stock food from cotton seed; Process of obtaining ——. T. H. Covey, Cleburne, Tex. U.S. Pat. 1,067,975, July 22, 1913.

The seed is cleansed, hulled, rolled and cooked, together with, say, not more than 30 per cent. of the hulls, for a given period (*e.g.*, 35 minutes). The mass is then pressed to separate the oil, and the oil-cake finely divided. Steam under a pressure of about 60 lb. may be used for the cooking.—C. A. M.

Fats and oils; Process for the decomposition of ——. B. E. Reuter, Chicago. U.S. Pat. 1,068,079, July 22, 1913.

Glycerides are hydrolysed by heating with successive limited portions of sulphonated fatty acids at temperatures (*e.g.*, 100° C.) insufficient to volatilise the products of decomposition, and at substantially atmospheric pressure, air being practically excluded, whilst after each stage of the treatment the aqueous glycerin and spent reagent are removed.—C. A. M.

Fats; Process of removing rancidity from ——. Verein. Chem. Werke Akt.-Ges. Fr. Pat. 454,315, Feb. 13, 1913. Under Int. Conv., Feb. 26, 1912.

The free fatty acids are esterified by means of aromatic sulpho-acids after the addition of a quantity of glycerin corresponding to the acidity. The process may be carried out *in vacuo* or in a current of a neutral gas, which will also effect agitation of the mass.—C. A. M.

Toilet soaps; Method of preparing ——. C. D. Mayer, London. Eng. Pat. 23,518, Oct. 15, 1912.

Milk powder is added directly, or in the form of a paste, to the soap at any stage of its manufacture.—C. A. M.

Soap; Insecticidal ——. H. Gouthière et Cie., and P. Ducancel. Third Addition, dated May 18, 1912, to Fr. Pat. 444,021, July 27, 1911 (this J., 1912, 1138, 1190).

Quinoline bases are made to combine with fatty acids (oleic, sulphoricinic, etc.) and with resins, with or without the addition of copper compounds. To these soaps, toxic salts, such as arsenites or arsenates of lead, sodium iron, etc., may be added. Or mixed soaps may be obtained by neutralising the basic substance with a mixture of fatty acid and arsenious or arsenic acid.—C. A. M.

Brewers' grains and the like; Utilisation of —— *whereby detergent and other products are obtained.* J. C. Richardson, London. Eng. Pat. 16,971, July 20, 1912.

The spent grains are treated with caustic alkalis, with or without previous or subsequent separation of refractory cellulose fibre. The resulting magma is used as a detergent by itself or in admixture with other detergents. Any volatile products resulting from the reaction, when carried out under the influence of heat, may be collected.—C. A. M.

Fatty acids from soaps; Process for producing ——. G. Bottaro, Genoa, Italy. Eng. Pat. 23,663, Oct. 16, 1912.

See Fr. Pat. 449,392 of 1912; this J., 1913, 498.—T. F. B.

Unsaturated fatty acids and their glycerides; Process for saturating —— *by addition of hydrogen.* E. Utescher. Fr. Pat. 454,423, Feb. 15, 1913. Under Int. Conv., Feb. 17, 1912.

See Eng. Pat. 20,061 of 1912; this J., 1913, 797.—T. F. B.

Catalytic reactions, particularly the conversion of unsaturated fatty acids and their glycerides into saturated compounds. Techno-Chemical Laboratories, Ltd. Fr. Pat. 454,702, Feb. 22, 1913. Under Int. Conv., Feb. 24, 1912.

See Eng. Pat. 4702 of 1912; this J., 1913, 705.—T. F. B.

Manufacture of margarine and analogous substances, using cooling surfaces for cooling the liquid fats or emulsions. Fr. Pat. 454,640. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Mineral pigments in the United States; Production of ——. U.S. Geol. Survey, 1913. [T.R.]

The following table shows the production of various mineral pigments and paints in the United States during 1911 and 1912:—

	1911.		1912.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.	$	Short tons.	$
Ochre	11,703	109,465	15,269	149,289
Umber and sienna	1,005	26,225	805	21,975
Metallic paint ..	25,599	181,163	28,347	181,352
Mortar colours ..	7,922	76,517	9,272	87,595
Ground slate and shale, etc.	16,510	105,451	20,964	121,482
Zinc oxide, leaded zinc, sublimed white lead, and sublimed blue lead	75,611	7,343,762	106,497	9,507,895
Chemically manufactured pigments*	200,747	23,970,244	228,135	26,356,232

* Includes, red lead (21,250 tons in 1912), litharge (29,111 tons), orange mineral (545 tons), lithopone (24,220 tons), and Venetian red (6306 tons).

Drying rates of raw paint oils. A comparison. Redman and others. *See* XII.

Patents.

Lampblack; Process and apparatus for the manufacture of ——. Lampblack, Ltd., London, and W. D. Menzies, Herne Hill. Eng. Pat. 17,223, July 24, 1912.

The products of incomplete combustion from oil burners or sprays are condensed in a series of connected chambers, each of which is provided with means for removing the lampblack. These chambers may be connected in such a way that the combustion products pass through them in zig-zag fashion, and may have means for grading the deposited lampblack. Carbon dioxide may be removed from the combustion products by means of lime water, caustic soda solution, etc., which may be sprayed from perforated pipes within the chamber. The spent gases issuing from the last condensation chamber pass into a compartment where they meet a spray of fresh oil, preferably under pressure, and the mixture of oil and unburned vapour is led back to the burners to form a fresh charge. —C. A. M.

Resinous substances; Manufacture and production of ——. J. Y. Johnson, London, from Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 23,543, Oct. 15, 1912.

Solid odourless resinous compounds of pale colour are obtained by acting upon dihydrobenzene or homologues or ring-isomeric compounds or derivatives thereof (or substances which yield such compounds) with condensation agents under conditions that prevent violent evolution of heat. Example: 1-3-dihydrobenzene (200 parts) is boiled for 7 hours with glacial acetic acid (500 parts) and 97 per cent. sulphuric acid (5 parts), the acetic acid is removed by distillation and the sulphuric acid by washing with water and with sodium carbonate solution.—C. A. M.

Resinous substances in the residues from the distillation of gums or turpentines; Process of extracting ——. C. Granel. Fr. Pat. 453,881, April 15, 1912.

The residue is extracted with a solvent such as carbon bisulphide or carbon tetrachloride, in a manner analogous to that used for the extraction of oil from seeds, etc. —C. A. M.

Oil for use in making pastes of colouring matters and other products, and its manufacture. E. Richter. Fr. Pat. 454,742, Feb. 24, 1913.

A mixture of sodium salicylate, quinine hydrochloride, ethyl carbamic ester, and di-iodo-*p*-phenolsulphonate of sodium is triturated with a small quantity of water, heated, mixed with 10 per cent. sulphuric acid and then with 50 per cent. acid, and finally heated: an oily product is obtained, said to possess the property of absorbing metallic oxides, salts, sulphur, mercury, organic colouring matters, etc., forming homogeneous pastes.—T. F. B.

Paints or similar products; Manufacture of ——. G. L. Davies and W. E. Windsor-Richards. Fr. Pat. 453,985, Feb. 5, 1913. Under Int. Conv., Feb. 6, 1912.

See Eng. Pat. 3008 of 1912; this J., 1913, 666.—T. F. B.

Preventive and curative treatment of industrial lead poisoning. Oliver. *See* XIXb.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Vulcanisation; Migration of sulphur, and ——. H. Skellon. India Rubber J., 1913, **46**, 251—252.

It is shown that migration of sulphur from one piece of rubber to another, during vulcanisation, takes place with equal facility upwards and downwards, and that an equilibrium is rapidly attained when the ratio of free sulphur to rubber is identical in each piece. The author considers that in vulcanisation, probably the sulphur first melts, then dissolves in the rubber and slowly combines therewith. It is suggested that the migration method will be useful in determining the influence of various fillers on vulcanisation, since, if two sheets of different mixings are in contact the concentration of free sulphur in the rubber will be the same throughout the vulcanisation, which would not be so if the sheets were separate.—H. E. P.

Patents.

India rubber; Extraction or coagulation of —— *from the latex.* S. C. Davidson, Belfast. Eng. Pat. 16,352, July 12, 1912.

The latex, particularly that of *Hevea Brasiliensis*, is treated with a "saponified oleaginous substance" and formaldehyde, prior to coagulation, with the object of obtaining rubber free from proteins and other impurities. An addition of glycerin or a phenoloid antiseptic agent (*e.g.*, creosote, or carbolic acid) may also be made, preferably after being made alkaline. Or the latex may also be given a preliminary treatment with a soluble salt or salts of sulphur. After treatment by one or more of these processes the rubber is coagulated by the addition of a hot or cold acid solution.—C. A. M.

Indiarubber goods; Manufacture of ——. W. E. Windsor-Richards, London. U.S. Pat. 1,069,508, Aug. 5, 1913.

A mixture of waste indiarubber and cellulose is treated in a suitable mixer at a temperature of about 200° C.; afterwards fillers are added and the mass vulcanised. —B. N.

Benzine in admixture with rubber; Process and apparatus for recovering ——. R. P. G. Buzat. Fr. Pat. 454,443, Feb. 17, 1913.

The benzine (petroleum spirit) used in the preparation of rubber goods is recovered by evaporation and condensation, a current of air or an aspirator conducting the vapours that would escape, into an apparatus where they are submitted to refrigeration.—C. A. M.

Rubbers; Process for the improvement of inferior grade ——. D. Spence, W. F. Russell, and The Diamond Rubber Co., Akron, Ohio, U.S.A. Eng. Pat. 17,667, July 30, 1912.

See Fr. Pat. 448,974 of 1912; this J., 1913, 499.—T. F. B.

Caoutchouc-like substance; Process of producing a ——. F. Hofmann and K. Delbrück, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,068,770, July 29, 1913.

See Eng. Pat. 8065 of 1912; this J., 1913, 35.—T. F. B.

Elastic substances; Manufacture of ——. Gummi (Foreign), Ltd. Fr. Pat. 454,905, Feb. 28, 1913.

See Eng. Pat. 26,935 of 1911; this J., 1913, 438.—T. F. B.

Manufacture of unsaturated hydrocarbons. Eng. Pat. 17,234. *See* XX.

Manufacture of butadiene and homologues thereof. Eng. Pat. 17,235. *See* XX.

Process for producing isoprene. Addition to Fr. Pat. 440,130. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

East Indian tanned hides; Analysis of various ——. M. C. Lamb. Analyst, 1913, **38**, 363—364.

From the analyses of a large number of samples of East Indian tanned leather, the author concludes that the adulteration of Indian tannages by the use of a large excess of oil and fatty matter, by mineral weighting materials or by an excess of tanning matter, is not so common as has been suspected. The analyses compare quite favourably with those of English tanned calf and dressing hides, in spite of the fact that the flesh side of the hides is usually plastered over with a mixture containing a natural chalk.—W. H. P.

Tanning by means of fatty and resinous acids. F. Garelli and C. Apostolo. Collegium, 1913, 425—428.

It has been shown by one of the authors that, in oil tannage, the tanning action is due to the fatty acids, which are readily and strongly fixed by the skin. Neutral glycerides have only a mechanical action, filling the leather and rendering it supple. Aqueous solutions of ammoniacal soaps were used in the experiments, the skin being placed in emulsions obtained by neutralising 3 parts of fatty acid with ammonia and diluting with 100 parts of water. After agitating for 5—6 hours the skins were placed in a 0·5—1 per cent. lactic acid solution to decompose the ammonium soap and after drying out and staking, a very white, soft and supple leather resulted, similar to Japan leather. Fahrion attributed the tanning action of fats solely to unsaturated fatty acids with more than one double linkage in the molecule, but the authors show that it is possible to tan, not only with oleic acid, but also with palmitic, stearic, and caproic acids, etc., under conditions which render it very improbable that the oxidation phenomena, indispensable according to Fahrion's theory, take place. Insoluble fatty acids, simply suspended in water, are fixed by skin and tan just as efficiently as when dissolved in alcohol or emulsified in water with ammonium soaps. Aqueous solutions of ammonium soaps are hydrolysed and contain free fatty acids in colloidal suspension which are directly absorbed by the skin without undergoing solution (see this J., 1913, 800). Aqueous suspensions of fatty acids which will tan hide are obtained as follows: 5 parts of stearic acid are dissolved in a little alcohol and warm water slowly added with constant stirring up to 100 parts. The use of alcohol may be avoided by simply pulverising solid fatty acids in water or mixing oleic acid and other liquid acids in a machine. The skins, prepared for tanning, are agitated in the liquor for 10—12 hours. The leather obtained, is perfectly resistant to cold water but less so to hot water, possessing however a coefficient of resistance, by Fahrion's test (see this J., 1908, 1031), of 30, which is higher than that of alum leather. A part only of the fatty acids is soluble in ether and, after extracting ten times in the Soxhlet apparatus, the leather remains tanned and contains fatty acids not extractable by neutral solvents. Boiling alcohol removes only the portion of the acids held mechanically in the pores of the skin. The fatty acids extracted by warm alcohol and determined by titration amounted to 6·7—7·2 per cent. To remove all the fatty acids, alcoholic potash must be used and then the leather returns to the state of raw skin. The fatty acids combined with the corium, that is, those to which the actual tannage is due, may be estimated by the method used by Fahrion. The leather is warmed for about 15 minutes with an excess of $N/10$ alcoholic potash. The alcohol is removed, the soap dissolved in water, a slight excess of sulphuric or hydrochloric acid added and the fatty acids extracted with ether when they may be weighed and identified. Unchanged stearic acid (from 2 to 2·6 per cent.) was always found. Rosin behaves like the fatty acids but the resulting leather is less supple than that obtained with fatty acids.
—D. J. L.

Tanning of hides by means of freshly precipitated sulphur. C. Apostolo. Collegium, 1913, 420—421.

A fairly strong solution of sodium thiosulphate was decomposed by the gradual addition of lactic acid, leaving an excess of thiosulphate in the liquor. A lamb skin was introduced into the opaque solution and shaken for half an hour after which time the solution was quite clear, all the sulphur having been absorbed by the skin. A further precipitate of sulphur, produced by adding more lactic acid, was also taken up by the skin. Finally the whole of the thiosulphate was decomposed, avoiding however, an excess of acid. 200 c.c. of a 20 per cent. thiosulphate solution was used and lactic acid added 5 c.c. at a time till all was decomposed. On drying out the pieces of skin, a very white and soft leather was produced. If the whole of the thiosulphate is decomposed at once the leather is not so soft. The leather is not affected by cold water and yields only about 1 per cent. of sulphur to carbon bisulphide, this being probably only the sulphur mechanically held, as the leather remains fully tanned after the extraction. The leather after treatment with carbon bisulphide contains 2·5—3·5 per cent. S.—D. J. L.

Sulphite-cellulose lyes; Content of tanning substances in waste ——. A. Stutzer. Z. angew. Chem., 1913, **26**, 463—464.

For removing calcium compounds from the lye, the addition of ammonium sulphate before concentrating is recommended: in this way it is possible to obtain a liquor of 30° B. (sp. gr. 1·262) containing only 0·08 per cent. CaO and 0·84 per cent. of mineral matter. The content of tanning substances (substances absorbed by hide powder) in the lye can be increased by the addition of different substances (sodium sulphate and bisulphate, salts of aluminium, zinc, iron, manganese and chromium, phosphoric, acetic, and lactic acids). For example on addition of 50 grms. of 74 per cent. lactic acid (per litre of original lye) to a lye to which 30 grms. of ammonium sulphate had been added before concentrating to 30° B., the content of tanning substances expressed as a percentage of the organic dry substance rose from 49·65 to 62·9 per cent. The leather produced by the concentrated liquor was of a light colour.—A. S.

Gallic acid and gallo-tannic acid (tannin); Atmospheric oxidation of —— *in presence of alkalis, and a colour reaction for lead.* O. Schewket. Biochem. Zeits., 1913, **54**, 277—281.

If 10 c.c. of a very dilute solution of gallic acid, mixed with 5 c.c. of alcohol, are treated with 3—10 drops of 10 per cent. sodium hydroxide solution and shaken for ½ min., a green colouration is produced. If an excess of alkali is used the colouration is red. These colours correspond to different degrees of oxidation of the gallic acid, and may be observed, separated by a yellowish zone, when a solution of gallic acid is poured carefully on to an alkaline liquid. Tannin behaves similarly, except that it forms no green colour. *Colour test for lead.* Ten c.c. of a very dilute solution of a lead salt are treated with just sufficient sodium hydroxide to redissolve the lead hydroxide first formed. The liquid is divided into two parts, to one of which 1—5 drops, and to the other, 1—4 c.c. of a 1 per cent. solution of gallic acid are added. In the former case a carmine colouration is produced (provided the amount of lead present is greater than that of gallic acid) and in the latter case a green colouration. The red colour, which disappears on addition of acid, is especially characteristic of lead. *Separation and recognition of gallic acid and gallotannic acid (tannin).* A freshly prepared solution of 0·3 grm. of the solid mixture in 25 c.c. of water is mixed with 25 c.c. of a 2 per cent. solution of caffeine citrate. The precipitate formed, which contains the tannin, is filtered off and washed three times. Three portions of 10 c.c. of the filtrate are tested for gallic acid as follows:—(1) Five c.c. of alcohol are poured on without mixing; addition of a few drops of sodium hydroxide solution then produces a green colour in the alcoholic layer (distinction from tannin). (2) An aqueous solution containing 0·2 per cent. of crystallised lead acetate and 5 per cent. of sodium hydroxide is added drop by drop, the liquid being shaken after each addition; a green colouration appears which changes to a Bordeaux red tint if the liquid is acidified. Tannin gives a brown to reddish yellow colour in place of the green. (3) Addition of barium chloride followed by a few drops of sodium hydroxide solution produces a blue precipitate. The caffeine-tannin precipitate is dissolved in hot alcohol and the cooled solution is tested for tannin as follows:—(1) Addition of a few drops of sodium hydroxide produces a reddish yellow precipitate dissolving on shaking with water (gallic acid gives a green colouration). (2) A portion of the alcoholic liquid, diluted with an equal volume of water, and treated with barium chloride, gives a green colouration on addition of a few drops of alkali.—J. H. L.

Patents.

Leather; Method of transforming bad —— into good leather suitable for boot manufacture, etc. L. Bogaerts. Fr. Pat. 454,678, Feb. 22, 1913.

Leather of poor quality, tanned in the usual way, is immersed in a bath of an elastic mass composed of nitrocellulose, camphor, scrap cellulose or celluloid with oil and sulphur or sulphur chloride, dissolved in volatile or appropriate solvents, and is then dried immediately at 50° C.—D. J. L.

Tanning agent. H. Renner and W. Moeller. Ger. Pat. 262,333, July 31, 1912.

The so-called "acid resin," freed from sulphuric acid, obtained in the refining of mineral oils by means of sulphuric acid, is claimed as a tanning agent. It is preferably obtained by dissolving the resinous mass in water and adding sufficient alkali or alkaline-earth carbonate to neutralise the free acid, the sulphate being then removed by crystallisation. The resulting solutions may be concentrated.—T. F. B.

Tanning agents; Process for preparing ——. E. Stiasny. Ger. Pat. 262,558, Sept. 12, 1911.

Phenols or phenolsulphonic acids, or mixtures of the two, are condensed with formaldehyde or its equivalent in presence of sulphuric acid or a substituted sulphuric acid, under such conditions and in such proportions that the products are wholly or almost entirely soluble in water. It is especially desirable to avoid excessive development of heat. The phenol may be heated with an equal quantity of sulphuric acid and the product treated with formaldehyde, or the insoluble condensation products from phenols or their sulphonic acids, formaldehyde, and dilute sulphuric acid may be rendered soluble by treatment with concentrated sulphuric acid (see also Fr. Pats. 451,875 and 451,876; this J., 1913, 668).—T. F. B.

Horn; Bleaching of ——. A. Blazy. Fr. Pat. 454,765, Feb. 25, 1913.

Horn of a green, black or yellow colour can be made white and opaque by the deposition of sulphur. The articles are soaked in a bath of 20—25 kilos. of potassium sulphide in 100 litres of water, washed 4—5 hours, and then immersed in a bath of 6—8 litres of sulphuric acid in 100 litres of water for 1—3 days according to the thickness of the articles. They are then well washed and dried in the air.—D. J. L.

Leather; Liquid glue for use with ——. Ago Lederkitt Industrie Ges. m. b. H. Fr. Pat. 454,379, Feb. 15, 1913. Under Int. Conv., Feb. 15, 1912.

Solutions of celluloid in acetone and other solvents containing more than 16—18 per cent. of the material become too viscous to be conveniently applied as an adhesive. This viscosity is lessened by incorporating with the mixture an organic acid, preferably oxalic acid. A very fluid solution containing a large percentage of celluloid is prepared by mixing in an iron vessel hermetically sealed, 100 kilos. of acetone, 20—30 kilos. of celluloid and 0·5—2 kilos. of oxalic acid. The mixture is stirred at the ordinary temperature for 12—24 hours.—D. J. L.

Skins, Process for hardening and waterproofing animal ——. K. Hartmann. Fr. Pat. 454,921, Feb. 28, 1913.

See Ger. Pat. 256,406 and Eng. Pat. 29,997 of 1912; this J., 1913, 438, 618.—T. F. B.

Oil for treating belting and other purposes. A. Vacheron. Fr. Pat. 455,071, May 11, 1912.

See Eng. Pat. 20,553 of 1912; this J., 1913, 707.—T. F. B.

Oil [for treating leather, etc.]. A. Vacheron. Fr. Pat. 455,072, May 11, 1912.

See Eng. Pat. 20,554 of 1912; this J., 1913, 836.—T. F. B.

XVI.—SOILS; FERTILISERS.

Calcium thioarsenate as a spray. Katz and Buckminster. *See* XIXb.

Patents.

Peat; Treatment of —— for manurial and other purposes. W. B. Bottomley, London. Eng. Pat. 17,487, July 27, 1912.

Peat, or a prepared form of peat, is treated with water containing soil micro-organisms capable of producing ammonia, with or without nitrogen-fixing organisms. After some days, the material is dried or extracted with water, so as to furnish a dry or liquid manure, or it may be used for the manufacture of humic acid by adding acid to the aqueous extract. Suitable nitrogenous matter, such as the waste liquor from the boiling of bones, and sugar or starch (about 0·1 per cent. of the dry peat), dissolved or suspended in a little water, may be added to the peat. Before the treated material is dried, it may be sterilised and further treated with nitrogen-fixing organisms.—F. Sodn.

Fertilisers; Manganese —— with a base of blast-furnace slag. P. Variot. First Addition, dated Jan. 20, 1913, to Fr. Pat. 452,602. Dec. 28, 1912 (this J., 1913, 669).

Claim is made for drying the slag to facilitate grinding, and for utilisation in the manganese fertiliser, of the contained magnesia, lime, and aluminium sulphate as additional fertilising agents.—F. Sodn.

Bicalcium phosphate; Process for producing ——. The Electric Smelting and Aluminium Co. Fr. Pat. 454,056, Feb. 6, 1913.

Powdered mineral phosphate, or other material containing tricalcium phosphate, is treated with hydrochloric acid and water (2 mol. equivalents of hydrogen chloride for each molecular equivalent of tricalcium phosphate and, in addition, sufficient acid to react with other compounds present capable of forming soluble chlorides), and, after filtering, the product is washed and dried. A little sulphuric acid may be added to the reaction mixture if desired. As a fertiliser, the product is said to be readily distributed.—F. Sodn.

Fertilisers [and cement]; Production of ——. The Electric Smelting and Aluminium Co. Fr. Pat. 454,336, Feb. 13, 1913.

Tricalcium phosphate (apatite, bone-ash, etc.) is mixed with potash felspar or other form of potassium silico aluminate (preferably 1 mol. wt. of silica for every 2 mol. wts. of calcium oxide or its equivalent and 2 mol. wts. of silica for each mol. wt. of calcium fluoride, acid oxides, such as titanium oxide, being reckoned as silica), and the mixture is heated to fusion, *e.g.*, in a rotary kiln, similar to those used for cement, at 1000°—1700° C. The product is ground and used directly as a fertiliser, or it is washed with acids (such as sulphuric acid) or solutions of salts which do not form insoluble phosphates or aluminates, so as to extract the desired phosphoric acid and salts (of potassium and aluminium). The residual bicalcium silicate is utilised for the preparation of a hydraulic cement by adding lime or calcium carbonate (1 mol.) and heating to incipient fusion, or by heating to a temperature sufficient to expel water of hydration and intimately mixing with lime.—F. Sodn.

Fertilising agents; Manufacture of ——. O. K. Slater, Chicago, U.S.A. Eng. Pat. 7234, March 26, 1913.

See U.S. Pat. 1,067,224 of 1913; this J., 1913, 836.—T. F. B.

Extracting products richer in potash from silicates of potassium. Fr. Pat. 454,632. *See* VII.

Insecticidal soap. Addition to Fr. Pat. 444,021. *See* XII.

Acid arsenate of lead. [*Insecticide.*] U.S. Pat. 1,064,639. *See* XIXb.

XVII.—SUGARS; STARCHES; GUMS.

Patents.

Sugar; Process of clarifying raw ——. A. von Wachtel and C. Woegerer, Philadelphia, Pa. U.S. Pat. 1,067,890, July 22, 1913.

The raw sugar is treated with water containing in suspension an alkaline-earth carbonate, a bleaching agent, such as calcium hypochlorite, and an acid, such as phosphoric acid, capable of liberating the chlorine of the hypochlorite and a portion of the carbon dioxide of the carbonate while maintaining the bases in an insoluble condition. The solution, containing less water than is ultimately required, is stirred and heated to about 150° F. (66° C.) and water is added to produce a liquid of density 20°—25° B. (sp. gr. 1·162—1·320) when all the crystals are dissolved. The agitation is then stopped and the temperature is raised to less than 212° F. (100° C.); the lighter impurities are removed as a floating scum and the remainder is allowed to settle as a precipitate.—J. F. B.

Sucrose from sugar cane; Process of extracting ——. H. Edson, Ensenada, Porto Rico, Assignor to Guanica Centrale, Jersey City, N.J. U.S. Pat. 1,068,748, July 29, 1913.

See Fr. Pat. 441,912 of 1912; this J., 1912, 945.—T. F. B.

Sugar; Method of producing ——. L. Gathmann, Washington, D.C., Assignor to Guanica Centrale, New York. U.S. Pat. 1,068,758, July 29, 1913.

See Fr. Pat. 440,242 of 1912; this J., 1912, 740.—T. F. B.

Starch; Process for treating —— to make it suitable for coating paper. Casein Co. of America. Fr. Pat. 454,456, Feb. 17, 1913.

See U.S. Pat. 1,053,719 of 1913; this J., 1913, 302.—T. F. B.

Process and apparatus for the extraction of materials in the distillery, sugar house, etc. Addition to Fr. Pat. 445,976. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Enzyme action; Inhibition of —— by lime-softened waters. O. Bergeim and P. B. Hawk. J. Amer. Chem. Soc., 1913, **35**, 1049—1056.

Water softened by the use of lime was found to exert a pronounced inhibitory influence on the action of salivary and pancreatic amylases. This was due chiefly to adsorption of the enzymes by colloidal magnesium hydroxide present in these waters. Using a saturated solution of magnesium hydroxide (15 to 20 parts per million) it was found possible to reduce the enzyme activity by about 99 per cent. It was also found that salivary and pancreatic amylases are not identical, the difference between them being indicated by the manner in which they respond to the action of various constituents contained in hard and softened waters.—W. P. S.

Saccharin in beer; Detection of ——. [*Extraction apparatus.*] R. Ledent. Ann. Chim. Analyt., 1913, **18**, 314.

The apparatus described, has been used for the extraction of saccharin from beer for several years with success. It consists of a glass tube 90 cm. long and 1·5 cm. internal diam., fixed vertically and fitted by means of corks, at the top with a stoppered dropping funnel, and at the bottom with a narrow glass tube which is bent round so as to pass up parallel to the wide tube to a height of 35—40 cm., at which point it is bent round and cut off in such a way that liquid flowing from it can fall into a flask placed below. Fifty c.c. of beer are run into the wide tube, and then so much ether that the beer begins to drip from the side tube. The rest of the beer is then run into the wide tube drop by drop. As the drops fall into the ether they are broken up and the saccharin is extracted, but there is no formation of emulsion and it is not necessary to submit the beer to any preliminary treatment such as defecation. If necessary, the beer can be passed through the apparatus several times.—J. H. L.

Wine, Spirits and Vinegar Act, 1913. Union of South Africa.

Wines may be treated with calcium sulphate equivalent to not more than 140 grains of potassium sulphate per gall., and with potassium metabisulphite or sulphurous acid (in dry wines a maximum of 14 grains total, or 1·5 free SO_2, and in other wines 25 total, or 2·25 grains free SO_2 per gall.). All brandy or whisky must be labelled brandy, wine brandy (cognac type), grape brandy, whisky, malt whisky or blended whisky. The addition of silent spirit or of colouring or injurious matters to rum and gin is prohibited. Vinegar must contain at least 4 per cent. of acetic acid. Spirit- or distilled vinegar must not be artificially coloured. Vinegar substitutes must be labelled "vinegarine," and contain not less than 4·5 per cent. of acetic acid but no other acid or injurious substance. All the products mentioned are defined. The Act takes effect from Nov. 1, 1914, for products on order for importation, from Apr. 1, 1914, for those actually imported before June 1, 1913, and from July 1, 1913, for other products.
—J. H. L.

Patents.

Mannite [mannitol] from natural musts; Preparation of ——. G. P. Guignard, Melun, France. Eng. Pat. 3261, Feb. 7, 1913.

Natural musts (*e.g.*, those from grapes or beetroots) containing lævulose or carbohydrates which yield this sugar on hydrolysis, are hydrolysed with acid, neutralised, concentrated and sterilised, and then inoculated with mannitic ferments which have been accustomed to live in musts of higher concentration than those employed in the process. For the extraction of mannitol from fermented beetroot musts, the alcohol is first removed by distillation and the vinasse is evaporated to dryness and freed from glycerol, alkali malates and some nitrogenous matter by extraction with cold alcohol saturated with mannitol. The dried residue is taken up with water to which ferrous sulphate is added, and after evaporation to dryness again, is extracted with hot alcohol which dissolves only the mannitol, the succinic, lactic and acetic acids remaining in the residue in the form of insoluble ferrous salts.—J. H. L.

Malt; Manufacture of ——. R. Wahl, Chicago, Ill. U.S. Pat. 1,068,028, July 22, 1913.

In the manufacture of malt, the husks of the cereal are first cleansed from foreign organisms adhering thereto and, at a stage of the manufacture, a culture of lactic acid bacteria in a liquor soured by the bacteria propagated therein, is added.—J. F. B.

Malt; Closed germinating vessel for the preparation of green ——. J. A. Topf und Soehne. Fr. Pat. 454,369, Feb. 14, 1913.

Air is introduced into the vessel by one or more ducts which, entering near the top, pass downwards in the vessel and open below the false perforated bottom on which the grain rests, so that during aeration the fresh air passes upwards through the grain and escapes by openings at the top. All the important openings are situated near the top of the vessel, in order to minimise leakage of carbon dioxide between successive aerations. Below the false bottom is a space in which, when the vessel is closed, air rich in carbon dioxide tends to accumulate; and this air may be continuously withdrawn, cooled and freed from excessive moisture by contact with a cold surface (coil) and then conducted to the upper part of the vessel where it is distributed over the surface of the grain. The apparatus by which this circulation and cooling of the air are effected, may be disposed outside the vessel, or inside, *e.g.*, within the ducts mentioned above.—J. H. L.

Malt ; Process of manufacture of —— with the use of added nutritive substances. J. von der Kammer. Fr. Pat. 454,534, Feb. 19, 1913.

The barley, not previously steeped, is introduced into a rotatory drum, and in the course of 30—36 hours, is steeped three or four times in a nutrient solution for half an hour each time. The solution may contain, per 10,000, about 1 part each of lime, nitrogen, potash, a carbohydrate such as sugar, and other suitable matter. The grain is then kept in the drum for a further period of 62—68 hours. Except during the introduction and running off of the liquid, the drum is kept in continuous rotation throughout the whole process. It is claimed that germination and the formation of enzymes in the grain commence at a very early stage of the process, that after a time germination is arrested whilst modification proceeds, and that the consumption of the endosperm during germination is small owing to utilisation, by the embryo, of the dissolved matters in the steeping liquid. Claim is made for a rotatory drum consisting of a perforated cylinder supported inside a corrugated cylindrical casing, the corrugations in the latter forming channels by which liquid from the inner cylinder can be run off.—J. H. L.

Sulphited glycerophosphate, its manufacture and its application in wine making. G. E. Jacquemin. First Addition, dated May 17, 1912, to Fr. Pat. 440,778, May 10, 1911 (this J., 1912, 844).

The applications of sulphited ammonium glycerophosphate have been extended as follows :—It may be added (80—100 c.c. per hectolitre) to the water used for washing brewery pitching yeast, and also to beer wort (50—75 c.c. per hectolitre), to distillery wort, and, in the preparation of cider, to apple juice (30—80 grms. per hectolitre) prior to fermentation. In malting, the water used for washing the barley may be treated with 75—100 c.c. per 100 kilos. of grain.—J. H. L.

Distillery, sugar house, etc. ; Process and apparatus for the extraction of materials in the ——. V. Raisin. First Addition, dated Feb. 21, 1913, to Fr. Pat. 445,976, July 11, 1912 (this J., 1913, 156).

The additions made to the original patent include : (1) the use of an endless conveyer or a combination of endless chains provided with blades for carrying the solid material through the successive extraction chambers, (2) the use of a mixing back in which the material to be extracted is first agitated with the rich juice from the last of the chambers, and (3) the washing of the material after it has passed through the chambers by spraying it on perforated conveyers with water, which is afterwards used for extraction in the chambers.—J. H. L.

Distillation of alcohol by direct flame and by steam. P. Mando. Fr. Pat. 455,108, Jan. 11, 1913.

In a plant for the distillation of wine and grape marc, a furnace is used in which the heat is conducted by a number of radiating channels to the steam generator, the stills and the vessels in which tartar is extracted from the marc. The apparatus comprises stills heated by a water-bath, and also an elongated form of dephlegmator of which the lower end is vertical but which is bent over so that the greater part of it inclines downwards slightly towards the end remote from the still. This dephlegmator is divided inside into compartments for the efficient baffling of the vapour, and further dephlegmation occurs in a vertical condenser.—J. H. L.

Wine ; Process for clarifying ——. A. Ornstein. First Addition, dated Feb. 22, 1913, to Fr. Pat. 438,185, Dec. 23, 1911. Under Int. Conv., Feb. 23, 1912.

See Eng. Pat. 4597 of 1913 ; this J., 1913, 548.—T. F. B.

Utilisation of brewers' grains and the like, whereby a detergent and other products are obtained. Eng. Pat. 16,971. *See* XII.

Filtration and sterilisation of beer and other liquids. Eng. Pat. 17,472. *See* XIXb.

XIXa.—FOODS.

Milk ; Chemical changes produced in cows' —— by pasteurisation. P. Rupp. U.S. Dept. Agric., Bureau of Animal Ind., Bull. 166, April 22, 1913, 1—15.

When milk is pasteurised at a temperature of 62·8° C. (145° F.) for 30 minutes, it does not undergo any appreciable chemical change. The quantities of phosphoric acid, calcium, and magnesium in milk pasteurised at 68·3° C. (155° F.) are practically the same as in raw milk. The albumin is not coagulated at 62·8° C., but at 65·6° C. (150° F.) 5·75 per cent., at 68·3° C. 12·75 per cent., and at 71·1° C. (160° F.) 30·78 per cent. of the albumin is rendered insoluble. The time required for coagulating the casein by rennin is slightly less in milk pasteurised at temperatures up to 65° C. (149° F.), than it is in the case of raw milk ; at 75° C. (167° F.), the time is almost doubled. The acidity is slightly diminished in pasteurised milk.—W. P. S.

Milk ; Influence of calcium chloride on the coagulation of ——. L. Lindet. Comptes rend., 1913, **157**, 381—384.

The addition of calcium chloride to milk increases the quantity of proteins in the curd when the milk is coagulated. This is due to the reaction between the calcium chloride and the natural phosphates and citrates contained in the milk. The author is of opinion that milk contains two caseins ; the one (β) is present in small quantity, and is entirely soluble in the milk serum, whilst the other (α) is dissolved to the extent of about 10 per cent. of its quantity, the remainder being present in colloidal suspension.—W. P. S.

Patents.

Cereal coffee or coffee substitute. J. H. Kellogg, Battle Creek, Mich. U.S. Pats. 1,069,265, 1,069,266, 1,069,267, and 1,069,268, Aug. 5, 1913.

(1). A decoction of "cereal coffee" is evaporated, sugar is added, and the syrup obtained is mixed with "cereal coffee" so as to form a coating on the same. (2). A roasted cereal, in granular form, is coated with the syrup obtained by concentrating a decoction of "cereal coffee." (3). A mixture of malt and cereal grains is roasted and extracted with boiling water ; the extract is concentrated to a syrupy consistence and added to about one-half of the extracted grains, the mass being then dried. (4). "Cereal coffee" is extracted with boiling water, the extract is concentrated, and the "grounds" are dried ; the latter are then coated with the syrupy extract, and again dried.—W. P. S.

Margarine and analogous substances ; Manufacture of —— using cooling surfaces for cooling the liquid fats or emulsions. E. Schou. Fr. Pat. 454,640, Feb. 20, 1913.

The liquid, especially a margarine emulsion of the same composition as is desired for the finished margarine, is applied to the cooling surface in a thin film, and is removed by a scraper in the form of thin scales, which are afterwards warmed so as to soften the fat, and agglomerated by pressure into a homogeneous and coherent mass.—A. S.

Coffee beans ; Process of treating —— for the elimination of deleterious constituents thereof. Gebr. von Niessen, Berlin. Eng. Pat. 23,087, Oct. 9, 1912. Under Int. Conv., Oct. 9, 1911.

See Fr. Pat. 449,343 of 1912 ; this J., 1913, 504.—T. F. B.

Discharge of liquid from centrifugal separators. Fr. Pat. 454,010. *See* I.

XIXb.—WATER PURIFICATION ; SANITATION.

Manganese in drinking and mineral waters. F. Jadin and A. Astruc. Comptes rend., 1913, **157**, 338—339.

From 1 to 3 litres of each of a number of waters were evaporated, and the manganese in the residues determined colorimetrically. Of the supply-waters of eight towns four contained no manganese, and the others not more than 0·0015 mgrm. per litre. Six Vichy (mineral) waters contained from 0·10 to 0·20 mgrm. per litre, and three Boulou (mineral) waters had from 0·09 to 0·15 mgrm. per litre. —T. St.

Lead; The action of an alkaline natural water on ——. J. F. Liverseege and A. W. Knapp. British Association. Section B.—Birmingham, 1913. (Advance proof.)

The water supply of Birmingham is gathered chiefly in Wales. The water is slightly alkaline: it does not appreciably dissolve lead (absence of "plumbo-solvency"), but unless treated it corrodes or "erodes" bright sheet lead. To prevent any danger from this action, a small proportion of powdered chalk is added to the water in Wales. This treated water flows to Birmingham through an aqueduct seventy-three miles long. *Lead pipes.*—As a rule a pipe becomes with age less sensitive to the action of the water. Treatment of new pipes with a dilute solution of potassium permanganate gives them a considerable power of resistance to the action of the water. *Sheet lead.*—Many experiments were made on the sheet lead "erosion" test, and for practical purposes a duration of one day is preferred to that of seven or fourteen days. Erosion appears to be due to the action of oxygen in the presence of water. The amount of lead eroded depends on the distance from the lead to the water surface, is generally proportional to the area of the surface of the lead exposed, and does not depend on the volume of the water. With untreated water, carbon dioxide up to one per cent. by volume produced little effect on the amount of erosion; when two or more per cent. of carbon dioxide is present erosion no longer occurs; the liquid remains clear, but lead is dissolved, in amount much less than that removed by erosion. Given sufficient oxygen, the alkalinity of the water is the principal factor determining the amount of erosion. The use of (*a*) lime to prevent erosion was not found satisfactory, the presence of three to nine parts per 100,000 of water reduced the erosion, but smaller or larger quantities were of little, if any, use. Four parts per 100,000 of (*b*) calcium carbonate gave protection, and as little as two parts per 100,000 of (*c*) calcium bicarbonate were sufficient to practically prevent erosion. (See also Heap, this J., 1913, 771; 881.)

Lead poisoning; Preventive and curative treatment of industrial ——. T. Oliver. Lancet, Aug. 23, 1913, 527—529.

H. Lewis Jones pointed out, 11 years ago, that the elimination of lead from the system in cases of lead poisoning is facilitated if an electric current be passed through a single bath in which the patient is immersed. The author now recommends a method, suggested by T. M. Clague, in which two baths are used, the anode being in one and the cathode in the other. Arm and leg baths made of earthenware or wood are used, in which several persons can be treated at once. The resistance of the water is reduced by addition of sodium chloride, and using an E.M.F. of 16 volts, a current of from 20—40 milliampères is introduced gradually through a rheostat. The electrodes are of aluminium, the anode being placed in the leg bath and the cathode in the arm bath, so that the whole of the current has to pass through the body of the patient. The method has been tested on workmen engaged in the manufacture of white lead with encouraging results; the bath was given for half an hour daily or on every second day. Lead was always found in the bath and on the cathode, even in the case of a patient who had not worked for 10 weeks; here the lead could have come only from the tissues of the body and not from a deposit on the skin. The health of the workmen improved under the treatment and the well-marked blue line on the gums, symptomatic of plumbism, disappeared much more rapidly than under medicinal treatment. The double electric bath treatment is recommended not only for curative purposes, but also as a preventive measure in suspected cases before well-marked symptoms appear.—A. S.

Oxidising agents [in the sterilisation of water]; Electrochemical indicator for ——. E. K. Rideal and U. R. Evans. Analyst, 1913, 353—363.

The authors describe apparatus designed primarily to indicate when sufficient oxidising agent (hypochlorite, chlorine or ozone) has been added for the sterilisation of water. The water is passed at a constant rate through a narrow tube of copper which is insulated from an axial rod of platinum. These metals are connected with the poles of a sensitive galvanometer of high resistance. When ordinary tap water is flowing through the tube the only current which passes is that necessary to replace the hydrogen carried away from the platinum pole by the flowing water. This is very small in amount and may be corrected for in the zero adjustment of the galvanometer. In the presence of an oxidising agent the hydrogen is removed more rapidly and a greater current must flow in order to keep the concentration of hydrogen at the platinum pole up to the small polarisation value. The magnitude of the current is, at small concentrations, an indicationof the amount of oxidising agent present. The temperature and rate of flow must be kept constant as far as possible. With the authors' most sensitive ammeter 1 part of chlorine per million gave a deflection of 10 scale divisions on the ammeter. The measurements are not interfered with in the presence of dissolved salts such as are usually found in ordinary water. It will be noted that since the current is only dependent on the amount of oxidising agent passing within striking distance of the platinum, it is not greatly dependent on the resistance of the circuit, so that the cell approximates more to a constant current generator than to a constant E.M.F. generator. When mineral acids are present in the water there is at first a big deflection owing to the new equilibrium conditions demanded by the greater hydrion concentration of the electrolyte. As the concentration of hydrogen in and around the platinum approaches the value required for the new conditions the current sinks, but never quite reaches the value for neutral solutions. The small residual deflection is due to the fact that when there is more hydrogen in the platinum it is more rapidly removed by the flowing water, and more current is required to replace it. With some oxidising agents (*e.g.*, hydrogen peroxide) a temporary deflection in the negative direction is observed, which disappears and is replaced by a low positive deflection. This is probably accounted for by the fact that at first the peroxide has a greater power of absorbing hydrions at a copper surface than of attacking the hydrogen occluded in platinum. Some reducing agents (*e.g.*, phenylhydrazine hydrochloride) cause a permanent negative deflection, probably because they absorb OH′ ions at the platinum pole and discharge hydrogen at the other, owing to the superior catalytic properties of the platinum. —W. H. P.

Disinfection of faeces and town sewage, and treatment of the latter with nitrates. E. Glaser. Arch. Hyg., 1913, 77, 165—309. Chem. Zentr., 1913, 2, 623—624.

The decomposition of nitrates added to sewage is due to bacteria, for whilst it proceeds vigorously under non-sterile conditions, it takes place neither in the light nor in the dark after sterilisation; the decomposition by bacteria is accelerated by light. Disinfection of Vienna sewage was effected within 2 hours with bleaching powder at a concentration of 1 : 2000, and frequently even at 1 : 5000. For detecting variations in the character of sewage, determination of the electrical conductivity is considered preferable to that of the permanganate consumption, but it is not suitable for controlling the purification, for the changes involved take place mostly in the organic substances which have little effect on the conductivity. The decrease in the content of fat in the suspended matter and in sewage sludge is attributed to the action of enzymes; considerable quantities of lipase and smaller quantities of diastase, pepsin, and trypsin are present in Vienna sewage. —A. S.

Calcium thioarsenate as a spray. S. H. Katz and P. D. Buckminster. J. Ind. Eng. Chem., 1913, 5, 663—664.

Calcium thioarsenate solution was prepared by dissolving precipitated arsenic trisulphide (25 grms.) in a "lime-sulphur" solution of sp. gr. 1·310 (100 c.c.), together with a small quantity (0·5 grm.) of gelatin. The resulting solution, after filtering, had the sp. gr. 1·37, and on exposure to air, decomposed, yielding a yellow gel which on drying adhered tenaciously to the underlying surface. Experiments by C. Brooks on *Penicillium glaucum* spores, with solutions of sp. gr. 1·0003 to 1·01, showed that the thioarsenate solutions are many times more powerful as a fungicide than "lime-sulphur" solutions of the same density. The thioarsenate solutions injure apple foliage, but may prove useful for spraying plants less sensitive to arsenic.—A. S.

Patents.

Sewage sludge ; Method and apparatus for effecting odourless decomposition of ——. K. Imhoff and H. Blunk, Essen-Ruhr, Germany. Eng. Pat. 9092, April 17, 1913. Under Int. Conv., April 30, 1912.

The sludge is pumped into an equalising chamber and discharged thence into a tank in such a manner that it mixes with the decomposing sludge already in the tank. Means are provided for maintaining a constant level of liquid in the tank and for supplying a current of water, air, or gas to the lower portion of the tank in order to aid in the mixing. An alternative method consists in pumping a portion of the decomposing sewage into the pipe through which the fresh sludge is introduced. A series of inclined baffle-plates may be fitted in the tank to ensure complete mixing of its contents. When decomposed sufficiently the sludge is discharged through a pipe extending to the bottom of the tank.—W. P. S.

Nightsoil ; Process and apparatus for the treatment of —— and extraction of ammonia from ammoniacal solutions in the cold. Soc. anon. La Suburbaine (Vidanges et Engrais). Fr. Pat. 454,498, Feb. 18, 1913. Under Int. Conv., Feb. 24, 1912.

The nightsoil or other ammoniacal liquid, together with milk of lime, is pulverised by a turbine device and a strong current of air is brought into intimate contact with the spray. The air, laden with ammonia, then passes to an absorption chamber where it is washed by an acid in the form of spray. Tho liquid from the first chamber may be passed to a second chamber, where it is again pulverised, and so on, the same current of air being drawn through all the chambers in succession.—A. S.

Water-purifying plant. J. C. Barr, Joplin, Mo. U.S. Pat. 1,069,368, Aug 5, 1913.

A series of stepped basins are filled with filtering material, the floors of the basins being inclined upwards from the inlet ends. The filtering material extends above the skimming weirs over which the water flows from one basin to the next lower one. Means are provided for passing a cleansing fluid upwards through the filters and for drawing off this fluid and the sediment removed by it. —W. P. S.

Filtration and sterilisation of beer and other liquids. C. H. Field, London. Eng. Pat. 17,472, July 27, 1912.

Claim is made for the use of known filtering materials impregnated with gun-cotton in the form of acetic acid collodion, containing 0·5—5 per cent. of gun-cotton, and gelatinised by immersion in water.—J. H. L.

Sterilisation by ultra-violet rays ; Apparatus for ——. M. von Recklinghausen, A. Helbronner and V. Henri. First Addition, dated April 20, 1912, to Fr. Pat. 453,191, March 28, 1912 (this J., 1913, 766).

In using a U-shaped lamp, the inner wall at the bend becomes excessively heated, as the arc takes the shortest path and hence in passing round the bend approaches close to the inner wall. In order to avoid trouble due to this cause, the inner wall is made thicker at this part, or is provided with projecting ribs which direct the arc away from the wall of the tube.—A. S.

Tobacco preparations ; Manufacture of ——. T. Oelenheinz, Karlsruhe, Germany, and A. A. van der Meulen, Hilversum, Holland. Eng. Pat. 17,037, July 22, 1912.

Ready-fermented, high-grade tobacco or its constituents are extracted first with alcohol "or a liquid of the nature of alcohol" and then with water, or first with water and then with alcohol; the two extracts are mixed and the juice pressed out of the extracted tobacco is added to the mixture. Similar liquid preparations are obtained by subjecting the juice of green tobacco plants to a process corresponding to the fermentation of tobacco leaves; this may be done by gradually heating the juice to 60°—70° C., until a "peculiar aroma" indicates the end of tho process. Any decomposition products may be removed from the preparations obtained by either process, by heating for a short time to about 80° C. during or after the treatment. A pure culture of the bacteria active during the fermentation, which may be obtained from superior tobacco, may be added to the juice during or after the treatment in the second method described. Loss of nicotine may be avoided by adding a suitable acid, etc., to the liquid, or the nicotine may be extracted by known means. Preparations made in the above manner may be used in horticulture and agriculture, or they may serve for treating low-grade tobaccos.—T. F. B.

Disinfectants ; Manufacture of solid ——. Chem. Fabr. "Vahrenwald," Ges. m. b. H. Fr. Pat. 453,923, Aug. 13, 1912.

Phenylsulphuric or cresylsulphuric acid or homologues of the same are mixed with borax or zinc oxide or a mixture of the two. The borax or zinc oxide may be replaced partly or completely by alkali sulphates or chlorides. The solid disinfectants thus obtained are soluble in water and may be mixed with sulphites or with paraformaldehyde.—A. S.

Arsenate of lead ; Acid —— [*Insecticide*]. C. H. Hall, Assignor to Corona Chemical Co., Milwaukee, Wis. U.S. Pat. 1,064,639, June 10, 1913.

A relatively strong solution of say disodium arsenate is added to a very dilute solution of a lead salt (such as lead nitrate), and the precipitate obtained is pressed, dried and powdered. The product is specially suited for use as an insecticide and is claimed as "a dry, soft, white, bulky powder, essentially acid arsenate of lead ($PbHAsO_4$), distinguished by the fact that, when mixed with water in the percentage of 15 grms. to a total volume of 250 c.c. and allowed to settle, the line of demarcation between the clear and clouded parts of the fluid is not below 175 c.c. at the end of 5 minutes."—F. Sodn.

Sewage ; Apparatus for treating ——. H. Fairbrother, London. From Hammond Engineering Co., Warren, Pa., U.S.A. Eng. Pat. 18,502, Aug. 12, 1912.

See U.S. Pat. 1,035,797 of 1912 ; this J., 1912, 837.—T.F.B.

Liquids ; Apparatus for treating —— by means of ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. U.S. Pat. 1,068,898, July 29, 1913.

See Eng. Pat. 12,947 of 1910 ; this J., 1911, 708.—T. F. B.

Insecticide soap. Addition to Fr. Pat. 444,021. *See* XII.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Epinephrine [adrenaline] in desiccated suprarenal glands ; Colorimetric determination of ——. A. Seidell. J. Biol. Chem., 1913, 15, 197—212.

The potassium iodate method (Hale and Seidell, Amer. J. Pharm., 1911, 83, 551), the phosphotungstic acid method of Folin and Denis (this J., 1913, 159), and the use of the gold chloride reagent proposed by Gautier (Compt. rend. Soc.

biol., 1912, 73, 564) all present certain disadvantages or defects when applied to the standardisation of commercial suprarenal glands. The author proposes a method based on the use of manganese dioxide (the commercial product, not specially purified) as oxidising agent. 0·01 grm. of the sample is shaken thoroughly with 0·005 grm. of manganese dioxide and 10 c.c. of water, and after standing for 1 hour, the mixture is filtered into a test-tube, and the colour compared with that of a colour standard in a test-tube of similar dimensions. The colour standards are prepared from solutions of cobalt chloride (2 grms. $CoCl_2,6H_2O$ and 1 c.c. of concentrated hydrochloric acid per 100 c.c.) and gold chloride (0·1 grm. Au per 100 c.c.) as shown in the following table :—

Epinephrine.	Colour standard.		
	Cobalt solution.	Gold solution.	Water.
grm.	c.c.	c.c.	c.c.
0·00001	1·15	0·70	8·15
0·00002	1·85	0·95	7·20
0·00003	2·40	1·10	6·50
0·00004	2·95	1·25	5·80
0·00005	3·50	1·30	5·20
0·00006	4·05	1·35	4·60
0·00008	5·15	1·55	3·30
0·00010	6·30	1·75	1·95

The method gives somewhat higher results than the phosphotungstic acid method.—A. S.

Oil of cypress. G. Zalouc. Bull. Soc. Chim., 1913, **13**, 752—754.

The branches of *Cupressus sempervirens fastigiata* L. yielded about 0·25 per cent. of essential oil which had the following characters: sp. gr. 0·8744 at 15° C. ; optical rotation +12° 6′; optical rotation of acetylated oil +14° 16′; soluble in 3·5 volumes of 90 per cent. alcohol; acid value 0·7 ; saponification value 4·9 ; saponification value after acetylation 14·7. The amount of essential oil obtained from the branches of *C. lusitanica* Mill. was about 0·2 per cent. The characters were : sp. gr. 0·8723 at 15° C. ; optical rotation +9° 10′; optical rotation after acetylation +8° 36′; soluble in 3 volumes of 90 per cent. alcohol; acid value 1·05; saponification value 9·8 ; saponification value after acetylation 26·6. The cones of *C. sempervirens* yielded 0·415 per cent. of essential oil. The characters were : sp. gr. 0·8739 at 15° C. ; optical rotation +29° 52′; optical rotation after acetylation +29° 48′; soluble in 4 volumes of 90 per cent. alcohol; acid value 1·0 ; saponification value 9·8 ; saponification value after acetylation 21·0.—F. Shdn.

Citral in oil of lemon; Determination of ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1913, **4**, 269.

Concordant results can be obtained by different analysts if the following process be adopted. 20 grms. of oil are boiled for 30 mins. under a reflux condenser with 20 c.c. of $N/2$ solution of hydroxylamine hydrochloride in 80 per cent. alcohol, 8 c.c. of $N/1$ alcoholic potash and 20 c.c. of alcohol in a 200 c.c. flask. After cooling, the solution is diluted with 250 c.c. of water, the hydrochloric acid combined with hydroxylamine is neutralised with alcoholic potash, using phenolphthalein as indicator, and the hydroxylamine remaining uncombined with the citral is then titrated with $N/2$ sulphuric acid, using methyl orange as indicator. A blank test is made without the oil of lemon, and the difference between the number of c.c. of acid required in the two tests, when multiplied by 0·076 gives the amount of citral. Five independent analysts working on similar samples, obtained the following results: 4, 4, 3·82, 3·8, and 3·86 per cent. respectively, by the above method.—A. S.

Japanese peppermint oil. Y. Shinosaki. J. Ind. Eng. Chem., 1913, **5**, 658—660.

The author gives a series of tables showing (1) a comparison of peppermint plants of English, German, and Japanese origin cultivated at Hokkaido, Japan, and of the oils therefrom, (2) a comparison of the oils from plants of German and Japanese origin cultivated at Okayama, (3) a comparison of different methods of drying the herb both as to yield of dried herb and of oil and characters of oil, (4) characters of leaf oils, and (5) characters of commercial peppermint oils.—A. S.

Eucalypts and their economics; Some New England ——. R. T. Baker and H. G. Smith. J. and Proc. Royal Soc. N.S. Wales, 1911, **45**, 267—291.

The ground covered by the authors includes botanical descriptions of and the chemistry of the oils obtained from several species of Eucalyptus. *E. acaciaeformis*, Deane and Maiden, yielded 0·197 per cent. of essential oil. This had the sp. gr. 0·8864 at 15° C. ; $\alpha_D = +35·7°$, refractive index 1·4713 at 20° C., and was insoluble in 10 vols. of 80 per cent. alcohol. The saponification value determined by boiling with potassium hydroxide was 17·41 and by 2 hours contact in the cold 16·21. A fairly large amount of geranyl acetate was present. The leaves of *E. Andrewsi* J. H. Maiden yielded 1·27 per cent. of oil. The characters were sp. gr. 0·8646 at 15° C. ; $\alpha_D = -41·5°$; refractive index 1·4854 at 20° C. ; saponification value 4·3 ; insoluble in 10 vols. of 80 per cent. alcohol. The principal constituents are *l*-phellandrene and piperitone. Oils from *E. Bridgesiana*, R.T.B. had the characters : sp. gr. 0·9223—0·9246 ; $\alpha_D = +1·9°$ to $+1·8°$; refractive index 1·4716 to 1·4729 at 19°—20° C. ; eucalyptol in portion distilling below 183° C., 73—78 per cent. The oil of *E. laevopinea* R.T.B. consists principally of *l*-pinene. The chief constituent of the oil of *E. nova-anglica* is *d*-pinene. The oil of *E. campanulata* consists for the most part of phellandrene, and a yield of 0·851 per cent. was obtained from the leaves. —F. Shdn.

Melaleucas; Australian —— *and their essential oils. III. and IV.* R. T. Baker and H. G. Smith. J. and Proc. Roy. Soc. N.S. Wales, 1910, **44**, 592—615 ; 1911, **45**, 365—378. (See also this J., 1908, 353, 765.)

M. trichostachya. Material (dry leaves and branchlets) from (*a*) Gladstone, Queensland and (*b*) Port Macquarie, N. S. Wales, was examined, the yield of oil being (*a*) 1·25 and (*b*) 2·58 per cent. respectively. The oil is one of the richest in cineol (80—81 per cent.) of any known essential oil and possesses the advantage over the oils of *Eucalyptus globulus*, etc. of being quite colourless. The characters of the oil were : sp. gr. at 15° C., (*a*) 0·9144, (*b*) 0·9153 ; $\alpha_D = (a)\ +2·3°$, (*b*) +3·1° ; refractive index at 20° C., (*a*) 1·4636, (*b*) 1·4655. The oil is soluble in 1·3 vols. of 70 per cent. alcohol, and besides cineol, contains small quantities of terpinyl acetate and a high-boiling sesquiterpene. When dissolved in acetic acid and treated with excess of bromine, a colouration changing from reddish through violet, to deep indigo-blue is produced. This colour reaction is due to the sesquiterpene; it is also given by the oil of *M. uncinata*, and less distinctly by that of *M. linariifolia*, but not by that of *M. thymifolia*.

M. bracteata. The oil (yield, about 1 per cent.) has the sp. gr. 1·032—1·036 at 18° C., $\alpha_D = -1·4°$ to $-3·1°$, n_D at 20° C. = 1·5325—1·535, saponif. value, 5·3—20·8 ; acid value, 0·7—1·26 ; it is soluble in 0·7—0·8 vol. of 70 per cent. alcohol. The chief constituent is methyleugenol (70 per cent.), and there are present also eugenol (0·36 per cent.), cinnamic acid (0·33 per cent.), cinnamic aldehyde, cinnamyl cinnamate (styracin), and *l*-phellandrene. Methyleugenol could probably be obtained more cheaply and in larger quantity from this species of Melaleuca than from any other source.

M. styphelioides yields only traces of essential oil.

M. genistifolia. The oil (yield, 0·526 per cent.) consists mainly of *d*-pinene (80—90 per cent.).

M. gibbosa. The yield of oil is only 0·158 per cent. The oil contains 61·5 per cent. of cineol and also *d*-pinene and small quantities of ester and sesquiterpene.

M. pauciflora. The oil (yield 0·3 per cent.) is free from pinene ; it contains 8·7 per cent. of cineol, but the principal constituent appears to be a high-boiling sesquiterpene, similar to that present in smaller quantities in many other Melaleuca oils, and to which the characteristic colour reaction described for *M. trichostachya* oil (see above) is due.—A. S.

Prostanthera ; A new species of ——, *and its essential oil.* R. T. Baker and H. G. Smith. J. and Proc. Royal Soc. N.S. Wales, 1912, **46**, 103—110.

The leaves of a new species of Prostanthera, *P. cineolifera*, yielded 0·71 per cent. of oil. The characters were: sp. gr. 0·9204 at 15° C., refractive index 1·4711 at 22° C.; soluble in 1·7 volumes of 70 per cent. alcohol. The oil contains 2·9 per cent. of geranyl acetate, and small amounts of phenols and cuminaldehyde. The principal constituents are cineol (61 per cent.) and cymene.—F. Shdn.

Phenols ; New method of synthesising higher ——. T. B. Johnson and W. W. Hodge. J. Amer. Chem. Soc., 1913, **35**, 1014—1023.

Mixed ketones, containing hydroxyl or ether radicals (OCH_3) in the benzene nucleus, are reduced with zinc-amalgam and hydrochloric acid, the CO-group being converted into a CH_2-group. Thus, acetylanisole yields ethylanisole, acetylquinol yields ethylquinol, and so on. —W. P. S.

Esters of dibasic organic acids ; Catalytic decomposition of —— *by alumina.* L. Michiels. Bull. Soc. Chim. Belg., 1913, **27**, 227—230.

Experiments with the ethyl esters of succinic, glutaric, and adipic acids at temperatures ranging from 260° to 320° C., indicated that under the catalytic influence of alumina, esters of this type are decomposed mainly into ethylene and the corresponding acid :

$$C_2H_5OOC.(CH_2)_x.COOC_2H_5 = HOOC.(CH_2)_x.COOH + 2C_2H_4.$$

In the case of ethyl succinate, the succinic acid first formed is converted into the anhydride.—A. S.

Patents.

Hydrocarbons ; Manufacture of unsaturated ——. F. E. Matthews, H. J. W. Bliss, and H. M. Elder, London. Eng. Pat. 17,234, July 24, 1912.

Unsaturated hydrocarbons are obtained from mono-halogenated hydrocarbons by treatment with steam at a suitable temperature, with or without the aid of a catalytic agent. When dihalogen hydrocarbons are treated with water or with steam, with or without a catalytic agent, unsaturated hydrocarbons are also obtained; it is possible in this way to produce hydrocarbons with conjugated double linkages in a single operation.—T. F. B.

Butadiene and homologues thereof ; Manufacture of ——. W. H. Perkin, Manchester, and F. E. Matthews, London. Eng. Pat. 17,235, July 24, 1912.

Butadiene is obtained by heating any one of the following substances, with or without a catalyst :—Butylenes other than 1.2-butylene, butyl alcohol, a butyl halide, butyl aldehyde. The homologues of butadiene are produced by similar means from the corresponding homologous hydrocarbons, etc. Butadiene is also formed when ethylene is heated with a catalyst. For example, butyl alcohol may be passed over a mixture of reduced copper and aluminium silicate at a red heat; the alcohol vapour is preferably diluted with an inert gas, or the process may be carried out at reduced pressure. The butadiene may be separated from the resulting gases by fractionation and polymerisation.—T. F. B.

Isoprene ; Process for producing ——. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 19, 1913, to Fr. Pat. 440,130, Feb. 13, 1912. Under Int. Conv., Nov. 18, 1912.

It is found that isopropylacetylene is converted into isoprene when passed over alumina or aluminous compounds, in a manner analogous with that described in connection with asymmetrical dimethylallene in the principal patent (this J., 1912, 735).—T. F. B.

Camphene and isobornyl acetate ; Process for preparing a mixture of —— *from pinene hydrochloride or oily mixtures containing it.* C. Ruder und Co. Fr. Pat. 453,992, Feb. 5, 1913. Under Int. Conv., Feb. 20, 1912.

In the preparation of mixtures of camphene and isobornyl acetate by heating pinene hydrochloride with a fatty acid and a zinc salt of a fatty acid, the zinc chloride, formed during the reaction, has a considerable condensing effect on the terpenic compounds, materially reducing the yield. A small quantity of zinc chloride must, however, be present to ensure effective dechlorination. It is now proposed to add to the dechlorinated mixture a second salt of the fatty acid or a suitable metallic oxide, such as lead oxide; part of this addition (up to one half) may be made at the commencement of the process, although the reaction is somewhat retarded if this be done. *Example:* 172 parts of pinene hydrochloride, 120 parts of anhydrous zinc acetate, and 500 parts of glacial acetic acid are heated to 100° C. for four hours; 98 parts of potassium acetate is then added, and the acetic acid is removed by distillation. On washing the residue with water, a mixture of camphene and isobornyl acetate free from chlorine is obtained.—T. F. B.

Compounds having the same components as esters ; Process for preparing ——. C. Luckow and W. Dederich. Fr. Pat. 454,183, Jan. 7, 1913.

A mixture of a carbohydrate with a very small quantity of an acid or substance with acidic properties is dissolved in water. These solutions have the power of decomposing considerable quantities of insoluble compounds, such as calcium carbonate, phosphate, or oxalate, uric acid, urates, etc. Thus, in the case of calcium carbonate, the acid liberates the carbon dioxide, and the base then combines with the carbohydrate, leaving the acid free to decompose further quantities of carbonate. For example, 100 to 300 grms. of lactose and 10 to 50 grms. of casein may be dissolved in 700 to 800 c.c. of water.—T. F. B.

Glycerol ; Sulphur derivative of ——. A. L. F. Bru. Fr. Pat. 455,124, Feb. 15, 1913.

When anhydrous glycerol is heated with powdered sulphur to a high temperature, a dark liquid is obtained, whilst hydrogen sulphide is evolved. On filtering the product a black residue is left, which, when treated with hot glycerol, water, or alcohol, gives a solution having properties resembling those of the first filtrate; the residue consists of sulphur and an insoluble sulphur compound. The first and second filtrates consist of solutions of a new sulphur compound, which appears to be a thionic acid, probably of the formula, $CSOH.CHOH.CH_2OH$, since it contains one atom of sulphur to each molecule. Hydrogen sulphide is not liberated when the diluted solutions are treated with strong acids, nor are black precipitates formed with lead salts. After a time, addition of acids and heavy metal salts gives rise to precipitates, those with lead and silver being brown. The solutions are decolourised by nitric acid.—T. F. B.

Piaselenol ; Process for producing derivatives of —— *soluble in alkali.* F. Heinemann, Berlin. Eng. Pat. 3042, Feb. 5, 1913. Under Int. Conv., Feb. 27, 1912.

See Ger. Pat. 261,412 of 1912; this J., 1913, 842.—T. F. B.

Piaselenol derivatives soluble in alkali ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 455,148, Feb. 24, 1913. Under Int. Conv., Feb. 27, 1912.

See Ger. Pat. 261,412 of 1912; this J., 1913, 842.—T. F. B.

Pinacone ; Process of producing ——. A. Jonas and E. Tschunkur, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,068,777, July 29, 1913.

See Eng. Pat. 22,795 of 1911; this J., 1912, 151.—T. F. B.

Phenylcinchoninic acid ; Derivatives of ——. R. Schwabe, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,069,296, Aug. 5, 1913.

See Eng. Pat. 10,352 of 1912 ; this J., 1913, 624.—T. F. B.

Beta-gamma-dimethylerythrene ; Process of producing ——. F. Hofmann, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,069,422, Aug. 5, 1913.

See Eng. Pat. 1557 of 1912 ; this J., 1912, 951.—T. F. B.

1.3-*Butyleneglycol ; Process for making* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 455,205, March 6, 1913. Under Int. Conv., March 16, 1912.

See Eng. Pat. 940 of 1913 ; this J., 1913, 550.—T. F. B·

Lecithin from vegetable or animal products containing it ; Process for extracting tasteless and odourless ——. H. Buer. Fr. Pat. 455,257, May 30, 1912. Under Int. Conv., Oct. 17, 1911.

See U.S. Pat. 1,055,514 of 1913 ; this J., 1913, 450.—T.F.B.

Acetic esters of amyl alcohol and its homologues ; Process for making the ——. F. Kaufler. Fr. Pat. 454,275, Feb. 12, 1913. Under Int. Conv., Feb. 23, 1912.

See Eng. Pat. 2779 of 1913 ; this J., 1913, 767.—T. F. B.

Preparation of mannitol from natural musts. Eng. Pat. 3261. *See* XVIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour-screens ; Process for manufacturing ——. C. Späth, Steglitz, Germany, Assignor to Eastman Kodak Co., Rochester, N.Y. U.S. Pat. 1,069,039, July 29, 1913.

Lines of resist are applied to the surface of a sheet of "converted cellulose" (*e.g.*, nitrocellulose), the unprotected parts are then treated with a solution of acetone and alcohol and stained with an aqueous solution of a dyestuff containing a colloid, tanned, washed, and partially dried and the resist removed. A second resist is now applied to parts only of the surface protected by the first resist, the exposed portion is again stained, the resist is removed, and the remaining surface is treated with a solution of a dyestuff which will not injuriously affect the dyestuff previously used.—T. F. B.

Photographic paper. W. C. Renfrow and F. G. Wilcox. Fr. Pat. 454,229, Feb. 11, 1913.

A thin paper support is provided on both sides with a sensitive emulsion, and the support or the emulsions are rendered opaque to actinic light by means of suitable substances, *e.g.*, red or orange dyestuffs, which do not greatly diminish the sensitiveness of the emulsions. It is thus possible to print on either side of this paper without fogging the emulsion on the other side.—T. F. B.

Photographic images ; Process for toning and modifying ——. Neue Photographische Ges. Akt.-Ges. Fr. Pat. 454,792, Feb. 25, 1913.

Photographic silver images are converted into easily reducible silver compounds, and then treated with a developing agent of which the oxidation product is coloured and is fixed to the silver during its formation. In this way it is possible to tone images a number of different shades. *Examples.* A black silver image is bleached with a solution containing 10 per cent. of alkali ferrocyanide and 10 per cent. of alkali bromide, washed, and developed to brownish-yellow by means of a solution of 0·1 grm. of pyrogallol and 2 grms. of sodium carbonate in 100 c.c. of water. A red image is obtained by replacing the pyrogallol solution by one containing 0·5 grm. of carbothioindoxylic acid, 5 c.c. of acetone, and 2 grms. of potassium carbonate in 100 c.c. of water.—T. F. B.

Colour photography ; Process for making polychrome screens for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 454,839, May 6, 1912.

See Ger. Pat. 254,180 of 1910 ; this J., 1913, 214.—T. F. B.

Cells which are sensitive to light, and provided with aluminium electrodes, and for which acetone is used as electrolyte. Eng. Pat. 9060. *See* XI.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; Thirty-seventh Annual Report of H.M. Inspectors of —— *for* 1912. [Cd. 6958.]

Factories and magazines.—The number of factories under continuing certificate was 134 and 101 under licence, 246 visits being paid to these factories during the year. There were 87 magazines under continuing certificate and 359 under licence, and 506 visits were made to these magazines during the year.

Packing and conveyance.—The laws in this connection have undergone no alteration during the year.

Importation.—The importation licences granted in 1912 were 159, as against 160 in 1911, the importations being as follows :—

		1911.	1912.
Nitroglycerin explosives	lb.	876,850	605,281
Non-nitroglycerin explosives	,,	15,434	57,321
Detonators	,,	139,456	147,610
Fireworks	,,	971,950	876,020

Of the total number of detonators imported in 1912, 20,595 lb. were immediately transhipped to other countries.

Chemical adviser's report.—Messrs. Dupré examined 464 samples during the year, of which 70 were rejected on the following grounds : failure of heat test (8), incorrect composition (25), exudation (37). The total number of rejections was about normal, but an unusually large number of samples was rejected for exudation.

Accidents.—The total number of accidents in 1912 was 456 (as against 515 in 1911), viz., in manufacture 25, causing 1 death and 33 injuries, and 79 in which no deaths or injuries were caused ; in keeping, 2, causing 4 deaths and 3 injuries, and 1 accident in which there was no loss of life or injury ; in conveyance, 1 accident, causing no deaths or injuries ; in use, and miscellaneous, 348, causing 30 deaths and injuries to 393 persons. The number of deaths (1) in the manufacture of explosives has brought down the annual average of deaths for the decade from 7·3 to 6·1, which result reflects creditably on the working of the Explosives Act, the provisions of which are enforced by local supervision.

Cellulose ; Behaviour of —— *with pure nitric acid. II.* C. Haeussermann. Z. angew. Chem., 1913, 26, 456.

In a similar manner to cotton (this J., 1910, 1151), sulphite-cellulose is converted into nitro-compounds, with little alteration of structure, by the action of concentrated nitric acid. With acid of sp. gr. 1·495 the product contains 11·1 per cent. and with acid of sp. gr. 1·48, 9·6 per cent. N after 3—4 days' action. With a large excess of acid, the cellulose is converted almost completely into soluble products in the course of some months. The behaviour with concentrated nitric acid of hydrocelluloses prepared from cotton-wool and sulphite-cellulose respectively, by the action of cold nitric acid of sp. gr. 1·1 for about 1 year, was also studied. The hydrocellulose was dissolved only very slowly in the cold but very rapidly on warming with the concentrated acid. With acid of sp. gr. 1·5, 1·485, 1·48, and 1·4, in the cold, the cotton hydrocellulose yielded products containing 13, 9·5, 8·9 and 2·3 per cent. N respectively, whilst the hydrocellulose from sulphite-cellulose, with acid of sp. gr. 1·495, 1·48, 1·45, and 1·4 yielded products containing 11·2, 8·8, 6·6, and 2·1 per cent. N respectively. Neither the highly nitrated sulphite-cellulose, nor the highly nitrated hydrocellulose, was completely soluble in acetone.—A. S.

Patents.

Explosive compounds. G. W. Davies, Wellington, New Zealand. Eng. Pat. 10,203, Sept. 20, 1912.

One part of a solution of aniline resinate in aniline, is mixed, without heating, with six or seven parts of potassium chlorate. The latter may be wholly or partially replaced by other oxidising salts.—T. St.

Nitrocellulose ; Method of preparation of ——. Vereinigte Kunstseidefabriken A.-G. Fr. Pat. 455,011, March 4, 1913. Under Int. Conv., March 5, 1912.

The cellulose is nitrated in vessels with perforated bottoms, the acid being circulated by means of a pump. After nitration is complete, the acid is allowed to drain off, and the nitrocellulose is washed with cooled acid from a previous nitration operation. When the nitrocellulose has thus been cooled sufficiently, the acid is separated and the treatment is continued by the usual methods. It is claimed that by this treatment spontaneous decomposition of the nitrocellulose is prevented.—T. St.

Explosives. C. Claessen. Berlin. Eng. Pat. 29,901, Dec. 28, 1912.

See Fr. Pat. 451,925 of 1912 ; this J., 1913, 674.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Vacuum drying ; Volatility of sulphuric acid when used in ——. H. C. Gore. J. Biol. Chem., 1913, 15, 259—261.

Using 200 c.c. of 95 per cent. sulphuric acid in a Hempel desiccator, the area of the surface of the acid exposed being about 188·5 sq. cm., it was found that in 237 days, with a vacuum of 1 mm., the loss of acid by volatilisation was 0·2930 grm., or 1·236 mgrm. per day.—A. S.

Carbon bisulphide ; Safe distillation of —— *in the laboratory.* A. R. Myhill. J. Gas Lighting, Aug. 12, 1913, 440.

The heavy vapour of carbon bisulphide may ignite, even in the absence of a flame, when distillation is effected by means of steam at 100° C. The author recommends heating the flask containing carbon bisulphide by placing it in hot water in a hemispherical copper basin, which rests on the open top of a double gauze cylinder, and makes a good fit therewith. This cylinder comprises two screens of fine iron gauze similar to that used in safety lamps. A Bunsen burner within the gauze cylinder serves for heating the water, which should not be allowed to boil.—A. T. L.

Carbon in organic substances ; Determination of ——. E. B. Hart and K. J. Woo. J. Amer. Chem. Soc., 1913, 35, 1056—1061.

A method, which may be applied to the determination of carbon in soils, urine, etc., is described, consisting in fusing the substance with sodium peroxide and titrating the resulting carbonate. Six grms. of sodium peroxide and from 0·1 to 2 grms. of the substance are mixed in a porcelain, iron, or nickel crucible, the latter is covered, placed in another crucible, also covered, and then heated cautiously. When the reaction has subsided, the crucible is heated for a further 5 minutes, then cooled in a desiccator, and its contents rinsed into a flask with water free from carbon dioxide. The mixture is acidified with sulphuric acid and distilled, about 60 c.c. of distillate being collected in a receiver filled with beads and containing 10 c.c. of 30 per cent. sodium hydroxide solution. The fluid contents of the receiver are now washed into a 250 c.c. flask, phenolphthalein is added, and 25 per cent. sulphuric acid run in until the colour begins to change. The solution is then diluted to 250 c.c. and 50 c.c. are titrated with $N/10$ sulphuric acid. At the neutral point all the carbon will exist in the solution as sodium bicarbonate, when methyl-orange is added and titration continued. The number of c.c. of $N/10$ acid used for the latter titration are multiplied by 0·0012 to give the weight of carbon in the 50 c.c. of solution. A blank determination is advisable to ascertain the carbon dioxide yielded by the reagents.—W. P. S.

New colour reactions of di- and tri-hydric phenols. Schewket. *See* III.

Determination of small quantities of wool in cotton goods. Heermann. *See* V.

Testing the degree of bleaching wood cellulose. Johnsen. *See* V.

Testing sulphite-cellulose lyes with iodine. Von Zweigbergk. *See* V.

Action of persulphate on iodate and determination of periodate in the presence of persulphate. Müller and Jacob. *See* VII.

Atmospheric oxidation of gallic acid and gallotannic acid (tannin) in presence of alkalis, and a colour reaction of lead. Schewket. *See* XV.

Detection of saccharin in beer. [Extraction apparatus.] Ledent. *See* XVIII.

Colorimetric determination of epinephrine [adrenaline] in desiccated suprarenal glands. Seidell. *See* XX.

Determination of citral in oil of lemon. *See* XX.

Microscopic examination of coal. Wahl and Bagard. *See* IIa.

Patent.

Quartz tubes ; Process of uniting metals or other electrically conducting bodies to ——. G. Berlemont. Fr. Pat. 454,431, Apr. 27, 1912.

A process intended more especially for uniting platinum conductors to quartz tubes. By means of a blowpipe flame, a wire of platinum-iridium is fused to one end of the tube, which end is then immersed in a solution of platinic chloride while suction is applied to the other extremity, to cause the pores of the quartz to become filled with the liquid. The saturated portion of the tube around the wire is subsequently fused again to effect homogeneous jointing of the materials.—W. E. F. P.

Books Received.

Literatur-Register der Organischen Chemie, geordnet nach M. M. Richters Formelsystem. Herausgegeben von der Deutschen Chemischen Gesellschaft, redigiert von Robert Stelzner (1910—1911). Erster Band, umfassend die Literaturjahre 1910 und 1911, anschliessend an die dritte Auflage von Richters Lexikon der Kohlenstoff-Verbindungen. Friedrich Vieweg und Sohn's Verlag. Braunschweig. 1913. Price M. 84 ; bound M. 86.

This volume (10⅝ by 7¾ ins.) consists of an index to the literature of organic chemistry for the years 1910 and 1911. In the main portion, occupying 1248 pages, the arrangement is based on the chemical formulæ of the compounds referred to, and references are given both to the original sources and to the abstracts appearing in the "Chemischen Zentralblatt." The order in which the formulæ are arranged is based on : (1) the number of carbon atoms, (2) the number of other elements present together with carbon in the molecule, (3) the nature of the elements other than carbon, these being placed in the order : H, O, N, Cl, Br, I, F, S, P, followed by any others arranged alphabetically, (4) the number of atoms of each element other than carbon. This portion of the work is followed by an alphabetical index (38 pages) of the names of the more important compounds, with structural formulæ showing the system of nomenclature, and of compounds of unknown composition. The work as a whole forms a supplement to the third edition of Richter's "Lexikon der Kohlenstoffverbindungen," which formed an index of organic chemistry up to the end of the year 1909, and it is stated that the German Chemical Society intend to publish similar volumes at intervals of two years so as to keep the work up to date.

The Purification of Public Water Supplies. By George A. Johnson. Department of the Interior, United States Geological Survey. Water Supply. Government Printing Office, Washington. 1913. [Paper 315.]

Volume (9½ by 5⅞ ins.), containing 82 pages of subject matter, with 14 illustrations, and an alphabetical index. The leading subjects treated are as follows:—I. Polluted water. II. Sources of water supply. III. Development of waterworks in the United States. IV. Water consumption. V. Typhoid fever in the United States. VI. Water purification. VII. Sterilisation of water. VIII. Municipal water softening.

The Application of Physico-Chemical Theory to Technical Processes and Manufacturing Methods. By Prof. Dr. R. Kremann. Translated from the German by Harold E. Potts, M.Sc., and edited by Albert Mond, Ph.D. Constable and Company, Ltd., 10, Orange Street, Leicester Square, London, W.C. 1913. Price 8s. 6d. net.

Volume (9 by 5⅞ ins.) containing 205 pages of subject matter, with 35 illustrations, and alphabetical indexes of names of authors and subjects. The subject matter is classified as follows:—I. The two fundamental laws of the mechanical theory of heat. II. Reaction velocity and catalytes. III. Other special applications of the law of mass action. The influence of temperature on the equilibrium-constant. IV. Dissociation-pressure. Application of the phase-rule. V. Application of the phase-rule to solid-liquid systems. VI. Transformation phenomena in hydraulic binding agents. VII. Other applications of the phase-rule. The distribution law. Adsorption compounds. Reciprocal pairs of salts.

Mines and Quarries: General Report, with Statistics, 1912. Part I. District Statistics. [Cd. 7025.] Wyman and Sons, Fetter Lane, E.C. Price 7d.

This return, which forms the first part of the General Report on Mines and Quarries for 1912, contains statistics of the number of persons employed, the output of minerals, and the accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. (See also under Class X., page 869.)

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Marchis*, L.: Le froid industriel, 104 fig. (Nouvelle collection scientifique), in-16. F. Alcan. Paris. 1913. 3 fr. 50.

Turin, A.: La chaufferie moderne. Les foyers de chaudières, leur construction, leurs accessoires, leurs services annexes, 461 fig., in-8°. Dunod et Pinat. Paris. 1913. Cloth 21 fr. 50.

Weber, R.: Die Fabrikation des Hartgusses. Mit 19 Abbildgn. u. zahlreichen Tab. (VIII. 132 S.) 8°. Berlin, H. Meusser. 1913. Cloth 3.50.

IIA. *Statistik* des böhmischen Braunkohlen-Verkehrs im J. 1912. 44. Jahrg. Hrsg. v. der Direktion der Aussig-Teplitzer Eisenbahn-Gesellschaft. (CXXXII, 116 S. m. 3 farb. Taf.) Lex 8°. Teplitz-Schönau, (A. Becker). 1913. M. 2.50.

IV. *Friedlaender*, Prof. P.: Fortschritte der Teerfarbenfabrikation u. verwandter Industriezweige. An der Hand der systematisch geordneten u. m. krit. Anmerkgn. versehenen deutschen Reichs-Patente dargestellt. 10. Tl. 1910—1912. (VII, 1422 S.) Lex 8°. Berlin, J. Springer. 1913. Cloth M. 75.

VII. *Oden*, S.: Der kolloide Schwefel. IV, 193 S. m. Fig. u. 2 Tab. (Nova Acta Regiae Societatis Scientiarum Upsaliensis. Ser. IV. Vol. III.) Lex 8°. Upsala, Akademische Buchh. 1913. M. 16.

Rutherford, E.: Radioactive substances and their radiations. N. Y., Putnam. 7+699 p. ill. pls. diagrs. 8°. 1913. $4.50.

IX. *Butler*, D. and B.: Portland cement, its manufacture, testing and use. 3rd edition, revised and enlarged. 8vo. pp. 470. Spon. London. 1913. Net 16s.

Hambloch, Dr. A.: Graphische Darstellungen üb. Festigkeit u. Dichte der in neuester Zeit angewendeten Mörtel (Trass-Kalk-, Trass-Kalk-Zement- u. Zement-Trass mörtel) nach längerer Erhärtungsdauer, nebst Angaben ihrer hauptsächlichsten Verwendungszwecke. (3 farb. Taf.) 33×21 cm. Leipzig, Siegismund & Volkening. 1913. M. 1.50.

X. *Adressbuch* der Bergwerke, Hütten- u. Walzwerke Deutschlands nebst der Nebenbetriebe. 9 Ausg. (VI. 511 S.) 8°. Leipzig, H. A. L. Degener. 1913/14. Cloth M. 8.

Beyschlag, F., P. *Krusch*, J. H. L. *Vogt*, Proff.: Die Lagerstätten der nutzbaren Mineralien u. Gesteine, nach Form, Inhalt u. Entstehung dargestellt. (3 Bde.) II. Bd. 2. Hälfte. Metasomatische Antimonerzgruppe. Eisenerzganggruppe. Metasomatische Eisenerzgruppe. Manganerzganggruppe. Metasomatische Manganerzgruppe. Kupfererzganggruppe. Metasomatische Kupfererzgruppe. Schwefelkies- u. Arsenkiesganggruppe. Metasomatische Kiesgruppe. Gediegen Kupfergruppe. Nickel-Kobalt-Arsenerzganggruppe. Nickelsilikatgruppe. Rückblick auf die Genesis der Erzgänge. Erzlager. Allgemeines. Eisenerzlager. Manganerzlager. Kupferschiefergruppe. Faulbandgruppe. Schwefelkiesgruppe. Witwatersrandgruppe. Geschwefelte Kupfer-Blei-Zinkerzgruppe. Antimonerz gruppe. Zinnstein- u. Edelmetallseifen. (XXVII u. S. 279—727 m. 109 Abbildgn.) Lex 8°. Stuttgart, F. Enke. 1913. M. 14.40.

Dammer, B., u. O. *Tietze*, Drs.: Die nutzbaren Mineralien m. Ausnahme der Erze, Kalisalze, Kohlen u. des Petroleums. Mit Beiträgen v. Drs. R. Bärtling, G. Einecke, Prof. F. Kaunhowen u. a. (2 Bde.) 1. Bd. (XV, 501 S. m. 57 Abbildgn.) Lex 8°. Stuttgart, F. Enke. 1913. Cloth M. 16.40.

Hintze, Prof. C.: Handbuch der Mineralogie. 28. Lfg. I. Bd. Elemente, Sulfide, Oxyde, Haloide, Carbonate, Sulfate, Borate, Phosphate. 16. Lfg. (S. 2401—2560 m. 30 Abbildgn.) gr 8°. Leipzig, Veit & Co. 1913. M. 5.

Demarty, J.: L'échantillonnage et la préparation des minerais destinés à l'analyse chimique et en particulier des minerais d'or français, in-8°. Dunod et Pinat. Paris. 1 fr. 25.

Statistique de l'industrie minérale et des appareils à vapeur en France et en Algérie pour l'année 1911, in-8°. Ch. Béranger. Paris. 1913. 10 fr.

Libert, J., et V. *Firket*: Métallurgie du plomb et de l'argent. Conditions de salubrité intérieure des usines belges pendant la période de 1901-1910, fig., in-8°. Ch. Béranger. Paris. 1913. 3 fr.

Noble, H.: Fabrication de l'acier, 2^e^ édit. rev. et augm., fig., in 8°. Dunod et Pinat. Paris. 1913. Cloth 26 fr. 50.

XIV. *Porritt*, B. D.: The Chemistry of Rubber. Cr. 8vo., pp. 104. Gurney & J. London. 1913. Net 1/6.

XVI. *Beucke*, A.: Die Erzeugung künstlicher Düngemittel mit Luftstickstoff. VII, 204 S. m. 58 Abbildngn. (Bibliothek, Chemisch-technische.) 8°. Wien, A. Hartleben. 1913. Cloth M. 4.90.

Thorne, C. E. : Farm manures. N.Y., O. Judd Co. c. 7+242 p. il. tabs. 12°. 1913. $1.50.

Gologurski, Dr. T. M. : Die technologischen Prozesse bei der Bodenbearbeitung. (158 S. m. 27 Fig.) Lex 8°. Krakau, D. E. Friedlein. 1913. M. 5.

XIXA. *Mugnani*, L. : Trattato di chimica bromatologica industriale ad uso degli studenti, dei commercianti e dei privati per scoprire le falsificazioni dagli alimenti e delle bevande. Napoli, 16° fig., p. 166. 1913. Lire 2.

Tellier, C. : La conservation de la viande et des matières organiques alimentaires par des moyens naturels, in-8. Dunod et Pinat. Paris. 1913. 2 fr. 50.

XIXB. *Handbuch* der Hygiene. Hrsg. v. Proff. M. Rubner, M. v. Gruber u. M. Ficker. III. Bd., 1 Abtlg. Die Infektionskrankheiten. Die pflanzl. Parasiten. Allgemeiner Tl. : Morphologie, Biologie, Epidemiologie, Seuchenbekämpfg., Desinfektion, Infektion u. Immunität. (VIII, 853 S. m. 146 Abbildgn.) Lex 8°. Leipzig, S. Hirzel. 1913. Cloth M. 30.

Jahresberichte der konigl. sächischen Gewerbe-Aufsichtsbeamten f. 1912. Nebst Berichten der königl. sächs. Berginspektoren., betr. die Verwendg. weibl. u. jugendl. Arbeiter beim Bergbau, sowie die Beaufsichtigung. der Unterirdisch betriebenen Brüche u. Gruben. Sonder-Ausg. nach den vom Reichsamte des Inner veröffentl. Jahresberichten der Gewerbe-Aufsichtsbeamten. (XII, 309 S.) gr. 8°. Berlin. 1913. (Dresden. A. Jahrg. 24. F. A. Schroer). Cloth M. 3.

XX. *Bertheim*, Dr. A. : Handbuch der organischen Arsenverbindungen. (XII, 238 S.) Chemie in Einzeldarstellungen. Hrsg. v. Prof. J. Schmidt. gr 8°. Stuttgart, F. Enke. 1913. Cloth M. 8.40.

XXIII. *Léri*, L. : Essai chimiques des marchandises, 31 fig., in-8°. Dunod et Pinat. Paris. 1913. 3 fr.

Roux, J. : Les laboratoires industriels d'essais en Allemagne, in 4°. Dunod et Pinat. Paris. 1913. 3 fr.

XXIV. *Cassuto*, L. : Lo stato colloidale della materia. Livorno, 8°, p. 386. 1913. Lire 8.

Ekecrantz, Prof. T. : Geschichte der Chemie. Kurzgefasste Darstellg. Aus dem schwed. Original vom Verf. bearb. (VIII, 231 S. m. 25 eingedr. Bildnissen.) gr 8°. Leipzig, Akadem. Verlagsgesellschaft. 1913. Cloth M. 10.

Handbuch der biochemischen Arbeitsmethoden. Hrsg. v. Prof. E. Abderhalden. VII. (Schluss-) Bd. Bearb. v. Drs. H. Dold, Proff. F. Ehrlich, H. v. Euler u. a. (XXVIII, 912 S. m. 198 Fig.) Lex 8°. Wien, Urban & Schwarzenberg. 1913. Half mor. M. 41.

Herz, Prof. W. : Verbindungen, Lösungen, Gemenge. —In elementarer Darstellg.—Ciamician, Dr. G. : Die Photochemie der Zukunft. Deutsch v. Dr. H. Grossmann. [Aus. : "Sammlg. chem. u. chem.-techn. Vorträge."] (30 S. m. 2. Fig.) gr. 8°. Stuttgart, F. Enke. 1913. M. 1.50.

Hoffmann, M. K. : Lexikon der anorganischen Verbindungen. Unter Berücksicht. v. Additionsverbindgn. m. organ. Komponenten. Mit. Unterstützg. der deutschen chem. Gesellschaft hrsg. im. Auftrage des Vereins deutscher Chemiker. (In deutscher, engl., französ. u. italien. Sprache.) Lex 8°. Leipzig, J. A. Barth.

I. Bd. 2. u. 3. Lfg. Einleitung cet., Tl. I—V. Wasserstoff bis Bor, Nr. 1—55. Abteilung Schwefel bis Ammonium, Nr. 7—14b. (S. 81—208.) 1913. M. 8.

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STUDIES ON OXIDATION. II.—THE NATURE OF THE PROCESS IN WHICH HYDROGEN PEROXIDE IS UTILISED. IRON SALTS AS CATALYSTS.

BY C. S. MUMMERY, B.SC.

(Presented by Professor Armstrong.)

39. Although the primary agent in all cases of oxidation under natural conditions is atmospheric oxygen, if the thesis originally advanced by M. Traube, advocated in Part I. of these Studies [15]* be admitted, it follows that the oxygen is directly active only *as an acceptor of hydrogen*, being converted initially into hydrogen peroxide in the manner represented by the equation :—

$$\begin{array}{c}H\\ \dot{H}\end{array}+\begin{array}{c}HO.HX.H\\ HO.HX.H\end{array}+\begin{array}{c}O\\ \dot{O}\end{array}=\begin{array}{c}H_2O\\ H_2O\end{array}+\begin{array}{c}HX\\ HX\end{array}+\begin{array}{c}HO\\ H\dot{O}\end{array}$$

40. Consequently, in every process in which gaseous oxygen is used as the primary agent, hydrogen peroxide is operative at an early stage. But oxygen is not the only source of the peroxide. It is probable, that in the plant, it is also formed under the influence of sunlight, through the occurrence of change perhaps in the manner represented in outline by the equation :—

$$\underset{\text{Chlorophyll.}}{Ch}+\begin{array}{c}H.HX.OH\\ H.HX.OH\end{array}=\underset{\text{Reduced Chlorophyll.}}{ChH_2}+\begin{array}{c}HX\\ HX\end{array}+\begin{array}{c}HO\\ H\dot{O}\end{array}$$

41. However produced, under natural conditions, hydrogen peroxide is subject to change in two ways : either it is resolved into oxygen and water or it acts as an oxidising agent. In both cases apparently, the occurrence of the change is dependent on the presence of a *catalyst*, as hydrogen peroxide, like water and even together with water, is not an electrolyte and it is doubtful if it ever act as an oxidising agent by itself. Such catalysts, at present of unknown nature, are of common occurrence in living structures and play a dominant part in vital processes : it is therefore all important to determine both their character and the precise manner in which they act.

The natural catalysts which determine the resolution of hydrogen peroxide into oxygen and water are commonly termed *catalases*, whilst those which promote its activity as an oxidising agent are known as *peroxydases*—both are particularly inappropriate terms. It is customary to regard these catalysts as enzymes ; though not a few arguments may be advanced against such a view, it would be premature to discuss this question on the present occasion ; before it can be considered, if the complex phenomena attending oxidation under vital conditions are to be unravelled, it is obvious that the functions of the simplest catalysts which determine oxidation must be understood.

It is therefore essential that the action of iron and manganese, two recognised carriers of oxygen, should be thoroughly inquired into, as these are both at the disposal of plants and it is held that the former at least is an indispensable agent of vital activity. The action of iron salts is the subject of the present communication.

42. The oxygen transferring power of ferrous salts was first pointed out in 1857 by Schönbein,[16] who appears to have been led to the discovery by noticing that the addition of the red colouring matter of the blood to a dilute solution of potassium iodide and hydrogen peroxide was immediately followed by the liberation of iodine. He found not only that ferrous sulphate also produced the effect but that this salt at once determined the appearance of a blue colour in a mixture of hydrogen peroxide with a tincture of guiacum resin and the rapid disappearance of the blue colour from a solution containing indigo and hydrogen peroxide.

43. But the "*oxyphoric*" power of ferrous salts was not properly appreciated until attention was drawn to the use of hydrogen peroxide in conjunction with ferrous sulphate as a powerful oxidising agent by Fenton's notable discovery,[17] in 1894, of dihydroxymaleic acid, which he prepared by merely adding the peroxide to a solution of tartaric acid containing a ferrous salt.

The method has been successfully applied by Fenton and others in a great variety of cases.

Ruff has shown that ferric acetate may be used in place of ferrous sulphate but the action is very slow at first and apparently the ferric salt is reduced to the ferrous state at an early stage : there is no doubt, in fact, that Fenton's contention is correct that the ferrous salt is the really active agent.

The only explanation of its activity hitherto advanced by Fenton is that given in the following passage[18] :—

"The two non-hydroxylic hydrogen atoms in tartaric acid may be supposed to possess feebly acid functions owing to the neighbourhood of the CO_2H- and OH-groups and it is possible that an atom of divalent iron may replace these two hydrogen atoms, giving the compound $CO_2H.C(OH)\,Fe\,C(OH).CO_2H$. On the addition of the oxidising agent, the iron atom assumes the trivalent state and can therefore no longer be 'retained.' The result is an unsaturated acid and the iron enters into solution as a ferric salt, *e.g.* ferric tartrate."

Not only is this explanation unsatisfactory in the case of tartaric acid but it cannot well be applied to the sugars or to the liberation of iodine from potassium iodide.

44. On the other hand, it has been suggested [19] that the active oxidising agent is an intermediate compound formed from the peroxide and the ferrous salt (Brode) ; also that the iron salt is raised to a higher stage of oxidation, Fe_2O_5 or $Fe_2O_3.2H_2O_2$ (Manchot). Spring, in like manner, has ascribed the resolution of hydrogen peroxide, by ferrous sulphate, into oxygen and water, to the interaction primarily of the ferrous salt and the peroxide ; whilst Bredig and von Bernec, in discussing its action as an inorganic ferment, have suggested that the active catalyst is possibly a basic iron sulphate or a compound of ferric hydroxide with the peroxide.

Considering the amount of attention that has been paid to the subject by the Ostwald school and the very numerous measurements that have been made of the accelerating influence of iron salts, it is remarkable, as Manchot points out, that so little should have been done to explain their effect.

45. The only significant experiments on the subject on record are those made by Manchot and Wilhelms. On adding to a solution of ferrous sulphate half a molecular proportion or only a little more of the peroxide, they were able to detect the presence of ferrous salt at the end of the operation but the liquid became turbid before all the peroxide had been added. Even when the ferrous salt was gradually added to 0·5—1·4 molecular proportions of the peroxide, ferrous salt could always be detected at the end of the experiment. By operating at 0°, instead of at laboratory temperature, they were able to detect in the mixture both ferrous salt (by the ferricyanide test) and hydrogen peroxide (by the titanic acid test) : even when more than 1·5 molecular proportions of the peroxide was added to ferrous sulphate, by operating very quickly, it was possible to detect ferrous salt.

They also found that oxygen was evolved in quantities which varied according to the way in which the mixture was made, the temperature and the concentration of the solutions : the amount of peroxide decomposed on adding the ferrous sulphate to the peroxide varied between 1 and 1½ molecular proportions, more nearly the latter. Manchot and Wilhelms recognised that ferric salts can be used instead of ferrous salts in promoting oxidation but pointed out that the ferric act far less rapidly than the ferrous.

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* References 1—14 are in Part I.

46. *Interaction of ferrous sulphate and hydrogen peroxide.* —My own results, though in general agreement with these of Manchot and Wilhelms, are different in certain respects. When hydrogen peroxide is added gradually to a solution of ferrous sulphate, the ferrous salt is completely converted into ferric salt when exactly one-half of a molecular proportion of the peroxide has been added. As a mean of four experiments, 10 c.c. of decinormal ferrous sulphate requires 10·1 c.c. of twentieth normal hydrogen peroxide (solutions of equal permanganate value), the same proportion of peroxide being required when neutral solutions are used as when a large excess of sulphuric acid is present.

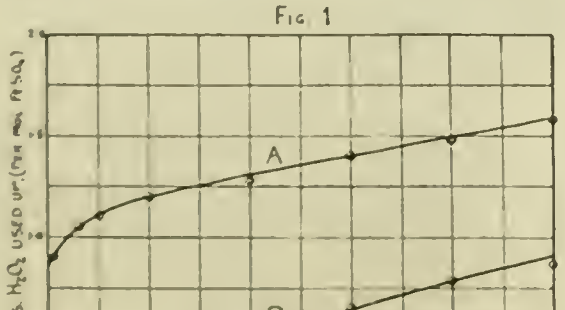
47. Ferrous salt and hydrogen peroxide could not both be recognised as existing together in a solution even at —5° C.; and when solutions of ferrous sulphate and hydrogen peroxide previously cooled below 0° were mixed in the ratio $H_2O_2/2 : FeSO_4$, no ferrous salt could be detected by the ferricyanide test even directly after mixing.

Presumably Manchot and Wilhelms lost sight of the known fact that ferricyanide is converted by hydrogen peroxide into ferrocyanide, which gives a blue colouration with ferric salts. On this account, in testing for ferrous salt by ferricyanide in presence of ferric salt and hydrogen peroxide, it is necessary to observe whether a blue colour be produced at once on adding the ferricyanide: if the blue colour appear only after several seconds, it is due to the action on the ferric salt of ferrocyanide produced from the ferricyanide by the action of the peroxide.

48. When, instead of adding the peroxide to the ferrous salt, a solution of ferrous sulphate is gradually added to one of hydrogen peroxide (10 c.c. M/20), the volume of decinormal ferrous sulphate which has to be added before ferrous salt remains in the mixture lies between about 6 and 8 c.c. (mean 7·2 c.c.)—corresponding to about 0·7 molecular proportions of peroxide per molecular proportion of ferrous salt. The actual amount required varies according to the rate at which the ferrous sulphate is added and also as the temperature varies. In this case, therefore, a certain amount of peroxide is destroyed beyond that required to convert the ferrous into ferric salt.

49. To determine the amount of hydrogen peroxide decomposed in presence of ferrous sulphate in definite intervals of time, several small flasks were each charged with 2 c.c. decinormal ferrous ammonium sulphate and 8 c.c. water; and 10 c.c. twentieth-normal hydrogen peroxide was then introduced into each flask (*i.e.*, 2½ molecules of peroxide per molecule of ferrous salt). To put a stop to the action, after definite intervals of time, sulphuric acid was added in excess and the undecomposed hydrogen peroxide was then titrated with permanganate. The results obtained are represented graphically in Fig. 1A.

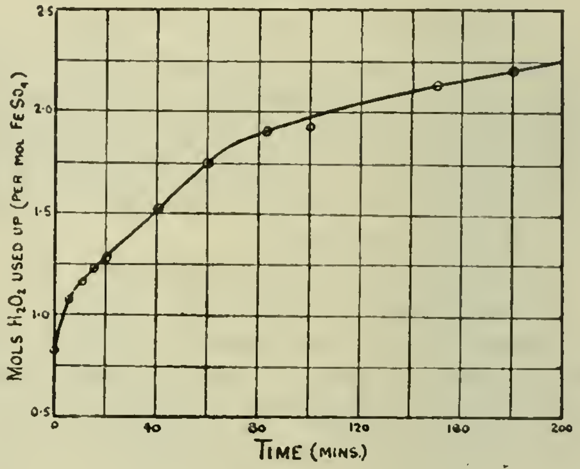
Fig 1



It will be seen that in presence of this excess of hydrogen peroxide, ferrous sulphate decomposes slightly more than three-quarters of a molecular proportion of peroxide practically instantaneously; the graph therefore starts from a point near to that representing three-quarters of a molecular proportion of hydrogen peroxide; after this point is reached, the peroxide is rapidly decomposed but the rate soon falls off and a very gradual and slow decomposition takes place, which continues until all the peroxide is destroyed.

50. The rate at which this final decomposition takes place decreases but very slowly as the concentration of the peroxide is decreased; in fact, it at first appeared to follow a linear course (Fig. 1A) but experiments carried out over a longer period showed that there was a falling off in rate towards the end of the interaction (Fig. 2). In any case, this "catalytic" decomposition of the peroxide by no means follows the unimolecular law; it would seem probable that the peroxide enters into combination with the iron salt and that the decomposition measured is that of this compound. If such be the case, only a very small amount of the compound is formed; hence the decrease in the amount of peroxide has very little effect on the rate of its decomposition, as there is sufficient peroxide present almost to the end of the interaction to form the maximum amount of the unstable product. That the rate does fall off at all is probably best explained by assuming that the interaction is reversible.

Fig. 2



51. On adding hydrogen peroxide to a solution of ferrous sulphate a bright orange coloured liquid is obtained from which, on standing and more quickly on heating, a bright yellow solid is deposited which is a basic ferric sulphate.

Weltzien ascribed the formula $2Fe_2O_3.SO_4.6H_2O$ to this yellow compound, and states that an acid ferric salt remains in solution; Dammer has suggested[20] the alternative formula—$(HO)_5Fe_2—SO_4—Fe_2(OH)_5+H_2O$.

My own analyses of the precipitate give approximately the ratio $SO_4 : Fe = 1 : 5$.

When the concentrated mother liquor from the precipitate is mixed with alcohol, after a time a pale yellow solid is precipitated which becomes red on standing. When a large proportion of alcohol is used initially and the precipitate is produced quickly, it has a deep crimson colour.

52. When excess of hydrogen peroxide (2½ molecular proportions) is added to a solution of ferrous sulphate containing a considerable amount of sulphuric acid, only one-half instead of rather more than three-quarters of a molecular proportion of peroxide is utilised.

Also when a mixture containing ferrous sulphate together with sulphuric and titanic acids is titrated with peroxide, a yellow colouration indicative of the presence of the free peroxide is apparent when just over one-half of a molecular proportion of hydrogen peroxide has been added (*e.g.*, 10·2 c.c. *N*/20 H_2O_2 per 10 c.c. *N*/10 $FeSO_4$). Hence the presence of a large excess of sulphuric acid does not hinder the oxidation of ferrous sulphate (by one-half a molecular proportion of peroxide) but prevents subsequent "catalytic" decomposition of the peroxide. The addition of sulphuric acid in the series of experiments referred to (§ 49), in order to stop the interaction, has its justification in this circumstance.

53. *Interaction of ferric sulphate and hydrogen peroxide.*—On carrying out a series of experiments similar to those described in § 49, using this salt and hydrogen peroxide in

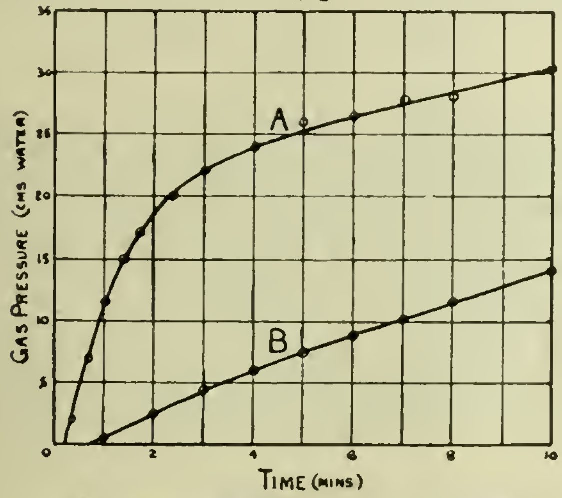
the proportion of 1 atom of ferric iron to 2½ molecules of peroxide, no sudden decomposition of about three-quarters of a molecular proportion of peroxide similar to that produced by ferrous salt was observed; consequently the graph representing the rate at which hydrogen peroxide is decomposed by ferric sulphate (Fig. 1B) starts from zero instead of (as in Fig. 1A) from a point representing about three-quarters of a molecular proportion of peroxide, the quantity decomposed instantaneously by ferrous sulphate.

In other respects the graph (Fig. 1B) representing the decomposition by ferric sulphate is practically identical with that representing the action of ferrous sulphate (Fig. 1A); the slightly lower rate in the latter case is due doubtless to the lower concentration of the peroxide—owing to the removal of about three-quarters of a molecular proportion at the beginning of the interaction.

54. *Evolution of oxygen from hydrogen peroxide under the influence of iron salts.*—When hydrogen peroxide and ferrous sulphate solutions, in the proportion of one-half of a molecule of the former to one molecule of ferrous salt, are mixed in a vessel such as is described in Part I. of these Studies (§ 5) but furnished with a delicate pressure gauge (the vessel being of thin glass and immersed in a water-bath to prevent temperature alterations during the experiment), practically no gas is evolved during the oxidation of the ferrous salt by the peroxide.

When excess (2½ molecular proportions) of hydrogen peroxide is added to ferrous sulphate, however, there is a sudden outburst of gas due to the instantaneous decomposition of the quarter of a molecular proportion of peroxide, which is followed by a slow gradual evolution (Fig.˙1A). A series of results are recorded in Fig. 3A. A similar slow evolution of gas takes place when hydrogen peroxide is mixed with ferric sulphate (Fig. 3B).

Fig. 3



A. Ferrous Sulphate B. Ferric Sulphate

55. *Evidence of the formation of a ferrous perhydrol.*—When hydrogen peroxide is added to ferrous sulphate in presence of Trillat's agent (tetramethyl-*p.p*-diaminodiphenylmethane) dissolved in citric acid (I. § 25), a brilliant blue colour is produced. The action does not take place, however, if the agent be added last; that is to say, the orange yellow liquid formed by the oxidation of ferrous sulphate by hydrogen peroxide does not give the blue oxidation product. Ferric salts and hydrogen peroxide also do not determine the appearance of the blue colour but give rise to a brown colour instead of a blue. As Fenton has shown, when hydrogen peroxide is added to a solution containing ferrous sulphate and tartaric acid, the tartaric acid is at once oxidised, the oxidation product—dihydroxymaleic acid—in presence of iron salt giving a fine violet colouration with excess of caustic alkali.

In his original paper, Fenton definitely states that ferric salts do not act as oxygen carriers; actually, however, as Ruff has shown, action takes place less rapidly at first than when ferrous salts are used, so that on oxidising tartaric acid by hydrogen peroxide and ferric sulphate the violet colour is apparent on adding caustic alkali only after a few minutes' interval, not immediately as is the case when ferrous sulphate is the catalyst.

Tartaric acid does not reduce ferric sulphate but when hydrogen peroxide is added to a solution of these two substances, after a few minutes, ferrous salt is to be found in the solution by testing with ferricyanide. It is formed, doubtless, from the ferric sulphate by the action of the dihydroxymaleic acid which is produced initially, this being a powerful reducing agent.

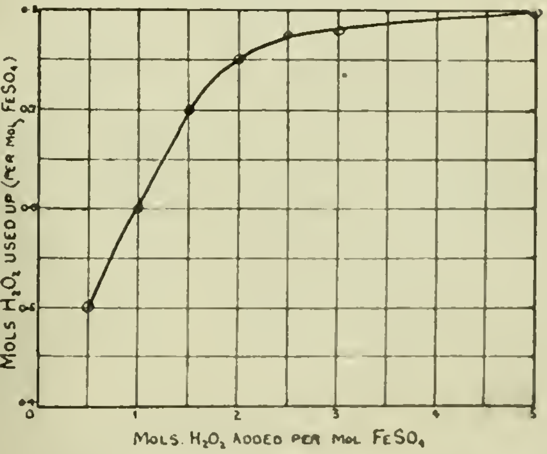
This behaviour of ferrous and ferric salts towards oxidisable substances, which is comparable with their action towards hydrogen peroxide alone (Fig. 1), is of importance in connexion with the arguments advanced in §61—64.

56. As neither ferric sulphate nor hydrogen peroxide nor a mixture of the two produces the blue colour when added to Trillat's agent, it is obvious that there is an intermediate stage in the oxidation of ferrous sulphate to ferric salt by hydrogen peroxide at which a ferrous compound is produced which is a more powerful oxidising agent than either the peroxide or the ferric salt alone or this salt in combination with peroxide.

This intermediate ferrous compound must be the origin of the sudden evolution of oxygen which involves the instantaneous decomposition of about one-quarter of a molecular proportion of hydrogen peroxide in addition to the amount which is required to produce it. In the absence either of hydrogen peroxide or of an oxidisable substance, the intermediate compound is at once spontaneously converted into a ferric salt, which, as has been seen, is only a comparatively weak oxygen carrier and catalyst; it therefore follows that the outburst of oxygen is due to the interaction of the ferrous intermediate compound and hydrogen peroxide.

57. It is important to note that the proportion of hydrogen peroxide decomposed in the interaction of hydrogen peroxide and the intermediate compound depends upon the amount of hydrogen peroxide present. In the experiments described in § 49, in which 2½ molecules of hydrogen peroxide were used per molecule of ferrous sulphate, the amount of peroxide decomposed at this stage was about one-quarter of a molecular proportion; but when other proportions of peroxide were taken, it was found that the amount of peroxide decomposed, in addition to the one-half of a molecular proportion required for the formation of the intermediate compound, was more or less than one-quarter of a molecular proportion according as more or less than two and a half molecular proportions of peroxide were used. The results of a series of experiments are represented by Graph No. 4. In these experiments, 5 c.c. of decinormal ferrous ammonium sulphate were quickly introduced into the flask containing the peroxide (total volume 50 c.c. in each case) and as soon as the solutions had been mixed an excess of sulphuric acid was added to stop further action; the amount of undecomposed peroxide was then estimated by means of decinormal permanganate.

Fig. 4

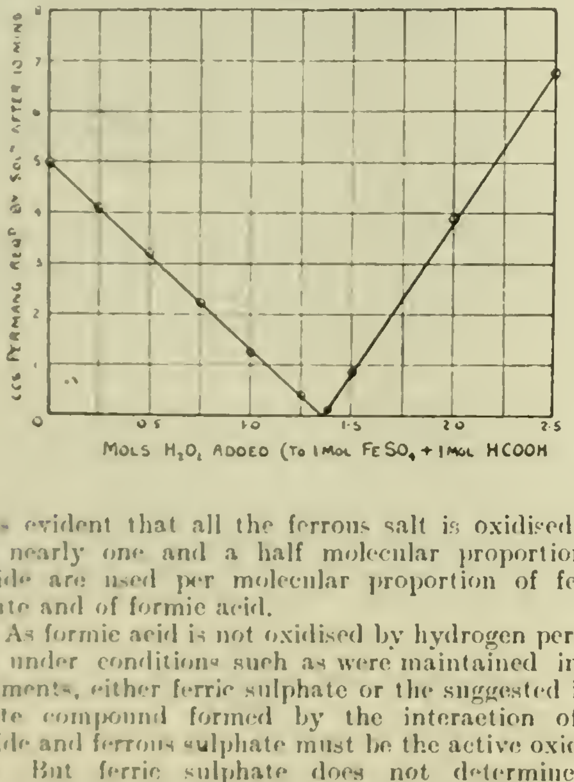


The results indicate that some reversible interaction takes place at this stage.

58. *Oxidation of formic acid in presence of iron salts.*—Fenton and Jones[21] have shown that formic acid is readily oxidised by hydrogen peroxide in presence of a ferrous salt. As the oxidation products are very simple substances, carbon dioxide and water, the interaction is one which can be easily followed.

On adding a decinormal solution of hydrogen peroxide to a mixture of 5 c.c. of decinormal solution of ferrous ammonium sulphate with 5 c.c. of a decinormal solution of formic acid, using potassium ferricyanide as an "outside" indicator, it was necessary to use between 1¼ and 1½ molecular proportions of peroxide to convert the whole of the ferrous salt into ferric. Similar results were obtained in cold and in hot solutions. In carrying out the experiments, a number of flasks were charged with 5 c.c. of ferrous sulphate, 5 c.c. of formic acid and varying proportions of hydrogen peroxide, the volume of liquid being kept constant; after an interval of 10 minutes the residual ferrous salt or hydrogen peroxide (it has been shown that both cannot exist together) was titrated with permanganate, this method of estimating either the peroxide or ferrous salt being possible on account of the slowness with which a cold solution of permanganate oxidises formic acid even in presence of an iron salt. The results are represented by Graph 5.

FIG 5



It is evident that all the ferrous salt is oxidised only when nearly one and a half molecular proportions of peroxide are used per molecular proportion of ferrous sulphate and of formic acid.

59. As formic acid is not oxidised by hydrogen peroxide alone under conditions such as were maintained in the experiments, either ferric sulphate or the suggested intermediate compound formed by the interaction of the peroxide and ferrous sulphate must be the active oxidising agent. But ferric sulphate does not determine the oxidation at a rate in any way comparable with that at which oxidation takes place under the influence of a ferrous salt; therefore it is not the ferric sulphate but the ferrous intermediate product which is the oxidising agent.

Also it is apparent, as the ferrous salt is demonstrably an oxygen carrier, that the oxygen of the peroxide is first transferred to the ferrous salt; if the ferrous salt were initially converted into ferric salt, no ferrous salt would remain in solution when just over one-half of a molecular proportion of hydrogen peroxide had been added, as ferric sulphate is not reduced by formic acid; actually, however, between 1¼ and 1½ molecular proportions of peroxide are necessary to remove the ferrous salt.

All the arguments therefore favour the conclusion that the oxidising agent (the suggested intermediate compound formed in the oxidation of ferrous sulphate to ferric sulphate) is a ferrous salt.

60. *Nature of the oxidising agent.*—In any attempt to explain the interactions considered in this communication in which ferrous sulphate and hydrogen peroxide take part, the following facts must be taken into account:—

(a) That the interaction of hydrogen peroxide and ferrous sulphate is one in which initially a ferrous compound is produced which is a powerful oxidising agent;

(b) That in the absence of other oxidisable material, this compound is at once transformed into ferric salt, no oxygen being evolved in this change;

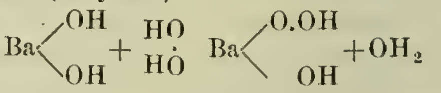
(c) That the interaction of the compound contemplated in (a) and hydrogen peroxide gives rise to an unstable substance which at once undergoes decomposition, oxygen being evolved and the ferrous converted into a ferric salt;

(d) That apparently this last interaction is reversible; (e) that hydrogen peroxide is also, though slowly, decomposed by a ferric salt and that a mixture of a ferric salt with hydrogen peroxide acts as a feeble oxidising system in cases in which the ferric salt itself proves to be inactive; presumably therefore a ferric compound analogous to that contemplated under (a) can be formed but is a far less active oxidising agent than the corresponding ferrous compound; this ferric compound in turn may give rise to an evolution of oxygen.

It is suggested that the several interactions considered are those indicated in the following scheme:—

61. In view of the marked tendency of sulphuric acid to behave as a monobasic acid and of the retention of a molecule of "water" by the isomorphous sulphates of the ferrous sulphate class, these salts may be regarded as *hemisulphate hemihydrols* of the form $R''{<}^{SO_4H}_{OH}$

The normal mode of action of hydrogen peroxide is that involved in the formation of barium hemiperhydrol from barium hydrate (dihydrol)—

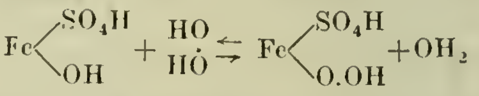


$$Ba{<}^{OH}_{OH} + \begin{matrix}HO\\ H\dot{O}\end{matrix} \; Ba{<}^{O.OH}_{OH} + OH_2$$

Such an interaction takes place the more readily apparently the more "basic" the compound.

The behaviour of the ferrous sulphate—hydrogen peroxide system is not that of a persulphate; consequently it cannot well be other than a *perhydrol.*

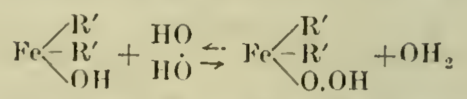
Such a perhydrol may be represented as formed in the following manner:—



$$Fe{<}^{SO_4H}_{OH} + \begin{matrix}HO\\ H\dot{O}\end{matrix} \rightleftarrows Fe{<}^{SO_4H}_{O.OH} + OH_2$$

Fenton's agent, from this point of view, is comparable with Caro's persulphuric acid, $HSO_3.O.OH$. Both compounds owe their activity as oxidising agents to the fact that they are perhydrols and at the same time electrolytes; in other words, the activation of hydrogen peroxide, whether effected through the agency of sulphuric acid or of ferrous sulphate, is the consequence of its conversion into an electrolyte; *and it is on this account that ferrous sulphate is effective as a catalyst in promoting oxidation.*

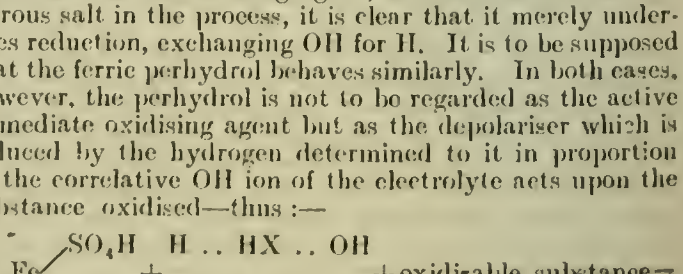
62. *Ferric salts as catalysts.*—The fact that ferric salts also promote oxidation may be accounted for in the same way—as the result of the formation of a ferric perhydrol, *e.g.*:—



$$Fe\begin{matrix}\diagup R'\\ - R'\\ \diagdown OH\end{matrix} + \begin{matrix}HO\\ H\dot{O}\end{matrix} \rightleftarrows Fe\begin{matrix}\diagup R'\\ - R'\\ \diagdown O.OH\end{matrix} + OH_2$$

The inferior value of ferric salts may be ascribed to the fact that, being less basic than ferrous salts, they give rise to a far smaller proportion of the perhydrol.

63. *Oxidation in presence of iron salts.*—When Fenton's agent acts as an oxidising agent, as it is reconverted into ferrous salt in the process, it is clear that it merely undergoes reduction, exchanging OH for H. It is to be supposed that the ferric perhydrol behaves similarly. In both cases, however, the perhydrol is not to be regarded as the active immediate oxidising agent but as the depolariser which is reduced by the hydrogen determined to it in proportion as the correlative OH ion of the electrolyte acts upon the substance oxidised—thus:—

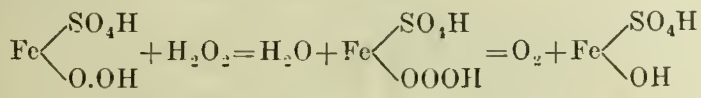


$$Fe{<}^{SO_4H}_{O.OH} + \begin{matrix}H\,..\,HX\,..\,OH\\ H\,..\,HX\,..\,OH\end{matrix} + \text{oxidisable substance} =$$

$$Fe{<}^{SO_4H}_{OH} + \begin{matrix}H_2O\\ 2HX\end{matrix} + \begin{matrix}OH\\ OH\end{matrix}{>}\text{oxidisable substance.}$$

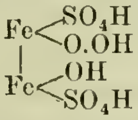
64. *Decomposition of hydrogen peroxide by iron salts.*—In the absence of an oxidisable substance, Fenton's agent

and hydrogen peroxide interact and give rise to oxygen and a ferric salt; it is more than probable that the oxygen is the product of the decomposition of a higher oxide less stable than either agent; this may be either a higher ferrous perhydrol or a higher oxide of hydrogen. In other words, it is conceivable that whilst in the earlier stage the peroxide is the oxidising agent, in the later it is itself oxidised. As the ferrous perhydrol is undoubtedly an electrolyte in solution, it will unquestionably be a far better oxidising agent than is the peroxide; on the other hand, in view of the fact that perbenzoic acid is a weaker acid than benzoic and persulphuric than sulphuric, the ferrous perhydrol should be even more oxidisable than ferrous hydrol; so, if the latter be oxidised by hydrogen peroxide, it would seem probable that the perhydrol would be still more easily attacked. On all grounds, therefore, it appears to be more logical to assume that the unstable compound from which the oxygen is eliminated is derived from the salt rather than from hydrogen peroxide; but it is conceivable that the action may take place to some extent in both directions though mainly in that represented by the equation :—



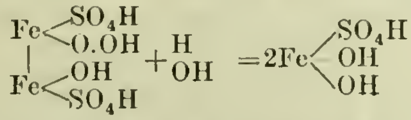
$$\mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{O.OH}\end{matrix}\right. + \mathrm{H_2O_2} = \mathrm{H_2O} + \mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{OOOH}\end{matrix}\right. = \mathrm{O_2} + \mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{OH}\end{matrix}\right.$$

65. *Formation of ferric salts from Fenton's agent.*—Although a single molecular proportion of hydrogen peroxide suffices to convert two molecular proportions of ferrous salt into ferric salt, Fenton's agent is formed by the interaction of a molecule of each of its two components; apparently therefore the formation of ferric salt involves the interaction of Fenton's agent and unchanged ferrous salt. In view of the tervalent nature of iron and the colour and other properties of the ferrous salts, it is not improbable that these contain at least two atoms of metal in the molecule; if this point of view be adopted, Fenton's agent may be represented by the formula :—



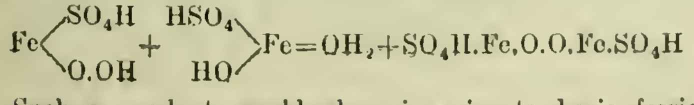
$$\begin{matrix}\mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{O.OH}\end{matrix}\right.\\ |\\ \mathrm{Fe}\left\langle\begin{matrix}\mathrm{OH}\\ \mathrm{SO_4H}\end{matrix}\right.\end{matrix}$$

It appears probable that such a compound would be easily hydrolysed and that it would give rise almost directly to two molecules of "basic ferric sulphate" :—



$$\begin{matrix}\mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{O.OH}\end{matrix}\right.\\ |\\ \mathrm{Fe}\left\langle\begin{matrix}\mathrm{OH}\\ \mathrm{SO_4H}\end{matrix}\right.\end{matrix} + \begin{matrix}\mathrm{H}\\ \mathrm{OH}\end{matrix} = 2\mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{OH}\\ \mathrm{OH}\end{matrix}\right.$$

66. If, however, the change be regarded as involving the interaction of the sulphate perhydrol and the hydrol, it may be represented in the following manner ;—



$$\mathrm{Fe}\left\langle\begin{matrix}\mathrm{SO_4H}\\ \mathrm{O.OH}\end{matrix}\right. + \left.\begin{matrix}\mathrm{HSO_4}\\ \mathrm{HO}\end{matrix}\right\rangle\mathrm{Fe} = \mathrm{OH_2} + \mathrm{SO_4H.Fe.O.O.Fe.SO_4H}$$

Such a product would also give rise to basic ferric sulphate on hydrolysis.

SUMMARY.

The facts brought forward in this communication appear to justify the conclusion that ferrous salts promote oxidation by means of hydrogen peroxide in virtue of the formation of a "perhydrol" of the type $\mathrm{Fe}\left\langle\begin{matrix}\mathrm{X}\\ \mathrm{O.OH}\end{matrix}\right.$, the which salt is formed reversibly, being alternately produced from and reconverted into ferrous salt when an oxidisable substance is present together with hydrogen peroxide.

The catalytic decomposition of hydrogen dioxide by iron salts may be ascribed to the formation of higher perhydrols which are to be regarded as derivatives of hydrogen trioxide.

The advantage derived from the conversion of hydrogen dioxide into the ferrous perhydrol arises doubtless from the fact that this latter is an electrolyte. From this point of view the office of the ferrous salt is that of a catalyst as defined by E. F. and H. E. Armstrong in a recent communication to the Royal Society[22], in which they discuss the phenomena of catalysis generally: "the catalyst may well be defined as the agent which brings about the inclusion of the interacting substances in the (electrolytic circuit within which the change takes place so soon as the circuit is established, the electrolyte being the actual agent by which the change is affected."

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STUDIES ON OXIDATION. III.—THE OXIDATIVE AND CATALYTIC ACTIVITY OF MANGANESE COMPOUNDS.

BY R. T. COLGATE, B.SC.

(Presented by Professor Armstrong.)

67. In the discussion of the action of oxidising agents in Part I of these Studies (§ 30—34) attention is directed to the production of oxygen when either hydrogen or carbonic oxide is oxidised by permanganate (Victor Meyer) and to the separation of oxygen as a result of the decomposition of permanganate in presence of manganese dioxide : it is suggested that in both cases the oxygen may have been derived from hydrogen peroxide and equations are given (§ 34) showing how this substance might arise. In opposition to Victor Meyer's objection to this explanation, the statement was made (§ 32) "That the view taken involves the conclusion that hydrogen peroxide would be produced whatever substance were oxidised." It is necessary to acknowledge here that an incautious use was made of "would" and to substitute for it the conditional "might"; indeed, it will be obvious that the subject was dealt with only in a preliminary way, especially as it is pointed out in the summary, at the close of the communication, that much remains to be learnt before the behaviour of so familiar an oxidising agent as potassic permanganate and of oxidising agents generally is understood.

The present communication is an attempt to elucidate the behaviour of permanganate as an oxidising agent and to explain the catalytic effects sometimes produced by manganese compounds.

68. Slater Price, in the opening chapter of his monograph on Per-acids[24] and their salts, endeavours to draw a distinction between true and false peroxides and peracids and defines the latter as either formed by the action of hydrogen peroxide on the lower acids or as giving rise to this oxide under the influence of dilute sulphuric acid; he therefore excludes permanganic acid. But the two well-known persulphuric acids are demonstrably related to hydrogen peroxide in the manner shown by the following formulæ :—

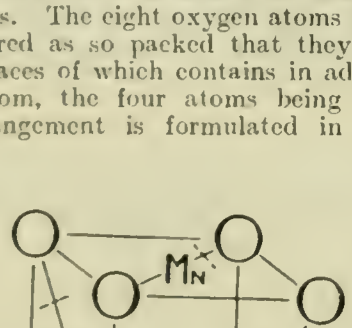
$$HSO_3.O.OH \qquad HO.OH \qquad HSO_3.O.O.SO_3H$$

Moreover, the behaviour both of manganic and of permanganic acid as oxidising agents cannot well be explained except on the assumption that they are more or less analogous in structure to the persulphuric acids and contain the radicle O.OH—in other words that they are true derivatives of hydrogen peroxide. That they are neither formed directly from nor give rise to a recognisable amount of hydrogen peroxide is not surprising, in view of their instability in presence of this compound. (Cp. § 88.)

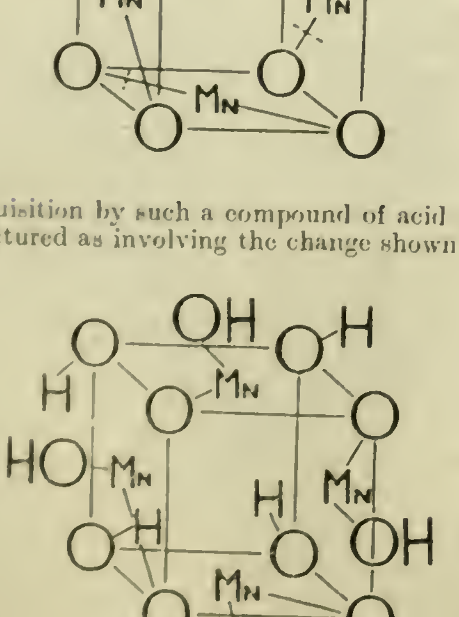
69. *Crystalline structure of manganese compounds.*—On account of the intensity of their colour, it appears not improbable that their structure is somewhat complex: hence, in view of the success which has attended recent attempts to correlate structure with crystalline form, it is desirable to consider the crystallographic evidence bearing on the structure of the manganese compounds.

If the valency volume of manganese, like that of iron in the ferrous salts, approximate to that of oxygen, according to the Barlow-Pope hypothesis, the space occupied by a manganese atom should be very nearly that occupied by an oxygen atom. If this view be taken, it is to be expected that the crystalline structure of the dioxide will be that of a closely packed arrangement of equal spheres: actually Pyrolusite belongs to the tetragonal system and exhibits the high degree of symmetry which would be conditioned by such an arrangement.

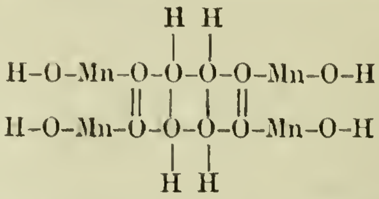
70. It is more than probable that manganese dioxide is not simple but consists of complexes of the type $(MnO_2)_x$ in which the value of x is at least 4 and may well be some multiple of this. The eight oxygen atoms in the complex may be pictured as so packed that they form a cube, each of four faces of which contains in addition a single manganese atom, the four atoms being in one plane. Such an arrangement is formulated in the following figure.



The acquisition by such a compound of acid properties may be pictured as involving the change shown below,

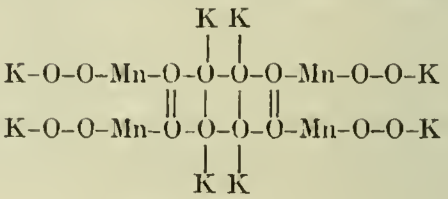


followed by the opening out of the complex thus :



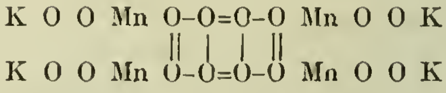
$$\begin{array}{c} \mathrm{H\ \ H} \\ |\ \ \ | \\ \mathrm{H{-}O{-}Mn{-}O{-}O{-}O{-}O{-}Mn{-}O{-}H} \\ \|\ \ \ |\ \ \ |\ \ \ \| \\ \mathrm{H{-}O{-}Mn{-}O{-}O{-}O{-}O{-}Mn{-}O{-}H} \\ |\ \ \ | \\ \mathrm{H\ \ H} \end{array}$$

71. The passage from such a compound to potassium manganate or permanganate is accounted for without difficulty on the assumption that these compounds may be represented by formulæ such as the following :—



$$\begin{array}{c} \mathrm{K\ K} \\ |\ \ | \\ \mathrm{K{-}O{-}O{-}Mn{-}O{-}O{-}O{-}O{-}Mn{-}O{-}O{-}K} \\ \|\ \ \ |\ \ \ |\ \ \ \| \\ \mathrm{K{-}O{-}O{-}Mn{-}O{-}O{-}O{-}O{-}Mn{-}O{-}O{-}K} \\ |\ \ | \\ \mathrm{K\ K} \end{array}$$

Potassium manganate



$$\begin{array}{c} \mathrm{K\ \ O\ \ O\ \ Mn\ \ O{-}O{=}O{-}O\ \ Mn\ \ O\ \ O\ \ K} \\ \|\ \ \ |\ \ \ |\ \ \ \| \\ \mathrm{K\ \ O\ \ O\ \ Mn\ \ O{-}O{=}O{-}O\ \ Mn\ \ O\ \ O\ \ K} \end{array}$$

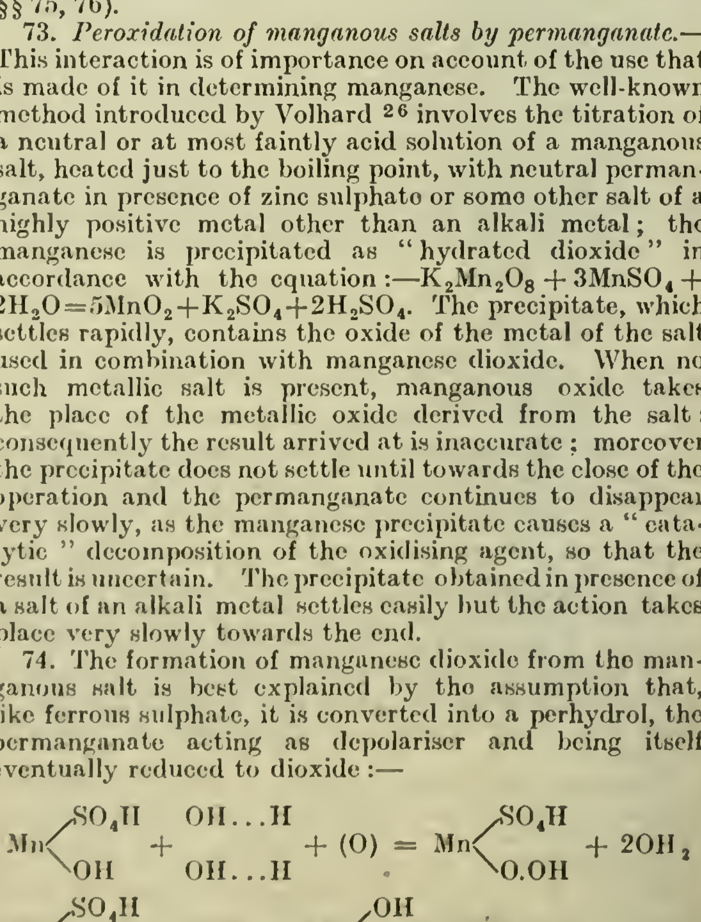
Potassium permanganate

72. *Peroxidation of manganous salts by hydrogen peroxide.*—Stress is laid in the previous communication[25] on what appears to be the essentially characteristic property of hydrogen peroxide, viz., that it tends to displace hydrogen in the OH group of hydroxides generally and give rise to perhydrols; it is there argued that ferrous sulphate is converted by its action into the perhydrol $HO.O.Fe.SO_4H$, which is a powerful oxidising agent (§§ 61, 62).

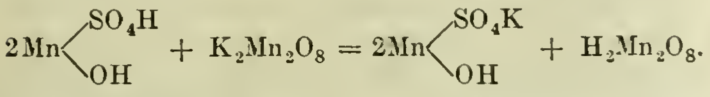
Manganous sulphate in no way corresponds to ferrous sulphate in this latter respect and has but little catalytic effect when used in conjunction with hydrogen peroxide. Apparently, the presence of an acid radicle in conjunction with the manganese has an inhibitive effect, the metal being but slightly receptive of oxygen unless this be presented together with a positive or metallic radicle or in such way as to favour the production of the dioxide (cp. §§ 75, 76).

73. *Peroxidation of manganous salts by permanganate.*—This interaction is of importance on account of the use that is made of it in determining manganese. The well-known method introduced by Volhard[26] involves the titration of a neutral or at most faintly acid solution of a manganous salt, heated just to the boiling point, with neutral permanganate in presence of zinc sulphate or some other salt of a highly positive metal other than an alkali metal; the manganese is precipitated as "hydrated dioxide" in accordance with the equation :—$K_2Mn_2O_8 + 3MnSO_4 + 2H_2O = 5MnO_2 + K_2SO_4 + 2H_2SO_4$. The precipitate, which settles rapidly, contains the oxide of the metal of the salt used in combination with manganese dioxide. When no such metallic salt is present, manganous oxide takes the place of the metallic oxide derived from the salt: consequently the result arrived at is inaccurate; moreover the precipitate does not settle until towards the close of the operation and the permanganate continues to disappear very slowly, as the manganese precipitate causes a "catalytic" decomposition of the oxidising agent, so that the result is uncertain. The precipitate obtained in presence of a salt of an alkali metal settles easily but the action takes place very slowly towards the end.

74. The formation of manganese dioxide from the manganous salt is best explained by the assumption that, like ferrous sulphate, it is converted into a perhydrol, the permanganate acting as depolariser and being itself eventually reduced to dioxide :—



75. Apart from the fact that permanganate is a more powerful oxidising agent than hydrogen peroxide, the change is probably promoted by the partial interaction of the manganous salt and the permanganate, a salt being thus produced which is more oxidisable than the original salt:



$$2Mn\genfrac{}{}{0pt}{}{\diagup SO_4H}{\diagdown OH} + K_2Mn_2O_8 = 2Mn\genfrac{}{}{0pt}{}{\diagup SO_4K}{\diagdown OH} + H_2Mn_2O_8.$$

76. On the other hand, when acid is added to the mixture, interaction takes place more and more slowly as the amount is increased and ultimately the precipitation of the dioxide is prevented; the higher the concentration, the greater is the amount of acid required to inhibit the formation of dioxide. Evidently, under such conditions, the hydrolysis of the perhydrol is prevented; but it is not to be supposed that it is not produced, as the oxidation of oxalic acid and of hydrogen peroxide is promoted by the presence of manganous salt. Presumably oxidation is thus effected by the manganese perhydrol as well as by the permanganate; in fact, to explain the accelerative effect of the salt, it is necessary to assume that the manganous persalt is the more powerful agent.

The effect of acid is well illustrated by the following results obtained on titrating oxalic acid with permanganate in presence of varying proportions of sulphuric acid.

The figures in Column I. of the table represent the quantities of the permanganate required to produce a precipitate of the dioxide in presence of increasing proportions of sulphuric acid.

20 c.c. (5 molecular proportions) oxalic acid solution=19·9 c.c. (1 molecular proportion) $N/10$ permanganate solution.

Oxalic acid. 20 c.c.		I.	II.
	Sulphuric acid. Molecular Proportion.	$KMnO_4$ required to produce precipitate of MnO_2.	$KMnO_4$ required to give permanent colour.
	3·0	19·7	31·6
	3·2	19·75	32·4
	3·4	19·80	32·0
	3·8	19·85	32·1
	4·2	19·85	32·2
	6·0	19·9	32·2
	8·0	19·9	32·1

In each case the precipitate was formed just before all the oxalic acid was oxidized. After this point it was possible, though only approximately, to oxidise the manganous salt produced during the first stage, a second end-point being thus obtained; the values of this latter are shown in Column II.

The following results were obtained on using a still larger proportion of acid:—

Sulphuric acid. Molecular proportion.	
25	Very faint turbidity on adding the last drop of permanganate required to oxidise the oxalic acid; 1 c.c. additional permanganate reduced in 1 minute.
27	First end-point sharp; 1 c.c. additional permanganate reduced in 2 min.
30	First end-point sharp; 1 c.c. additional permanganate reduced in 4 min.

The results show that the final end-point was arrived at the more slowly the larger the proportion of acid present.

77. *Evolution of oxygen in presence of a manganous salt.*—In the previous communication (§ 64) it is argued that the evolution of oxygen which takes place suddenly when ferrous sulphate is mixed with more than half a molecular proportion of hydrogen peroxide is due to the formation of a per-peroxy-salt, which either loses oxygen directly or is hydrolysed and gives rise to a higher hydrogen peroxide, this latter being at once decomposed. No such action takes place between manganous sulphate and hydrogen peroxide but if a hot solution of the salt containing sufficient excess of acid to prevent any precipitation of manganese peroxide be slowly mixed with permanganate, not only does the colour disappear but oxygen is also evolved. It is to be supposed that the sulphate, in this case, is converted into a perhydrol such perhaps as is represented by the formula $Mn\genfrac{}{}{0pt}{}{<SO_4H}{<OO.OH}$, which then undergoes decomposition in one or other of the ways suggested.

78. *Peroxidation of manganese dioxide by permanganate.*—In the first of these communications, reference is made (§ 34) to experiments carried out by Morse, Hopkins and Walker on the decomposition which permanganate undergoes in presence of manganese dioxide whereby it is slowly converted into the dioxide, oxygen being evolved. The equation representing the change is usually written as follows:—

$$K_2Mn_2O_8+xMnO_2=2K_2O+(x+2)MnO_2+3O_2/_2$$

but, in point of fact, the liquid remains neutral, the whole of the alkali being taken out of solution with the "dioxide."

79. The explanation of the "catalytic" decomposition of permanganate by manganese dioxide offered by Morse is to the effect that the latter perhaps has the power of polymerising and to satisfy this tendency takes molecules of the dioxide from the permanganate, thus liberating oxygen (Olsen)[27].

80. Though the decomposition occurs in neutral solutions, it is only in acid solutions that it is effected at all rapidly; strange to say, it takes place about three times as rapidly in presence of nitric as in that of sulphuric acid (Morse and Byers)[28]. In this connexion, it is noteworthy that the "dioxide" precipitated from a solution containing sulphuric acid retains part of this acid with some persistence, whilst that precipitated from a solution containing nitric acid does not retain a trace of the acid (Olsen and White)[29]. It may be therefore that the greater decomposition in presence of nitric than of sulphuric acid is in part at least to be connected with the superior stability of manganous sulphate.

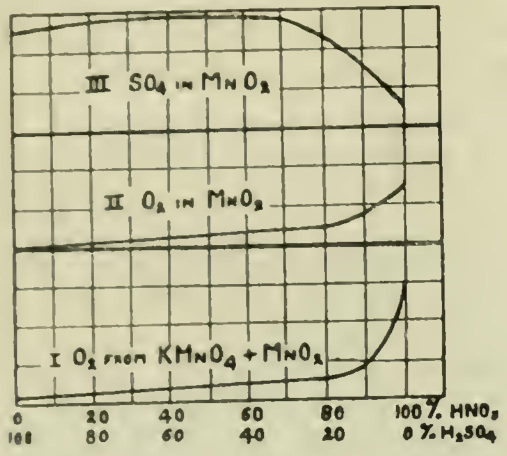
81. According to Volhard, a well defined "pure" hydrated manganese dioxide may be obtained by precipitating a boiling hot solution of manganous sulphate with permanganate in presence of a large excess of nitric acid: if a small proportion of acid be used, the precipitate is less dense and contains more potassium; the precipitate obtained in neutral solutions contains manganous oxide.

According to Morse, Hopkins and Walker, the precipitate obtained in presence of a moderate amount of nitric acid contains manganese and oxygen in the ratio 1 : 2 so long as permanganate is present in excess; but if the precipitate be kept in the solution or in a wet state, it loses oxygen: this, however, may be restored by digesting the precipitate with permanganate; the lowest value they found corresponds to the formula: $MnO : 40MnO_2$.

Later experiments by Olsen and White[29] show that the precipitate may contain an excess of oxygen above that required by the formula MnO_2(36·78 per cent.). A solution was made containing 0·80 gramme of potassic permanganate and sufficient acid to neutralise the potassium and leave 1·5 molecular proportions of acid free per molecular proportion of permanganic acid; one-fourth of the permanganate was reduced to dioxide by standard oxalic acid and the volume made up to 60 c.c.; the precipitate was allowed to remain undisturbed in contact with the liquid over night; in the morning it was filtered off on asbestos and washed free from permanganate. The highest amount of oxygen (38·91 per cent.) was found in a precipitate made in presence of nitric acid, the lowest (36·4 per cent.) in one obtained in presence of sulphuric acid; when both acids were present, the values ranged between these extremes. The nature of the results obtained by Olsen and White is represented by the graphs in the figure below. That the extra oxygen is held very loosely is shown by the fact that when the precipitate is shaken with the permanganate and then filtered off, the amount of oxygen present was practically that required by the formula MnO_2.

82. The explanation of these facts suggested by Olsen and White is that manganese dioxide, acting as a base, combines either with sulphuric or permanganic acid and that in the latter case an unstable salt is formed

which readily decomposes into oxygen and a polymerised manganese peroxide which is very much less active than the original compound.



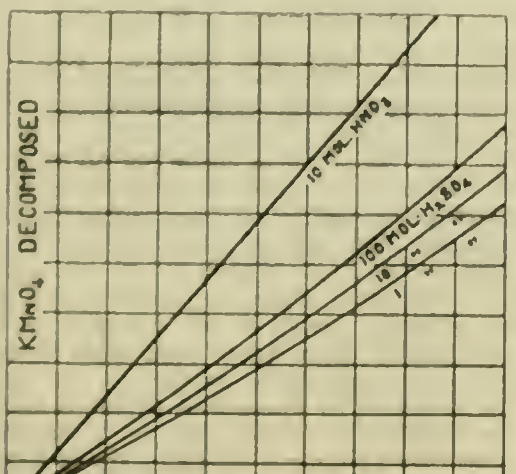
On this assumption, it is difficult to understand the reducing effect of permanganate on the precipitate and it appears far more probable that the "dioxide" hydrate is to some extent peroxidised. This interpretation appears, in fact, to afford a rational explanation of the "catalytic" decomposition of permanganate in presence of the dioxide.

It may be assumed that one or more of the MnO_2 radicles contained in the peroxide complex is present as $\mathrm{Mn}\Big\langle{\mathrm{OH}\atop\mathrm{OOH}}$ (cp. Fig. § 70) and that the permanganate acts upon this in the manner already shown to be probable in the case of ferrous and manganous salts, forming the salt of a higher perhydrol which readily loses oxygen :—

$$\mathrm{Mn}\Big\langle{\mathrm{OH}\atop\mathrm{OOH}} + {\mathrm{.OH}\atop\mathrm{.OH}} = \mathrm{H_2O}+\mathrm{Mn}\Big\langle{\mathrm{OH}\atop\mathrm{OOOH}} = \mathrm{Mn}\Big\langle{\mathrm{OH}\atop\mathrm{OH}}+\mathrm{O_2}.$$

83. The rate at which oxygen is evolved is affected by the amount of acid present, as is illustrated by the following results obtained by constantly agitating, during 24 hours, 50 c.c. of a solution containing 0·6545 gramme of permanganate together with varying amounts of sulphuric acid. The oxygen evolved was measured directly:

$KMnO_4$.	H_2SO_4 Molecular proportions.	cc. O_2 (N.T.P.).
0·6545 (1 molecular proportion)	24	1·02
	34	2·08
	44	7·9
	57	9·5



The fact that the decomposition is promoted by increasing the amount of acid may be ascribed to the effect acid has in increasing the amount of peroxidisable material; this postulate is satisfied by supposing that a group is formed in the "peroxide" complex corresponding to the perhydrol above formulated and that the amount of this "salt group" $\mathrm{Mn}\Big\langle{\mathrm{SO_4H}\atop\mathrm{O.OH}}$ is increased as the amount of acid is increased.

The results of a further series of experiments carried out at about 97° are represented by the graphs shown. The experiments were conducted as follows. Manganese dioxide (0·1 gramme) and a known quantity of acid were weighed into a 200 c.c. Jena conical flask; water was then added to make up a volume of 90 c.c. This mixture was heated in a water bath to 97° C. and was mechanically stirred. 10 c.c. of a solution of potassic permanganate containing 12·685 grammes per litre was then added and 5 c.c. samples taken out every 10 minutes. The samples were delivered into a Soxhlet tube fitted to a pump flask containing a known volume of $N/100$ oxalic acid solution and an excess of sulphuric acid. Ultimately the unoxidised oxalic acid was titrated with $N/200$ permanganate.

Experiments were carried out in presence of 1, 10, 100 molecules of sulphuric acid and of 10 molecules of nitric acid per molecule of permanganate. The graphs above show that decomposition takes place far more rapidly in presence of nitric than of sulphuric acid but that increasing quantities of sulphuric acid do not increase the rate to any great extent.

84. *Reduction of permanganate by hydrogen peroxide.*—Throughout this communication it is argued that permanganate acts always as the oxidising agent and that it is far superior in oxidising power to hydrogen peroxide. It is only rational to extend this view to the well-known interaction of permanganate and hydrogen peroxide in presence of acid in which ultimately both substances are reduced and oxygen evolved. As a matter of fact, this explanation was put forward by Berthelot[30] in 1880 but called in question by Baeyer and Villiger[31] in 1900. The question at issue is a very narrow one. Berthelot states that by operating at —12° it is possible to mix dilute solutions of potassic permanganate and of hydrogen peroxide in sulphuric acid and to obtain a colourless liquid without oxygen being given off, decomposition setting in only when the temperature of the mixture is raised to that of the air. Baeyer and Villiger, however, maintain that this is merely because the liquid remains supersaturated with oxygen and that if, in making the mixture, agitation be resorted to oxygen is steadily evolved from the beginning.

As the colour is not changed on mixing the solutions and merely disappears eventually, there can be no doubt that no alteration (other than reduction) takes place in the permanganate; it therefore follows, apparently, that the peroxide is the oxidised substance. To explain the formation of oxygen, it is only necessary to assume that hydrogen trioxide is so unstable that it is resolved immediately into oxygen and water:—

$$\mathrm{H_2O.O.OH = O_2 + H_2O.}$$

The same interpretation may be given of the interaction in alkaline solutions; but under these conditions manganate is formed:—

$$\mathrm{2KMnO_4 + 2KOH + HOOH = 2K_2MnO_4 + H_2O + HOOOH = 2K_2MnO_4 + O_2 + 2H_2O.}$$

85. If a dilute solution of hydrogen peroxide be slowly added to a solution of permanganate containing an excess of alkali (KOH), the solution becomes dark blue in colour and finally green. By using solutions of suitable strength, it is possible to see when the permanganate is completely changed to manganate—after this point is reached, further addition of hydrogen peroxide diminishes the intensity of the green manganate colour and manganese dioxide is precipitated. It is possible to see when the manganate disappears completely.

The following experiments were carried out to ascertain the proportions in which the substances interacted.

2 c.c. of a decinormal solution of permanganate to which alkali had been added were titrated with a dilute solution of hydrogen peroxide; the volume of hydrogen peroxide used was noted when the permanganate colour had given

way to that of manganate ; it was again noted when the manganate colour had disappeared.

The end-points were not very sharp but sufficiently so for the purpose.

	1.	2.	Mean.
1st end point—Manganate	13·0	13·5	13·25
2nd end point—MnO_2	41·5	42·0	41·75

The permanganate used destroyed in acid solution 66·6 c.c. of the peroxide solution or 5 molecular proportions ; hence, in converting it into manganate, the amount of peroxide used was 0·99 molecular proportions.

86. In the second stage, the proportion required was 3·13. A few measurements of the volume of gas evolved in presence of alkali were also made, using the apparatus described in a previous communication (I, § 5, fig. 5) except that a short burette was substituted for the dropping funnel, so that a known amount of solution might be let into a 50 c.c. flask.

Very nearly the theoretical amount of oxygen was obtained, provided the flask were well shaken ; thus :—

5 c.c. *N*/10 $KMnO_4$ + 3·0 c.c. H_2O_2 gave (1) 5·49 c.c. at N.T.P.
(2) 5·49 ,,
+ 1·8 c.c. H_2O_2 gave (1) 3·32 c.c. ,,
(2) 3·30 c.c. ,,
+ ·6 c.c. 1·1 c.c.
5 c.c. *N*/10 $KMnO_4$ should give in acid solution 5·55 c.c.

87. *Oxidation of hydrogen by permanganate.*—In Part I. of these studies (§ § 30—34), attention was directed to experiments carried out in Victor Meyer's laboratory showing that hydrogen and carbon monoxide are oxidisable by permanganate and that when an acid medium is used an amount of oxygen is given off equivalent to half the volume of the absorbed gas. The evolution of oxygen was attributed by Morse and Reese[32] to the reducing action of the manganese peroxide produced by the deoxidation of the permanganate, an explanation which was rejected by Meyer on the ground that oxygen was more rapidly evolved during the progress of the oxidation than subsequently when the permanganate solution was agitated in contact with the precipitated peroxide alone. While agreeing that the evolution of oxygen is more rapid during the oxidation period, Morse and Reese were of opinion that "the great initial evolution observed when hydrogen and carbon monoxide are absorbed is in some way dependent on the *gaseous* character of these reducing agents." No further explanation of this suggestion was offered but it is noteworthy that the American chemists were inclined to attribute the greater initial evolution of oxygen "to the greater initial simplicity of the precipitated peroxide molecules." In connexion with the discussion, however, Morse and his co-workers carried out a most valuable experimental inquiry into the general behaviour of permanganate solutions. Victor Meyer, using a 5 per cent. solution of permanganate acidified with sulphuric acid, arrived at the conclusion that only a limited amount of oxygen was evolved on agitating the acid mixture with air. This result has not been verified by Morse, who concludes that the action only comes to an end when the whole of the permanganate is reduced. My experiments show that this latter conclusion is correct.

88. When great care was taken to use solutions free from suspended peroxide, the rate at which oxygen is liberated was found by Morse, Hopkins and Walker to depend on the concentration of the permanganate and on the proportion of acid present. It is very noteworthy that whereas, according to their experiments, weak solutions undergo little or no change in presence of proportions of sulphuric varying between 0 and 6 times the amount required to neutralise the potassium, a not inconsiderable amount of oxygen is given off (in the course of 150 hours) from a 5 per cent. solution of permanganate (20 c.c.) ; thus :—

Proportion of acid	0	K	K_2	K_3
Volume of oxygen evolved	0	0·2	0·55	2·8 c.c.

It is difficult to explain these results except on the assumption that the permanganate is hydrolysed to an appreciable extent in the more concentrated solutions, so that hydrogen peroxide is set free. The influence of acid in promoting the decomposition of permanganate in presence of the dioxide is at least in part explicable from this point of view.

89. In view of the unsatisfactory nature of the explanation offered by Morse and his co-workers and as he had made no direct measurements of the amount of oxygen evolved during the oxidation of hydrogen, at the commencement of the inquiry, when no very definite opinion had been formed as to the nature of the oxidation process, it appeared desirable to study the interaction in all its details. This was the more necessary in view of the statement made by Francis Jones, in 1878,[33] that in all cases of oxidation, including that of hydrogen, by permanganate, oxygen is evolved. That this can only be true under certain conditions is clear from the fact that permanganate is regularly made use of in estimating oxalic acid, from which Jones obtained oxygen.

90. To test his statement, a quantity of permanganate solution containing acid was introduced into a conical flask (150 c.c.) fitted with a rubber stopper carrying a dropping funnel and inlet and exit tubes for the passage of carbon dioxide ; the exit tube was bent down so as to dip beneath the surface of strong potash solution contained in a trough.

Carbon dioxide was first passed through the apparatus until the issuing gas was completely absorbed by the alkali ; a solution of oxalic acid was then introduced gradually from the dropping funnel. The gas evolved was collected over the potash solution and when all the oxalic acid had been added, the gas remaining in the flask was swept out by a current of carbon dioxide. The unabsorbed gas which was collected in this way was measured and proved to be oxygen.

The results were as follows :—

Acid (H_2SO_4) molecular proportions per molecular proportion $K_2Mn_2O_8$	$K_2Mn_2O_8$ grammes.	Oxalic acid grammes.	Oxygen evolved c.c. (N.T.P.)
5·3	2	2	0·56
5·3	2	2	0·70
21·2	2	2	3·02
30·0	2	2	4·63
60·0	8	8	15·29

Manganese oxide was precipitated in all cases.

91. In all Jones's experiments, a precipitate was formed which he regarded as manganese sesquioxide, actually quoting figures which appear to justify this statement. In view of the conclusions arrived at in §§ 82, 84, it is clear that the evolution of gas is to be attributed to the presence of the "peroxide," as Morse and his co-workers have contended. It may be added that in estimating oxalic it is the custom to add sufficient acid to prevent acid, any precipitation of the oxide.

92. When neutral permanganate is used in oxidising hydrogen, no gas is evolved and the amount of permanganate reduced is in the proportion of three molecules of the gas to one of the oxidising agent. The permanganate is not decomposed by the precipitated oxide under such conditions.

The experiments were carried out in glass bulbs, about 150 c.c. in capacity, fitted with a ground glass stopper carrying a stopcock. After introducing the permanganate, the bulb was evacuated and then filled with hydrogen at atmospheric pressure. The bulbs were attached to clamps at the end of a spindle carried by a pulley which made one revolution in about two seconds. At the close of the experiment, the gas was pumped out of the flask, measured and analysed. 50 c.c. of permanganate containing 0·6545 gramme of salt were used in each case.

The results were as follows:—

Volume of H_2 oxidised at N.T.P. c.c.	Permanganate reduced.	$\frac{K_2Mn_2O_8}{H_2}$
74·05	0·330	0·32
61·22	0·282	0·33
56·67	0·270	0·34

93. A similar series of experiments was carried out with acid solutions in which the proportion of acid was varied: 70 c.c. of liquid containing 0·6545 gramme of permanganate was used in each case.

The following results were obtained:—

Acid H_2SO_4 molecular proportions.	Time of agitation. hours.	H_2 oxidised c.c.(N.T.P.)	Oxygen evolved. c.c.	Permanganate used. grammes.
24	18	52·58	20·47	
24	20	55·73	21·96	
24	23	59·53	22·42	0·4958
57	22	46·62	31·89	0·5283
57	23	47·88	32·07	0·5207
57	23	47·58	32·29	0·5201
57	43	52·39	37·34	

It will be seen that the hydrogen was oxidised more slowly in presence of the larger proportions of acid but that the amount of oxygen given off was greater in the latter case. My observations therefore corroborate those of Morse and Reese in showing that oxygen is not evolved in proportions which are equivalent to the hydrogen but lower when a relatively small excess of acid is present and higher when the excess is large. It should be noted, however, that Morse and Reese have deduced incorrect values for the amounts of oxygen evolved, as they have failed to take into account the permanganate used in oxidising the hydrogen. Assuming that the hydrogen is oxidised in the manner ordinarily supposed and that oxygen is evolved in accordance with the equation

$$x\,MnO_2 + H_2Mn_2O_8 = (x+2)MnO_2 + H_2O + 3/2O_2$$

the amount of permanganate used should be that found in my experiments. Thus:—

Permanganate calculated from		Total.	Total permanganate used in experiment.
H_2 oxidised grammes.	O_2 evolved grammes.		
0·2809	0·2115	0·4924	0·4958
0·2200	0·3010	0·5210	0·5283
0·2259	0·3027	0·5286	0·5207
0·2244	0·3045	0·5289	0·5201

94. It has been shown by Morse and Reese that oxygen is evolved at a relatively rapid rate during the oxidation of hydrogen in comparison with that at which it is given off when the permanganate is agitated merely with manganese dioxide prepared from manganous sulphate, it seems probable that the difference is due to the state of the peroxide and that at the instant of its formation it is more active because it is either more readily or to a greater extent converted into the perhydrol $Mn{<}^{SO_4H}_{OOH}$ which has been postulated as being the active agent in the decomposition.

Summary.

The arguments adduced in this communication tend to show that, in so far as they promote oxidation at all, manganous salts resemble ferrous salts and that a similar explanation is to be given of their oxyphoric and catalytic power.

But a more powerful agent is required to effect the oxidation of the manganous salt—namely, permanganate instead of hydrogen peroxide.

A similar explanation is advanced of the catalytic activity of manganese peroxide; it is argued that this compound, in its "hydrated" form, may in like manner be converted into a perhydrol which is either itself so unstable that it is at once resolved into oxygen and a manganous compound or gives rise by hydrolysis to hydrogen trioxide which immediately decomposes.

It is argued that permanganate is invariably active only as an oxidising agent and in virtue of its peroxide character, not as a reducing agent. The thesis put forward in Part I. is maintained, however, that it is not the immediate agent of oxidation but acts as hydrogen depolariser, the OH ion of the electrolyte being the effective oxidising agent when it is used.

The suggestion put forward in Part I. (§ 32) that hydrogen peroxide is conceivably a product of the oxidation process is withdrawn: the conclusion arrived at being that this assumption is unnecessary and true perhaps only of oxygen itself. None the less, it is probable that under certain conditions permanganate gives rise to hydrogen peroxide by hydrolysis, since it is very slowly decomposed in presence of sulphuric acid apparently even in the absence of manganese dioxide.

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(32) Morse, H. W., and Reese, C. L. Reduction of permanganic acid by manganese peroxide. Amer. Chem. Journ., 1898, **20**, 521.
(33) Jones, F. Action of reducing agents on potassium permanganate. Chem. Soc. Trans., 1898, **95**.

Communication.

A RAPID METHOD FOR THE DETERMINATION OF PHOSPHORUS IN STEEL.

BY HARIPADA BHATTACHARYYA, M.A.

(This Journal, July 31, 1913, 738.)

Claim for Priority.

Mr. James O. Handy, writing from Pittsburgh, Pa., U.S.A., claims that the method described is identical with one devised by him and published in the Proceedings of the Engineers' Society of Western Pennsylvania in 1893, since which it has been in use in the Pittsburgh district under the name of "the Alkalimetric Method."

Obituary.

SIR WALTER NOEL HARTLEY.

Sir Walter Noel Hartley, D.Sc., F.R.S., who was an original member of this Society, was for many years a leading figure in the scientific life of Dublin. He occupied there with great distinction the chair of Chemistry and was Dean of Faculty of the Royal College of Science in Ireland. In 1906 he was awarded the Longstaff Medal of the Chemical Society for researches in spectro-chemistry, and was President of Section B (Chemistry) of the British Association, 1903-4 (this J., 1903, 1108). He contributed many papers on applied chemistry and metallurgy to various societies, among which may be mentioned, thermochemistry of the Bessemer process, the drying and bleaching of oils, temperature of flames, constitution of nitric acid and its hydrates, and spectrographic analysis. He died at Braemar on September 11th in his 68th year.

HUGH MARSHALL.

Prof. Hugh Marshall, D.Sc., F.R.S., was a native of Edinburgh and graduated as B.Sc. at the University there in 1886. Soon afterwards he became assistant to Prof. Crum Brown, and in due course received the D.Sc. degree. In 1894 he was appointed Lecturer in Mineralogy, and in 1902 Lecturer in Chemistry, in Edinburgh University. He spent some time at Münich under Profs. Kruss and Groth, and then went to Ghent, where he studied under Prof. Renard. He was appointed to the Dundee Chair of Chemistry in 1908. He was a gifted investigator and was the discoverer of persulphates (this J., 1891, 1004; 1897, 396). He contracted enteric fever on the Continent and died of pneumonia in London on September 5th last, aged 45. He was a man of many activities, and his untimely death is greatly to be deplored.

STATUE TO THE LATE DR. LUDWIG MOND, F.R.S.

In the presence of a large gathering of those intimately associated with Messrs. Brunner, Mond and Co., a life-sized bronze statue of the late Dr. Ludwig Mond was unveiled on Saturday, Sept. 13th, in Winnington Park by Sir John Brunner, Bart., Chairman of the Company. The statue, which is the work of Prof. Lanteri, of the South Kensington School of Art, represents Dr. Mond in characteristic attitude and dress, and faces Winnington Hall, where he resided for many years. Mrs. Ludwig Mond and the members of the family were present, and, in addition to Sir John Brunner's opening address, speeches were delivered by Mr. Louis Solvay, of Messrs. Solvay and Co., Brussels, Mr. Fred. Hazard, of the Solvay Process Co., Syracuse, U.S.A., and Sir Alfred Mond. The Society of Chemical Industry was represented by the Secretary, in the unavoidable absence of Mr. Tyrer.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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German.—1 mark each with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Heating or cooling fluids; Apparatus for ——. C. Whittaker and Co. and T. Whittaker, Accrington, Lancs. Eng. Pat. 23,789, Oct. 18, 1912.

The apparatus is of the type in which a nest of concentric drums, having alternately plain and corrugated surfaces, are rotated about a horizontal axis and dip into a liquid so as to expose continually, fresh films of the liquid to a current of air or gas. In order to prevent the retention of liquid in bulk in the rotating drums, distance pieces are arranged between the corrugated and the plain surfaces.—A. T. L.

Drying humid gases or vapours [of acids, etc.]; Method for ——. E. Collett, Christiania. Eng. Pat. 26,098, Nov. 13, 1912. Under Int. Conv., Nov. 18, 1911.

See Fr. Pat. 450,448 of 1912; this J., 1913, 600. The gases are first washed with relatively large quantities of drying agent of low concentration, and then with smaller quantities of concentrated drying agent.—T. F. B.

Drying machine. J. H. Lorimer, Assignor to W. S. Lorimer, Philadelphia, Pa. U.S. Pat. 1,069,342, Aug. 5, 1913.

Hot air is introduced into the top of a drying chamber from a heating chamber arranged at the side, passes downwards over the material to be dried, which is carried upon endless band conveyers moving transversely, and is drawn off from the bottom of the drying chamber into a circulating chamber which encloses both drying and heating chambers. A portion of the moist air is removed, and the remainder, together with fresh air, enters the bottom of the heating chamber to be again circulated through the apparatus.—H. H.

Drying apparatus. J. Pizzica, Syracuse, N.Y. U.S. Pat. 1,070,173, Aug. 12, 1913.

A casing with rack supporting the pans which hold the material to be dried. Access to the interior is obtained by swinging back one side of the casing, hinged for that purpose. A current of air is drawn through the casing by a fan arranged in a chamber at one end.—W. H. C.

Evaporating apparatus. D. Cozzolino, San Diego, Cal. U.S. Pat. 1,069,394, Aug. 5, 1913.

A vacuum evaporator is provided with a porous diaphragm, above the liquid and of sufficient weight to balance the pressure of foam but sufficiently porous to admit of evaporation. The diaphragm is formed of wire netting and cloth fabric, and is clamped between flanges on the lower section of the vessel, the upper section containing the outlet to the vacuum-producing device.—H. H.

Evaporator. A. S. Morris. Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pat. 1,069,566, Aug. 5, 1913.

In an evaporator of the type in which the liquid to be evaporated passes into a large number of vertical evaporating tubes from a casing below, the tubes reach nearly to the bottom of the casing and the liquid is distributed to them by means of a small number of short vertical supply tubes entering the casing from below and passing nearly to the top. Each supply tube communicates by a separate channel with the liquid inlet.—H. H.

Filter press. F. S. Guy (Assignor to S. C. Fiddyment, Lockport, Ill.) and E. M. Smith, Peoria, Ill. U.S. Pat. 1,069,546, Aug. 5, 1913.

A filter press has a cylindrical body portion, one end of which is provided with slots to form a strainer while the other end acts as a receptacle for the solid matter and is provided with a discharge device therefor. The material to be treated is supplied to the press by a double rotary conveyer fitted outside, and is forced through the press by a single helical screw rotating within the strainer portion.—H. H.

Filter. W. G. Hall, Honolulu, Hawaii. U.S. Pat. 1,070,249, Aug. 12, 1913.

A number of structurally independent horizontal filter plates are arranged within a vessel, a vertical rod passing through the centre of the plates, and serving to lift them when the filtering material is to be cleansed.—W. H. C.

Furnace. J. Churchward, Mount Vernon, N.Y., Assignor to Churchward International Steel Co., New York. U.S. Pat. 1,069,601, Aug. 5, 1913.

The upright furnace is lined with refractory material and mounted so that it can be rotated on a vertical axis. Alternate courses of the refractory lining project somewhat into the furnace, and at the bottom the walls converge so as to form an inclined discharge trough. Projecting into the furnace from the wall is a baffle-plate adapted to throw down and agitate the material in the furnace, whilst keeping the upper surface of the material substantially level.—A. S.

Still; Multiple ——. B. Thoens and S. S. Shears, New York. U.S. Pat. 1,069,829, Aug. 12, 1913.

The still consists of a number of superposed, closed cylindrical chambers, surmounted by an open chamber. Each chamber is provided with a tubular steam heating drum, provided with steam inlet and exhaust pipes, and is connected with a vacuum pipe. The heating drum of each compartment is connected with that of the chamber above by a vertical tube, from the lower end of which a tray for collecting liquid is suspended.—W. H. C.

Distillation apparatus; Multiplex —— with vaporising and condensing chambers surrounding one another. O. Schmeisser. Ger. Pat. 262,008, June 22, 1912. Addition to Ger. Pat. 260,059 (this J., 1913, 688).

The flanges on the partitions separating the vaporising and condensing chambers are dispensed with and the partitions are held together by connecting pieces across their edges. Distance-pieces, preferably of]-shaped section are interposed between the ends of the partitions. —A. S.

Chemical reactions at high temperatures; Process for effecting ——. F. Meyer. Ger. Pat. 261,922, Sept. 24, 1912.

The reacting substances or the substance to be reduced, in the form of gas, liquid or fine powder, are blown into or through a so-called reversed flame. (See also this J., 1912, 1030.)—A. S.

Liquids of different specific gravities; Process for separating ——. J. P. Bush. Ger. Pat. 262,463, Nov. 3, 1912.

A portion of the surface of the mixture is separated from the remainder and is then diminished in area, so that the depth of the layer of lighter liquid is increased, whereby this liquid can be separated and run off. The apparatus consists of an outer vessel in which a conical, pyramidal or similarly shaped chamber is disposed. For example, a chamber of the shape of a frustum of a cone, open at the top, is disposed within a cylindrical outer vessel of somewhat greater height. When this is immersed in the mixture of liquids, the lighter liquid rises within the cone and overflows into the outer vessel. Or an inverted cone closed at the apex, but with openings near its upper, wide end, is disposed within a cylindrical outer vessel open below: the lighter liquid rises in the space between the cone and the outer vessel and overflows through the openings into the conical vessel.—A. S.

Filling material for reaction towers. E. Berl and A. G. Innes. Ger. Pat. 263,200, Aug. 29, 1912.

The filling material consists of tetrahedrons of wire gauze or the like, the sides of which can be bent in somewhat towards the centre.—A. S.

Evaporators, boiling pans, and the like. F. Schutz, Weetzen, Germany. Eng. Pat. 18,296, Aug. 8, 1912. Under Int. Conv., Sept. 15, 1911.

See Ger. Pat. 254,486 of 1911; this J., 1913, 184.—T. F. B.

Evaporating apparatus with superposed compartments and progressive level. C. L. Prache, Assignor to Soc. d'Exploit. de Procédés Evaporatoire Système Prache et Bouillon, Paris. U.S. Pat. 1,071,341, Aug. 26, 1913.

See Eng. Pat. 25,458 of 1912; this J., 1913, 275.—T. F. B.

Drying apparatus. H. Haas, Manchester. Eng. Pat. 20,864, Sept. 13, 1912.

See Fr. Pat. 450,706 of 1912; this J., 1913, 586.—T. F. B.

Extraction apparatus. J. Merz, Brünn, Austria-Hungary. U.S. Pat. 1,070,828, Aug. 19, 1913.

See Eng. Pat. 9736 of 1911; this J., 1912, 216.—T. F. B.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Patent fuel [briquettes]; Manufacture of ——. Second report to Home Office on Draft Regulations, by A. H. Lush. Cd. 7051. Pp. 1—13. Aug. 12, 1913.

Draft regulations, having for their object the prevention of cancer (*epithelioma*), developing from pitch-warts, among workers in the patent fuel industry, provide for the encasing of disintegrators and conveyors so as to prevent dust, and the compulsory use of baths, wash-basins, overalls, and goggles. The first report (Cd. 5878, Aug. 15, 1911) recommended the adjournment of the inquiry for purposes of experiment, and it has since been found that washing and bathing is not a complete prevention of the evil, and it is doubtful whether it is in all cases advisable. Compulsion appears impracticable, but adequate provision has been, or will be made at all of the larger factories for the voluntary use of baths and wash-basins. The prevention of dust is also being undertaken voluntarily, by the use of casings and exhausters, and the enclosing of pitch sheds. No satisfactory forms of either goggles or overalls has been devised. It has been found that the evil arises from an impurity in the pitch, probably an amidine, which distils in the same fraction as anthracene oil, and the best method of preventing pitch-warts appears to be the removal of this impurity. It is therefore recommended that the Draft Regulations be withdrawn, and tests are shortly to be made at one of the factories with pitch made from tar to which formaldehyde has been added in order to neutralize or destroy the noxious impurity. (See also this J., 1913, 416.)—A. T. L.

Explosion; Gaseous ——, *caused by the electric heating of bitumen in cable troughs.* W. M. Thornton and J. A. Smythe. J. Gas Lighting, 1913, 123, 555—556.

A fatal explosion at Hebburn-on-Tyne, which occurred in an electric-cable junction-box, was due to the production of gases from the Trinidad pitch in which the cable was laid, owing to the heat generated by a leakage of current. The pitch had sp. gr. 1·24, and contained moisture, 0·8 ; volatile matter, 57·7 ; fixed carbon, 7·0 ; and ash, 34·5 per cent. Dry distillation under varying conditions gave samples of gas containing methane, 80·0 to 43·1 ; unsaturated hydrocarbons, 7·1 to 29·8; hydrogen, 0 to 20·6 per cent., together with smaller quantities of carbon monoxide and dioxide, hydrogen sulphide, oxygen and nitrogen. The volume of air required for complete combustion was 8·0 to 11·6 times the volume of the gas. The gas is readily inflammable, and appears to be between marsh gas and coal gas in this respect.—A. T. L.

Petroleum ; Formation of hydrochloric acid in the distillation of ——. E. Pyhälä. Petroleum, 1913, **8**, 1603—1605.

The corrosion of the iron retorts, used in distilling crude petroleum, is found to be due to the presence of free hydrochloric acid in the aqueous portion of the distillate. The quantity of acid was 0·107, 0·043 and 0·026 per cent., with samples of oil containing 29, 12 and 7 per cent. of water respectively. Water, separated from the crude oil and having sp. gr. 1·1426 at 20° C., yielded 0·33 per cent. of hydrochloric acid when distilled. The acid was not formed until 86 per cent. of the water had passed over, the temperature being then 125°—130° C. The acid is probably formed by the decomposition of chlorides dissolved in the water.—A. T. L.

Patents.

Peat ; Drying and heating of wet carbonised ——. T. Rigby, Dumfries, and Wetcarbonising, Ltd., London. Eng. Pat. 17,426, July 26, 1912.

The peat in a finely divided condition is introduced into hot flue gases containing sufficient inert gas to prevent ignition of the material, and is kept in contact with the gases until partially or completely dried, and, if desired, further heated. Eng. Pat. 24,748 of 1911 (this J., 1913, 77) is referred to.—H. H.

Briquetting soot without a binding agent. K. Liese and W. Walther. Ger. Pat. 262,181, May 18, 1911.

The soot is intimately mixed with water and the moist material formed into briquettes by slight compression. —A. S.

Briquetting with pitch. C. Fohr and E. Kleinschmidt. Ger. Pat. 263,158, Aug. 3, 1912.

The melted pitch is atomised and blown directly on to the material to be briquetted, whereby the particles of the latter each become coated with a thin layer of solidified pitch.—A. S.

Coke ovens. N. Schuster, London. Eng. Pat. 7938, April 4, 1913.

The walls separating the carbonising chambers of vertical coke ovens, are formed with a number of superposed pairs of horizontal heating flues, the upper and lower flues of each pair being connected at one end by passages controlled by dampers. At the other end, gas supply passages communicate respectively with all the upper and all the lower flues, and similarly with air supply passages leading from two sets of regenerator chambers below. When gas is supplied to the lower flues, the gas supply to the upper flues is cut off, heated air is admitted from one set of regenerator chambers to the lower flues, and the burnt products escape from the upper flues through the other air supply passage to the second set of regenerator chambers, the rate of flow being regulated by the dampers. When the action of the apparatus is reversed, the gas is supplied from the other supply pipe and the air inlet and waste gas outlet passages exchange functions.—H. H.

Coke oven ; Recuperative ——. T. von Bauer. Ger. Pats. 262,116, July 13, 1912, and 262,695, Oct. 27, 1912.

(1) The coking chambers and the heating flues are horizontal, and air and gas are supplied to the heating flues through longitudinal channels in the division walls with outlets directed downwards. At the rear side of the oven each heating flue is provided with inlets for the supply of additional gas and air. Above each division wall through which gas and air are supplied is a partition, provided with vertical flues, which acts as a distributor for the hot gases. (2). Between the vertical flues in the lowest partition are vertical air pipes into which nozzles project at different heights for the purpose of heating to a higher degree the preheated air from the recuperator.—A. S.

Recuperator for coke-ovens in which the air is supplied to the heating flues partly from below and partly from the rear side of the ovens. T. von Bauer. Ger. Pat. 262,117, Oct. 27, 1912.

The air conduits of the recuperator are divided and both divisions are provided with dampers for admitting the air to be preheated, in order that preheated air may be supplied to different parts of the battery of ovens as required.—A. S.

Vertical retort gas apparatus. A. J. Robus, Assignor to Evens and Howard Fire Brick Co., St. Louis, Mo. U.S. Pats. 1,068,452 and 1,068,820, July 29, 1913.

(1) Gas retorts are arranged vertically in a retort chamber which is heated by producer gas admitted at the bottom and is provided with a number of flues extending round the retort chamber at different elevations for collecting the waste combustion gases. Regulators are fitted to control the discharge of waste gases from each flue. (2) Vertical gas retorts are supported in a retort chamber by means of piers arranged between the retorts, and by perforated walls connecting the retorts respectively with the piers, the walls of the retort chambers, and the adjacent retorts.—H. H.

Coke and gas ; Apparatus for making ——. W. M. Carr, Wheeling, W. Va. U.S. Pat. 1,070,666, Aug. 19, 1913.

Retorts are carried in firing chambers mounted on trucks, and are brought, in turn, in proximity to a stationary regenerative heating device, the retort outlets being connected temporarily with a fixed gas-main and the firing chambers with the heating device.—A. T. L.

Gas generators. F. Krauss, Vienna, and E. Ludwig, Munich. Eng. Pat. 1221 of 1913, date of appl., July 19, 1912.

In gas generators of the type in which a solid material capable of reacting with a liquid to evolve a gas, is dipped into a relatively large body of the liquid, the pressure and volume of the gas generated, are regulated by means of a body of the gas compressed to any desired extent within one part of the gas generator, and acting in the manner of a spring to raise or lower the solid relatively to the liquid, in opposition to the pressure generated by the evolved gas in another part of the generator.—H. H.

Gas-producers ; Method of operating ——. H. L. Doherty, New York. U.S. Pat. 1,069,866, Aug. 12, 1913.

The producer is fed with a mixture of fuel and basic material, other than alumina, added in quantity at least equal to the total alumina present in the coal. If necessary, enough silica is added to produce a slag fusing below 2600° F. (1427 C.)—W. H. C.

Gas-generating apparatus. G. Osten, Perry, Iowa. U.S. Pat. 1,070,721, Aug. 19, 1913.

The shell of the apparatus is divided by vertical partitions into a producer chamber, a water-seal chamber, a scrubbing chamber, and a condenser chamber. The gas from the producer passes downwards through a sealed dip-pipe, and from the top of the water-seal chamber downwards through the scrubber and upwards through the condenser to the outlet. There is a constant water supply to the seal chamber, with branches for sprinklers in the scrubber and condenser.—A. T. L.

Gas producers; Means for operating ——. H. E. Longwell, Assignor to The Colonial Trust Co., Pittsburgh, Pa. U.S. Pat. 1,070,825, Aug. 19, 1913.

In suction gas-plant, in which the suction is maintained by an exhauster, a valved by-pass is provided for the exhauster, and the valve is controlled by the movements of a pressure regulator on the delivery side of the exhauster.—A. T. L.

Combustible metallurgical-furnace gas; Process of treating —— to increase its calorific value. H. L. Doherty, New York. U.S. Pat. 1,069,865, Aug. 12, 1913.

Combustible furnace gas, containing carbon dioxide, is withdrawn from the furnace at such a temperature that it retains sufficient sensible heat to balance the heat required to dissociate the carbon dioxide. It is then passed through the fuel bed of a down-draught producer.—W. H. C.

Nitrogen from products of combustion; Production of ——. J. Harger, Gateacre, Lancs. Eng. Pat. 16,855, July 19, 1912.

An inert gas, consisting principally of nitrogen and a little carbon dioxide, and intended for preventing or extinguishing fires (see Eng. Pat. 28,075 of 1911, this J., 1912, 658), is prepared by passing the products of a carefully regulated combustion, first over a catalytic agent to oxidise any carbon monoxide, and secondly over an "equilibrator" to remove any excess of oxygen. The gases are then compressed and cooled in the presence of water, to extract the greater part of the carbon dioxide and are finally cooled by expansion in such a manner that most of the residual carbon dioxide is liquefied and may be removed. A suitable catalyst is titaniferous bog iron ore at a temperature of not less than 200° C., and a suitable "equilibrator" consists of a mixture of copper and cupric oxide.—O. R.

Nitrogenous compounds and combustible gas from nitrogenous fuel; Process for the simultaneous production of ——. C. F. Maule, Gentofte, Denmark. Eng. Pat. 722, Jan. 9, 1913.

The temperature of the producer is lowered to about 600° or 650° C., *i.e.* considerably below the igniting temperature to avoid risk of explosions, by introducing below the grate, together with the air, a portion of the cooled combustible gaseous mixture produced. The portion of gas so reintroduced into the producer is saturated with moisture and has its temperature reduced to about 150° C. This is attained by using fuels, *e.g.* peat, which contain up to 60 per cent. of moisture.—W. H. C.

Cleaning gases; Apparatus for and method of ——. H. A. Brassert and R. W. Cousins, Chicago, Ill. U.S. Pat. 1,070,398, Aug. 19, 1913.

Magnetic particles are removed from furnace gases by first cooling the gas, and condensing the moisture. The gas is then passed through a magnetic field, but out of contact with the magnets, the direction of flow being changed as the gas enters and leaves the vessel in which the magnetic field is produced. The gases are subsequently caused to expand.—W. H. C.

Gas purifier. W. Greding. Ger. Pat. 263,201, July 12, 1912.

The purifier is of the type in which a cylindrical screen rotates through liquid contained in the lower portion of the purifier casing. The screen is built up of perforated plates, pieces of wire gauze, or loose rods pressed tightly one against the other, so as to form a cylindrical coil of wire gauze or the like. The liquid is forced outwards by centrifugal force and being retained by the close-meshed gauze, forms an enclosing film or envelope around the gas passing axially through the purifier. The gauze or the like may be fixed between the gas-tight blades of a screw rotating with its lower portion immersed in the liquid in the casing.—A. S.

Gases; Apparatus for separating dust or the like from hot ——. M. Neumark. Ger. Pat. 263,285, May 1, 1912.

In apparatus of the type in which the gas is introduced from above into an upright dust-separating chamber, the wall of the latter is made of corrugated plate in order that a large cooling surface may be provided without unduly increasing the height of the chamber.—A. S.

Combustion of a gas flame; Method of producing a retarded ——. H. L. Doherty, New York. U.S. Pat. 1,069,867, Aug. 12, 1913.

Currents of air and gas are passed through horizontal parallel conduits so that they enter the highly heated combustion chamber in substantially superposed, parallel currents and having approximately the same velocity. —W. H. C.

Paraffin; Process and apparatus for the continuous sweating of ——. S. Nitsch and F. Winsterstein, Pressburg, Austria. Eng. Pat. 18,193, Aug. 7, 1912. Under Int. Conv., Aug. 7, 1911.

This apparatus comprises a series of sweating chambers through which air is circulated, and is such that at any moment one chamber, being charged with paraffin, is cooled by the admission of cold air, whilst an adjacent chamber, from which melted paraffin is being discharged, is heated by a steam coil. The air from the charging chamber is caused to flow through the steam-heated chamber and then successively through the other chambers of the series.—H. H.

Paraffin; Production of translucent uniformly coloured ——. J. Van Rijn Van Alkemade, Pangkalam Brandan, Sumatra. Eng. Pat. 18,925, Aug. 19, 1912. Under Int. Conv., Aug. 24, 1911.

Air is removed from the molten paraffin by heating it in an exhausted vessel or by passing steam through it, and the paraffin is allowed to cool nearly to its solidifying point in the absence of air before being run into moulds. —A. T. L.

Paraffin; Process for separating —— *from paraffin oil, and for fractionating paraffin.* Triester Mineralöl-raffinerie, and K. Opl. Ger. Pat. 262,153, Jan. 17, 1912.

The paraffin oil or paraffin mixture is subjected to a prolonged process of cooling and agitation in a cylindrical vessel, furnished with horizontally rotating stirring arms. It is stated that when this process is used, the paraffin crystals of higher melting point settle on the bottom of the vessel in a porous mass, and serve as filtering material for the supernatant oil or soft paraffin.—T. F. B.

Oils; Reducing the viscosity of —— *to render them suitable for heating and lighting purposes.* J. McL. McMurtrie and I. Roberton, Glasgow. Eng. Pat. 18,460, Aug. 12, 1912.

The pipe between the storage tank and the burner has a U-shaped portion, of which one limb is connected with the bottom of the tank and the other limb is provided with a steam coil for heating the oil passing to the burner without heating the oil in the tank. A second coil may be provided in the tank in case the oil should become too viscous to flow into the U-shaped bend.—A. T. L.

Gasolene; Method of making ——. E. W. Tait, Bradford, Pa. U.S. Pat. 1,069,908, Aug. 12, 1913.

Natural gas, mixed with a higher liquid paraffin, is heated so as to vaporize the liquid. The vapour is then condensed, whereby a liquid of lower specific gravity is obtained.—A. T. L.

Petroleum; Refining ——. M. J. Trumble, Los Angeles, Cal., Assignor to Trumble Refining Co. U.S. Pat. 1,070,361, Aug. 12, 1913.

In order to separate from petroleum an oil of given vaporizing temperature, the petroleum is heated to that temperature in a coil and then delivered to the top of an evaporating tower, which is also maintained at that temperature. Steam, superheated to a higher temperature, is admitted to the tower through which the oil descends over inclined plates which divide it and retard the flow. The tower is provided with outlets for the vapour and residual oil.—A. T. L.

Oil [Petroleum]; Cleaning and refining ——. C. W. Stone, Hollywood, Cal., Assignor to E. B. Gilmore, Los Angeles, Cal. U.S. Pat. 1,070,555, Aug. 19, 1913.

Petroleum is heated in bulk so as to cause water to separate out, and the oil is then drawn off and run rapidly over heated metallic surfaces kept at a temperature above 100° C. By this means, water present as emulsion is expelled, together with the fraction of the oil volatile at 100° C., and the vapours are passed through the coil for heating the oil in bulk. Finally, the oil is allowed to stand for the water to separate, and the foam which has been produced in the second heating process is dissolved in the separated oil.—A. T. L.

Steam containing hydrocarbons for use in combustion motors and for other purposes; Production of ——. W. Taboulewitsch, St. Petersburg, Russia. Eng. Pat. 18,487, Aug. 12, 1912.

Water containing 1/2000 part of its weight of fat, fatty or mineral oil is vaporized and the vaporized mixture is superheated, and used as fuel for explosion motors. Reference is directed to Eng. Pat. 3154 of 1882 and 189 of 1905.—W. H. C.

Combustible mixtures for use in internal combustion engines. G. E. Heyl and T. T. Baker, London. Eng. Pat. 4570, Feb. 22, 1913.

Liquid hydrocarbons containing sufficient hydrogen in solution to cause ready ignition, are vaporized and mixed with sufficient air to give a mixture which, when introduced into the cylinder of the explosion motor, will be completely consumed.—W. H. C.

Mixtures of heated gas or vapour and products of combustion; Processes and apparatus for the production of ——. C. D. McCourt, Streatham Common, and C. Ellis, Montclair, N.J., U.S.A. Eng. Pat. 25,627, Nov. 8, 1912. Under Int. Conv., Jan. 4, 1912.

See Fr. Pat. 450,732 of 1912; this J., 1913, 587.—T. F. B.

Furnace gases; The cleaning of ——. R. Bocking und Co., Erben Stumm-Halberg, und R. Bocking G. m. b. H., Halbergerhütte, Germany. Eng. Pat. 894, Jan. 11, 1913. Under Int. Conv., April 6, 1912.

See Fr. Pat. 451,815 of 1912; this J., 1913, 688.—T. F. B.

Suspended matter in gases; Device for detecting ——. W. W. Strong, Pittsburgh. U.S. Pat. 1,070,556, Aug. 19, 1913.

See Eng. Pat. 21,199 of 1912; this J., 1913, 713.—T. F. B.

Hydrocarbons of higher into those of lower boiling point; Process for converting ——. L. G. Leffer, Wevelinghoven, Germany. Eng. Pat. 19,051, Aug. 20, 1912.

See Addition of Aug. 19, 1912, to Fr. Pat. 439,476 of 1912; this J., 1913, 224.—T. F. B.

Hydrocarbons and asphalt; Process of treating residue of petroleum distillation to obtain low boiling ——. Standard Oil Co., Whiting, Ind., U.S.A. Eng. Pat. 29,862, Dec. 28, 1912.

See U.S. Pat. 1,055,707 of 1913; this J., 1913, 414.—T.F.B.

Paraffin-wax or like mixtures of substances which melt at different temperatures; Apparatus for sweating crude ——. D. Pijzel, Balik Papan, Borneo. U.S. Pat. 1,070,730, Aug. 19, 1913.

See Eng. Pat. 22,313 of 1910; this J., 1911, 795.—T. F. B.

Hydrocarbons and asphalt; Process of treating residue of petroleum distillation to obtain low boiling ——. Eng. Pat. 29,862, Dec. 28, 1912. *See* III.

Pyrometers, gas analysis apparatus and the like. Eng. Pat. 15,019. *See* XXIII.

Pyrometer. U.S. Pat. 1,069,318. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Furnaces; Liquid fuel ——. E. Buchholtz, Harrow, Middlesex. Eng. Pat. 10,565, May 3, 1912.

In a furnace for the combustion of liquid fuel, the latter is contained in a series of superposed trays arranged within an opening communicating with a mixing chamber, upon the rear wall of which (at a slightly higher level than the surface of the liquid in the lowest tray) a nose or bridge is disposed immediately above the exit nozzles. Under the combined influence of the concave upper surface of the bridge, and the curved roof and floor of the chamber, a swirling motion is imparted to the entering current of air and fuel-vapour. The flat under-surface of the bridge acts as a baffle, with the result that the combustible mixture is directed through the nozzles into the adjacent combustion chamber. The primary air-supply to the mixing chamber is regulated by sliding-plates attached to the bottoms of the oil-containers. An additional air-inlet is also provided, this being inclined downwards, and valved, and situated above the opening in which the oil-containers are disposed. —W. E. F. P.

Combustion; Method of promoting ——. G. W. Morgan, Hamilton, Ontario, Canada. Eng. Pat. 26,520, Nov. 19, 1912.

A heating stove is provided with non-adjustable air inlets for admitting to the combustion chamber the minimum amount of air necessary for combustion of the fuel on the grate, and with adjustable inlets for admitting more air when desired. The products of combustion are led downwards through a passage heated by the fire into a chamber below the grate, where the current is deflected towards a lateral outlet leading to the chimney. An adjustable air inlet is provided in this chamber for the purpose of varying the draught through the fire, this inlet being so arranged that the cold air does not mix with the products until both enter the chimney flue.—A. T. L.

Regenerators for heating air or gases. O. Gobbe, Jumet, Belgium. Eng. Pat. 5034, Feb. 27, 1913. Under Int. Conv., Feb. 27, 1912.

Horizontal air or gas heating flues are formed of long hollow bricks of square or rectangular section laid end to end. These bricks are laid with their diagonals vertical and horizontal, and rest at the end joints on inclined plates which cover the butt joints and keep them tight merely by the weight of the bricks. These inclined plates also form distance pieces and the heating-gases pass up or down through the spaces thus left between the horizontal flues.—A. T. L.

Electrodes for arc lamps; Manufacture of ——. J. Roubal, Prague, Austria. Eng. Pat. 10,210, April 30, 1913.

A cored carbon of high emissivity, which is only slowly consumed when used in an enclosed arc lamp, is made with 10 per cent. of a binder consisting of sodium or potassium hydroxide, 10 parts, aluminium hydroxide, 5, finely divided graphite, 10, and phosphoric acid (36° B. sp. gr. 1·332), 75 parts. The graphite may contain up to 30 per cent. Al_2O_3, CaO, MgO, "manganese," or SiO_2. The material used for the core may contain 30 per cent. of calcium saccharate, made by mixing 7 parts of calcium carbonate with 3 parts of sugar solution and heating to redness in the absence of air.—A. T. L.

Filaments of tungsten or molybdenum for electric incandescence lamps ; Manufacture of ——. A. Lederer, Vienna. U.S. Pat. 1,071,325, Aug. 26, 1913.

See Eng. Pat. 9020 of 1906 ; this J. 1907, 42.—T. F. B.

Incandescent bodies of tungsten ; Manufacture of ——. A. Pacz, Cleveland, Assignor to General Electric Co., New York. U.S. Pat. 1,071,568, Aug. 26, 1913.

See Eng. Pat. 8781 of 1909 ; this J., 1910, 618.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Examination of pyridine bases [for denaturing duty-free sugar]. See XVII.

Patents.

Furazane-oxides and their derivatives ; Manufacture of ——. A. G. Green. Leeds. Eng. Pat. 25,205, Nov. 4, 1912.

Furazane oxides (*o*-dinitroso compounds, or *o*-quinonedioxime peroxides) of the general formula, $R \cdot N_2O_2$, are obtained by treating *o*-nitroamines with hypochlorites. For example, 10 parts of *o*-nitraniline is dissolved in water at 50°—80° C., 5 parts of 30 per cent. aqueous caustic soda is added, and a solution of sodium hypochlorite containing 5 per cent. of active chlorine is slowly run into the hot solution until it is decolourised. On cooling, benzfurazane-oxide separates out in small yellowish-white crystals. Under certain conditions the reaction is accompanied by further substitution ; for example, when an alkaline solution of 4·2·3-dinitraniline in methyl or ethyl alcohol is treated with hypochlorite, chloromethoxy- (or ethoxy-) benzfurazane-oxide is obtained.—T. F. B.

Bitumen, tar, pitch, and other similar bituminous substances ; Chemical treatment of ——. M. G. C. R. d'Olivier-Mansan, London. Eng. Pat. 26,426, Nov. 18, 1912. Under Int. Conv., Nov. 17, 1911.

Bitumen, tar, pitch, and similar substances are heated to temperatures below their boiling points and mixed with a small quantity of an oxidising agent (*e.g.*, potassium chlorate) : the temperature is then raised and a further quantity of oxidising agent added, the process being continued until products of the required softening point and binding power are obtained. When using potassium chlorate as oxidising agent, it is preferable to add, before the last heating, a small quantity of manganese dioxide as well as the chlorate. Coal tar is said to require about 6 per cent. of chlorate, bitumen 4·2 to 4·5 per cent., and pitch 3 per cent. The resulting products may be mixed with sand, gravel, silicates, etc., and used for road treatment or for briquetting purposes. The same process may be applied to mixtures of sand, gravel, etc., with tar, pitch, or bitumen, but in this case it is advisable to add a mixture of potassium chlorate and manganese dioxide at each stage of the treatment.—T. F. B.

Acid tar from the treatment of petroleum with sulphuric acid ; Process for working up the ——. Rütgerswerke A.-G. Ger. Pat. 261,777, Jan. 12, 1911.

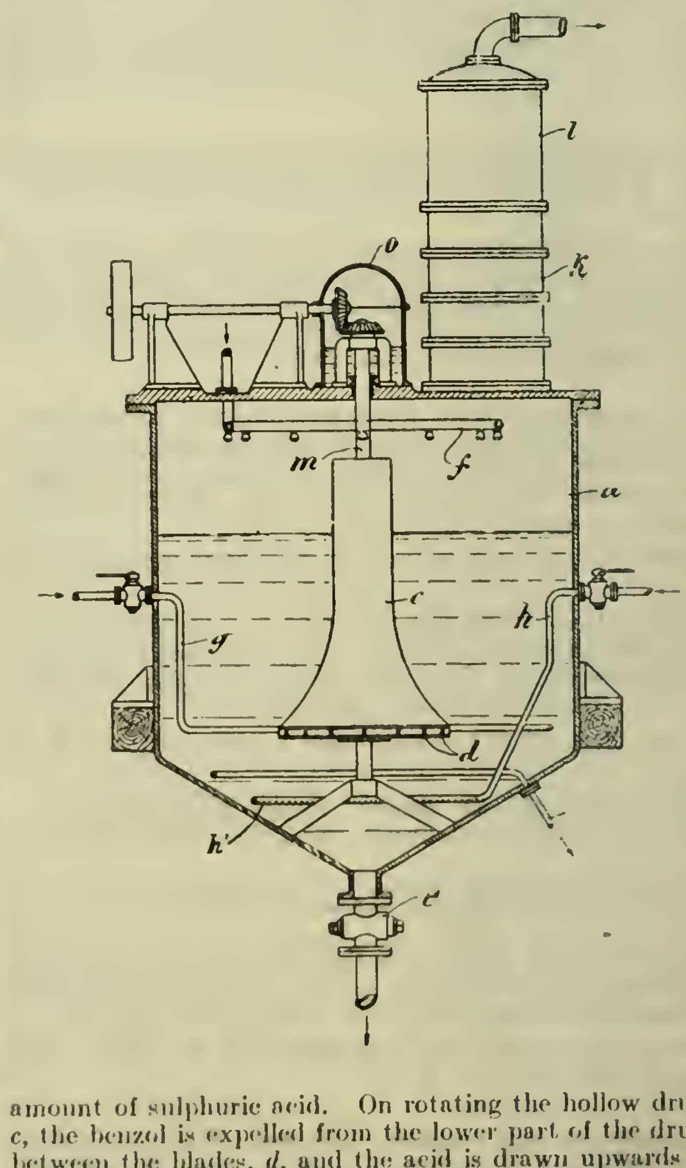
The acid tar, which may or may not be diluted with water, is dissolved in tar oils of high boiling-point, preferably with the aid of heat, the acid solution is separated, and the acid remaining in the tar oil solution is removed with caustic soda lye. The tar oil solution is distilled, and the residue treated with steam, leaving a neutral product of sp. gr. 1·05, similar to asphaltum and suitable for use in road construction and/or insulating and like purposes.—T. F. B.

Distillation or dehydration of hydrocarbons or liquids likely to form froth or foam. J. Rosen, London. Eng. Pat. 17,954, Aug. 2, 1912.

Relates to the distillation of coal tar, crude naphtha containing water, gelatin solutions, etc. The froth or foam which forms is directed by suitable partition walls to the upper part of the apparatus, where it is heated by a separate heating apparatus, which may consist of a number of superposed tubes or other device to provide a large heating surface. Baffle plates may also be provided above the surface of the liquid, to spread out the foam in a number of layers. To encourage the formation of foam, the liquid may be agitated by means of a number of jets of steam or hot air. In one form of the apparatus, the agitating devices and the partition walls are arranged so that the froth is only formed from a comparatively small surface of liquid, whence it is led to the heating devices in the upper part of the apparatus.—T. F. B.

Benzol ; Apparatus for the purification and distillation of ——. H. A. Gasser, Wiesbaden, Germany. Eng. Pat. 3465, Feb. 10, 1913. Under Int. Conv., July 29, 1912.

The invention relates to a combined purifying and distilling apparatus for crude benzol. The benzol is introduced into the vessel, *a*, together with the necessary amount of sulphuric acid. On rotating the hollow drum, *c*, the benzol is expelled from the lower part of the drum, between the blades, *d*, and the acid is drawn upwards by the suction thus created, thereby effecting intimate mixture of the two liquids. The drum, *c*, may be dispensed with if the pipe, *h*, is used for introducing air under pressure. The acid is now drawn off through *e*, and dilute soda lye is added : after the lye has been removed, water is sprayed through the pipe, *f*, and after passing through the benzol, is run off through *e*. The liquid is then distilled by passing steam through the closed worm, *g*, *i*, and also through the perforated pipe, *h'*, the vapours being condensed in the usual manner in the



apparatus, *k*, *l*. To prevent escape of benzol vapour through the stuffing-box of the driving shaft, *m*, a dome, *o*, is provided over the stuffing-box, and is preferably filled or partly filled with oil.—T. F. B.

Benzol hydrocarbons from saturated [gas] wash-oil, or benzolated creosote; Method of distilling ——. C. Still, Recklinghausen, Germany. Eng. Pat. 16,493, July 15, 1912.

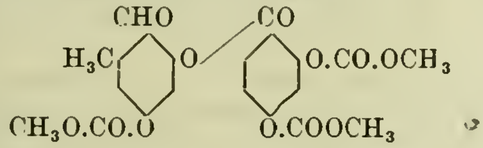
See Ger. Pat. 251,562 of 1911; this J., 1912, 1173.—T.F.B.

Oil mixture suitable for lubricating, impregnating, or coating purposes; Process for preparing an ——. Ger. Pat. 263,278. *See* XII.

IV.—COLOURING MATTERS AND DYES.

o-Diorsellinic acid; Synthesis of ——. E. and H. O. L. Fischer. Sitzungsber. Kgl. Preuss. Akad. Wiss., 1913, **28**, 507—512.

The monocarbomethoxy-orcyl aldehyde described by Hoesch (Ber., 1913, **46**, 887) is in all probability the *p*-compound, as judged by its method of preparation and its behaviour towards ferric chloride. It can be readily condensed in alkaline solution with dicarbomethoxy-orsellinoyl chloride, giving a good yield of a product to which the following formula is assigned :—



On oxidation with potassium permanganate, the aldehydic group is oxidised to the carboxylic group, and on eliminating the carbomethoxy groups by means of dilute ammonia, the corresponding *o*-diorsellinic acid is produced. It differs from lecanoric acid in its greater solubility in water, its melting point (120°—125° C. with decomposition), and its behaviour towards ferric chloride, since it does not give the violet colouration characteristic of *o*-phenolcarboxylic acids. It also differs materially from natural gyrophoric acid, for which the constitution of an *o*-diorsellinic acid had been previously suggested.—T. F. B.

Patents.

Colouring matters; Production of black —— *and their employment in dyeing and calico printing.* A. G. Green, Leeds. Eng. Pat. 19,124, Aug. 21, 1912.

Nigraniline is condensed with a primary aromatic amine or amino-acid, forming black products in which one or more mols. of the amino compound are combined with one mol. of Nigraniline. When primary monoamines of the benzene or naphthalene series are used, black colouring matters are obtained which, in the form of their bases and free from mineral compounds, can be dissolved in somewhat diluted (*e.g.*, 70—90 per cent.) acetic or formic acid: these solutions may be used in dyeing and printing by applying the solution, thickened if necessary, to the material, and fixing by drying, steaming, or chroming. When amino-sulphonic or -carboxylic acids containing sufficient acid groups are used, the products form sodium salts soluble in water, which are also suitable for use in dyeing and printing. Condensation is best effected by treating a finely suspended paste of Nigraniline with a slightly acid aqueous solution of the amino-compound or of a salt thereof. The reaction usually occurs in the cold, but the application of heat is sometimes necessary. To introduce the largest proportion of amine into the Nigraniline molecule, the first product is reoxidised by means of chromic acid, etc., and again treated with the amine, the oxidation and condensation being repeated alternately until the desired product is formed. The same condensation product may frequently be obtained in a single operation by carrying out the reaction in presence of a sufficient amount of an oxidising agent. The Nigraniline may be replaced by Pernigraniline or by its reduction products, Emeraldine, Protemeraldine, or Leucemeraldine, provided that an oxidising agent is also used.—T. F. B.

Chromium compounds [of azo dyestuffs]; Manufacture and employment of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,460, Nov. 18, 1912. Addition to Eng. Pat. 7892, April 1, 1912 (see this J., 1913, 226).

The chromable azo dyestuffs can be converted into chromium compounds, analogous to those described in the principal patent, by heating such dyestuffs containing at least one hydroxyl and one sulphonic group, or their salts or derivatives, with a chromium salt in presence of water; these compounds can be converted into lakes by precipitating on a substratum, or the lakes may be formed at once by adding a substratum to the mixture of the dyestuff and chromium salt, and precipitating with an alkaline substance if necessary. Fast prints are obtained by applying these chromium compounds to the fibre and treating with steam or an alkaline agent. The dyestuffs derived from *o*-aminophenols, *o*-aminonaphthols, anthranilic acid, and their derivatives, and from salicylic acid and its derivatives, are stated to be particularly suitable for use in this process.—T. F. B.

Anthraquinone-acridones. A. Lüttringhaus, Mannheim, and W. Braren, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,067,046, July 8, 1913.

1-Chloro-anthraquinone-2-carboxylic acid is condensed with 3-amino-4-methyl-diphenylketone-2′-carboxylic acid or with 3-amino-4-chlorodiphenylketone-2′-carboxylic acid, and the product is treated with a condensing agent in such a manner that an acridone ring is formed: by this process the second carboxylic group also enters into reaction, forming a second anthraquinone residue. The products thus consist of dianthraquinonyl-acridones. They are soluble with difficulty in the ordinary solvents, and form deep violet vats with alkaline hydrosulphite from which cotton is dyed fast reddish-orange to yellowish-orange shades.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 263,078, Aug. 13, 1912.

Halogen derivatives of anthraquinone-acridones, containing three or more atoms of halogen in the molecule, are heated at high temperatures with organic or inorganic bases or salts of weak acids. The resulting compounds may be used as vat dyestuffs or for the preparation of other dyestuffs.—T. F. B.

Azo dyestuffs insoluble in water; Manufacture of yellow ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 6779, March 19, 1913. Under Int. Conv., May 25, 1912.

When the diazo compound of *o*-nitraniline-*p*-sulphonic acid is combined with aceto-acetanilide or a substitution product thereof, yellow dyestuffs are obtained, the sodium salts of which are so sparingly soluble in water and alcohol that they can be used directly as pigments.—T. F. B.

Cotton [azo] dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8767, April 14, 1913. Under Int. Conv., April 19, 1912.

Two mols. of the diazo compound of an aromatic acidyldiamine or nitroamine are combined with one mol. of the symmetrical urea of 2.5.7-aminonaphtholsulphonic acid or with one mol. of 5.5′-dihydroxy-2.2′-dinaphthylamine-7.7′-disulphonic acid, the acidyl group is saponified or the nitro group is reduced, and the product is diazotised and combined with two mols. of resorcinol, *m*-aminophenol, *m*-phenylenediamine, or their substitution products. The resulting dyestuffs produce brilliant red to blue shades on cotton.—T. F. B.

Monoazo dyestuffs insoluble in water ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,110, June 5, 1913. Under Int. Conv., June 7, 1912.

PURE greenish-yellow dyestuffs fast to light, and suitable for the production of lakes, are obtained by combining the diazo compounds of halogen derivatives of aniline or of its homologues with the condensation products from aceto-acetic ester and alkyl ethers of *p*-aminophenols. The combination may be effected in presence of baryta or other substratum. The dyestuffs from *o*-chloroaniline and aceto-acetic-*p*-anisidide, and from 2.5-dichloroaniline and aceto-acetic-*p*-phentidide are described.—T. F. B

Monoazo dyestuffs ; Manufacture of yellow ——. A. G. Bloxam. London. From Chem. Fabr. Griesheim-Elektron. Frankfort on Maine, Germany. Eng. Pat. 10,549. May 5, 1913.

A SERIES of yellow wool dyestuffs, stated to exceed Tartrazine in greenness of shade and fastness to light, is obtained by diazotising adjacent *m*-xylidine ($CH_3 : NH_2 : CH_3 = 1 : 2 : 3$) or its 4- or 5-sulphonic acid and combining it with an arylpyrazolone of the benzene series, or a carboxylic or sulphonic acid thereof, such as 1-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid ; dyestuffs of still more greenish tint are obtained by using 1-*p*-sulpho-*o*-tolyl-5-pyrazolone-3-carboxylic acid, whilst a dyestuff said to surpass Quinoline Yellow in greenness is obtained by combining diazotised adjacent *m*-xylidine-4-sulphonic acid with *m*-sulpho-*o*-chlorophenyl-5-pyrazolone-3-carboxylic acid. The sulphonic acids of adjacent *m*-xylidine are obtained by treating the base with monohydrate or fuming sulphuric acid.—T. F. B.

Vat dyestuffs of the anthraquinone series ; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 12,152, May 24, 1913.

AN *o*-diaminoanthraquinone is treated with glyoxylic acid, preferably in the proportion of two mols. to one mol. The reaction may be effected by boiling the components in presence of acetic acid. The products dye cotton fast deep black shades from the vat ; they appear to contain no iminazole grouping, each of the two carbon atoms of the glyoxylic acid being probably united to two nitrogen atoms of two anthraquinone radicals. (Compare Ger. Pat. 210,019, Fr. Pat. 399,495, and Eng. Pat. 9111 of 1911 ; this J., 1909, 650, 933 ; 1912, 426.)—T. F. B.

Salts of phenolphthalic acid and its derivatives ; Manufacture of ——. P. A. Kober, Hastings on Hudson, N.Y., and J. T. Marshall, Philadelphia. U.S. Pat. 1,071,321, Aug. 26, 1913

PHENOLPHTHALEIN or a derivative thereof is treated with an aqueous solution of an alkali to form an alkali phenolphthalate, which is crystallised from the solution by evaporation *in vacuo* ; the free alkali is washed out of the product and it is dried, or it may be converted into the monobasic salt.—T. F. B.

Anthraquinone series ; Preparation of condensation products of the —— containing sulphur. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,477, Nov. 7, 1911.

α ANTHRAQUINONYLMERCAPTANS or analogous compounds, such as *αα*-dianthraquinonyl disulphides, *α*-anthraquinonylsulphinic acids, etc., are condensed with benzene, naphthalene, or anthracene, or their homologues or substitution products, in presence of sulphuric acid. The products are arylated anthraquinonyl thioethers.—T. F. B.

Vat dyestuffs of the anthracene series ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,788, Aug. 11, 1911. Addition to Ger. Pat. 240,080 (see this J., 1911, 1445).

WHEN *α*-polyanthrimides, containing more than three anthraquinonyl groups, are treated with aluminium chloride, products are obtained which produce fast grey to olive dyeings from the vat.—T. F. B.

Sulphinic acids of the anthraquinone series and their salts ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 263,340, July 23, 1912. Addition to Ger. Pat. 224,019 (see this J., 1910, 1295).

THE chlorides of anthraquinonesulphonic acids or their substitution products are reduced by means of alkali sulphides in presence of water ; anthraquinonesulphinic acids and their salts are obtained.—T. F. B.

Indigo White ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 262,833, Dec. 22, 1911.

INDIGO is reduced to Indigo White by heating it with silicon in presence of alkali hydroxide. It is stated that the reducing power of the silicon in this respect is about five times that of zinc, owing to its low atomic weight and its quadrivalency.—T. F. B.

Azolitmin from litmus ; Process for preparing highly-sensitive ——. J. Mayer. Ger. Pat. 262,838, Aug. 15, 1912.

LITMUS is mixed with concentrated sulphuric acid, and after the mixture has become dry it is powdered and extracted with strong alcohol, the extract poured into water, and the precipitated azolitmin separated from the liquid. After washing with cold water, the dyestuff is dried in a water-oven and pulverised.—T. F. B.

Vat dyestuffs ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüring, Höchst on Maine, Germany. Eng. Pat. 19,599, Aug. 27, 1912.

SEE Fr. Pat. 447,592 of 1912 ; this J., 1913, 226.—T.F.B.

Pentabromindigo. A. Schmidt and K. Thiess, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,070,541, Aug. 19, 1913.

SEE Fr. Pat. 392,638 of 1908 ; this J., 1909, 17.—T. F. B.

Vat dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,267, Sept. 5, 1912.

SEE Ger. Pat. 258,258 of 1912 ; this J., 1913, 529.—T.F.B.

Vat [anthracene] dyes and process of making same. F. Singer, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,070,196, Aug. 12, 1913.

SEE Eng. Pat. 8422 of 1912 ; this J., 1912, 766.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Flax retting ; Studies on ——. T. Tadokoro. J. Coll. Agric. Tohoku Imp. Univ., Sapporo, Japan, 1913, 5, 31—55.

IN the cold-water retting of flax, as practised in Japan, the loss of substance is 18—19 per cent., about 60 per cent. of this being due to the extractive action of the water, so that when the retting-water is not changed the loss is reduced to 14—15 per cent. Summarising the main components of the various tissues, cutin is the essential constituent of the cuticle, tannin being also present in the epidermal cells. The fibres consist of cellulose with small quantities of pectin compounds, protein and a fat-like substance. The cell-walls of the cambium, epidermis and parenchyma are composed mainly of pectin compounds with a small quantity of cellulose. The middle lamella of the fibres consists mainly of pectin compounds. Lignin is the chief constituent of the cell-walls of the xylem whilst those of the pith are mainly pectin compounds. In the first stage of retting the destruction of the cambium is observed, and then that of the parenchyma, accompanied by the separation of fibre bundles. As the retting proceeds, the isolation of the fibres and the mechanical detachment of the cuticle take place; the xylem and the pith remain practically unchanged. The greater portion of the cellulose remains unaffected after retting, but the small quantity which constitutes the cell walls of the cortical parenchyma, cambium, phloem-parenchyma and epidermis is lost at the end of the last stage. The pectin compounds of the middle lamella of the fibres and those of the cell walls of parenchyma, epidermis and cambium are dissolved almost completely at the end of the retting, and the highly resistant cuticle then falls away. Tannin is lost completely, and the larger portion of the mineral matters, and the glucose. The principal substance which is removed during the retting is the pentosan or gummy substance of the bark region; this has been isolated by extraction with cold sodium hydroxide and found to consist chiefly of xylan with some araban and a small quantity of a methylpentosan.—J. F. B.

Cellulose; Determination of —— by means of nitric acid. V. Rao and B. Tollens. J. f. Landw., 1913, **61**, 237—244. Chem. Zentr., 1913, **2**, 903.

The method of Dmochowski and Tollens (this J., 1910, 1003) has been simplified as follows:—The material is heated with the different liquids in the same Wattenberg's dish of 200 c.c. capacity, and the liquid is drawn off through a funnel, immersed therein, the large opening of which is closed by a sealed-on plate perforated with fine holes; the funnel is covered with linen or hardened filter paper. The purified cellulose is collected in a Gooch crucible, dried, weighed, incinerated, and the ash weighed. The method gives lower results than that of Cross and Bevan (J. Chem. Soc., 1889, **55**, 199) and the factors necessary to bring the results obtained by one method into agreement with those obtained by the other, vary according to the nature of the material under examination.—A. S.

Patents.

Artificial silk, fibres, hair, horsehair, etc., from cellulose solutions; Preparation of lustreless ——. B. Borzykowski. Ger. Pat. 262,253, July 12, 1912.

Lustreless cellulose fibres may be obtained by precipitating cellulose solutions by means of strong alkali hydroxides to which are added salts of lead, tin, or other metals whose oxides are soluble in alkali hydroxide solutions. Another method consists in treating the fibres prepared in the usual manner with alkaline salts of the metals mentioned above.—T. F. B.

Paper; Process for removing the printing ink from printed —— by means of petroleum and fat-solvents. A. L. de Stürler. Ger. Pat. 263,220, Aug. 30, 1912.

Printed paper is reduced to a pulp with water, the water is removed, and the pulp is heated with "solid petroleum," benzine, or other hydrocarbon, preferably with the aid of steam under pressure. It is stated that the printing-ink is completely removed from the paper by this method. —T. F. B.

Plastics; Compound [from cellulose esters] for and method of producing ——. W. A. Beatty, New York. Eng. Pat. 18,822, Aug. 16, 1912.

See Fr. Pat. 447,645 of 1912; this J., 1913, 283.—T. F. B.

Artificial silk and the like; Manufacture of ——. E. G. Legrand, Ste. Adresse, France. Eng. Pat. 19,001, Aug. 19, 1912. Under Int. Conv., Sept. 16, 1911.

See Ger. Pat. 250,357 of 1911; this J., 1912, 1120.—T.F.B.

Artificial silk threads or the like; Manufacture of ——. E. G. Legrand, Ste. Adresse, France. Eng. Pat. 5154, Feb. 28, 1913. Under Int. Conv., April 23, 1912. Addition to Eng. Pat. 19,001 of 1912, dated Sept. 16th, 1911.

See Addition of April 23, 1912, to Fr. Pat. 445,896 of 1911; this J., 1913, 865.—T. F. B.

Artificial silk from viscose; Process for the manufacture of ——. F. Küttner, Pirna on Elbe, Germany. Eng. Pat. 27,676, Dec. 2, 1912. Under Int. Conv., Nov. 13, 1912.

See Fr. Pat. 451,276 of 1912; this J., 1913, 596.—T F. B.

Pump for use in connection with the spinning of artificial threads. F. Küttner, Pirna on Elbe, Germany. Eng. Pat. 28,320, Dec. 9, 1912. Under Int. Conv., April 29, 1912.

See Fr. Pat. 450,906 of 1912; this J., 1913, 596.—T. F. B.

Filaments, strips, films, sheets, and the like, from cellulose solutions; Process for the manufacture of ——. Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. Eng. Pat. 2992, Feb. 5, 1913. Under Int. Conv., April 13, 1912.

See Fr. Pat. 454,011 of 1913; this J., 1913, 865.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Acid dyebath; The mechanism of the ——. I. M. Fort. J. Soc. Dyers and Col., 1913, **29**, 269—277.

The author's view of the specific preparing action of acid dyebaths on wool, is that the latent basicity of the wool is developed by the acid and that the combination of the dyestuff with the fibre depends on the increase of the number of basic groups thus made available by the hydrolytic action of the acid. The amine groups of the wool must be supposed to combine with acids or colour-acids to form additive salts, analogous to the salts of aniline. The reactions taking place in the acid dyebath may be expressed thus: (1) H_2SO_4 + Na-colour-acid $\rightleftarrows$ Na_2SO_4+free colour-acid. On the fibre: (2) Wool + water $\leftrightarrows$ wool-hydrate, (3) Wool-hydrate + H_2SO_4 $\leftrightarrows$ wool-basic-hydrate-H_2SO_4, (4) Wool-basic-hydrate.H_2SO_4 + colour-acid $\leftrightarrows$ H_2SO_4 + wool-basic-hydrate-colour acid. Apart from colour or its absence, there appear to be two types of acid as regards behaviour towards wool: (1) A class which rapidly hydrolyses the wool complex, thereby increasing the basic groups available, such acids being usually removable by exhaustive extraction with water; these acids are the ordinary "assistant" acids employed in dyeing, also picric acid which happens to be coloured. (2) Acids possessing a weak hydrolysing action on the wool substance and only slightly capable of combining directly but readily replacing the acid groups of the first class in combination with the developed basic groups and not readily extracted by water. This second class comprises the colour-acids and certain others which do not happen to be coloured. By comparing the absorption of sulphuric acid alone and in presence of the colour-acid, it was found that definite molecular ratios exist between the two types of acid in relation to the wool and that, for instance, 2 mols. of sulphuric acid are replaced by 1 mol. of Bordeaux colour-acid in forming additive salts with wool. The function of sodium sulphate and the influence of the "neutral salt reaction" both in dyeing and stripping has also been studied, the effects being resultants of equilibria of a reversible reaction expressed thus: Wool-basic-hydrate-colour-acid + Na_2SO_4 $\leftrightarrows$ wool-basic-hydrate-H_2SO_4 + Na-colour-salt.—J. F. B.

Aniline black on wool. M. Prud'homme. Sealed note No. 1392, May 7, 1903. Report thereon by M. Battegay. Bull. Soc. Ind. Mulhouse, 1913, **83**, 371—372.

Instead of chlorinating the wool previous to dyeing with Aniline Black, the author oxidises with a mixture of chromic and oxalic acids. In the dyeing operation, aniline is used in conjunction with ferric chloride, or a copper salt. (See Fr. Pat. 333,386, this J., 1903, 1345.) —J. B.

Silk dyeing and finishing; Defects in ——. The neutral salt reaction with animal fibres. L. L. Lloyd. J. Soc. Dyers and Col., 1913, **29**, 259—265.

Boiling solutions of sodium sulphate, alone or in conjunction with dilute acetic or formic acid, cause a brown discolouration on silk, with loss of weight and lustre, and the solution deposits a gelatinous substance on cooling. This effect is due to the hydrolysis of the neutral salt in combination with the silk, forming silk-acid and silk-alkali compounds, the latter being the more soluble. A similar discolouration is produced by drying-in a dilute solution of sulphuric acid at the ordinary temperature. The action of potassium nitrate is similar but less pronounced; the discolouration is more intense in presence of acetic acid and strong if a trace of nitrite be present. The silk-gum or sericin, especially if fixed by the previous or simultaneous action of organic acids, is more liable to the discolouration, by the formation of silk-acid compound with neutral salts, than the fibroïn: hence the stains often observed with unevenly de-gummed silks. The immediate effect of the alkali halogen salts is far less than that of the sulphates, the initial loss of silk substance by solution being less. On storage or heating, however, a catalytic oxidation, with liberation of free halogen and production of soluble nitrogenous derivatives, takes place; the silk is discoloured and tendered and the ultimate effect is more serious. Chlorides are particularly destructive and their action is intensified by exposure to sunlight; the silk acts catalytically as an oxygen-carrier and the action is a continuous one. The baths used in dyeing and weighting silk generally contain neutral salts, often chlorides, frequently in conjunction with organic acids which intensify the action, and the oxidation effects are enhanced in the case of weighted silks by the catalytic influence of salts of iron, copper or chromium. Stains on dyed silk may be due to the local formation of silk-acid compound by splashes of neutral salts or acids, and the stain may result not only by the action on the silk substance but also by the action of free halogen or nitric acid on the dyestuff. A fruitful source of stains on undyed silk, particularly spun silk, is the presence of residues of soap from the scouring liquors, the soap being fixed by acids or by hydrolysis and setting up secondary actions in various ways.—J. F. B.

Steam brown on cotton; Process for producing a ——. Fabr. de Prod. Chem. de Thann et de Mulhouse. Sealed note No. 1350, Oct. 23, 1902. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1913, **83**, 369—371.

The fabric is padded with nitroso-β-naphthol (1 mol.) and *p*-phenylenediamine (1/16 mol.) together with a fixing agent such as chromium acetate. The reserve consists of sodium bisulphite and ammonium citrate. The print is fixed by steaming and finally soaping. Other amines can be employed besides *p*-phenylenediamine. The report states that the process has been used for a number of years, but is now made obsolete by the "Oxidation Browns," especially referring to "Paramine Brown."—J. B.

Patents.

Leaching and rinsing fabrics; Apparatus for ——. C. J. Feeny, London. From J. P. Bemberg A. G., Barmen-Rittershausen, Germany. Eng. Pat. 1633, Jan. 20, 1913.

With the object of diluting and rinsing out the caustic lye from mercerised cloth, the cloth is alternately steamed and passed over cooling rollers. The steam which has penetrated into the cloth is thereby condensed, the condensed liquor being removed by squeezing rollers. The steaming is carried out in a steam box free from air. In one arrangement the cooling rollers are inside the box, which is fitted with water seals. In another type of machine the cooling rollers are fixed to the side of the box, the cloth, which passes over them, forming a seal between the steam chamber and the rollers.—J. B.

[*Textile*] *material; Machine for treating —— with a liquid.* F. Schubert, Hamburg, Germany. Eng. Pat. 4569, Feb. 22, 1913.

The machine consists of a tank, and a conduit into which the liquid and the material pass, the conduit being brought round to the top of the tank so that liquid and material are returned to the tank. Circulation is secured by blowing gases into the conduit and heat may be applied by fire or by steam. The machine is stated to be specially useful for washing textiles at a low temperature.—J. B.

Dyeing apparatus. B. S. Summers, Port Huron, Mich., Assignor to Summers Linen Co., Maine. U.S. Pat. 1,069,827, Aug. 12, 1913.

The apparatus comprises a tank having a vertical partition dividing it into a dye vat and a plunger chamber, these being connected by an opening in the bottom of the partition. An up and down motion is given to the liquid by means of the plunger, while by means of a perforated bottom in the dye vat located above the opening in the partition, a lateral motion is given to the contained material. By means of a system of pipes and a pump, the liquid is withdrawn from the bottom of the tank and discharged into the top. A storage tank is also connected with the system on the suction side of the pump, and there is also a connection from the exhaust side of the pump to the storage tank for transferring the liquid thereto.—B. N.

Finishing of textile fibres. J. Gibson, Heaton Norris, Lancs. Eng. Pat. 19,016, Aug. 20, 1912.

Kieselguhr is used as an addition to the finishing preparation in place of the usual china clay.—J. B.

Sizing agents [*for textiles, etc.*]*; Production of a product for use in making feebly acid ——.* A. Deckers. Ger. Pat. 262,551, June 14, 1910.

A material suitable for use in preparing a sizing and glossing agent for yarns and fabrics, is obtained by melting a fat or fatty acid with boric acid and mixing one of the usual sizing salts with the product.—T. F. B.

Dyeing vegetable fibre. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 27,685, Dec. 2, 1912.

See Fr. Pat. 453,362 of 1913; this J., 1913, 749.—T. F. B.

Dyeing loose textile goods; Apparatus for ——. W. Berger, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,071,022, Aug. 26, 1913.

See Eng. Pat. 2547 of 1912; this J., 1912, 770.—T. F. B.

Brown shades on the fibre; Production of ——. A. Stiegler, Hagenau, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,071,274, Aug. 26, 1913.

See Addition of Feb. 15, 1911, to Fr. Pat. 357,472 of 1905; this J., 1911, 952.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Salts of the halogen acids and oxyhalogen acids; Action of sodium paratungstate in fusion on ——. S. B. Kuzirian. Amer. J. Sci., 1913, **36**, 301—304.

Sodium paratungstate can be used for the determination of the acid radical in iodides and iodates, just as in the case of carbonates and nitrates (this J., 1911, 800), the mixture of the iodide or iodate and paratungstate being gently ignited in a platinum crucible for 5—10 minutes. Chlorides, chlorates, perchlorates, bromides, bromates, fluorides and silicofluorides are not decomposed completely by sodium paratungstate under these conditions. The action in the case of halogen and oxyhalogen salts appears to be due to the agency of atmospheric oxygen or moisture, which oxidises the metal to a basic oxide capable of combining with the acidic tungstic oxide. —A. S.

Chlorides, chlorates, perchlorates, bromides, bromates, and fluorides; Use of sodium paratungstate and the blowpipe flame in the determination of the acid radicals of ——. S. B. Kuzirian. Amer. J. Sci., 1913, **36**, 305—312.

The salts mentioned in the title are only partially decomposed by heating with sodium paratungstate alone (see preceding abstract), but are completely decomposed in presence of superheated steam, *e.g.*, that present in the products of combustion of a blowpipe flame. A sharp, thin blowpipe flame is directed upon the surface of the fused mixture contained in a platinum crucible. With 0·2 grm. of sample and 2 grms. of sodium paratungstate, decomposition is complete in 5 mins. for perchlorates, 7—10 mins. for chlorates, 15—20 mins. for chlorides, 9 mins. for bromides, 12—15 mins. for bromates, and less than 5 mins. for fluorides.—A. S.

Sodium silicate and ferric chloride solutions; Reaction between ——. R. E. Liesegang. J. prakt. Chem., 1913, **88**, 358—360.

If a 20 per cent. solution of ferric chloride be introduced carefully so as to form a separate layer above a solution of sodium silicate of 40° B. (sp. gr. 1·41), the iron solution penetrates downwards solely at the wall of the containing vessel and finally forms an annular envelope around the sodium silicate solution. Between the two there is a thin, irregular but continuous, firm skin of silicic acid permeated by irregular veins of ferric hydroxide. No trace of iron silicate is formed. It is considered that these phenomena, depending upon the hydrolysis of ferric chloride and unequal diffusion of the products of hydrolysis and sodium silicate, may afford an explanation of some of the results obtained by Jordis (this J., 1908, 334; 1910, 563) in studying the reactions of silicates.—A. S.

Phosphate industry of Egypt. Board of Trade J., Sept. 4, 1913. [T.R.]

The exploitation of the phosphate deposits in Egypt was commenced in 1908, and the growth of the output of phosphates since then is shown by the following figures:—1908, 700 tons; 1909, 1,000 tons; 1910, 2,397 tons; 1911, 6,425 tons; 1912, 69,958 tons. As there is no factory in Egypt for the manufacture of superphosphates, and as the local demand for phosphates as fertiliser is at present negligible, practically the whole of the phosphate mined is now exported. There are many low-grade deposits, however, which may in time become of commercial value if a demand should arise for raw phosphate as a fertiliser.

Patents.

Nitric acid; Process for the continuous production of ——. A. Klages and Saccharinfabrik A. G., vorm. Fahlberg, List und Co., Salbke-Westerhüsen, Germany. Eng. Pat. 3264, Feb. 7, 1913.

Potassium nitrate and sulphuric acid (preferably in almost equivalent proportions) are poured simultaneously upon the surface of a large quantity of fused potassium bisulphate contained in a retort. The distillate is condensed in the usual manner, whilst the fresh bisulphate produced, which sinks to the sole of the retort, is continuously removed by an overflow device.—F. Sodn.

Sodium bisulphate in the manufacture of nitric acid; Process for obtaining —— *in a form in which it can be directly calcined.* A.-G. Dynamit Nobel. Ger. Pat. 263,120, Jan. 25, 1913.

Organic substances, preferably cellulosic materials such as sawdust, peat, or the like, are stirred into the fused bisulphate whilst it is solidifying: vigorous evolution of gas takes place and a loose spongy solid product is obtained, containing some carbon, which in the subsequent calcination acts as a reducing agent and is expelled as carbon dioxide.—A. S.

Ammonia; Manufacture of pure ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 25,259, Nov. 4, 1912.

Liquid ammonia, obtained catalytically, is rendered free from dissolved gases (uncombined nitrogen and hydrogen) by fractional distillation, preferably under pressure. —F. Sodn.

Ammonium sulphate; Apparatus for the manufacture of ——. Soc. Lorraine De Carbonisation. Fr. Pat. 454,246, Feb. 11, 1913.

The lower, open portion of a vertical bell-jar is immersed in the liquor of a saturator and is provided with perforations, so that free percolation takes place between the inside and the outside of the bell. Ammoniacal gases pass through a tube running axially down the centre of the bell-jar, to an open end, situated in the liquor slightly below the end of the jar, and also fitted with perforations. Unabsorbed ammonia rises into the unsubmerged portion of the bell and meets a downward shower of acid, introduced by a number of tubes, each fitted with a rose. The waste gases are aspirated through a drying apparatus fitted with baffle plates, which retain traces of liquor and ammonium sulphate, otherwise lost.—O. R.

Oxides of nitrogen; Apparatus for forming ——. J. S. Island, Toronto, Canada. Eng. Pat. 11,363, May 13, 1912.

Two electrodes (one fixed and the other movable) are so arranged that one, which is hollow, projects the gaseous mixture to be treated, in an annular sheet, and the other gives rise to an annulus of electric flame in the plane of the projected gas, which is forced directly into the hottest region of the flame and thence through the outer zone, so as to ensure rapid oxidation and fixation of the oxides. In the apparatus described, the outer positive electrode is stationary and consists of a hollow ring of triangular cross section, with the apex directed inwards; inlet openings for compressed air are provided in the outer surface of the electrode, and the inner periphery is pierced with a number of small holes through which the air is forced from the electrode, radially towards the centre of the ring. The inner electrode is rotary and disposed axially with respect to the ring electrode; it is formed with radial arms having segmental portions at the ends, which are triangular in section, and the apex of the triangle is, in this case, directed outwards so as to be in the same plane as the inwardly turned apex of the stationary electrode. The electrodes, and also a tubular cooling chamber, are enclosed within a cylindrical casing which is provided with openings for the exit of the gases.—F. Sodn.

Condensing towers with exhausters for nitrous gases; System of ——. H. Kirchhofer. Ger. Pat. 262,464, Nov. 3, 1912.

An exhauster is connected with the pipe leading to the first condensing tower, and blows air in the form of a jet into this pipe in the direction in which the nitrous gases are flowing. Just over the place where the inlet pipe enters the first condensing tower a helical partition is disposed, which forces the gases to take a spiral path upwards through the tower.—A. S.

Perborates; Process for the manufacture of ——. Chemische Fabrik Grünau Landshoff und Meyer, Aktienges., Grunau, and K. Arndt, Charlottenburg. Eng. Pat. 12,536, May 29, 1913. Under Int. Conv., June 25, 1912.

A process is claimed, generally, for preparing a perborate by electrolysing a solution of a borate and a carbonate, and specially for preparing sodium perborate, by passing a current of 2—4 amp., per sq. cm. of anode surface, through a solution containing 150 grms. of sodium carbonate and 60 grms. of borax per litre. The perborate separates on slight cooling.—F. Sodn.

Sulphur compound [sodium polysulphide]; Process of making ——. C. E. Hite, Burlington, N.J., Assignor to W. Pincus, Philadelphia, Pa. U.S. Pat. 1,068,769, July 29, 1913.

About equal parts by weight of sulphur and caustic soda are treated with water and heated, so as to evaporate a portion of the water without volatilising any appreciable amount of sulphur. The resulting product, containing practically no uncombined alkali and about 37 per cent. of "uncombined sulphur," is soluble in water.—O. R.

Alkali sulphides; Process of manufacture of ——. H. Gouthière et Cie. and M. P. Ducancel. First Addition, dated May 17, 1912, to Fr. Pat. 448,927, Dec. 9. 1911 (this J., 1913, 425).

The products of dry distillation of coal are passed into saturators containing milk of lime and alkali sulphate, with the production of soluble alkali sulphydrate and a residue of calcium carbonate and sulphate. The latter mixture may be briquetted with the raw materials, which are subjected to distillation, and the residual calcium sulphide and lime used in the saturators (this J., 1913, 425), thereby recovering a portion of the sulphur of the alkali sulphate used in the first absorption.—O. R.

Acid-phosphate chambers; Apparatus for emptying —— A. Shepanek, West Hammond, Ill. U.S. Pat. 1,070,296, Aug. 12, 1913.

A travelling support comprising base and upright is fitted with laterally projecting scraping mechanism mounted for vertical movement upon the upright, and there are means for actuating the mechanism and for moving it vertically (preferably at the same time). The scraping mechanism described consists of arms which project from opposite sides of the upright and upon each of which is mounted an endless travelling carrier with scrapers, the carriers being so driven that their under sides move towards the centre of the machine.—F. Sodn.

Sulphate of potash and alumina; Manufacture of ——. H. F. Chappell, New York. U.S. Pat. 1,070,324, Aug. 12, 1913.

Alumstone or alum rock is submitted to such a temperature (800°—1000° C.), that the aluminium compounds present are converted into insoluble aluminium oxide and the potassium compounds into potassium sulphate, which is then extracted by lixiviation.—F. Sodn.

Oxalates; Process of making ——. A. Hempel, Leipzig-Oetzsch, Germany. U.S. Pat. 1,070,806, Aug. 19, 1913.

Formates are gradually heated to 360°—440° C., during the passage through the material of the hot waste gas, obtained in the manufacture of formate from carbon monoxide and caustic alkali.—F. Sodn.

Barium salts; Manufacture of soluble ——. F. F. Hunt, New York. U.S. Pat. 1,070,810, Aug. 19, 1913.

Material containing barium in a form soluble in acid, such as residues from furnacing barytes, is moistened with a limited quantity of an acid forming a barium salt soluble in water (*e.g.*, an equivalent quantity of hydrochloric acid). The semi-liquid mixture is dried and heated to render impurities insoluble. The product is then leached with water, and the barium salt crystallised by concentrating the leachings.—F. Sodn.

Alkaline-earth sulphates; Process and apparatus for converting —— *into carbonates with recovery of sulphur.* G. Teissier. Fr. Pat. 454,036, Feb. 6, 1913.

The sulphate of an alkaline earth, such as barium sulphate, is reduced at a red heat with an equivalent quantity of coal-tar, with the formation of barium sulphide and carbon dioxide. The latter is led into a receiver and brought into contact with a filtered solution of the barium sulphide, which enters the receiver in the form of spray. Barium carbonate is formed and the hydrogen sulphide evolved, is washed, lime-purified, and sprayed in a second receiver with aqueous sulphurous acid, to recover sulphur.—O. R.

Magnesia from magnesian rocks; Process of extracting ——. Soc. Anon. Des Produits Dolomitiques de l'Hérault. Fr. Pat. 454,162, Feb. 10, 1913.

In the treatment of calcined dolomitic rocks with water and carbon dioxide under pressure (see Fr. Pat. 413,793 of 1910, this J., 1910, 1105), sufficient carbon dioxide is used to carbonate the magnesia only, this reaction being completed before the lime is attacked, and requiring only one-third of the amount of carbon dioxide necessary for complete solution. The filtered solution, allowed to stand in closed vessels at a temperature not exceeding 15° C., deposits the normal, crystalline carbonate ($MgCO_3$, $5H_2O$), and if exposed to the atmosphere at a temperature above 20° C., the carbonate ($MgCO_3$, $3H_2O$).—O. R.

Sodium hypochlorite; Apparatus for the manufacture of ——. A. Champ. Fr. Pat. 454,751, Feb. 24, 1913.

Two receivers are mounted one above the other; the upper one contains a perforated cage, in which the materials are dissolved, and communicates with the lower receiver by a tap, by which liquor can be drawn off at any desired level, above the height of the muddy deposits settling at the bottom of the upper receiver. The tap is a grooved spindle fitting in a bearing with a helicoidal groove, so that the two grooves engage at a point, higher up or lower down, according as the tap is turned one way or the other. By the use of this apparatus clear solutions of sodium hypochlorite are obtained without loss of chlorine or excess of causticity.—O. R.

Chlorides and sulphates of metals; Preparation of solid —— *capable of yielding colloidal solutions.* L. Karczag. Ger. Pat. 263,286, Sept. 9, 1911.

Salts of organic carboxylic acids are treated with thionyl chloride, sulphuryl chloride, or chlorosulphonic acid. Examples:—

$$R.COOMe+SOCl_2=MeCl+R.COCl+SO_2$$
$$2R.COOMe+SO_2Cl_2=2RCOCl+Me_2SO_4.$$

—A. S.

Hydrogen; Process of manufacturing ——. G. F. Jaubert. Fr. Pat. 454,616, April 30, 1912.

To obtain a rapid and constant evolution of hydrogen by the interaction of silicon, aluminium, or alloys containing the same, with an alkali hydroxide, an emulsion of a concentrated solution of the latter with a non-saponifiable oil or grease, such as a paraffin, is heated to 100° C. with the elements or alloys named in the form of fine powder, water being added as fast as it is decomposed, and the frothy mass being kept constantly agitated.—O. R.

Zirconium oxide free from iron; Preparation of white ——. B. Havas. Ger. Pat. 262,009, May 5, 1912.

Neutral or acid solutions of zirconium salts mixed with other salts are heated under pressure to a temperature higher than the boiling point of the solution at atmospheric pressure, and the precipitated zirconium oxide is separated from the impurities which remain in solution. Zirconium oxide obtained by hydrolysis from boiling solutions under atmospheric pressure cannot be easily filtered, but by heating to a higher temperature, under increased pressure, is converted into a product which can be readily separated by filtration.—A. S.

Sulphuric acid; Concentrating apparatus for ——. A. G. Duron, Wiesbaden, Germany. Eng. Pat. 3444, Feb. 10, 1913. Under Int. Conv., Feb. 14, 1912.

See Fr. Pat. 454,732 of 1913; this J., 1913, 790.—T.F.B.

Sulphuric acid; Process for the manufacture of ——. P. Farup, Trondhjem, Norway. Eng. Pat. 5079, Feb. 28, 1913. Under Int. Conv., Feb. 29, 1912.

See Fr. Pat. 454,893 of 1913; this J., 1913, 867.—T. F. B.

Ammonia or other nitrogen-hydrogen compounds; Processes for preparing synthetically ——. F. Hlavati, Vienna. Eng. Pat. 1142, Jan. 15, 1913.

See Fr. Pat. 453,207 of 1913; this J., 1913, 791.—T. F. B.

Furnaces of the channel or tunnel type. A. H. Cowles, Sewaren, N.J., U.S.A. Eng. Pat. 19,606, Aug. 27, 1912.

See U.S. Pat. 1,040,895 of 1912; this J., 1912, 1124.—T.F.B.

Zirconium oxide; Process of producing white —— and particularly zirconium oxide free from iron. B. Havas, Berlin. Eng. Pat. 9153, April 18, 1913. Under Int. Conv., May 4, 1912.

See Ger. Pat. 262,009 of 1912; preceding.—T. F. B.

Aluminium nitride from bauxite or other aluminiferous materials; Process and apparatus for the production of ——. G. Giulini, Como, Italy. Eng. Pat. 25,874, Nov. 11, 1912. Under Int. Conv., Jan. 29, 1912.

See Fr. Pat. 451,405 of 1912; this J., 1913, 600.—T.F.B.

Aluminous compounds; Production of ——. H. Spence and W. B. Llewellyn, Assignors to P. Spence and Sons, Ltd., Manchester. U.S. Pat. 1,070,300, Aug. 12, 1913.

See Eng. Pat. 3805 of 1912; this J., 1913, 363.—T. F. B.

Aluminium hydrate; Method of precipitating ——. E. S. Fickes, Pittsburgh. U.S. Pat. 1,070,438, Aug. 19, 1913.

See Fr. Pat. 451,593 of 1912; this J., 1913, 602.—T. F. B.

Nitrites; Production of ——. F. Rothe, Dessau, Assignor to Elektrochemische Werke G. m. b. H., Bitterfeld, Germany. U.S. Pat. 1,070,070, Aug. 12, 1913.

See Fr. Pat. 441,706 of 1912; this J., 1912, 922.—T. F. B.

Catalytic substances in a minutely-divided state; Process for the preparation of ——. H. Kast, Berlin. U.S. Pat. 1,070,138. Aug. 12, 1913.

See Ger. Pat. 256,962 of 1910; this J., 1913, 426.—T.F.B.

Hydrogen; Process for the manufacture of ——. G. F. Jaubert, Paris. Eng. Pat. 7494, March 29, 1913. Under Int. Conv., April 30, 1912.

See Fr. Pat. 454,616 of 1912; preceding.—T. F. B.

VIII.—GLASS; CERAMICS.

Glass manufacture; Application of oxides less often used in ——. L. Springer. Sprechsaal, 1913, **46**, 476—478, 495—496, 511—512, 525—527.

The introduction into glass of the oxides of barium, zinc, magnesium, aluminium, boron and phosphorus is regarded from the points of view of history, raw material, properties, and application. *Barium oxide*, first used by Döbereiner at Jena in 1829, is introduced generally as carbonate, less often as sulphate or nitrate. It increases the specific gravity, refractive index, elasticity and tenacity of glass, and imparts an attractive surface, but renders it more difficult to work; it also lessens the specific heat. Compared with calcium oxide, it is more expensive and does not impart chemical resistance, in this respect resembling more nearly the alkali oxides. Barium glasses fuse more quickly than similar lime glasses. Barium finds its chief application in rolled glass, but is also used in hollow ware, crystal and table glass, and in special glasses, such as the Jena phosphate crown glass, which is essentially a barium metaphosphate containing 28 per cent. BaO and 60 per cent. P_2O_5. It can act as a substitute for lead oxide in crystal glasses, a suitable formula being: $4Na_2O,4BaO,4CaO,36SiO_2$. In table-glass it can replace lime and soda. *Zinc oxide*, which was employed in Belgian factories in the middle of the last century, is introduced as oxide under the names of zinc white, snow white or crown white; also as zinc blende mixed with Glauber salt, and as calamine. The power of refraction it imparts is less than that produced by lime and much less than by lead and barium. It acts as a basic oxide like magnesia in producing a very low coefficient of expansion, for which reason it is used with boric acid in the manufacture of flashed glass. Zinc glasses have high tensile strength and high resistance, physical and chemical; they tend to crystallisation and devitrification. They are used chiefly for laboratory and optical purposes. *Magnesium oxide* is introduced as the carbonate, usually with lime in dolomite, but many felspars, granites, basalts, etc., contain as much as 10 per cent. MgO. Calcspars, with a magnesia content of 18 per cent., have been used. It has thus found application in glass from the earliest times without contemporary recognition in the literature of the subject. It finds greatest employment in the French factories. Magnesia increases the fluidity and lowers the viscosity of molten glass and does not unfavourably influence fusibility, tendency to devitrification, nor chemical resistance; the most suitable amount is 2—10 per cent. *Aluminium oxide* renders glass difficultly fusible, but prevents devitrification. It is introduced as clay, bauxite or felspar, but the range of raw materials was extended at the end of last century to include lavas and other similar aluminium silicates. The presence of alumina enables the lime-content to be increased without the glass becoming rough. It makes glass chemically resistant. In manufacture it assists the reactions between silica and the alkalis and hinders the reducing and other deleterious action of the fire-gases, when they come into direct contact with the melt. Alumina is used chiefly in the manufacture of flasks, acid receptacles, etc., the content being 4—10 per cent. *Boric acid*, which is found to be a constituent of old Venetian glass, is introduced as the crystalline hydrate or as borax. It imparts high refractiveness, and in the spectrum reduces the proportion of blue to red, a relation which had previously been exaggerated in flint and crown glass. Coefficient of expansion, tendency to devitrification, and melting point are lessened by high boric acid content. When boric acid is used in conjunction with other acid oxides, the glasses, as for example borosilicate glass, are very resistant to chemical action if the proportion of boric acid be not greater than 10 per cent. Boric acid is employed in crystal and optical glass. Owing to its low thermal conductivity it is also used in flashed glass. *Phosphoric acid* is introduced as bone ash or other phosphate. It is used for optical purposes, often in conjunction with boric acid. Phosphor-crown glass may contain as much as 70 per cent. P_2O_5. *Arsenic* and *antimony* are used in glass-making for assisting the progress of chemical reactions and as decolourizers. Jena cylinder glass has a high boric acid content with 4 per cent. Sb_2O_3.—H. H. S.

Charlottenburg porcelain factory; Chemico-technical research institute of the ——. R. Rieke. Sprechsaal, 1913, **46**, 491—495.

The 150th anniversary of the foundation of the research institute is marked by a brief history of its career and by a bibliography of its publications for the last ten years.
—H. H. S.

Patent.

Glass articles; Manufacture of ——. H. Fritsch, Karlsbad, Bohemia. Eng. Pat. 11,837, May 21, 1913. Under Int. Conv., Sept. 3, 1912.

Glass powder is heated in moulds made of a mixture of china clay, quartz and felspar until the powder fuses, when the moulds can be broken or scraped off the articles. By this process part of a mould may be filled with glass powder of one colour, which is fused, then the rest of the mould may be filled with powder of another colour and fused, without intermixture of the coloured glasses taking place.—W. C. H.

IX.—BUILDING MATERIALS.

Patents.

Cement plates ; Manufacture of ——. G. Oberleithner, Mahr Schonberg, Germany. Eng. Pat. 23,559, Oct. 15, 1912.

Portland or Roman cement paste is mixed with silica, pressed into plates, subjected to the action of carbon dioxide at normal or increased pressure, and dried by steam or hot air, whereby the formation of cement "bloom" (calcium carbonate incrustations) is avoided and the strength of the plates is increased.—O. R.

Cement mixtures ; Process for the preparation of a furnace charge in small lumps from moistened fine materials, especially —— the fuel being incorporated with the charge. F. C. W. Timm. Ger. Pat. 263,050, Dec. 15, 1911.

Water in a finely-divided condition is added to the material and is allowed time to soak in, whereby small lumps of moistened material are formed, and the turning over of the mixture for the purpose of agglomerating it is controlled so as to avoid, as far as possible, disaggregation of the firmer inner portions of these lumps. The turning over is continued after the addition of water has ceased, so as to effect a separation of the firmer lumps from the remainder of the mixture, and the latter is mixed with a fresh quantity of dry raw material and again subjected to the treatment.—A. S.

Slags ; Process for causing fused —— to solidify in a porous condition. C. H. Schol. Ger. Pat. 263,002, Aug. 7, 1912. Addition to Ger. Pat. 252,702.

The fused slag is distributed over a porous bed of sand containing air and water. The water is converted into steam, whilst the air is strongly heated and hence exerts a similar action to the compressed air which was supplied separately according to the chief patent.—A. S.

Wood ; Process for treating [tinting] ——. L. Doyen, Paris. Eng. Pat. 1063, Jan. 14, 1913. Under Int. Conv., Jan. 27, 1912.

The surface of wood that contains all its sap and resinous matter, is exposed in an air-tight vessel to the action of nitrous acid vapours or nitrogen peroxide, thereby acquiring a golden shade of variable intensity. —O. R.

Acid tar from the treatment of petroleum with sulphuric acid ; Process for working up the ——. Ger. Pat. 261,777. *See* III.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electro-deposited iron ; The crystallising properties of ——. J. E. Stead and H. C. H. Carpenter. Iron and Steel Inst., Sept. 1913. [Advance proof.]

The authors have found that sheets of pure electro-deposited iron undergo recrystallisation when cooled from above the Ac3 point to below the Ar3 point, resulting in the production of very coarse crystals, but that annealing at 700° C. to 800° C. has no effect in coarsening the structure. These results are directly contrary to those obtained with wrought iron and very mild steel by the same treatments. Moreover, the capacity of forming large crystals on cooling through Ar3 is not a general property of pure electro-deposited iron, but is confined to sheets whose thickness does not exceed about 0·011 to 0·012 of an inch. The most striking results are obtained at a thickness of 0·009 to 0·01 of an inch. Once the coarse crystals are formed they cannot be destroyed except either by cold mechanical work, or by heating above Ac3 followed by quenching. The authors consider that at Ar3 the iron changes direct from the γ to the α condition, and that a certain number of α nuclei are present, even after two or three hours' heating above Ac3, which act as centres of rapid crystallisation when the Ar3 change occurs. This latter view is supported by the fact that very prolonged heating above Ac3, followed by slow cooling, gives rise to very fine crystals. The crystallisation changes described are illustrated by photographs.—T. St.

[Steel] Critical points Ar1, Ac1 , A new method for the determination of the ——. J. E. Stead. Iron and Steel Inst., Sept. 1913. [Advance proof.]

Two bars of the steel to be tested, conveniently measuring $115 \times 10 \times 5$ mm., are supported out of contact with each other in a short porcelain tube, which is then inserted in the side of a muffle furnace, so that while the inner ends of the bars are heated to about 1000° C., the outer ends remain well below 700° C. After about 30 minutes the temperatures, which have then become constant, are ascertained by introducing thin wires of silver, aluminium, zinc, etc., into the passage between the bars, and noting the points at which the wires fuse. A scale giving the temperature at each point along the bars can thus be plotted. The bars are removed, quenched, ground to remove the decarburised skin, immersed in dilute nitric acid, washed in water and alcohol, and dried. The hardened part is then seen to be quite black, whilst the soft part is gray, the plane of abrupt change indicating the critical point Ac1. A method of obtaining the points Ar1 and Ac1 at the same time, is to heat two bars of the same steel together, and after the temperature is constant, slowly to withdraw one bar for about 15 mins., continue the heating for 15 or more minutes and then, after taking the temperature readings, to quench and etch the bars. The withdrawn bar will give the point Ar1. It is stated that the method gives results within 3° C. of the truth.—T. St.

Carbon in a 0·32 carbon steel ; Effect of heat treatment on the colorimetric test for ——. E. D. Campbell and F. D. Haskins. Iron and Steel Inst., Sept. 1913. [Advance proof.]

Portions of the same steel were subjected to different heat treatments and colour tests were applied in the case of each portion. The hardness of steel is indicated as primarily due to the presence of undissociated carbides of low molecular weight in solid solution in γ-iron. The solvent iron probably exists in two allotropic forms, having different solvent and dissociating powers, whilst the carbides constitute the solutes, the molecular weights, solubilities, dissociation, etc., of which depend upon the carbon concentration and heat treatment.—T. St.

Manganese steel ; Heating and cooling curves of ——. R. A. Hadfield. Iron and Steel Inst., Sept. 1913. [Advance proof.]

Samples of manganese steel, cast and forged, containing C 1·16 and 1·26, Si 0·21 and 0·32, and Mn 10·88 and 13·38 per cent., respectively, were heated to 1300°—1355° C. and subsequently cooled, both slowly and rapidly, to about 150° C. No critical points of any kind were indicated by the curves obtained, and this circumstance is remarked upon, since it is well known that the physical qualities of manganese steel are profoundly influenced by the rate of cooling. All the specimens employed, however, remained non-magnetic during heating and cooling, and, in view of a recent investigation by B. Hopkinson and the author (as yet unpublished) it is considered possible that a critical point commencing at about 630° C. exists in manganese steel rendered magnetic by long soaking at about 450°—500° C.—W. E. F. P.

Gold, Determination of —— in the presence of iridium and allied metals in materials such as black sand. J. Gray and C. Toombs. J. Chem., Met. and Min. Soc., S. Africa, 1913, **14**, 1—9.

By J. Gray. 0·5 to 2 assay tons of the material are assayed in the usual manner (inquartation silver also being preferably added to the charge) and the lead button cupelled. The silver is dissolved in hot concentrated sulphuric acid and the residue of gold and platinum metals, after weighing, is treated with *aqua regia.* The solution is filtered, made alkaline with sodium hydroxide, and the gold then precipitated by the addition of 10 to 20 c.c. of hydrogen peroxide. The precipitated gold is filtered, and after washing, is run down in a crucible with borax, litharge, and a reducing agent, or scorified, and the resulting lead button is cupelled, and the gold weighed. This weight deducted from the first weight gives the platinum metals. A blank test should be made simultaneously with pure gold.

By C. Toombs. One assay ton of the black sand is roasted at a scarcely perceptible red heat in the muffle till free from sulphur, and is then run down with a charge containing 4 grms. of flour. Inquartation silver is also added to the charge. The button is cupelled and the bead, after rolling and annealing, is parted in dilute nitric acid (5 of acid to 12 of water). The gold and iridium are weighed together, and the gold is then dissolved out by 1 c.c. of 10 per cent. *aqua regia* in a long test tube. The iridium is filtered off, ignited and weighed. The gold may be taken by difference, or may be precipitated by cuprous chloride from an alkaline cyanide solution, obtained in a button, cupelled and parted. The sum of the separate estimations of gold and iridium should agree with the first weighing within ±0·02 mgrm. Blank tests with pure gold should be made, starting from the cupellation of the button obtained from the original black sand fusion. The roasting, followed by fusion with excess of flour in the charge, has been found by the author to give good gold results, with maximum values for iridium.—T. St.

Copper; Action of sulphur dioxide on —— at high temperatures. C. M. Stubbs. Chem. Soc. Trans., 1913, **103**, 1445—1461.

The author's experiments on the depression of the freezing point of copper by dissolved sulphur dioxide and on the influence of excess of cuprous sulphide or oxide on this depression, indicate that the dissolved sulphur dioxide interacts with the copper, with the formation of cuprous sulphide and oxide, but that the reaction is only 70 per cent. complete at atmospheric pressure (see also this J., 1910, 1161; 1913, 292). The work of Schenck and Hempelmann (Metall u. Erz, 1913, **1**, 283) on the equilibrium between sulphur dioxide, solid copper, cuprous sulphide and cuprous oxide has been extended to temperatures from 700° C. to near the melting point and a curve showing the equilibrium pressures of sulphur dioxide at temperatures up to about 1050° C. is given: this pressure rises from less than 1 atmosphere at 726° C. to nearly 7 atmospheres at 1050° C.—A. S.

Oxygen; The determination of —— in copper and brass. T. West. Inst. of Metals, August, 1913. [Advance proof.]

Oxygen in brass occurs chiefly as zinc oxide and its estimation by reduction with hydrogen is unsatisfactory. It can be satisfactorily determined by reduction with a quick stream of carbon monoxide, the carbon dioxide formed being equivalent to the zinc oxide present. Carbon monoxide prepared from sodium formate and sulphuric acid was used, and the combustion tube was of glazed silica, resting in the porcelain tube of an electric furnace fitted with water-cooled ends. In making a determination, the sample was introduced only after a two-hour run with the furnace heated to 1050° C. had given a blank not exceeding 0·0002 grm. Weights of between 30 and 80 grms. of brass were taken, as the oxygen content scarcely ever exceeded 0·002 per cent. Before introducing into the combustion tube, the piece of alloy was carefully filed, washed in alcohol, and dried over quicklime. The method is not applicable to brasses containing tin or nickel, as in these cases the carbon monoxide is decomposed with deposition of carbon.—T. St.

Metals: Corrosion of ——. Second Report to the Corrosion Committee of the Institute of Metals. G. D. Bengough and R. M. Jones. Inst. of Metals, August, 1913. [Advance proof.] (See also this J., 1911, 219.)

The effect of sea-water under varying conditions has been investigated on brass tubes of the following percentage compositions :—(1) Cu 70, Zn 30; (2) Cu 70, Zn 28, Pb 2; (3) Cu 61, Zn 39; (4) Cu 70, Zn 29, Sn 1. Immersion in stationary sea-water at room temperature gave rise in all cases to general corrosion, in which both copper and zinc were removed, but no pits were formed. Pieces of graphite, coke, clinker, etc., fastened to the tubes did not give rise to any increased action, and flaws in the tubes did not appear to have any influence. A film of cuprous and zinc oxides first formed, due to the action of dissolved oxygen, and this at once reacted with the salts in the water with formation of basic chlorides and carbonates. All the copper and most of the zinc removed were precipitated. Immersion in stationary sea-water at 40° C. gave rise, in addition to general corrosion, to dezincification. It would appear that, at this temperature, the zinc first dissolved reacts with oxygen to form a basic oxychloride which is precipitated on the tube at any point of roughness. When once this white salt has been deposited at any point, the action becomes localised, and it appears that the salt exerts a regenerative action in bringing about the transfer of chlorine from the sea-water to the zinc of the brass. Tests made at 50° C. on tubes (1) and (4) showed that the attack on tube (1) had become almost entirely confined to the zinc, marked dezincification taking place. Tube (4) however was less acted on than at 40° C., and showed no signs of dezincification after six weeks' immersion. Both at 40° C. and at 50° C. the presence of foreign matter in contact with the tubes appeared to have little or no effect. Tests with the four classes of tubes were also made in an experimental condenser plant, the same sea-water being passed again and again through the tubes, until the total chlorides had risen from 3·19 to 4 per cent. This took place during warm weather in about six weeks. The sea-water was then replaced by a fresh quantity. The plant was run for nine months, and was shut down each night and for week ends. The tubes (4) and (2) were least attacked, whilst tube (3) was most attacked. Temperature was found to play a most important part, the hotter parts of the tubes being in all cases more strongly attacked. Corrosion occurred mostly along the bottoms of the tubes, but was found also along the sides and occasionally along the tops. Tubes which had been protected with iron slabs were found to contain a thin adherent film of calcium carbonate, formed, it is considered, by the decomposition of the bicarbonate by the action of the current in the iron-sea-water-brass circuit. The electrical resistance of the film of calcium carbonate affords an explanation of why iron slabs secured to the tube plates can effect a protective influence on the centre parts of the tubes. The authors consider that selective corrosion, resulting in dezincification and pitting, is an inherent property of the alloys examined, provided that sea-water and the requisite temperature conditions are present, and that the best means at the disposal of engineers for hindering corrosion appear to be :—(1). The entire abandonment of the use of alloy (1), and its replacement by either the Admiralty alloy (4), or Muntz's special brass (2). (2). Careful control of the temperature in condensers. (3). The extended use of electro-chemical protection.—T. St.

Nickel-brasses. L. Guillet. Rev. Mét., 1913, **10**, 1130—1141.

Nickel by reason of its negative coefficient of equivalence ($t = -1{\cdot}3$) is the most efficient of the metals yet examined in raising the "imaginary percentage" of copper in brass (see this J., 1906, 540, 813, where these expressions are

explained), *i.e.*, a brass containing a certain percentage of nickel in addition to copper and zinc is similar in mechanical properties to an ordinary brass of higher copper content than would be the case if the nickel were replaced by another metal. Other things being equal, the addition of a small percentage of nickel makes a brass easier to work cold. Tables are given showing the improvement in the mechanical properties of brasses effected by the presence of up to 10 per cent. of nickel.
—A. S.

Copper-tin alloys; Electrical conductivity of——. N. A. Puschin and A. V. Boskov. J. Russ. Phys.-Chem. Soc., 1913, **45**, 746—752.

The curves showing the variation of (1) the specific resistance and (2) its temperature coefficient with the composition of copper tin alloys indicate the existence of a definite compound, Cu_3Sn. The low value of the temperature coefficient, corresponding with the composition Cu_4Sn, indicates the formation, not of a definite compound, but of a solid solution. The addition of tin to copper causes a very rapid increase in the resistance, while copper produces but little change in the resistance of tin.—T. H. P.

Copper-aluminium alloys; Influence of phosphorus on some——. A. A. Read. Inst. of Metals, Aug., 1913. [Advance proof.]

Alloys containing 5 and 10 per cent. Al and varying amounts of phosphorus (0·03—0·50 per cent. for the 10 per cent. Al and 0·06—1·02 per cent. for the 5 per cent. Al alloys) were submitted to the following tests: rolling, wire-drawing, tensile strength, alternating stress, hardness, conductivity, melting-point, corrosion, microscopical examination. Some of the results showing the effects produced by phosphorus are tabulated below:—

Test.		Cu 90, Al 10.	Cu 95, Al 5.
	Rolling	Rolled quite well	0·09%P: broke badly.
Tensile tests	Annealed (800°)	Yield point slightly raised.	Yield point rises a little.
	Chill castings	Yield point unaltered.	Yield point rises continuously.
Hardness	Annealed	Hardness unaltered.	Hardness unaltered.
	Cold drawn	Hardness slightly raised.	Chill castings: hardness (above 0·25%) raised considerably.
	Conductivity	Diminished.	Diminished more strongly.
	Wire drawing	Wires sound and smooth.	
	Melting point	Falls as P increases.	
Corrosion	Fresh-water	No sign of corrosion.	
	Sea-water	Phosphorus reduces corrosion.	

—W. R. S.

Zinc and cadmium; Influence of temperature and pressure on the volatility of——. T. K. Nair and T. Turner. Chem. Soc. Trans., 1913, **103**, 1534—1543.

In attempting to remove zinc by volatilisation *in vacuo*, on a practical scale from a charge of about 150 kilos. of a zinc alloy (see this J., 1912, 134, 391), it was found that small imperfections in the vacuum considerably diminished the rate of volatilisation. Laboratory experiments with zinc and with cadmium showed that at a given pressure, appreciable volatilisation does not take place until a definite critical temperature is attained, but from this point the rate of volatilisation increases with rise of temperature independent of the initial pressure. A rise of temperature about 90° C. above that required for 10 per cent. volatilisation will increase the volatilisation to 100 per cent. in the same period of time. The critical temperature is raised by gaseous pressure; air has a somewhat greater effect than carbon dioxide and the latter somewhat greater than hydrogen, but at low pressures the differences are negligible in practice. Down to about 50 mm., each mm. reduction of pressure causes a small but equal lowering of the critical volatilisation temperature, but at lower pressures the effect is much more marked, and when a perfect vacuum is nearly attained, a reduction of pressure of 1 mm. has an effect 70 times greater than at higher pressures. It was observed that zinc is oxidised to a much greater extent by air in motion than by still air.—A. S.

Tin analysis. Solution and oxidation of the metal in dilute nitric acid. C. Bunge. Pharm. Zentralh. 1913, 845. Apoth.-Zeit., 1913, **28**, 699—700.

When a drop of mercuric chloride solution is added to the sample of finely divided tin, the solution in dilute nitric acid, and subsequent precipitation of the metal as metastannic acid, proceed more easily and with less violent evolution of gas.

Metals; Intercrystalline cohesion of——. *II.* W. Rosenhain and D. Ewen. Inst. of Metals, Aug., 1913. [Advance proof.]

Test pieces of lead, tin, aluminium, and bismuth were subjected to a constant load of about 72 lb. per sq. in. at temperatures not far below the melting point, and in all cases well-marked intercrystalline fractures (photomicrographs of which are given) were obtained, the crystals themselves showing no appreciable deformation. The temperatures at which intercrystalline fracture took place under a load insufficient to cause material elongation were as follows, the melting points of the metals being given in brackets for comparison: lead, 323°—324° C. (327° C.); tin, 223° (232°); bismuth, 261° (268°); aluminium, 637° (657° C.). These results are put forward as strong additional evidence in support of the authors' theory that the crystals of a metal are held together by thin films of an "amorphous cement" composed of the metal in a condition analogous to that of an undercooled liquid (see J. Inst. Metals, 1912, **8**, [2]; also this J., 1913, 536). It is shown that the results cannot be explained by the concentration of impurities in the crystal boundaries. Analogous phenomena are exhibited by the pure eutectic alloy of lead and tin. (See also Humfrey, this J., 1913, 829.)—A. S.

Patents.

[*Iron*] *Ores; Reduction of*——. E. R. Sutcliffe, Leigh, Lancs. Eng. Pat. 17,935, Aug. 2, 1912.

In preparing iron ores, burnt pyrites, etc., for smelting by partial reduction and subsequent briquetting, the ore is preheated, partly reduced by carbon (the gases from the reduction furnace being utilised for the preheating), and subsequently "weathered" by exposure to the atmosphere for the purpose of converting the mass into hard lumps by the binding agency of ferric hydroxide.
—W. E. F. P.

Annealing magnetic material [*steel*]; *Improved method and apparatus for*——. The British Thomson-Houston Co. Ltd., London. Eng. Pat. 25,902, Nov. 11, 1912.

The magnetic properties of silicon-steel are improved by annealing for a short time in a non-oxidising atmosphere at about 1000° C.—W. R. S.

Ores; Furnaces for roasting, smelting or otherwise treating——. E. Buchholtz, Harrow, Middlesex. Eng. Pats. 10,564, May 3, and 27,531, Nov. 29, 1912.

A combined roasting and smelting furnace in which the heat of the gases issuing from a horizontal, rectangular smelting chamber (fired by means of liquid fuel) is utilised for preheating and roasting the ore in a continuous series of increasingly inclined channels (or rotary cylinders) the lowermost of which is the most inclined and forms part of the structure of the smelting chamber. Provision is made for regulating the temperatures of the various sections of the roasting channel by means of flues, dampers, etc., and for supplying ore to, and withdrawing the gases from, the upper end of the apparatus.—W. E. F. P.

Ores and the like materials; Mechanical furnaces for roasting or roasting and drying ——. O. Spinzig and W. Hommel, Clausthal, Germany. Eng. Pat. 15,778, July 5, 1912.

A horizontal furnace contains a rabbling device which propels the charge along the hearth or muffle-chamber in a direction at right angles to that of the movement of the rabbling device. The latter is water-cooled, and consists of a series of removable bars, to which V-shaped scraper-blades are hinged in the usual manner. To prevent portions of the charge from accumulating at the sides of the chamber, the lower longitudinal corners of the latter are rounded.—W. E. F. P.

Roasting furnaces. Helsingborgs Kopparverks Aktiebolag, Helsingborg, Sweden. Eng. Pat. 29,235, Dec. 19, 1912. Under Int. Conv., Dec. 23, 1911.

To effect downward gas-tight feeding between the floors of a circular multiple-hearth furnace, a rotary feeding table or drum is provided near the periphery; the choking of the channel by the ore is prevented by lateral projections adapted to the shaft of the feeding device, which is driven directly from the furnace shaft by means of outside gearing. (See also this J., 1912, 287.)—W. R. S.

Furnace for roasting ores or other materials. J. Sovignet, Paris. Eng. Pat. 146, Jan. 2, 1913.

A rotating tubular furnace, the inclination of which is adjustable, terminates, at the lower discharge end, in a drum fitted with screens which classify the ore. Internal lifters serve to make the charge fall through the flame. Air and fuel are admitted at the discharge end, the air passing in (1) through an outer casing surrounding the end of the furnace, (2) through a tube passing through the hot roasted ore, and (3) under pressure into the middle of the flame.—T. St.

Roasting-furnace. F. Laist, Anaconda, Mont. U.S. Pat. 1,070,490, Aug. 19, 1913.

The furnace consists of a series of superimposed hearths and contains rabbles attached to a central rotating shaft. On the upper hearths the ore is subjected to oxidising roasting by direct fire, and on the lower to chloridising roasting without the further addition of heat. Means are provided in the topmost chloridising hearth for removing the fumes from the chloridising roasting at a rate sufficient to maintain a pressure differential between the bottom oxidising hearth and the adjacent top chloridising hearth. —T. St.

Blast furnaces; Air heater for heating the blast for ——. P. Prégardien, Cologne-Lindenthal, Germany. Eng. Pat. 28,847, Dec. 14, 1912. Under Int. Conv., Dec. 14, 1911.

The air to be heated is passed through sets of vertical U-shaped tubes, the branches of each U-tube being of different lengths. The shorter inlet branches receive the air to be heated directly from the inlet chamber, the longer outlet branches passing direct into the exhaust-chamber immediately above.—W. R. S.

Furnaces; Electric [induction] ——. W. N. Crafts, Oberlin, Ohio. U.S. Pats. 1,069,923, 1,069,924, and 1,070,017, Aug. 12, 1913.

(1) The furnace comprises a basin containing molten material, with an induction coil, consisting of a horizontal annular core and a primary surrounding it, located beneath the basin. The annular secondary is formed from U-shaped passageways about each leg of the core containing molten metal, which join at their upper ends the molten metal in the basin. (2) The furnace is made in two separable parts, the upper portion forming the basin with openings communicating through the bottom of the body, and the lower part forming a base portion with a U-shaped passageway. The two parts are clamped together for use, and released for repairs, the openings on the upper part communicating with the legs of the U-shaped passageway, and forming part of the latter. Rings are embedded in the adjoining faces of the upper and lower portions, and surrounding the legs of the U, so as to form a non-fusible liquid-tight joint. (3) The induction furnace is similar to that described above in U.S. Pat. 1,069,923, but the basin is surmounted by a shaft adapted to contain material descending continually by gravity, heat rising from the basin into the shaft. A suitable opening is provided at the lower part of the secondary for tapping the furnace without destroying the secondary circuit, and the entrance of the material to the shaft is regulated by suitable means, such as a cup and cone arrangement. —B. N.

Furnace, Electric ——. A. E. Greene, Chicago, Ill., Assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. U.S. Pat. 1,070,337, Aug. 12, 1913.

The furnace comprises a tilting chamber enclosing material for treatment, with a number of electrodes projecting through one side into the chamber, and an enlarged tuyère containing a second electrode opening into the chamber from the opposite side above the material. By tilting the chamber, the material may be brought into contact with the first-named electrodes for starting the arc, and this is maintained by means of a polyphase current between the electrodes and the material and between the opposite electrodes. A current of gas is passed in through the tuyère for lengthening the arcs.—B. N.

Basic hearths in metallurgical furnaces; Process for burning and improving the surfaces of ——. H. C. Hansen. Ger. Pat. 262,484, Aug. 25, 1912.

The fusing or sintering of the refractory basic material is effected by means of a flame supplied with oxygen instead of with air.—A. S.

Gold and silver ores; Treatment of refractory ——. C. Butters, London. Eng. Pat. 18,660, Aug. 14, 1912.

A dilute solution (0·3 per cent.) of sodium hydroxide is mixed with the fluid pulp of ore, and the mixture agitated in contact with metallic aluminium or an alloy of aluminium. The ore thus acts as the cathode in an electrolytic action which results in the gold and silver being liberated. When the action is complete, the sodium hydroxide solution is separated, and the residue is treated with a suitable solvent to extract the precious metals.—T. St.

Solder for aluminium. C. Willmott, Smethwick, Staffs. Eng. Pat. 19,214, Aug. 22, 1912.

This solder contains from 4 to 12 parts of tin to one of bismuth.—W. R. S.

Thorium; Process of obtaining ——. M. Koss, Assignor to Chemische Fabrik Germania Ges. m. b. H., Oranienburg, Germany. U.S. Pat. 1,069,959, Aug. 12, 1913.

Monazite, or other material containing thorium, is treated with sulphuric acid, and the thorium precipitated from the solution by hypophosphoric acid. The other rare earths remain in solution and are removed by filtration.—T. St.

Copper; Method of recovering —— from its ores. E. Schaaf, St. Marys, Mo., and S. G. Martin, Chicago, Ill., Assignors to W. O. Bartholomew, St. Louis, Mo. U.S. Pat. 1,069,981, Aug. 12, 1913.

A solution of the copper content of the ore is heated, charged with nitrogen peroxide and the lower oxides of nitrogen, and then subjected to the action of steam under pressure.—T. St.

Ores; Method for concentration of ——. O. J. Adams, Grand Junction, Colo. U.S. Pat. 1,070,313, Aug. 12, 1913.

A part of the finer or slimed values are separated by mechanical means, and the remaining material is leached with dilute sulphuric acid. The acid solution is separated from the insoluble substances, and is then treated with the slimes first obtained, whereby the mineral dissolved in the acid is precipitated.—T. St.

"*Sublimed lead*"; *Apparatus for producing* ——. L. S. Hughes, Chicago, Ill. U.S. Pat. 1,070,688, Aug. 19, 1913.

A number of furnaces, each with an air inlet and feed door near the top, are arranged side by side, and communicate with a flue through an intermediate chamber. The chamber is elliptical in ground plan and at one end its sides merge into the sides of the flue. At the other end it communicates with the furnaces through a draught-port, disposed opposite the feed doors of the furnaces, and having approximately the same area as the cross-section of the chamber.—A. S.

Agglomerating dusty ores, burnt pyrites, flue-dust and the like; Process for ——. G. Polysius Eisengiesserei und Maschinenfabrik. Ger. Pat. 262,241, June 6, 1912.

The ore is roasted in a rotary kiln and the roasted material is discharged into two separate rotary agglomerating kilns, a suitable device being provided for distributing the material between the two kilns in the desired proportions. The hot gases from the agglomerating kilns are utilised for preheating or roasting the ore.—A. S.

Iron or steel; Treatment of —— *to prevent oxidation or rusting.* F. R. G. Richards, Coventry. U.S. Pat. 1,069,903, Aug. 12, 1913.

See Eng. Pat. 17,563 of 1911 ; this J., 1912, 1184.—T. F. B.

Metals, alloys, and steels; Process of treating melted ——. L. M. V. H. Baraduc-Muller, Paris. U.S. Pat. 1,071,632, Aug. 26, 1913.

See Eng. Pat. 30,198 of 1910 ; this J., 1912, 135 —T. F. B.

Ores; Treating ——. E. Kerr, Pittsburg, U.S.A. Eng. Pat. 18,598, Aug. 13, 1912. Under Int. Conv., Feb. 8, 1912.

See U.S. Pat. 1,032,007 of 1912 ; this J., 1912, 780.—T.F.B.

Metals; Cementation of ——. G. Sirovich, Rome. Eng. Pat. 19,461, Aug. 24, 1912.

See Fr. Pat. 447,606 of 1912 ; this J., 1913, 238.—T. F. B.

Galvanised iron; Process for the removal of metallic zinc from ——. C. A. Beringer, Charlottenburg, Germany. Eng. Pat. 19,574, Aug. 27, 1912. Under Int. Conv., Sept. 20, 1911.

See Ger. Pat. 250,283 of 1911 ; this J., 1912, 994.—T. F. B.

Zinc ores; Apparatus for the continuous removal of the residues from the reduction of —— *in vertical retorts.* A. Roitzheim, Köln, and W. Remy, Aachen, Germany. Eng. Pat. 732, Jan. 9, 1913. Under Int. Conv., Jan. 11, 1912.

See Fr. Pat. 451,806 of 1912 ; this J., 1913, 663.—T. F. B.

Tungsten and molybdenum or alloys thereof; Method of making sheets, rods, wires, filaments and the like of ——. Westinghouse Metallfaden Glühlampenfabrik G. m. b. H., Vienna. Eng. Pat. 3162, Feb. 6, 1913. Under Int. Conv., Feb. 9, 1912.

See Fr. Pat. 454,083 of 1913 ; this J., 1913, 862.—T. F. B.

Alloy. A. L. Brooke and R. D. Mackintosh, Mortlake. U.S. Pat. 1,070,007, Aug. 12, 1913.

See Eng. Pat. 14,192 of 1910 ; this J., 1911, 961.—T. F. B.

Melting metals and alloys; Method of ——. R. S. Wile, Pittsburgh. U.S. Pat. 1,070,568, Aug. 19, 1913.

See Eng. Pat. 27,836 of 1911 ; this J., 1913, 93.—T. F. B.

Metals; Process of extracting —— *from minerals, rocks, and other materials.* K. Birkeland, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,071,290, Aug. 26, 1913.

See Fr. Pat. 451,291 of 1912 ; this J., 1913, 610.—T. F. B.

Combustible metallurgical-furnace gas; Process of treating —— *to increase its calorific value.* U.S. Pat. 1,069,865, Aug. 12, 1913. *See* IIa.

XI.—ELECTRO-CHEMISTRY.

Patents.

Accumulator cases; New material for ——. W. E. W. Richards, London. Eng. Pat. 223, Jan. 3, 1913.

The material consists of waste rubber, or a mixture of this with new rubber, a fibre which resists the action of acid and the heat of vulcanisation, such as asbestos, together with a certain amount of sulphur for vulcanising the material.—B. N.

Cell; Electrolytic ——. T. Griswold, jun, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pat. 1,070,454, Aug. 19, 1913.

The cell comprises two bi-polar electrodes, with a separating member secured between them, thus forming a chamber for the electrolyte. The electrodes consist in each case of a plate-like carrying member of non-conducting material, with removable electrode elements of conducting material, secured in the member so as to project on both sides of the same.—B. N.

Air or gases containing dust or mist; Electrical purification of ——. H. Püning. Ger. Pat. 262,882, Jan. 16, 1913.

Instead of using fine metal points as sparking electrodes, thin jets of liquid, *e.g.*, water, are used.—A. S.

Insulating layers or coatings on electrical conductors; Production of ——. J. Loewenthal, Berlin. Eng. Pat. 27,651, Nov. 30, 1912.

See Fr. Pat. 454,292 of 1913 ; this J., 1913, 874.—T. F. B.

Insulating-coating on electrical conductors; Process for the production of an ——. J. Loewenthal, Berlin. U.S. Pat. 1,069,151, Aug. 5, 1913.

See Fr. Pat. 454,292 of 1913 ; this J., 1913, 874.—T. F. B.

Bearing compositions; Process of making ——. E. G. Gilson, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,071,044, Aug. 26, 1913.

See Eng. Pat. 27,621 of 1911 ; this J., 1912, 1187.—T. F. B.

Oxides of nitrogen; Apparatus for forming ——. Eng. Pat. 11,363, May 13, 1912. *See* VII.

Electrical purification apparatus [*for sewage*]. U.S. Pat. 1,069,993, Aug. 12, 1913. *See* XIXb.

XII.—FATS; OILS; WAXES.

Phytosterol; Detection of —— in mixtures of animal and vegetable fats. R. H. Kerr, U.S. Department of Agric. Bureau Animal Chem. Circ. 212, May 10, 1913.

From 200 to 300 grms. of the fat are melted and poured into a flat-bottomed flask of 1 litre capacity fitted with a rubber stopper perforated with three holes. The flask is set on a steam bath and connected with a reflux condenser and with a 700 c.c. round-bottomed distilling flask containing 500 c.c. of 95 per cent. alcohol. A glass tube, adjusted so that its lower end is about one-fourth of an inch above the surface of the fat and the upper end of which is bent at a right angle and closed by means of a short piece of rubber tubing with pinch cock, fills the third hole of the stopper. The whole of the alcohol is now distilled over, the vapour being conveyed through the fat, which it keeps in a state of vigorous agitation, to the reflux condenser, from which the condensed alcohol drops back on to the fat. The alcohol layer is next siphoned back into the distilling flask through the bent tube mentioned above, and the whole process is repeated twice more. The alcoholic solution now contains practically all of the cholesterol and phytosterol originally present in the fat. It is distilled until about 250 c.c. only are left, and 20 c.c. of a solution of potassium hydroxide (100 grms. in 100 c.c. water) are added to the boiling liquid, boiling being continued for 10 minutes to ensure complete saponification. The cooled soap solution is thoroughly shaken with 500 c.c. of warm ether, and then after further addition of 500 c.c. of water, the whole is gently but thoroughly mixed. The soap solution is drawn off and the ether layer washed with water, evaporated, and the dry residue containing the cholesterol, phytosterol, and other unsaponifiable matter is collected in a tall 50 c.c. beaker. From 3 to 5 c.c. of acetic anhydride are added, the beaker covered, and the contents boiled for a few seconds, after which the excess of acetic anhydride is removed on a steam bath. 35 c.c. of hot 80 per cent. alcohol are added to the acetylated residue in the beaker and heated to boiling with vigorous stirring. The liquid is quickly filtered and the residue washed with boiling 80 per cent. alcohol. The combined filtrate and washings are allowed to stand at 10°—12° C. for two or three hours, when the acetates of cholesterol and phytosterol crystallize out. They are filtered off, washed with cold 80 per cent. alcohol and then dissolved off the filter with the smallest possible amount of hot absolute alcohol. The solution now has two or three drops of water added to it and heat applied, if not perfectly clear. The alcohol is allowed to evaporate spontaneously and the crystals are collected on a hardened filter, washed twice with cold 90 per cent. alcohol, and dried by suction, and finally by heating to 100° C. for half an hour. The melting point determination after recrystallising from absolute alcohol will now indicate the presence or absence of phytosterol. If the crystals are those of pure cholesterol acetate, the melting point should remain constant; if any phytosterol acetate be present a higher melting point will appear, phytosterol acetate being less soluble and less fusible than cholesterol acetate.—J. A.

Kapok seeds and oil. H. Matthes and H. Holtz. Arch. Pharm., 1913, **251**, 376—396.

The air-dried kapok seeds contain 25·6 per cent. of fatty oil. The oil does not become entirely clear till warmed to 28°—29° C. The sp. gr. at 15° C. is 0·9218 for expressed commercial oil and 0·9198 for extracted oil. The refractive index at 40° C. is 1·4630. When dissolved in toluene, the oil is optically inactive. In Engler's viscometer, the viscosity is 11·5 at 20° C. compared with water. The iodine value of the expressed oil was 88·7, and 93·3 to 94·5 for the extracted oil. The acid values were 21·6 for expressed oil and 3·4—4·6 for extracted oil. The saponification values were 192·3 for the expressed oil and 196·3 for the extracted oil. The Reichert-Meissl value was 0·8, and the Polenske value varied between 0·14 and 0·34. The fatty acids melted at 34°—35° C., and when freed from phytosterol they melted at 36° C. Characteristic reactions were obtained by the Halphen, Becchi and nitric acid tests. The oil did not show any drying properties. It was found to consist principally of the triglycerides of palmitic, oleic, and linolic acids. A small amount of a phytosterol, m. pt. 136° C., was isolated. A detailed anatomical description of the seeds is given. —F. Shdn.

Kaya oil; Composition of the fatty acids of ——. Seiichi Ueno. Chem. Rev. Fett. Ind., 1913, **20**, 208—209.

The fatty acids obtained from kaya oil (this J., 1908, 454) consist of 9 per cent. of a mixture of palmitic and stearic acids, 19 per cent. of oleic acid and 72 per cent. of linolic acid or an isomer.—J. A.

Enzyme action; Studies on ——. XXI. Lipase III. H. E. Armstrong and H. W. Gosney. Proc. Roy. Soc., 1913, B **86**, 586—600. (See also this J., 1905, 1242; 1906, 1106.)

Active lipase preparations are obtained by extracting shelled castor oil seed with petroleum spirit and ether and digesting the residue for about 15 minutes with 80 c.c. of $N/10$ acetic acid to every 10 grams of the meal. The liquid is decanted and the residue washed, filtered, dried in a vacuum, ground and sifted through muslin. About 9 per cent. of the original weight of the seeds remains. The hydrolytic experiments were carried out in hard glass flasks containing the enzyme and the oil which could be agitated at a constant temperature. The process described sets free enzyme from the zymogen. Lipase is shown to be very sensitive to the action of acids, though acids are produced by its action. The enzyme is interfered with by dilute acids and easily rendered inert by excess, Its inferiority as a hydrolyst of esters, other than fats. and its marked power of hydrolysing the complex natural glycerides, is due to the fact that the acids, which are liberated from fats, are scarcely soluble in water and very weak. Lipase is specially fitted to hydrolyse the oily glycerides and is not suited to act in aqueous solutions. The interaction must be supposed to take place at and between surfaces separated only by a thin film of water at most. The products of change, both fatty acid and glycerol, inhibit the interaction of enzyme and oil. The rate of change has been determined in several instances and it is probable that a given amount of enzyme changes equal amounts of material in successive equal intervals of time. The observed departures from this rate are due to the inhibiting effects of the products of change and to the destruction of the enzyme. The rate at which action takes place is dependent on the conditions at the colloid surfaces which cannot be expressed in terms of the concentration of the solution, Hence the law of mass action cannot be applied to such cases. It is considered that lipase contains a glycerol nucleus attached to a carboxylic centre in proximity to an acidic group. This determines the hydrolysis of a fatty molecule attached to the glycerol nucleus.—E. F. A.

Patents.

Unsaturated into saturated compounds; Conversion of ——. E. B. Higgins, Wallasey, Cheshire. Eng. Pat. 18,282, Aug. 8, 1912.

It is stated that the conversion of unsaturated fatty acids or their glycerides, or other unsaturated compounds into the corresponding saturated compounds, by means of hydrogen in presence of finely-divided nickel or other metal, is accelerated by the presence of formic acid or other volatile organic acid. From 1 to 2 per cent. of formic acid, calculated on the weight of unsaturated material, has been found a suitable proportion. The hydrogen may be passed through a vessel containing the volatile acid before admitting it to the mixture of unsaturated compound and metal.—T. F. B.

Hydrogenation of unsaturated substances. R. Lessing, London. Eng. Pat. 18,998, Aug. 19, 1912.

The hydrogenation of glycerides, fatty acids, or other unsaturated substances is effected by means of hydrogen or other hydrogenating agent and a metallic compound which is decomposed at the temperature used, with liberation of the metal. Thus, a metallic carbonyl, especially nickel carbonyl, may be used. The carbonyl may be dissolved in the substance to be hydrogenated, and the solution sprayed into a heated vessel in which it is brought in contact with hydrogen; alternatively, hydrogen containing carbon monoxide is passed over a mass of reduced nickel or other metal in the known manner, and the mixture of hydrogen and carbonyl is passed through the heated substance to be hydrogenated.—T. F. B.

Fat compound; Composite hydrogenated ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,070,331, Aug. 12, 1913.

Deodourised cottonseed oil is mixed with less than its own weight of a hydrogenated oil in such manner that the latter remains undissolved in the oil.—W. P. S.

Oils; Apparatus for treating —— with gases [hydrogen]. C. Ellis, Montclair, N.J. U.S. Pat. 1,071,221, Aug. 26, 1913.

The oil is contained in a closed receptacle which can be heated and into which a catalyser can be introduced without contact with air. The oil inlet and outlet are connected with the same valve structure and are some distance above the bottom of the receptacle so as to leave a well for the deposition of the catalyser. Adjacent to the bottom of the receptacle is a circulating pump enclosed in a casing, the upper part of which is connected with the receptacle, so that the casing becomes filled with oil under approximately the same pressure as that prevailing in the receptacle. The receptacle is fitted with an inlet and an outlet for the hydrogen, which is circulated by the pump. The pipe leading from the pump is divided inside the receptacle into two branches one with orifices directed upwards and the other with orifices directed downwards. A drying and purifying chamber is interposed in the conduit through which the hydrogen passes from the upper part of the receptacle back to the circulating pump.—A. S.

Linseed oil; Process for rendering soluble the solid or semi-solid oxidation products of ——. K. L. F. Friedemann, Löfed, Sweden. Eng. Pat. 28,208, Dec. 6, 1912.

See Ger. Pat. 258,853 of 1912; this J., 1913, 614. The products may be mixed with resins, and dissolved in alcohol, benzene, chloroform, etc.—T. F. B.

Oil mixture suitable for lubricating, impregnating, or coating purposes; Process for preparing an ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 263,278, Nov. 8, 1908.

Tar oils which have been thickened by treatment with gases containing oxygen, or by other means, are mixed with mineral oils and heated to about 80° C. until the pitchy and asphaltic constituents have separated.—T. F. B.

Soap and process for its manufacture. L. Derschow and F. Grasses, London. Eng. Pat. 18,723, Aug. 15, 1912.

Sawdust or finely divided wood (25 parts) is allowed to absorb 60—100 per cent. of its weight of petroleum or similar hydrocarbon solvent, and is then mixed, by kneading, with 100 parts of sodium soap.—A. S.

Potash soaps; Process for preparing solid, non-hygroscopic ——. R. Worms. Ger. Pat. 262,591, Oct. 1, 1911.

A small quantity of an unsaponifiable, liquid or semi-liquid substance, insoluble in water, especially a hydrocarbon, is incorporated with the soap; the addition may be made before, during, or after saponification.—T. F. B.

Solutions of organic compounds producing emulsions with water; Liquid or solid ——. R. Vidal, Paris. Eng. Pat. 15,827, July 6, 1912.

See Fr. Pat. 445,053 of 1911; this J., 1912, 1190.—T. F. B.

Oils from fullers' earth and like materials; Process of extracting ——. L. Félizat, Assignor to Soc. Huilerie et Savonnerie de Lurian, Bouches-du-Rhône, France. U.S. Pat. 1,070,435, Aug. 19, 1913.

See Fr. Pat. 409,915 of 1909; this J., 1910, 830.—T. F. B.

Paraffin wax or like mixtures of substances which melt at different temperatures; Apparatus for sweating crude ——. U.S. Pat. 1,070,730. Aug. 19, 1913. *See* IIa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

Coating composition for protecting surfaces against rust and corrosion. T. J. Stevens, Birmingham. Eng. Pat. 24,391, Oct. 25, 1912.

The coating is prepared by incorporating magnetic oxide of iron and a small quantity of a cobalt salt, preferably the nitrate, with a suitable varnish or lacquer. Claim is made specially for a mixture of about 10 per cent. of copal or similar gum, 35—40 per cent. of turpentine, 0·5—1 per cent. of a cobalt salt, a quick drying oil in excess of the ingredients mentioned, and magnetic oxide of iron. —A. S.

Zinc sulphide; Production of ——. S. E. Goldschmidt und Sohn. Ger. Pat. 262,701, March 7, 1912.

Zinc sulphide, suitable for use as a pigment and possessing excellent covering power, is prepared by the interaction of a solution of a zinc salt and a suitable sulphide at a temperature higher than that at which the solution boils under atmospheric pressure.—A. S.

Soots of various origins; Process for improving ——. O. Dieffenbach and W. Moldenhauer. Ger. Pat. 263,292, Feb. 18, 1912.

Lampblack or other kind of soot is said to be "improved" by treatment with an oxidising agent, such as an alkali hypochlorite, permanganate, chromic acid, chlorine, bromine, ferric chloride, etc.—T. F. B.

Resins, especially bitumen, from natural resin mixtures or crude resin; Process for obtaining ——. C. Melhardt. Ger. Pat. 263,350, March 4, 1913.

Resinous mixtures such as stick lac, or the products obtained from them or from crude resins by extraction, dry distillation, or volatilisation, are dissolved in sulphuric acid of 60° B. (sp. gr. 1·71) and precipitated from the solutions by diluting with water. It is stated that, by using acid of this concentration, the resins are purified without decomposition, whereas, when acid of 66° B. (sp. gr. 1·842) is used, soluble sulpho derivatives are produced, and acid below 60° B. has no solvent action. The process is especially applicable to the extraction of bitumen and montan wax.—T. F. B.

Resins; Solvent for ——. Badische Anilin und Soda Fabrik. Ger. Pat. 263,404, Sept. 28, 1912.

Solutions of resins, especially suitable for use as varnishes or lacquers, are obtained by the use of cyclic ketones as solvents, either alone or mixed with other compounds. Cyclopentanone and cyclohexanone are mentioned as especially suitable, being easily volatile and having the power to dissolve many dyestuffs.—T. F. B.

Condensation products [artificial resins]; Process for the manufacture of ——. F. Pollak, Berlin. Eng. Pat. 18,281, Aug. 8, 1912. Under Int. Conv., Sept. 25, 1911.

See Fr. Pat. 447,969 of 1912; this J., 1913, 438.—T. F. B.

Compositions of matter [artificial resins] and methods of producing same. W. A. Beatty, New York. Eng. Pat. 18,824, Aug. 16, 1912.

See Fr. Pat. 447,647 of 1912 ; this J., 1913, 244.—T. F. B.

Decalcomania material. E. Meckbach, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,070,713, Aug. 19, 1913.

See Fr. Pat. 413,562 of 1910 ; this J., 1910, 1120.—T.F.B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Patents.

Gutta-percha, indiarubber, and other like gums ; Extracting and purifying —— from raw materials. G. Hughes, London. From E. C. Larsen, Hongkong. Eng. Pat. 26,277, Nov. 15, 1912.

The leaves and branches of the gutta-yielding or like trees are crushed mechanically, the pulp mixed with 15—20 per cent. of gutta in small pieces, heated under pressure at 110°—125° C., pulverised, and washed with cold water on heated rollers. Or, the pulp may be boiled before the addition of the gutta, and then, after addition of the same, washed in hot or boiling water (fresh or salt), and the temperature of the bath reduced to 80°—100° C. : the floating gum is removed from the surface of the water, and the remainder, which sinks, is washed by a stream of water.—A. S.

Rubber mixings ; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 262,563, May 29, 1912.

The resinous chlorinated products, containing at least 20 per cent. of chlorine, obtained from vegetable or animal oils, fats, or waxes, resins and their distillation products, mineral oils, mineral wax, or montan wax (see this J., 1913, 499, 613) are incorporated, either singly or in mixtures, with rubber, and the resulting mass is vulcanised.—T. F. B.

Vulcanising rubber articles and the like ; Process for ——. G. Bernstein. Ger. Pat. 262,708, July 27, 1912.

Rubber articles containing sulphur, sulphides, or other vulcanising agents, are submitted to the action of photochemical light rays, especially violet or ultraviolet rays. The vulcanisation may be effected under increased or reduced pressure, and at the ordinary or high temperature. The ozone formed during the process is removed at once.
—T. F. B.

Caoutchouc and caoutchouc-like substances ; Production of coloured ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,830, Aug. 1, 1912.

See Fr. Pat. 450,567 of 1912 ; this J., 1913, 615.—T. F. B.

Caoutchouc substance and process of making same. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,069,951, Aug. 12, 1913.

See Eng. Pat. 15,254 of 1910 ; this J., 1910, 1215.—T.F.B.

Caoutchouc substances ; Production of ——. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,070,258 and 1,070,259, Aug. 12, 1913.

See Fr. Pat. 419,316 of 1910 ; this J., 1911, 226.—T. F. B.

Process of producing isoprene. Eng. Pat. 13,327. U.S. Pat. 1,070,120. *See* XX.

Process of producing βγ-dimethylerythrene. U.S. Pat. 1,069,423. *See* XX.

Process for preparing erythrene. Ger. Pats. 262,553, 262,884, etc. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Patents.

Tanning agents ; Manufacture of soluble ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik. Eng. Pat. 24,982, October 31, 1912.

Condensation products of aromatic phenols or their sulphonic acids, with or without the addition of formaldehyde, as obtained under Eng. Pats. 8511 and 24,216 of 1912 (this J., 1912, 668), are used to render soluble the insufficiently soluble portions of vegetable tanning extracts. Example : 500 parts of quebracho extract of 18°—20° B. (sp. gr. 1·142—1·162) is treated with the sodium salt of the product obtained from formaldehyde and cresol-sulphonic acid, dissolved in 100 parts of water. After stirring for a time, the extract, which is at first thick and viscous, becomes thin and is then soluble in water. Mangrove and chestnut extracts may also be treated, with similar results.—D. J. L.

Vulcanised fibre-board for use as substitute for leather, especially sole leather ; Process for impregnating ——. Hanseatische Vulkanfiber-Ges. m. b. H. Ger. Pat. 262,946, June 8, 1912.

Vulcanised fibre-board is dried in air and immersed in an emulsion of five parts of oil with two parts of 1 per cent. caustic potash solution ; after drying by aid of heat it is immersed in a mixture of 50 parts of the oil emulsion, 45 parts of oil, and 5 parts of rubber resin, again dried, and finally coated with a solution of rubber in solvent naphtha.—T. F. B.

Compounds suitable for tanning ; Manufacture and employment of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,216, Oct. 23, 1912.

See Fr. Pat. 451,876 of 1912 ; this J., 1913, 668.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soil ; Investigations on the protozoa of ——. T. Goodey. Brit. Assn. Report, 1913. (See also this J., 1912, 243))

Investigation indicates that ciliated protozoa are only present in the soil in an encysted condition and therefore cannot inhibit bacterial activity. Partial sterilisation had no effect on the rate of development of bacteria in a soil kept since 1846 at Rothamsted which contained no protozoa. But a soil of 1870, which contained a few protozoa, was improved by partial sterilisation, inasmuch as the destruction of the protozoa permitted the bacteria to thrive. Amœba and flagellates act as the limiting factors.
—E. F. A.

Nitrogen fixation and plant growth ; Effect of soluble humates on ——. W. B. Bottomley. Brit. Assoc., Birmingham, 1913. Sect. M. [Advance proof.]

The insoluble humic acid present in peat is converted into soluble humate by the action of certain aerobic soil bacteria and the treated peat, after sterilisation, forms a suitable medium for nitrogen-fixing bacteria : it is inoculated with the latter and either applied directly to the soil or used for the preparation of a culture solution. The prepared peat not only increases the fixation of nitrogen by the soil but also has a favourable effect on plant growth. Considerably increased yields of radishes, lettuce, turnips and potatoes have been obtained with it.
—A. S.

Ammonium humate as a source of nitrogen for plants. W. B. Bottomley. Brit. Assoc., Birmingham, 1913. Sect. K. [Advance proof.]

Ammonium humate has been found capable of supplying the nitrogen need of plants if soluble phosphates and potassium salts be present: it promotes the general growth and has a remarkable effect on the root development of plants. It is prepared by extracting bacteria-treated peat (see preceding abstract) with water, precipitating humic acid from the solution by hydrochloric acid, and dissolving the washed precipitate in ammonia solution.—A. S.

Patents.

Parasites in the soil; Process for the destruction of animal and vegetable ——. L. Hiltner, Munich, Germany. U.S. Pat. 1,070,808, Aug. 19, 1913.

Anthracene oil is introduced into the ground, together with a material, such as humus, capable of accelerating decomposition.—F. Sodn.

Nitrolim [crude calcium cyanamide]; Process for converting —— *into a fertiliser which is not dusty and only feebly caustic, by means of sulphite-cellulose waste lyes.* M. Müller. Ger. Pat. 262,473. Nov. 28, 1912.

The nitrolim is mixed with the powdered evaporation residue of sulphite-cellulose waste lyes containing about 12 per cent. of water; or the completely dried evaporation residue may be used, and the mixture then exposed to the air or treated in another suitable way until it has absorbed sufficient water to form a product free from carbide and showing no tendency to produce dust.—A. S.

XVII.—SUGARS; STARCHES; GUMS.

Pyridine bases [for denaturing duty-free sugar]; Examination of —— *[in Germany].* Vorschrift aus den Zuckersteuer-Ausführungsbestimmungen der deutschen Zollbehörde vom Aug. 1, 1913. Chem.-Zeit., 1913, **37**, 1035.

(1). *Colour.* Should not be darker than that of a freshly-prepared solution of 2 c.c. of $N/10$ iodine in 1 litre of water. (2). *Behaviour with cadmium chloride.* 10 c.c. of a solution containing 10 c.c. of the pyridine bases per litre are shaken vigorously with 5 c.c. of a solution of 5 grms. of anhydrous cadmium chloride in 100 c.c. of water. Within 10 minutes a crystalline precipitate (not less than 25 mgrms. after drying at 50°—70° C.) should appear. (3). *Test with Nessler's reagent.* 10 c.c. of a solution of the pyridine bases (see 2) should give a white precipitate with 5 c.c. of Nessler's reagent. (4). *Boiling point.* At least 50 per cent. (by vol.) should distil at a temperature not above 140° C., and 90 per cent. up to 160° C. (5). *Miscibility with water.* 50 c.c. should give with 100 c.c. of water a clear or faintly opalescent solution, without any formation of layers. (6). *Water-content.* 20 c.c. are shaken with 20 c.c. of sodium hydroxide solution of sp. gr. 1·40: after separation the upper layer should amount to at least 18·5 c.c. (7). *Titration.* 10 c.c. of a solution containing 10 c.c. of pyridine bases per 100 c.c., are titrated with $N/10$ sulphuric acid till a drop of the liquid gives on Congo paper (paper impregnated with a solution of 1 grm. of Congo red in 1 litre of water) a spot with a distinct blue border which soon disappears again: not less than 9·5 c.c. of acid should be required. Full details of the mode of carrying out the tests are given.—A. S.

Fermentation of beetroot [juices] and molasses. Martinand. See XVIII.

Patents.

Sugar cane and other sacchariferous plants; Process for obtaining juice from ——. O. Mengelbier. Ger. Pat. 261,999, Oct. 20, 1912.

The bagasse, in between two pressings, is introduced into a closed receptacle, in which it is treated first with steam, preferably under pressure, and then with the necessary quantity of sweet-water or wash-water. Or, the bagasse may be passed continuously through a receptacle divided into two compartments one behind the other: steam is passed into the first compartment and sweet-water or wash-water into the second. One or more auxiliary chambers may be disposed on either side of the receptacle, in order that any steam escaping owing to leakage may be condensed on the bagasse entering or leaving the receptacle.—A. S.

Sugar; Process for denaturing —— *for the purpose of preparing a winter food for bees.* E. Herbst. Ger. Pat. 262,852, March 2, 1911.

Bone oil (Dippel's animal oil) or tar is used as denaturing material.—A. S.

Raffinade (white sugar) direct from raw sugar-juices; Process for the manufacture of ——. A. Wijnberg and J. N. A. Sauer, Amsterdam. U.S. Pat. 1,070,654, Aug. 19, 1913.

See Eng. Pat. 21,204 of 1911; this J., 1912, 1047.—T. F. B.

Starch-containing material; Treatment of —— *and products obtained therefrom.* A. P. Anderson, Chicago. Eng. Pat. 18,946, Aug. 19, 1912.

See U.S. Pats. 1,035,829, 1,035,830, and 1,035,831 of 1912; this J., 1912, 944.—T. F. B.

Cereal grains; Treatment of ——. *Treatment and drying of cereal grains.* A. P. Anderson, Chicago. Eng. Pats. 18,947 and 18,948, Aug. 19, 1912.

See U.S. Pats. 1,035,838 and 1,035,839 of 1912; this J., 1912, 944, 945.—T. F. B.

Starch or starch-containing materials; Production of puffed or swelled ——. A. P. Anderson, Chicago. Eng. Pat. 18,949, Aug. 19, 1912.

See U.S. Pats. 1,035,835, 1,035,836, and 1,035,837 of 1912; this J., 1912, 944.—T. F. B.

Starch and other materials; Apparatus for the treatment of ——. A. P. Anderson, Chicago. Eng. Pat. 18,950, Aug. 19, 1912.

See U.S. Pats. 1,035,840 and 1,035,842 of 1912; this J., 1912, 945.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Diastase rendered inactive by heating; Action of hydrochloric acid and ammonia on ——. *XI.* T. Panzer. Z. physiol. Chem., 1913, **87**, 115—121.

The experiments were carried out as with active diastase (see this J., 1913, 620) and the results obtained were substantially the same, but after the treatment with hydrochloric acid and ammonia the enzyme regained slight but distinct hydrolytic activity (cp. this J., 1913, 837, 838).—J. H. L.

Alcoholic fermentation; Catalysers of ——. *II.* H. Euler. Z. physiol. Chem., 1913, **87**, 142—144 (see this J., 1913, 762).

The salts of aliphatic acids, which accelerate fermentation by living yeast (*loc. cit.*), are not appreciably if at all adsorbed by the outer membrane of the yeast. As very slight adsorption, not recognisable by chemical tests, might suffice to modify the surface tension at the cell wall and thereby influence fermentation, the behaviour of living yeast towards a number of salts of organic dyestuffs was investigated. It was found that whilst some of the latter were readily adsorbed, and some not at all, others were adsorbed to an extent depending on the fermentative activity of the yeast. Lundberg (Z. Gärungsphysiol., 1913, 2, 223) has observed that the fermentative activity of yeast has also an influence on its power of resistance towards the poisonous action of cyclamine.
—J. H. L.

Alcoholic fermentation ; Influence of inorganic salts on the course of ——*. Salts of tin and bismuth.* M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr., 1913, **31**, 49—53.

The experimental results obtained by the author do not confirm those published by Gimel (this J., 1909, 34). Basic bismuth nitrate, which according to Gimel accelerates fermentation, is, when well washed with hot water, quite insoluble in culture liquids and exerts no influence whatever. Stannous chloride, even in minute quantities, was found to have a retarding influence, especially during the first few days of fermentation, and it diminished the total quantity of carbon dioxide produced in six days. Yeast appears to become to some extent acclimatised to the presence of tin salts, but does not then ferment very vigorously, and unless frequently revivified by cultivation in normal media, it degenerates rapidly. Stannic chloride appears to be more toxic than stannous chloride. —J. H. L.

Beetroot [juices] and molasses ; New method of fermentation of ——. Martinand. Bull. Assoc. Chim. Sucr., 1913, **31**, 29—31.

In the manufacture of alcohol from beetroots, the juice is commonly acidified with sulphuric acid prior to fermentation, in order to check the development of foreign organisms. The author recommends the use of sulphurous acid in place of sulphuric acid. If beet juice is treated with sulphurous acid (*e.g.*, 0·53 grm. SO_2 per litre) and yeast is added, fermentation commences rather slowly because most of the acid remains in the free state. If, however, the sulphited juice is mixed with about 1/3 of its volume of juice already in vigorous fermentation, a rapid and satisfactory fermentation of the whole is ensured ; the greater part of the sulphurous acid enters into combination with reducing sugars and acetaldehyde but at the same time retains more or less of its antiseptic action towards foreign organisms. A part of the juice fermented in this way may be used for starting fermentation in fresh sulphited juice ; the yeast remains pure and may be employed for successive fermentations without further treatment. The same procedure may be applied to the fermentation of molasses.—J. H. L.

Enzymes ; Nature of —— *and of their action on hydrolytic agents.* E. F. and H. E. Armstrong. *See* XXIV.

Patents.

Hops ; Process for extracting ——. W. E. Lake, London. From Maschinenfabr. F. Weigel Nachf. Akt.-Ges., Niesse-Neuland, Germany. Eng. Pat. 22,039, Sept. 27, 1912.

See Fr. Pat. 448,989 of 1912 ; this J., 1913, 503.—T. F. B.

Granular materials, such as grain, malt, seeds, and the like ; Drum for the treatment of —— *with liquids or gases.* L. Topf, Erfurt, Germany. Eng. Pat. 23,366, Oct. 12, 1912.

See Fr. Pat. 451,726 of 1912 ; this J., 1913, 764.—T. F. B.

Alcoholic fermentations ; Method of utilising volatile products of —— *and apparatus therefor.* J. F. Wittemann, New York. Eng. Pat. 15,592, July 3, 1912.

See U.S. Pat. 1,029,838 of 1912 ; this J., 1912, 697.—T.F.B.

Dealcoholising beverages ; Process of ——. C. Jung, Lorch on Rhine, Germany. U.S. Pat. 1,071,238, Aug. 26, 1913.

See Ger. Pat. 193,879 of 1906 ; this J., 1908, 464.—T. F. B.

XIXa.—FOODS.

Patents.

Milk tester. O. Schupp, Langewiesen, Germany. Eng. Pat. 4088, Feb. 17, 1913.

A lactometer for household use is provided with a paper scale, divided into coloured zones, indicating the quality of the milk (whether pure, watered, etc.).—W. P. S.

Milk ; Manufacture of desiccated ——. J. D. Davies, Greenwich, Conn., Assignor to National White Cross Milk Co., Jersey City, N.J. U.S. Pat. 1,070,781, Aug. 19, 1913.

Milk is concentrated so as to form a powder containing only a small proportion of water and the powder is pressed into a block which is then cut up into fine shavings. The block may also be formed by adding cream or water to dried milk and pressing the mixture.—W. P. S.

Margarine and the like ; Manufacture of ——. E. V. Schou, Copenhagen. Eng. Pat. 4278, Feb. 19, 1913.

See Fr. Pat. 454,640 of 1913 ; this J., 1913, 880.—T. F. B.

Sterilising milk and other liquids ; Process and apparatus for ——. O. Lobeck, Leipsic, Germany. Eng. Pats. 14,249 and 14,256 of 1913, dates of appl., Aug. 16, 1912.

See Fr. Pat. 447,458 of 1912 ; this J., 1913, 249.—T. F. B.

Coffee-beans ; Process of treating —— *for the elimination of deleterious constituents thereof.* F. Schmidt, Hamburg, Germany. U.S. Pat. 1,069,982, Aug. 12, 1913.

See Fr. Pat. 449,343 of 1912 ; this J., 1913, 504.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

London waters ; Chemical and bacteriological examination of the ——. A. C. Houston. Seventh Annual Report of the Metr. Water Board. April, 1913. (See also this J., 1912, 355.)

This report covers the year ended 31 March, 1913. The most notable event was the opening of the Chingford reservoir on the river Lea. The reservoir has a capacity of 3000 million gallons and is supplied by Humphrey pumps lifting 180 million gallons per day. There was considerable complaint from consumers about the unpleasant "geranium" taste and smell of the water from the Staines reservoirs. This was found to be due to the excessive development of *Tabellaria* in the reservoirs, which rendered the water almost undrinkable at times, although it was quite innocuous. As regards the quality of the filtered water, the author remarks that the best month results were remarkably good, in some cases all the samples being first class, that is, containing no *B. coli* in 100 c.c., but the worst month results were open to criticism, as frequently only half the samples could be regarded as first class. Full tables with details of the chemical and bacteriological results for the raw and filtered waters throughout the year are given. The author considers the means now adopted for the purification of the supply to be such as to render the water reasonably, if not absolutely, safe for drinking purposes.—J. H. J.

Mercury cyanate, pure, and containing mercury cyanide ; Disinfecting action of ——. H. Kühl. Arch. Pharm., 1913, **251**, 340—349.

The disinfecting powers of mercury cyanate of 99 per cent. purity and of a mixture of 33·3 per cent. of cyanate with 66·7 per cent. of the much less active cyanide were found to be practically identical. Also, an addition of 1 part of sodium chloride to 2 parts of mercury cyanate was found to increase the disinfecting power of the latter. It is concluded that when a salt of low bactericidal power is added to a solution of a poison in water, the toxicity of the latter is not always depressed. The hydroxyl ions play an important part in the relations between the poison and the solvent and also between the poison and the protoplasm. Sodium chloride has no disinfecting power itself, but may favour the absorption of the poison by the protoplasm. Bacteria are stated to have more resistance towards disinfecting agents when under favourable conditions as to nutriment. —F. Shdn.

Patents.

Water ; Treatment of —— [*softening*]. J. F. Meyer, Bradford. Eng. Pat. 13,704, June 11, 1912.

The water is treated in a closed vessel with a quantity of inorganic or organic acids, or acid-salts, sufficient to decompose the salts constituting the temporary hardness. The air is then exhausted from the vessel and a current of air is passed through the water in order to remove the liberated carbon dioxide. Finally, the water is filtered through a layer of natural or artificial zeolites.—W. P. S.

Water ; Process for purifying ——. F. W. Drechsler, Dresden, Germany. Eng. Pat. 1416, Jan. 17, 1913.

The water is treated with a quantity of ferric or aluminium sulphate and potassium manganate or permanganate is then added while a current of air is blown through the water. From 5 to 10 grms. of manganate or permanganate are added to each cubic metre of water. (Reference is directed to Eng. Pats. 2674 of 1865 ; 3038 of 1884 ; 22,132 of 1895 ; 821 of 1896 ; 9665 of 1908 ; and 20,556 of 1911 ; this J., 1909, 216 ; 1912, 508.)—W. P. S.

Water ; Process for removing iron from ——. M. Wagner. Ger. Pat. 261,636, Oct. 15, 1910.

The water is mixed with excess of air and allowed to fall freely through a tube into a chamber, from which it is forced upwards through a suitable mass of filtering material. The water then overflows into another tube leading to a settling chamber, where the iron mud is deposited, and whence the purified water is run off.—T.F.B.

Sewage and the like ; Apparatus for the bacterial treatment of ——. E. J. M. Janvier, Paris. Eng. Pat. 29,192, Dec. 18, 1912. Under Int. Conv., Feb. 6, 1912.

A preliminary separator or detritus tank, fitted with a manhole and a flushing pipe, communicates with a septic tank by way of a ⊣ pipe, which also serves as an aeration pipe and is fitted with a water-seal. The septic tank comprises a cylindrical chamber, from the bottom of which a separating partition, provided with openings at a predetermined height, rises almost to the top of the chamber in such a manner that fermentation is localised and liquid only is allowed to pass through the openings to the top of the tank. The fermented liquid passes from the septic tank through a strainer, containing sand, slag, coke, or the like, into a sprinkler, which delivers it over the surface of a bacterial filter. The latter comprises a vertical chamber, in which a number of perforated trays or baskets, containing peat, clinkers, broken bricks, or the like, are arranged one above the other, care being taken that there is no contact between the filtering material and the walls of the filter, so as to ensure complete aeration. The entire apparatus may be constructed of ferro-cement, earthenware, fibro-cement, or sheet-iron. —O. R.

Purification apparatus [*for sewage*] *; Electrical* ——. R. W. Amos, Paterson, N.J., Assignor to National Purification Co., New York. U.S. Pat. 1,069,993, Aug. 12, 1913.

Electrolytic cells are arranged in separate compartments contained in a precipitation tank ; each cell is provided with a perforated metallic bottom which constitutes one electrode, the other electrode being arranged vertically in the cell. The electrodes are connected with a source of electricity and the sewage is passed upwards through the compartments and cells. Means are provided at the bottom of the tank for removing precipitated substances.—W. P. S.

Sludge ; Process for treating ——. E. Steuer, Neustadt on Hardt, Germany. U.S. Pat. 1,071,367, Aug. 26, 1913.

See Fr. Pat. 439,758 of 1912 ; this J., 1912, 744.—T. F. B.

Ozonides ; Production of gaseous ——. Eng. Pat. 27,371. *See* XX.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Apomorphine hydrochloride ; Formula of ——. V. Paolini. Atti R. Accad. dei Lincei, Roma, 1913, **22**, II., 121—125.

Analysis of a number of samples of different origin showed that crystallised apomorphine hydrochloride has the formula, $C_{17}H_{17}O_2N,HCl+\frac{3}{4}H_2O$. Two samples gave lower figures for the percentage of water of crystallisation, but gave correct results after liberating the base and re-converting this into hydrochloride. A determination of the molecular weight of the dibenzoyl-derivative of apomorphine gave a result in agreement with the above formula, thus showing that the formula, $C_{34}H_{36}O_5N_2,2HCl,2H_2O$, proposed by Dott (Pharm. J., 1908, **27**, [4], 801) is untenable.—A. S.

Berberine. Berberrubine. G. Frerichs and P. Stoepel. Arch. Pharm., 1913, **251**, 321—339. (See this J., 1910, 715.)

Good yields of berberrubine can be obtained by heating berberine chloride in a flask in a paraffin bath at 190° C., the air having been previously displaced by a current of carbon dioxide. Ethylberberrubine iodide is converted by boiling with alkali and acetone into the acetone compound, $C_{21}H_{20}NO_4,CH_2{\cdot}CO{\cdot}CH_3$, m.pt. 159° C. When ethylberberine chloride is reduced by means of zinc and sulphuric acid, tetrahydroethylberberine (tetrahydrohomoberberine), $C_{21}H_{23}NO_4$, is produced, which melts at 129° C. Berberrubine readily condenses with the ethyl esters of bromacetic and α-bromopropionic acids. Oxidation of berberrubine with hot nitric acid leads to the production of a ketone and an acid. The former can be reduced by means of sulphurous acid to berberrubinol, $C_{18}H_{13}NO_4$. Treatment with sodium hypochlorite produces chloroberberrubine, $C_{19}H_{14}ClNO_4$, from which chloroberberine is prepared. The corresponding bromine compounds are prepared by using sodium hypobromite.—F. Shdn.

Henbane leaves ; Commercial ——. O. Anselmino and E. Gilg. Arch. Pharm., 1913, **251**, 367—376.

An examination of samples of henbane leaves obtained from various commercial houses was made. None of these corresponded with the requirements of the German Pharmacopœia, 5th Edn. Instead of the leaves stripped from the flowering stem, many samples consisted of the entire plant, or the first year's crown of leaves gathered from the biennial *Hyoscyamus niger*. For preparing the powdered drug, the *Herba Hyoscami* is generally used. In Belgium and Southern Germany the biennial variety is sown in fields, and the crown of leaves cut off during the first year. When these are dried artificially a drug with a good appearance is obtained. This form, as well as the commercial entire plant or *Herba*, should be recognised by the Pharmacopœia. The microscopical characters given in the Pharmacopœia for the crystals found in the leaves apply only to young leaves. The crystal sand there described is too rare to serve as a means of identification. The official figures for alkaloid content appear to be based on results obtained from the herb and not from the leaves.—F. Shdn.

Betel-vine (*Piper betle*) *; Studies in the chemistry and physiology of the leaves of the* —— *and of the commercial bleaching of betel-vine leaves.* H. H. Mann, D. L. Sahasrabuddhe, and V. G. Patwardhan. Mem. Dep. Agric. India, Chem. Series, 1913, **3**, 17—63.

The main stems, branches, and leaves of the betel vine contain considerable quantities of potassium nitrate ; in the main vine, the amount increases from about 0·7 per cent. at the base to about 4·5 per cent. at the tip, calculated on the dry matter ; the leaves contain amounts varying from about 0·6 per cent. in the young leaves to about 2·7 per cent. in the mature leaves. The constituents of the leaves, as determined by the method of Brown and Morris (Chem. Soc. Trans., 1893, 604) are as follows :—Reducing sugars, 1·41 to 3·17 per cent. ; non-reducing sugars, 0·59 to 2·48 per cent. ; starch, 1·0 to 1·2 per cent. ; essential oil, 0·8 to 1·8 per cent.; tannin, 0·97 to 1·30 per cent.: the diastatic activity of the leaves varies from 4·5 to 14·3 The younger leaves contain much more essential oil, diastase, and sugars than the older leaves. The leaves are in a suitable condition for bleaching from August to October. The bleaching process consists in moistening the leaves and allowing them to stand in a warm, ventilated place in a suitable receptacle, away from sunlight; after about eight days the leaves are examined and those which are bleached are removed, the remainder being put back and left until the end of ten to twenty days, according to the season. About one half of the leaves become bleached, whilst the remainder rots and does not bleach. During the bleaching process a rapid loss of non-reducing sugars occurs in the early stages, but afterwards the loss is slight: the total loss amounted to about 35 per cent. in one case. The reducing sugars remain constant or increase slightly. Starch decreases to about one-half the original amount, whilst tannin remains fairly constant. In the leaves which do not bleach, essential oil remains constant, but in the bleached leaves it increases very largely, *e.g.*, from 1·2 to 4·2 per cent. Further, the bleaching is accompanied by a large increase in acidity, whilst the diastatic activity falls to about one-half its original value. The effect of the bleaching process on the nitrate appears to be very small, except in the case of leaves which bleach to a yellow colour, when the percentage of nitrates is very low, *viz.*, 0·04 to 0·20 per cent. Experimental bleachings carried out in presence of different gases indicated that the process is one of oxidation. Conditions which prevent oxidation hinder the bleaching and the development of essential oil. Moreover, slight acidity is necessary; traces of alkalinity lead to almost complete destruction of the essential oil and of the leaf.—T. F. B.

Lapachol from the heart-wood of Avicennia tomentosa; Separation of ——. K. Bournot. Arch. Pharm., 1913, **251**, 351—354.

The powdered heart-wood of *Avicennia tomentosa* was extracted with ether, and the latter distilled off. The residue was extracted with sodium carbonate solution, when lapachol or lapacho acid was isolated. This is a yellow crystalline substance with the composition, $C_{15}H_{14}O_3$, and melting at 140°—141° C. A microscopical description of the drug is given.—F. Shdn.

Terpeneless [*essential*] *oils.* E. J. Parry. Chem. and Drug., 1913, **83**, 378.

Lemon oil from which the terpenes have been removed contains 42—48 per cent., and oils from which both the terpenes and sesquiterpenes have been removed, about 65 per cent. or more of citral. Specimens of so-called sesquiterpeneless oils of lemon with high percentages of citral, examined by the author, proved to be terpeneless oils to which citral from lemongrass oil had been added. The author considers that the advantage due to the higher citral content and increased solubility in alcohol of the sesquiterpeneless oil of lemon is more than counterbalanced by the loss in sweetness and aroma as compared with the oil from which only the terpenes have been removed. The characters of a number of oils examined during the past few years are shown in the following table:—

	Sp. gr. at 15° C.	Optical rotation (100 mm.).
Terpeneless oils:—		
Lemon	0·893—0·899	—5° to —8° 30′
Limes (distilled) ..	0·918—0·922	—1° to —6°
Sesquiterpeneless and terpeneless oils:—		
Lemon	0·899—0·901	+ 1° to —4° 30′
Orange	0·887—0·891	+ 15° to + 27° 30′
Limes (distilled) ..	0·930—0·9325	—5° to —7°
Bay	1·030—1·033	inactive
Coriander	0·878—0·881	+ 8° 30′ to + 10° 30′
Lemongrass	0·893—0·896	—0° 35′ to — 1° 5′
Juniper	0·935—0·940	—0° 30′ to 0°

—A. S.

Oil of Seseli Bocconi; Constituents of the essential ——. L. Francesconi and E. Sernagiotto. Atti R. Accad. dei Lincei, Roma, 1913, 22, II., 116—121.

Further experiments have shown that the oil of *Seseli Bocconi* (see this J., 1912, 203) contains, in addition to *l*-α-pinene and *d*-β-phellandrene, a saturated bicyclic aldehyde, $C_{10}H_{16}O$, a saturated, bicyclic, primary alcohol, $C_{10}H_{18}O$, an unsaturated secondary alcohol, and *d*-methylethylacetic, formic and acetic acids. On oxidation the primary alcohol yields an aldehyde identical with that contained in the oil, whilst the secondary alcohol yields a substance, m.pt. 152°—153° C., having a camphor-like odour.—A. S.

Bornylene; Oxidation of —— *with hydrogen peroxide. Chemistry of the terpenes. Part XVI.* G. G. Henderson and W. Caw. Chem. Soc. Trans., 1913, **103**, 1543—1550.

Bornylene, dissolved in glacial acetic acid, is slowly oxidised by 30 per cent. aqueous hydrogen peroxide, yielding camphenanic and isocamphenanic acids, $C_9H_{15}COOH$, m.pt. 95° and 74° C. respectively, a liquid hydroxy-acid, $C_8H_{12}(OH)COOH$, a mixture of esters, and a trace of an aldehyde, but no ketone. The acids produced by hydrolysis of the esters consisted chiefly of acetic acid, together with smaller quantities of the three acids mentioned above, whilst the alcohols were borneol, epiborneol, and two isomeric saturated alcohols, $C_{10}H_{18}O_2$, m.pt. 247°—248° and 235°—236° C. respectively.—A. S.

Chloroform. K. Enz. Apoth.-Zeit., 1913, **28**, 672—674.

Some commercial samples of chloroform contain chloral alcoholate, or other closely related chloral derivatives. On distilling these, the boiling point remains constant at 62° C., till the last few drops are reached, when the temperature falls slightly. Pure chloroform should not neutralise weak alkali. 10 c.c. of the sample of chloroform are mixed with 20 c.c. of water and 10 c.c. of *N*/10 potassium hydroxide. After shaking occasionally during 15 minutes, the free alkali is titrated, using phenolphthalein. When chloral is present, some of the alkali will be neutralised. Chloroform free from aldehydic substances gives no immediate reaction with Nessler's solution.—F. Shdn.

Trichloro-acetic acid; Decomposition of —— *by mercuric oxide.* K. Brand. J. prakt. Chem., 1913, **88**, 342—357.

Mercuric oxide dissolves quietly in a moderately concentrated aqueous solution of trichloro-acetic acid, but on heating the solution, a vigorous evolution of gas occurs. At 100° C. the reaction products consist mainly of carbon dioxide and monoxide, mercurous and mercuric chlorides, and small quantities of chloroform. At 60° C. no appreciable quantities of carbon monoxide and chloroform are formed, but the other products are similar. The formation of chloroform appears to be due to decomposition of free trichloro-acetic acid by water: only traces are produced when an excess of mercuric oxide is used.—A. S.

Patents.

Tuberculosis; Process for making substances for curing or preventing ——. F. F. Friedmann, Berlin. Eng. Pat. 16,692, July 17, 1912. Under Int. Conv., July 19, 1911.

Living cultures of tubercle bacilli or other bacilli not affected by acids, which are non-virulent to human beings and mammals, or which have been made non-virulent, or mixtures of virulent and non-virulent bacilli, are constantly cultivated for long periods (two to four years) at short intervals in suitable artificial culture media. The non-virulent cultures obtained may be repeatedly passed for prolonged periods through the bodies of human beings, etc., and then again cultivated in suitable media. The solid or liquid media on which the bacilli have grown, may be freed from bacilli and used as curative or immunising agents. Instead of using the living non-virulent bacilli obtained as above, the bacilli may be killed before use.
—T. F. B.

Nicotine ; Extraction of —— from green or uncured tobacco. H. Villiers-Stuart, Dungarven, Ireland. Eng. Pat. 20,347, Sept. 6, 1912.

GREEN or uncured tobacco leaves are immersed in an alkaline solution in which nicotine is soluble (*e.g.*, a solution of caustic soda, ammonia, or lime), and the nicotine and other crystalloids are allowed to dissolve in the solution ; the process may be carried out in a series of cells containing tobacco leaves, the alkaline solution being transferred successively to the various cells until it contains nearly as much nicotine as the fresh uncured leaves. By again using the alkaline solution from which the nicotine has been removed, for treating fresh leaves, it is stated that less of the crystalloids other than nicotine is extracted from the leaves, rendering the extracted leaves more valuable for curing or for use as a fertiliser. A further modification consists in immersing the leaves for a short time in the alkaline solution and then extracting the nicotine from them by means of a liquid hydrocarbon. Again, the tobacco leaves may be immersed in the alkaline solution at a temperature of about 150° F. (66° C.), and the solution separated from the leaves after a part only of the nicotine has been extracted.—T. F. B.

Ozonides ; Production of gascous ——. W. J. Knox, New York City. Eng. Pat. 27,371, Nov. 28, 1912. Under Int. Conv., Dec. 2, 1911.

SUBSTANCES which are capable of forming ozonides are converted into a vapour and intimately mixed with ozone. Pinene and cinnamic aldehyde, when treated in this manner, are stated to yield ozonides in an extremely fine state of division, which remain suspended in the air and gradually assume the gaseous form. The process as applied to the production of pinene ozonide, consists in passing a current of dry air over pinene and mingling the pinene vapour with the ozone at a point separate from that at which the pinene vapour is generated. Apparatus suitable for the purpose is described and claimed. The use of dry air is necessary since in presence of moisture pinene ozonide is decomposed, with the formation of pinonic aldehyde and pinonic acid. The gaseous products are suitable for medicinal purposes.—T. F. B.

Dialkalicyanamide ; Method or process for the manufacture of ——. Chemische Fabrik von Heyden, Aktienges., Radebeul, Saxony. Eng. Pat. 5051, Feb. 27, 1913. Under Int. Conv., May 28, 1912.

CYANAMIDE and its polymerised forms, especially dicyandiamide, are converted into dialkalicyanamide, with evolution of heat, by the action of alkali metals, or their alloys, at an elevated temperature. For example, 3·5 parts of dicyandiamide are added in small quantities to 100 parts of a lead-sodium alloy containing 8 per cent. of sodium, which is heated above its melting point, out of contact with air, the apparatus being so arranged that the alloy is brought in a constant current to the surface of the mass.—F. SODN.

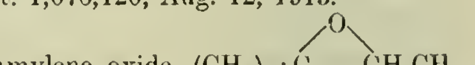
Methylbutenol esters ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 21,616, Sept. 23, 1912.

WHEN a 2·3-dihalogen-2-methylbutane or a 2·4-dihalogen-2-methylbutane is heated with a salt of an organic acid, such as an acetate, one molecular proportion of hydrohalogen acid is removed with the formation of a double linkage, while the second halogen atom is replaced by the group, O-acyl. The product thus consists of a mixture of the isomeric methylbutenol esters, which it is difficult to separate by fractional distillation. Instead of using the dihalogen-methylbutanes alone, it is possible to use mixtures of the two, such as are produced by chlorinating tertiary monohalogen-isopentane. Further, a mixture of either of the above dihalogenmethylbutanes with chloromethylbutene, such as is obtained by the action of chlorine on trimethylethylene, as described in Eng. Pat. 19,764 of 1912 (see this J., 1913, 550), when treated by the above process, is converted entirely into methylbutenol ester. —T. F. B.

Isoprene ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 13,327 of 1913, date of Appl., Sept. 23, 1912.

THE methylbutenol esters, prepared as described in Eng. Pat. 21,616 of 1912 (see preceding abstract), are easily converted into isoprene by treating them at a raised temperature and in the state of vapour, with a substance which will eliminate acid catalytically, such as alumina, barium chloride, or nickel chloride. A good yield of isoprene is stated to be obtained when alumina is used as the catalyst at a temperature of 400° C. and a pressure of about 50 mm.—T. F. B.

Isoprene ; Process of producing ——. R. B. Earle and L. P. Kyriakides, Assignors to Hood Rubber Co , Boston. U.S. Pat. 1,070,120, Aug. 12, 1913.



THE vapours of isoamylene oxide, $(CH_3)_2:\overset{O}{C\text{——}CH}.CH_3$, are passed over a heated dehydrating catalytic agent, such as aluminium silicate heated to 400°—600° C., at pressures less than 60 mm. of mercury. The isoprene formed is separated from the product by known methods.—T. F. B.

βγ-Dimethylerythrene ; Process of producing ——. F. Hofmann, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,069,423, Aug. 5, 1913.

βγ-DIMETHYLERYTHRENE is obtained by distilling a pinacone with a very small quantity of a dehydrating acid, *e.g* , 0·01 per cent. of dilute sulphuric acid (compare Eng. Pat. 1557 of 1912 ; this J., 1912, 951).—T. F. B.

Erythrene ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 262,553, 262,884, 263,016, and 263,066, March 21, July 26, June 7, and June 26, 1912.

(1.) CYCLOPENTANE is decomposed by aid of hot contact masses or other hot surfaces ; the cyclopentane may be diluted with an indifferent gas, and other agents facilitating the reaction may be present. The reaction may be carried out at normal or reduced pressure. (2.) Cyclohexanol or one of its homologues is heated in an apparatus made of quartz, platinum, silver, or other material which facilitates the reaction. The yield is stated to be 40 to 50 per cent. of the calculated yield. (3.) Erythrene is obtained by removing the elements of water from crotonyl alcohol by means of potassium bisulphate, toluidine bisulphate, anhydrous oxalic acid, alumina, etc. (4.) The elements of hydrogen chloride and of water are removed by means of suitable catalytic agents from monochlorobutyleneglycol (see Ger. Pat. 262,832, following). It is advisable to work under reduced pressure. The following reaction takes place :—$C_8H_{17}O_2Cl=2C_4H_6+2H_2O+HCl$. —T. F. B.

Monochlorobutyleneglycol ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 262,832, June 25, 1912.

WHEN 1.3-butyleneglycol is treated with hydrochloric acid, it is converted into a monochloro derivative, $CH_3.CHCl.CH_2.CH_2.O.CH_2.CH_2.CHOH.CH_3$.—T. F. B.

Trichloroethylene from acetylene tetrachloride ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 263,457, Aug. 14, 1912.

ACETYLENE tetrachloride is heated to a high temperature (*e.g.*, 300° C.) with the chloride of a tetravalent metal ; the products are said to be pure trichloroethylene and hydrochloric acid only.—T. F. B.

Suprarenal glands ; Metallic derivative or compound of the active principle of the ——. J. L. Turner, Assignor to The H. K. Mulford Co., Philadelphia. U.S. Pat. 1,061,148, May 6, 1913.

SUPRARENAL glands are disintegrated and extracted with water acidified by sulphuric acid, in presence of zinc dust, and the residue again extracted with water. The mixed extracts are filtered, evaporated to a small volume and poured into 95 per cent. alcohol. The precipitate is removed and the filtrate is mixed with alum and shaken: the filtrate is then neutralised, and the precipitate of the new aluminium compound separated and washed. The product is soluble in water and insoluble in alcohol; it possesses the blood-pressure-raising and astringent properties of the glands, and is capable of forming stable solutions in water which are practically colourless.—T. F. B.

Organic anhydrides; Method of purifying non-oxidising ——. G. Ornstein, Niagara Falls, Assignor to Hooker Electrochemical Co., New York. U.S. Pat. 1,069,168, Aug. 5, 1913.

Organic anhydrides which are stable to oxidation but contain oxidisable impurities (*e.g.*, acetic anhydride), are treated with fuming nitric acid or other oxidising agent under suitable conditions, and the product is distilled. —T. F. B.

Therapeutic compounds [salts of opium alkaloids] and process of making the same. E. Hug, Grenzach, Germany, Assignor to Hoffmann-La Roche Chemical Works, New York. U.S. Pat. 1,069,954, Aug. 12, 1913.

Double salts of opium alkaloids with monobasic (*e.g.*, halogen) acids are obtained by dissolving the two salts of the alkaloid with monobasic acids in water, adding alcohol, and allowing the salt to crystallise.—T. F. B.

Keto compounds; Process of producing ——. *Beta-acetyltrimethylenetetramethyldiamine.* G. Merling, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,070,622, 1,071,007, and 1,071,008, Aug. 19, 1913.

See Ger. Pat. 254,714 of 1911; this J., 1913, 380. β-Acetyltrimethylenetetramethyldiamine is a thick colourless oil, of b. pt. 96°—98° C. (16 mm.), soluble in water. —T. F. B.

Bromodiethylacetylurea; Process for preparing ——. B. Beckmann Chem. Fabr. G. m. b. H. Ger. Pat. 262,048, Aug. 25, 1912.

A good yield of bromodiethylacetylurea is said to be obtained by the action of carbamic chloride on bromodiethylacetamide, preferably in presence of a basic substance; a solvent may also be added, if desired. The bromodiethylacetamide not converted into the urea derivative remains unchanged and may be recovered (compare this J., 1910, 1332; 1912, 256, 900).—T. F. B.

Nitrohydroxystibinic acids; Process for preparing aromatic ——. Chem. Fabr. von Heyden. Ger. Pat. 262,236, July 24, 1912. Addition to Ger. Pat. 259,875 (see this J., 1913, 711).

In place of using the nitroaminoarylstibinic acids as in the chief patent, the corresponding nitrohalogen-arylstibinic acids may be heated with alkali hydroxide solutions.—T. F. B.

Salicylic acid compounds; Process for preparing ——. H. Weitz. Ger. Pat. 262,328, May 25, 1912.

Salicylic acid and boric acid are condensed with formic acid in presence of alkali. The product is an active antiseptic, and may be used, it is stated, in medicine as a substitute for salicylic acid and its salts.—T. F. B.

1.7-*Dimethylguanine; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 262,470, May 11, 1912.

1.7-Dimethylguanine, which is a powerful diuretic agent, is obtained by the methylation of 1-methylguanine. The latter is prepared by converting 2.4.5-triamino-6-oxypyrimidine into its 5-formyl derivative by means of dilute formic acid, methylating this, and boiling the product with concentrated formic acid.—T. F. B.

Valeric acid or bromovaleric acid and therapeutically-active alcohols or monohydric phenols; Preparation of compounds of ——. J. D. Riedel A.-G. Ger. Pat. 263,018, June 16, 1912.

Menthol, borneol, isoborneol, thymol, and similar hydroxy-compounds are combined with valeric acid or bromovaleric acid in such a manner that acidylated carbamic esters are produced. Thus, when the bornyl ester of carbamic acid is heated with bromoisovaleryl bromide and dimethylaniline to 70°—80° C., bromovaleryl bornylurethane, of m.pt. 138° C., is formed.—T. F. B.

Haemoglobin; Process for obtaining ——. "Sicco" A.-G., Chem. Fabrik. Ger. Pat. 263,057, June 4, 1910.

Defibrinated blood is fed into the bowl of a centrifugal separator (suitable for use in treating about 250 litres of milk per hour) at the rate of about 16 litres per hour. The separator is rotated at about 12,000 to 15,000 revolutions a minute, and the screw valve is so regulated that the proportion of serum to hæmoglobin liquid produced is about 2 to 1. After a few minutes, serum passes from the upper outlet tube, whilst the lower outlet discharges a clear hæmoglobin liquid, which requires no further clarification. —T. F. B.

Dichlorhydrin from monochlorhydrin and hydrochloric acid; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 263,106, March 21, 1912.

Hydrochloric acid gas is passed through heated monochlorhydrin, the water formed being removed continuously either by distillation under reduced pressure, or by means of a current of an indifferent gas.—T. F. B.

Carbazoledicarboxylic acid; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 263,150, Dec. 24, 1911.

When potassium carbazole is treated with carbon dioxide under pressure at temperatures above 200° C., a mixture of carbazolemono- and dicarboxylic acids is produced. By increasing the temperature and pressure and the time of reaction, a greater proportion of the dicarboxylic acid is formed. The temperature and pressure can be so regulated as to produce only the dicarboxylic acid. When mixtures of the two acids are produced, the dicarboxylic acid may be separated by means of bicarbonate solution. —T. F. B.

Organic acid anhydrides; Process for manufacturing ——. W. A. Beatty, New York. Eng. Pat. 18,823, Aug. 16, 1912.

See Fr. Pat. 447,646 of 1912; this J., 1913, 253.—T. F. B.

Camphene and isobornyl fatty acid esters from pinene hydrochloride or oily mixtures containing pinene hydrochloride; Process for producing a mixture of ——. Dr. C. Ruder und Co., Wandsbek, Germany. Eng. Pat. 2488, Jan. 30, 1913. Under Int. Conv., March 28, 1912.

See Fr. Pat. 453,992 of 1913; this J., 1913, 884.—T. F. B.

Butadiene and derivatives thereof; Producing ——. O. Schmidt, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,070,294, Aug. 12, 1913.

See Fr. Pat. 441,619 of 1912; this J., 1912, 951.—T. F. B.

Urea-hydrogen peroxide compound; Stabilised ——. M. Stern, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,071,186, Aug. 26, 1913.

See Addition of June 17, 1912, to Fr. Pat. 436,095 of 1911; this J., 1912, 1200.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic papers and the materials used in their production ; Photochemistry of ——. A. Cobenzl. Chem.-Zeit., 1913, **37**, 837—838, 886—888, 957—958, 990—991.

A general description is given of the manufacture and testing of the various kinds of photographic paper, and of the preparation and examination of the materials used in making them.—T. F. B.

Sulphide toning of silver prints. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1913, **59**, 254—256.

A part of the prolonged washing necessary to develop the full tone of silver images in the process of toning by means of colloidal sulphur (see this J., 1913, 110) may be avoided by omitting the washing after fixation, transferring the fixed prints directly to the sulphiding bath, and finally washing for about 1½ hours. A new process of toning is also suggested in which the addition of a colloid is dispensed with, the substance of the film serving as such during the formation of colloidal sulphur. The fixed print is transferred, without washing, to a dilute (*e.g.*, 1 per cent.) solution of hydrochloric acid for 30 to 40 minutes at 15°—17° C., and finally washed in water for 1½ hours.
—T. F. B.

Patents.

Toning of bromide and gaslight papers, plates, and films by a single solution ; Process for sepia sulphide —— C. F. E. Fenske, Thornton Heath. Eng. Pat. 18,545, Aug. 13, 1912.

One fluid ounce of a saturated solution of sodium thiosulphate is added to a solution of 120 grains of potassium sulphide in 15 oz. of water, and a further 4 oz. of water is added. Bromide or gaslight plates, papers, etc., are toned sepia in solutions so made, after filtration, at the normal temperature.—T. F. B.

Paper for the reception of transferable pictures ; Method of preparing ——. C. G. Schmidt, Saalfeld on Saale, Germany. Eng. Pat. 1817, Jan. 22, 1913. Under Int. Conv., Jan. 22, 1912.

Unsized paper is coated by means of a stone or a press with a dextrin-glycerin mixture, obtained by boiling 1175 parts of white dextrin with 1600 parts of glycerin, adding another 250 parts of glycerin, and continuing the heating until a varnish-like mass is obtained. When this paper is to be used for ceramic transfer pictures, 10 per cent. of flux is added to the printing varnish, so that the ceramic colours can be easily worked and burnt.—T. F. B.

Bleach-out images sensitised with thiosinamine ; Process for producing ——. R. Stahel. Ger. Pat. 262,492, July 12, 1912.

Photographic images prepared by the bleaching-out process, in which thiosinamine has been used as sensitiser for the dyestuffs, are washed with water or alcohol, treated with nitrous acid, and finally immersed in a solution of urea. This treatment is said to remove all traces of the thiosinamine.—T. F. B.

Photographic images ; Process for producing coloured —— *by bleaching-out.* A. Just. Ger. Pat. 263,221, Feb. 13, 1913.

In the bleaching-out process of colour photography it is proposed to use as yellow sensitive colours, the quinoxaline dyestuffs, and especially Flavinduline (obtained from phenanthrenequinone and *o*-aminodiphenylamine). These dyestuffs are stated to possess photographic properties in every way equal to those of Methylene Blue and Erythrosin.—T. F. B.

Photographic silver pictures ; Process of toning and intensifying ——. R. Fischer, Berlin-Steglitz, Germany. Eng. Pat. 5602, March 6, 1913. Under Int. Conv., March 7, 1912.

See Fr. Pat. 454,792 of 1913 ; this J., 1913, 885.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives (*Victoria*) ; *Report of the Chief Inspector* (*R. J. Lewis*) *of* —— *for* 1912.

During the year 22 over-sea ships, having 2340 tons of explosives (exclusive of service explosives) arrived at the port. In no case was it necessary to discharge a ship at the "outer anchorage," and it would thus appear that the limit of 250 tons of commercial explosives, fixed by the Ports and Harbours Department for the "inner anchorage," does not interfere with average shipments. New arrangements have been made with the importers in connection with the magazine sites on the Truganina Reserve. The new leases which have been made out for a period of five years, fixing the Government charge at one shilling for every 25 lb. of explosives, include lighterage and haulage. The question of a Commonwealth Testing Station for "Permitted Explosives" is referred to. In the Inspector's opinion "the establishment of such a station would be premature, costly, and liable to cause considerable useless friction with over-seas manufacturers, upon whom the Commonwealth is dependent for the bulk of its explosives. Until the Commonwealth can produce sufficient quantities of explosives to meet the demands in ordinary blasting operations, the manufacture of explosives intended for fiery mines should be left alone. Assuming a proper station were erected reasonable safety in use with "Permitted Explosives" can only be obtained by keeping the composition and quality of each cartridge in exact agreement with the very limited number of samples tested. This uniformity, upon which so much depends, is largely a question of the ripe experience of the manufacturer of explosives, and, until the Commonwealth has this experience, there is a grave risk of lowering the standard of safety, which is assured by adopting the "British Permitted List," the explosives on which can always be obtained at reasonable cost on the Australian market."

Importation.

Name of explosive.	1912.	1911.
	lb.	lb.
Gelignite	803,750	761,000
Gelatin dynamite	253,000	239,100
Blasting gelatin	86,700	89,500
Abbeite	5,000	5,000
Cheddite	7,500	2,500
Excellite	53,550	65,200
Lig. dynamite	—	6,250
Monobel	71,000	85,000
Pitsea powder	—	2,750
Rendite	—	700
Ammonia powder	20,000	—
Dynamite	1,000	—
Rippite	2,500	—
Powder, fuse	85,000	92,500
Powder, blasting	376,500	227,000
Powder, sporting	60,475	66,050
Total	1,825,975	1,642,550
	Total.	Number.
Detonators	2,982,500	1,749,000

In addition to the above, the following quantities were manufactured in the State:—Gelignite (106,850 lb.), gelatin dynamite (13,900), blasting gelatin (46,300), and dynamite (38,800 lb.).

Samples examined.—A total of 1127 samples of explosives was examined, of which 60 were rejected. Included in the total were 552 samples of gelignite, 153 of gelatin dynamite and 118 of blasting gelatin. The blasting gelatin imported during the year was satisfactory, with the exception of 3050 lb., and there were 750 lb. of old manufacture condemned and destroyed. Two consignments of gelignite, 30,500 lb., were found to be exuding and were condemned. Of these, 20,150 lb. were handed over to the Ports and Harbors Department for submarine blasting, and the balance, 10,350 lb., obtained from "sorting-over," being free from exudation, was passed. Also 560 lb. of gelignite of old manufacture, found in country magazines, were condemned on account of low heat test, and were destroyed. All the gelatin dynamite imported during the year was satisfactory.

The total number of factories under licence was six. Fourteen rack-a-rock and lithyte licences were issued during the year. The total number of magazines under licence was 263. Twelve Government magazines were available for public use. The number of licences issued during the year for licensed premises was 2147.

—G. W. McD.

Explosives ; Seventeenth Annual Report of the Chief Inspector (E. A. Mann) of —— for Western Australia for the year 1912.

The question of the physical condition and velocity of detonation of explosives is dealt with, and the inspector submits a definite recommendation to the Government that the regulations should be amended so as to specify certain minimum velocities of detonation as requisite in different classes of explosives. It is pointed out that all the more advanced countries have erected Testing Stations, including South Africa and Canada, and that it seems inadvisable that Australia alone should lag behind in this respect. Further that it is impossible for an inspector to carry the necessary responsibility for the control of explosives in this direction unless he is provided with the most ample and up-to-date methods of investigation. Should the Government adopt the recommendation for prescribing physical tests this will, in the inspector's opinion, be the first instance of such a step being taken, but he does not see that Western Australia should be afraid to take the lead in any advancement which has become very obviously necessary. The importation figures were as follows :—

	1911.	1912.	Value.
	lb.	lb.	£
Gelignite	3,038,250	2,779,002	109,457
Dynamite	12,500	32,500	1,692
Blasting gelatin	245,150	208,500	10,671
Gelatin dynamite	283,500	241,500	13,186
Powder, blasting	146,150	448,500	10,862
Powder, sporting	9,650	3,946	235
Detonators (No.)	—	3,109,240	4,983
Fuse (coils)	—	212,027	3,566
Fireworks	—	—	163
Cartridges and caps	—	—	9,014
Explosives, N.E.I.	—	—	84
			£163,913

The quantity and value of explosives and accessories imported into the States of the Commonwealth were as follows :—

The total number of samples tested was 3094. Included in this were 1024 special investigations, 1307 gelignites, 431 fuse samples, 212 blasting gelatins, and 116 gelatin dynamites. There were 49 explosives reserves with a total area of 3023 acres.—G. W. McD.

Patents.

Explosive. J. F. O'Brien, Chicago, Ill. U.S. Pats. 1,070,836 and 1,070,837, Aug. 19, 1913.

(1) The explosive consists of potassium chlorate and starch, in the approximate proportions of three to one, and silica. (2) The explosive consists of potassium chlorate 30, a carbohydrate 10, silica up to approximately 55, and carbon (coal dust) and liquid hydrocarbon (crude oil), together 5 parts.—T. St.

Match-striking surfaces ; Material for ——. W. A. Fairburn, Short Hills, N.J., Assignor to The Diamond Match Co., Chicago, Ill. U.S. Pat. 1,070,023, Aug. 12, 1913.

The material, designed for matches of the safety strike-on-box type, is composed of phosphorus sesquisulphide, asbestos powder, inert substance, a binding agent, and colouring matter.—T. St.

Match-splints ; Process of treating ——. W. A. Fairburn, Short Hills, N.J., Assignor to The Diamond Match Co., Chicago, Ill. U.S. Pats. 1,070,024, 1,070,025 and 1,070,026, Aug. 12, 1913.

(1). The splints are subjected to a bath consisting of two immiscible liquids of different specific gravities. The upper liquid is an alcoholic solution of a non-glowing agent for the splints, and the lower one, an oil which serves as a flame-carrier. (2). The splints are dipped into a flowing stream of molten paraffin wax, which contains admixed with it a finely divided material, which prevents the extinguished match from glowing. (3). The match-splints are treated in a solution of an anti-glowing substance in alcohol and water, maintained at a temperature below that of the surrounding air. A mild current of air is passed over the surface of the bath so that the vapours are removed without the rate of evaporation being materially increased. The treated splints are placed in a vaporizing chamber, the vapours from this chamber, and also those from the bath, being continuously condensed.—T. St.

XXIII.—ANALYTICAL PROCESSES.

Mineral phosphates and ashes ; Analysis of —— by the carbon tetrachloride method. P. Jannasch and R. Leiste. J. prakt. Chem., 1913, 88, 273—292.

The application of the carbon tetrachloride method (see this J., 1909, 961 ; 1913, 825) to the analysis of an ash and of the minerals, triphyline, vivianite, arsenical pyromorphite, and apatite is described.—A. S.

Determination of cellulose by means of nitric acid. Rao and Tollens. *See* V.

Explosives.	Western Australia.	N.S. Wales.	Queensland.	Victoria.	South Australia.	Tasmania.
	lb.	lb.	lb.	lb.	lb.	lb.
Nitroglycerin compounds......................	3,261,502	2,476,350	862,140	1,299,130	838,550	283,500
Blasting powder	448,500	1,193,005	499,500	460,100	152,415	66,600
Sporting powder	3,946	18,985	13,250	126,428	32,377	12,575
	3,713,948	3,688,340	1,374,890	1,885,658	1,023,342	362,675
	£	£	£	£	£	£
Fuse	3,566	7,126	4,474	1,164	4,187	—
Detonators	4,983	4,620	2,850	4,763	2,283	986
Explosives N.E.I..........................	9,261	20,108	18,261	69,794	9,981	3,002
	17,810	31,854	25,585	75,721	16,451	3,988
Total value of explosives enumerated above....	163,913	165,145	75,117	154,127	60,185	21,326

Western Australia took 30·82 per cent. of the total Commonwealth importations of explosives.

Action of sodium paratungstate in fusion on salts of the halogen acids and oxyhalogen acids. Use of sodium paratungstate and the blowpipe flame in the determination of the acid radicals of chlorides, chlorates, perchlorates, bromides, bromates, and fluorides. Kuzirian. *See* VII.

Oxygen; Determination of —— in copper and brass. West. *See* X.

Tin analysis. Solution and oxidation of the metal in dilute nitric acid. See X.

Phytosterol; Detection of —— in mixtures of animal and vegetable fats. Kerr. *See* XII.

Examination of pyridine bases [for denaturing duty-free sugar]. See XVII.

Patents.

Pyrometers, gas analysis apparatus and the like. M. Arndt, Aachen, Germany. Eng. Pat. 15,019, July 1, 1912. Under Int. Conv., June 30, 1911.

In apparatus of the kind referred to, when a volume of air or gas is to be pressed in periodically by means of a column of liquid, it is measured or shut off by means of a float acting in a receiving chamber. The required volume of gas pressed into the apparatus is equal to the volume of liquid forced into the chamber containing the float, any further quantity of the pressure liquid being prevented from entering the chamber, by means of a valve operated by the float.—W. C. H.

Pyrometer. J. Churchward, Mount Vernon, N.Y., Assignor to Churchward International Steel Co., New York. U.S. Pat. 1,069,318, Aug. 5, 1913.

Light rays from a glowing body, at the temperature to be measured, are passed through a medium of which the opacity can be adjusted until only light of a certain standard shade is transmitted, the degree of adjustment necessary being a measure of the temperature.—H. H.

Sampling substances in the form of fine powders or liquids; Apparatus for ——. T. Roberts. Ger. Pat. 262,896, Feb. 12, 1913.

The apparatus is of the type in which the vessels for receiving the samples are arranged on a disc rotated by clockwork and are brought successively below a channel through which the material is discharged. The clockwork is connected with two electrical circuits in one of which is an electromagnet controlling the working of a measuring device, whilst in the other is an electromagnet by which the rotation of the disc can be stopped or varied.—A. S.

Flask for distilling liquids. T. Hahn. Ger. Pat. 262,897, Jan. 15, 1913.

The flask consists of two portions, the lower one of metal and the upper one of glass, which are joined and held together by a sealing material in the enlarged upper edge of the lower portion, a bent piece placed on the stopper of the flask and two rings with connecting bolts.—A. S.

Colour reactions of liquids; Apparatus for determining —— by means of strips of test-paper wound on rollers. W. Steckel. Ger. Pat. 262,937, Oct. 22, 1912.

The liquid to be tested is applied to the test-paper at definite intervals of time by means of bent levers, which at one end dip into the receptacle containing the liquid, whilst at the other they are linked up to a common rod which is moved regularly to and fro by clockwork.—A. S.

Milk tester. Eng. Pat. 4088, Feb. 17, 1913. *See* XIXa

XXIV.—MISCELLANEOUS ABSTRACTS.

Enzymes; Nature of —— and of their action as hydrolytic agents. E. F. Armstrong and H. E. Armstrong. Proc. Roy. Soc., 1913, B **86**, 561—586. (See also this J., 1904, 388, 1165.)

In a summary of conclusions on enzyme action and the processes operative in solution, the "catalyst" is defined as the agent which brings about the inclusion of the interacting substances in the circuit within which the change takes place, the electrolyte being the actual agent by which the change is effected. Action is not possible between two non-electrolytes. An enzyme has a double function, (1), that of attracting or holding the hydrolyte and (2), that of determining its hydrolysis. The twofold action is attributed to the presence in the enzyme of an *acceptor* together with an *agent.* The efficiency of the enzyme depends also on its colloid character. The hydrolytic activity of enzymes is not exercised in accordance with the law of mass action. In each successive interval of time, the enzyme determines the hydrolysis of the same amount of hydrolyte, the observed departures from this rule being due to the influence of the products of change. Products having no special configurational relationship to the acceptor section of the enzyme act upon it by neutralising it, or by converting it into a derivative with new functions, or by changing the osmotic conditions in the solution. The enzymes hydrolysing the glucosides are considered to be glucoproteins containing either α- or β-glucoside radicles.—E. F. A.

Patent.

Impregnating solid or substantially solid substances with other substances or agents; Process of ——. A. R. Bullock, Cleveland, U.S.A. Eng. Pat. 18,536, Aug. 12, 1912.

See Fr. Pat. 448,191 of 1912; this J., 1913, 409.—T. F. B.

Books Received.

The Nickel Industry—with special reference to the Sudbury Region, Ontario. By A. P. Coleman, Ph.D., Canada Dept. of Mines, Ottawa, No. 170.

This report contains 206 pp. (10 by 6¾ ins.). In addition to descriptions of all the known nickel ore deposits in Ontario, there are accounts of methods of mining and smelting the ores, and of the chief nickels regions of other countries. A general geological map and eight special maps of the more important mines are included, together with 63 photographic reproductions, and 14 drawings.

Royal Commission on Sewage Disposal. Eighth Report. Standards and Tests for Sewage and Sewage Effluents discharging into Rivers and Streams. Vol. II. Appendix. By Dr. G. McGowan, Mr. C. C. Frye, and Mr. G. B. Kershaw. Wyman and Sons, Fetter Lane, E.C. [Cd. 6943.] Price 2s. 9d. Blue Book of 206 pp., 13 by 7½ ins.

This embodies the facts upon which are based the recommendations of the Commission as set out in their Eighth Report. The authors correlate actual effects produced by the discharge of sewage liquids or effluents into streams with the results of chemical analysis. As the result of this work, they have come to the conclusion that the five days' dissolved oxygen absorption test, taken along with the test for solids in suspension, is the best to apply when standards of purity are in question. In Part I. the results of the observations at each place are given; Part II. deals with the relative merits of various tests, observations on the discharge of sewage and effluents into streams, limiting figures of impurity for river waters, the collection of samples, the procedure to be adopted before analysis, the composition and properties of aquatic plants and river muds, and the position of sewage and effluent outfalls and methods for the gauging of rivers; and in Part III. are set out the results of the channel experiments.

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Newcastle Section.

Meeting held at Armstrong College, on Wednesday, May 14th, 1913.

MR. T. W. LOVIBOND IN THE CHAIR.

THE COMPOSITION OF SUGAR BEETS GROWN IN THE NORTHERN COUNTIES.

BY S. H. COLLINS AND A. A. HALL.

Mr. J. W. Robertson-Scott,[*] quoting from Newlands,[†] refers to the Northern Counties of England as one of the districts likely to be suitable for the growth of sugar-beet. In the following communication the authors propose to give the composition of some beets grown in those counties during the past two seasons.

The roots were grown at the farms and weighed to find the weight grown per acre. Of these some 50 representative roots were sent in for analysis. On receipt the roots were weighed, scrubbed clean and the tops cut off at the level of the lowest bud. Any side roots and other worthless matter were also removed. The beets were then dried with a cloth and weighed again. From the data so obtained, the percentage of dressed roots, as shown in the accompanying Tables, was found. Afterwards the beets were sliced and dried in an oven at the temperature of about 55° C. and the loss in weight determined, from which results the dry matter per cent. was obtained. The dried beets were then ground in a mill, bottled and analysed at convenience. That no inversion of cane sugar takes place under these circumstances is clearly shown by the low proportion of invert sugar. The general analysis followed the lines of the ordinary food analysis, the sugar obtained by polarimeter, with Clerget inversion, the invert sugar by Fehling's solution and the albuminoids by multiplying by 6¼ the nitrogen insoluble in lead acetate.

All the root crops analysed at Armstrong College during the past 15 years have been dried at 55° C. and the analyses here quoted are given in the same way.[*]

When root crops are dried at 100° C. some decomposition sets in, though with sugar beets this decomposition is less marked than with mangels, swedes and turnips. The difference in the moisture determinations at 100° C. and 55° C. is with sugar beets 0·43 per cent. on the average. The probable error of a single determination of moisture is ±0·18 per cent. with sugar beets, against ±0·29 per cent. with swedes, so far as laboratory work goes, but the errors of the field work are very much greater. There is in consequence little point in making any correction for different degrees of drying, but if desired for purposes of comparison, the figures quoted here could be adjusted to conditions of drying at 100° C. by adding 0·43 per cent. to the moisture and subtracting 0·43 per cent. from the dry matter and from the pectins, etc.

Table 1.

Northumberland. Cockle Park. 1911.

Plot	2	3	5	6	7	8	9	10	12	13	14
Manure	St. S.A.	St.	St. Salt.	St. Slag.	St. S.P.	O.	D.	D. St.	D. St.-N.	D. St.-P.	D. St.-K.
Yield, per acre .... tons	8¾	9½	15	12	13	7	12	12	13	10½	11¼
Dressed roots, per acre . . tons	8	8¼	11½	10¼	10¼	4½	9½	9¾	9¼	9¾	8½
Dry matter ..... per cent.	25·49	25·40	26·62	25·60	25·79	24·44	26·14	26·01	25·14	25·38	23·24
Dressed weight .. ,,	91·49	87·75	77·27	85·13	77·77	65·78	80·00	81·15	70·58	93·47	76·43
1 Dirty root .... lb.	0·89	0·94	1·27	1·04	1·36	0·70	1·40	1·33	1·21	0·88	0·94
1 Clean root .... ,,	0·81	0·83	0·98	0·88	1·06	0·46	1·12	1·08	0·86	0·83	0·72
Water .... per cent.	74·51	74·60	73·38	74·40	74·21	75·56	73·86	73·99	74·86	74·62	76·76
Amides, etc. .... ,,	0·42	0·44	0·44	0·43	0·62	0·44	·61	0·66	0·84	0·84	0·75
Albuminoids..... ,,	0·85	0·80	·96	·97	0·92	0·91	·82	0·98	0·84	0·84	0·98
Cane sugar ..... ,,	15·45	16·13	16·69	15·75	15·95	12·78	15·52	15·12	14·74	14·55	12·45
Invert Sugar .... ,,	0·90	0·26	·27	·23	0·30	0·18	·21	0·29	0·22	0·23	0·16
Pectins, etc...... ,,	5·77	5·44	5·94	6·08	5·78	7·86	6·72	6·45	6·18	7·26	6·33
Fibre .... ,,	1·51	1·75	1·72	1·55	1·55	1·69	1·53	1·63	1·44	0·77	1·57
Ash .... ,,	0·59	0·58	·60	·59	0·67	0·58	0·73	0·88	0·88	0·89	1·00
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen .... per cent.	0·20	0·20	0·22	0·22	0·24	0·21	0·19	0·26	0·27	0·27	0·25

Manures St.=Standard artificials. D=Dung. S.A.=Sulphate of Ammonia, used in place of Nitrate of Soda. S.P.=Sulphate of Potash instead of Muriate of Potash. O=No manure. -N.-P.-K. means that nitrogenous, phosphatic and potassic manures were respectively omitted. For further details see the Cockle Park Guide, issued by the Northumberland County Council.

In all cases the percentages refer to parts per hundred of dressed roots, except the dressed roots per cent. which refers to parts per hundred of roots as raised at the farm.

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[*] Sugar Beet by "Home Counties."

[†] "Sugar: A Handbook for Planters and Refiners," by J. A. R. and B. E. R. Newlands.

[*] See this Journal, 1902, p. 1513; Journal of Agricultural Science, 1905, p. 89; The Proceedings of the University of Durham Philosophical Society, 1910, p. 303.

TABLE 2.

Northumberland. Cockle Park. 1912.

Plot	2	3	5	6	7	8	9	10	12	13	14
Manure	St. S.A.	St,	St. Salt	St. Slag.	St. S.P.	O.	D.	D. St.	D. St.-N.	D. St -P.	D. St.-K.
Yield, per acre .... tons	4	4	4½	4¾	5½	3½	5¾	5¾	6¼	7½	7¾
Dressed roots, per acre . . tons	3¼	3½	3¾	3¾	4	2¾	4¼	4½	4½	5½	6¼
Dry matter ..... per cent.	25·83	25·83	25·22	25·95	25·33	26·83	25·39	24·65	25·68	25·63	25·34
Dressed weight .. ,,	84·25	86·20	85·10	77·00	74·20	73·75	75·70	78·50	72·50	75·30	81·10
1 Dirty root .... lb.	0·38	0·36	0·54	0·52	0·62	0·38	0·82	0·84	0·80	0·81	0·74
1 Clean root .... ,,	0·32	0·31	0·46	0·40	0·46	0·28	0·62	0·66	0·58	0·61	0·60
Water .... per cent.	74·17	74·17	74·78	74·05	74·67	73·17	74·61	75·35	74·32	74·37	74·66
Amides, etc. ... ,,	0·64	0·76	0·76	0·64	0·53	0·65	0·70	0·37	0·82	1·00	0·96
Albuminoids..... ,,	0·80	0·86	0·86	0·92	0·90	0·98	0·86	1·06	0·80	0·81	0·86
Cane Sugar ..... ,,	16·08	15·80	15·56	16·80	16·30	16·80	16·10	15·70	16·85	15·90	15·50
Invert Sugar .... ,,	0·27	0·23	0·33	0·23	0·23	0·22	0·21	0·22	0·25	0·24	0·20
Pectins, etc...... ,,	5·64	5·76	5·54	5·18	5·41	5·70	5·39	5·17	4·84	5·54	5·66
Fibre .... ,,	1·59	1·66	1·54	1·57	1·36	1·76	1·44	1·42	1·40	1·44	1·34
Ash .... ,,	0·81	0·76	0·63	0·61	0·60	0·72	0·69	0·71	0·72	0·70	0·82
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen .... per cent.	0·23	0·26	0·26	0·25	0·23	0·26	0·25	0·23	0·26	0·29	0·29

TABLE 3.

Durham. Raby Home Farm.

	1911.				1912.	
Manure	Dung and Complete Artificials.					
Seed..................................	Klein Wanzlebener.		Vilmorin Improved.		Mixed Seed.	
	Small.	Large.	Small.	Large.	East Side.	West Side.
Yield, per acre .... tons	15¼		16½		9½	10¾
Dressed roots, per acre.................. ,,	13		13		7¼	8
Dry matter .... per cent.	23·66	23·73	26·67	22·86	24·59	24·65
Dressed weight ,,	87·17	83·89	77·14	79·85	78·40	74·30
1 Dirty root .... lb.	0·78	2·98	0·69	2·43	1·02	1·40
1 Clean root .... ,,	0·68	2·50	0·53	1·95	0·80	1·04
Water .... per cent.	76·34	76·27	73·33	77·14	75·41	75·35
Amides, etc. .... ,,	0·53	0·43	0·75	0·54	0·50	0·52
Albuminoids .... ,,	0·79	0·74	0·85	0·62	0·75	0·85
Cane Sugar .... ,,	12·80	13·31	15·68	13·52	15·95	15·30
Invert Sugar .... ,,	0·13	0·03	0·21	0·16	0·20	0·23
Pectins, etc...................... ,,	7·46	7·05	7·01	6·15	5·06	5·20
Fibre .... ,,	1·28	1·23	1·42	1·09	1·40	1·67
Ash .... ,,	0·67	0·94	0·75	0·78	0·73	0·88
	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen .... per cent.	0·21	0·19	0·26	0·18	0·20	0·22

As 1911 was a dry hot season and 1912 was a wet cold one, the extremes of season-influence seem likely to have already occurred in producing the beets used in the investigations here recorded. Further at Cockle Park the variations of manurial treatment exceed those likely to be practised by farmers. Results have also been obtained from Durham and Cumberland. The soils used for growing the beets have varied considerably as may be seen from Table 6.

The most important point in the analyses given is the percentage of cane sugar, which averages 15·2 per cent. against the European decennial average 14·2 per cent.* The next most important point is the crop yielded, which averages 7·5 tons per acre of dressed roots against 7¼ tons from East Anglia, 10·6 tons from Holland, 11·2 tons from France and 11·8 tons from Germany.†

The yield per acre is certainly small compared with that reported for the Midlands by Golding and Hutchinson,‡ but the percentage of sugar in the Northern Counties appears to compare favourably with that in the Midlands.

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* Sugar Beet by " Home Counties," p. 76.
† *Loc. cit.* p. 5.
‡ This Journal, 1907, p. 512.

It is quite certain however that many of the poorer results obtained are due to unsuitable situations which would be eliminated in practice.

Further the size of the plots was small. At Raby Home Farm nearly one acre of land was set apart for beet growing but the other experiments were only small plots, varying from 1/88 acre to 1/16 acre.

The percentage of invert sugar is low and the percentage of ash appears to be on the low side. By careful breeding on the Continent the ash content of the sugar beet has been "diminished from 3·86 per cent. to 2·73 per cent. calculated on the dry substance of the beets."* The results here recorded show a mean ash of 2·78 per cent. calculated on the dry substance.

The composition of the beets considered generally is remarkably constant. The dry matter has only varied from 22·9 per cent. to 26·8 per cent., whereas the parallel figures for swedes are 9·3 to 15·5 and for mangels 8·5 to 20·4, all grown in the Northern Counties under strictly comparable conditions. The average figures for composition may therefore be regarded as fairly representing the type of beet likely to be grown. On the other hand, the figures for the tons of crop yielded per acre are very variable and a good deal of further work would be needed before conclusions could safely be drawn from them. The proportion of dirt accompanying the beets though large is no larger than that found in Continental practice. Many of the farmers of this district are accustomed to wash the potatoes fed to stock in a special washer made for the purpose, so it is by no means impossible that a suitable simple machine might be made to wash beets on the farm and thus save much useless carriage.

From the factory point of view this district possesses many advantages. Coal is cheap, lime is plentiful, and railway facilities excellent. From the agricultural point of view everything depends on finding suitable situations for developing the industry. Beet is not likely to be able to compete successfully with either milk or potatoes. Beet however, as the accompanying figures show, might easily replace mangels and perhaps swedes and turnips for feeding stock. The actual amount of dry food grown per acre is very similar whether beets, mangels, swedes or turnips are sown. If a sugar factory existed farmers would probably prefer the beet because of its double utility, they could either feed the beets direct or sell them to the factory and only feed the beet "slices."

Conclusion. The most important point to be noted is that sugar beet, with a fairly high percentage of sugar, can be grown in the Northern counties, contrary to general opinion.

TABLE 4.

Sugar Beets, 1911.

	Bishop Auckland.		Penrith.
Yield, per acre (tons)	9¾		19
Dressed roots, per acre (tons) ..	7¾		14½
	Small.	Large.	—
Dry matter ....per cent.	25·10	23·54	24·83
Dressed weight......... ,,	78·01	78·70	75·94
1 Dirty root .... lb.	0·63	1·60	1·49
1 Clean root .... ,,	0·49	1·26	1·13
Water ....per cent.	74·90	76·46	75·17
Amides, etc. .... ,,	0·71	0·56	0·65
Albuminoids .... ,,	0·57	0·72	0·79
Cane Sugar .... ,,	16·08	13·70	13·90
Invert Sugar .... ,,	0·29	0·17	0·14
Pectins, etc. .... ,,	5·28	6·34	7·09
Fibre .... ,,	1·48	1·21	1·62
Ash .... ,,	0·69	0·84	0·64
	100·00	100·00	100·00
Nitrogen ....per cent.	0·20	0·21	0·23

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* Sugar Beet by "Home Counties," p. 135.

TABLE 5.—ABSTRACT.

Composition of Sugar Beets grown in Northern Counties, 1911 *and* 1912.

	Mean.	Probable Variation.*	Minimum.	Maximum.
Yield, per acre ...... tons	9·4	±2·9	4	19
Dressed root, per acre .. ,,	7·5	±2·4	3	14
Dry matter ...... per cent.	25·2	±0·7	22·9	26·8
Dressed weight......... ,,	79·4	±4·2	65·8	93·5
1 Dirty root .... lb.	1·0	±0·3	0·4	3·0
1 Clean root .... ,,	0·8	±0·3	0·3	2·5
Water .... per cent.	74·8	±0·7	73·2	77·1
Albuminoids ...... ,,	0·8	±0·1	0·6	1·1
Amides, etc. ...... ,,	0·6	±0·1	0·4	1·0
Cane sugar .... ,,	15·2	±1·0	12·4	16·8
Invert Sugar...... ,,	0·2	±0·04	0·0	0·9
Pectins, etc. ...... ,,	6·0	±0·06	4·8	7·9
Fibre .... ,,	1·5	±0·1	0·8	1·8
Ash .... ,,	0·7	±0·1	0·6	1·0
Nitrogen .... per cent.	0·23	±0·02	0·18	0·29

* Calculated from $\frac{0{\cdot}85 \quad \Sigma v}{\sqrt{n}\,\sqrt{n-1}}$

TABLE 6.

Analysis of Soils used for Sugar Beet.

	Cockle Park.	Bishop Auckland.
Organic matter	9·94	
Ferric oxide soluble in hydrochloric acid	3·10	
Alumina ,, ,, ,,	4·01	
Lime ,, ,, ,,	0·67	
Potash ,, ,, ,,	0·28	0·08
Phosphoric anhydride ,, ,, ,,	0·09	0·15
Silica, etc., insoluble in hydrochloric acid	82·69	
Potash soluble in citric acid	0·013	0·009
Phosphoric anhydride soluble in citric acid	0·011	0·010
Nitrogen	0·179	0·15
Calcium carbonate.....................	0·21	
Stones, over 3 mm.	4	9
Grits, 0·55 mm. to 3 mm.	8	5
Sand, 0·24 mm. to 0·55 mm............	32	
Silt, 0·11 mm. to 0·24 mm.	10	
Clay, under 0·11 mm.	46	

Obituary.

JULIUS LEWKOWITSCH.

Julius Lewkowitsch was born at Ostrowo, in Prussian Silesia, in 1857, and was educated at Ostrowo, Breslau, Strassburg, and Berlin. He took the degrees of Ph.D. in 1879, and M.A. in 1881, at Breslau, and at first intended to devote himself to an academic career. He carried out a considerable amount of original investigation under Victor von Richter at Breslau, then took a position as teacher of Mathematics and Natural Science at the Friedrichs Real Gymnasium, Berlin, under Landolt, and afterwards became Assistant to Victor Meyer at the University of Heidelberg. His first published work was concerned with the action of nitric acid on fatty acids, and may perhaps be taken as indicating the direction in which he was attracted at this early stage and as opening the path to his real life's work. Studies in stereo-chemistry and the preparation of optically active compounds from the corresponding racemic substances followed, and then, abandoning academic work, he became research chemist at a tar and petroleum works, and, following this, managed for a short time a tar distillery near Brunswick. Finally, at about 30 years of age, he came to England and became Chemist and technical manager to Messrs. Jos. Watson and Sons at their Leeds Soap Works, where he was the first to prepare chemically pure glycerin from soapmakers' lyes. Later he became naturalised as a British subject, and in 1895 he started practice at Manchester as a consulting Chemist and Technologist in Oils and Fats. In the same year he published his book on Oils and Fats, which in later editions was known as "The Chemical Technology and Analysis of Oils, Fats, and Waxes." Though founded on Benedikt's "Analyse der Fette und Wachsarten" the work was considerably expanded by Lewkowitsch, and the second edition, published in 1898, must be regarded as an entirely independent production. The book rapidly became the leading publication on the subject, and it grew to three large volumes, successive editions being called for in 1904 and 1909, in addition to separate issues in French and German. At the time of his death he was engaged in the preparation of yet another English edition. The first volume of this fifth edition has just been issued, and the second volume is in the press. He became a member of the Society of Chemical Industry in 1889, and in 1890 he read his first paper before the Society on "The estimation of Glycerine." This was followed by several "Contributions to the analysis of Fats," by "Attempts to convert Oleic Acid into Candle material"; "The Theory of Saponification"; "Problems in the Fat Industry," and many others. Meantime he also contributed several papers on cognate subjects to the Society of Dyers and Colourists, and in 1904 delivered a course of Cantor Lectures for the Society of Arts on "Oils and Fats—their Uses and Applications." To the Encyclopædia Britannica he contributed the article on oils and fats, and he also wrote articles on these subjects and on Margarine for the Dictionary of Applied Chemistry. In Meyer's "Jahrbuch der Chemie" also he wrote the section dealing with fats and petroleum, and in Lunge's "Chemisch-technische Untersuchungsmethoden" he dealt with oils and fats. He became connected with the production of the Journal of the Society of Chemical Industry in 1890, when he was appointed an Abstractor, but in 1894 he ceased work as an Abstractor and became a member of the Publication Committee, and for the long period of eighteen years he served on that Committee with characteristic zeal and assiduity. In 1898 Lewkowitsch removed from Manchester to London, and in 1901, after having previously served as a Member of the Committees of the Yorkshire and Manchester Sections, he became a member of the Committee of the London Section. The following year he was elected to the Council, and in 1905 he became a Vice-President. In 1908 he became Chairman of the London Section, and his tenure of that office was rendered memorable by the Annual Meeting of the Society being combined with the holding in London, in 1909, of the Seventh International Congress of Applied Chemistry. In 1911 be became Foreign Secretary of the Society, and this office he continued to hold to the day of his death. From 1901 to 1904 he served on the Council of the Institute of Chemistry, and during 1902-3 he was a member of the Council of the Chemical Society. He was also a member of the Council of the Society of Public Analysts, and acted for many years as an examiner for the City and Guilds of London Institute. In 1909 he received the Lavoisier Medal as Conférencier of the Société chimique de France.

Julius Lewkowitsch was a memorable man. Physically he was active and robust, and, until within the last two years, his strenuous life, which left him no time for exercise and little for rest or recreation, appeared to have no ill effect upon his health. He was an inspiring though exacting teacher, and many of the younger generation owe their success in life to his personal influence and training. As a companion he was bright and genial, and as a friend generous and true. His knowledge and capacity were remarkable, and his energy and industry prodigious. Of German birth and education he spoke English with hardly a trace of foreign accent, and wrote it with a fluency and accuracy that many men of British origin might envy. At the entertainment given by the London Section of the Society of Chemical Industry to the Seventh International Congress of Applied Chemistry he addressed the great gathering in English, German, French, and Italian. He was a man of forceful personality, striking ability and admirable character, and among the members of the Society of Chemical Industry especially his memory will long be cherished. He died at Chamonix on the 15th September, after only two days' actual illness, leaving a widow and a young son and daughter. He was buried at Chamonix at the foot of the mountains which he loved.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Grading or sizing solid materials; Method and apparatus for ——. C. L. McKesson and B. F. Rice, Colorado Springs, Colo., U.S.A. Eng. Pat. 16,940, July 20, 1912.

The material travels across a "deck," to which longitudinal and vertical reciprocating movements are imparted simultaneously. Transverse deflectors extend across the "deck" and these have transverse corrugations with inclined surfaces of different pitch. The deflectors and the corrugations thereon progressively decrease in size from the feed to the discharge end of the "deck."

—W. H. C.

Separating light or smaller material from heavier or larger material by means of water currents, applicable to cereals and their products and for cleansing fruit and seeds, and for the separation of large and small particles of minerals in a granular state; Apparatus for ——. J. Higginbottom, Liverpool. Eng. Pat. 25,936, Nov. 12, 1912.

An annular revolving ring provided with a sill or overflow, and carrying a skimmer, is arranged in the upper part of the apparatus described in Eng. Pats. 876 of 1904 and

2754 of 1906, for the purpose of collecting the lighter and smaller articles.—W. H. C.

Air and gases; Apparatus for washing, or purifying and cooling ——. S. W. Cole, London. Eng. Pat. 17,946, Aug. 2, 1912. Addition to Eng. Pat. 21,605, Sept. 30, 1911 (this J., 1912, 1005).

Apparatus constructed according to the earlier patent is combined with a refrigerating plant for cooling the gas, the expansion coils of the refrigerating plant being placed in the bottom of the purifier in brine or glycerin, which is circulated through the purifier and passes downwards over perforated plates or screens therein, whilst the air passes upwards through the cold brine or glycerin. The coils for cooling the compressed ammonia of the refrigerating plant are contained in a casing having a water sprinkler at the top, and the air passing to the purifier may first be passed through this casing where it receives a preliminary washing. —H. H.

Gaseous fluids; Removing suspended matter from ——. H. L. Doherty, New York. U.S. Pat. 1,071,893, Sept. 2, 1913.

The gas passes through spiral passages in a cylindrical chamber, being led from the periphery to the centre in one direction of rotation and then again to the periphery in the reverse direction of rotation.—A. T. L.

Gases; Process of regulating the temperature for the purification of —— by means of drying filters. E. Dänhardt. Fr. Pat. 455,378, March 3, 1913.

To keep the temperature of the gases entering the filters constant, they are previously passed in succession through tubular heating and cooling chambers, controlled by dampers.—W. H. C.

Humidifying and drying apparatus. Lambert Frères and A. Papin. Fr. Pat. 455,949, March 15, 1913.

The temperature and humidity of the air supplied to the humidifying chambers, is brought to any desired degree by passing it through a chamber provided with a heating coil and steam and water sprays.—W. H. C.

Drying objects made of plastic materials; Process and apparatus for ——. O. Eberhard. Fr. Pat. 455,959, March 26, 1913.

To prevent unequal drying the objects have a continual slow motion imparted to them, so that fresh surfaces are continually exposed to the action of the drying agents. —W. H. C.

Drying apparatus with superposed floors and rotary agitators. C. Asselbergs, Breda, Holland. Eng. Pat. 18,442, Aug. 10, 1912.

A drying apparatus for parings, pulps, and other sticky substances comprises a vertical cylindrical casing divided into horizontal drying sections by heated partitions, over the upper surfaces of which scrapers fixed to a central vertical shaft rotate so as to cause the material to fall alternately at the periphery and at the centre from one partition to the next, whilst heated air passes upwards in a contrary direction. The partitions are formed of flat spiral steam pipes with the coils touching, so that a rough surface upon which material is not liable to stick is formed, and each steam coil is supplied separately with steam so that the temperature of each drying chamber can be made as high as the moisture conditions of the material at that point will allow. The material is kept out of contact with air, being fed to the apparatus and withdrawn by means of screw conveyers.—H. H.

Desiccating process. C. H. Brigham, Brooklyn, N.Y. Assignor to Powdered Milk Company of America. U.S. Pat. 1,071,692, Sept. 2, 1913.

The liquid or semi-liquid is blown by a blast of compressed air from an atomiser placed near the apex of a conical casing disposed horizontally and a blast of air is blown into the apex of the casing, so that both the atomised liquid and blast of air have the form of cones, diverging in the same direction, the outer cone of air enveloping the inner cone of atomised liquid. The liquid is evaporated and the mixture of dry powder and moist air escapes from a point near the larger end of the conical casing.—W. H. C.

Dryer; Centrifugal ——. J. T. Psarski, Cleveland, Ohio. U.S. Pat. 1,071,956, Sept. 2, 1913.

The dryer comprises a casing connected with an exhauster, and a rotating basket within the casing, which receives the moist material. The basket has a non-perforated bottom, and there are openings near the upper edge of the side wall, and near the outer edge of the top. These openings are in contact with the moist material, and hot air is delivered to the centre of the cover of the rotating basket and is drawn through the material and away from the casing by the exhauster.—A. T. L.

Dryer; Rotary ——. C. B. Smith, Cleveland, Ohio. U.S. Pat. 1,072,186, Sept. 2, 1913.

A cylindrical casing arranged to be heated by the gases from a furnace chamber, is rotated about an axis slightly inclined to the horizontal. The upper or feed end of the inclined cylinder is situated over the furnace chamber and has perforated walls. A short inner cylinder, which receives the fresh charge of material to be dried, has annular walls forming a chamber through which hot air passes from the exterior to the interior.—A. T. L.

Desiccating apparatus. O. E. Merrell, Syracuse, N.Y. U.S. Pat. 1,072,391, Sept. 2, 1913.

Air is forced through an "air-whirling" chamber into a desiccating chamber, and the liquid to be desiccated is discharged into the whirling air at a point just before it enters the desiccating chamber.—W. H. C.

Furnaces for boiling or melting purposes. L. F. Tooth, London. Eng. Pat. 18,523, Aug. 12, 1912.

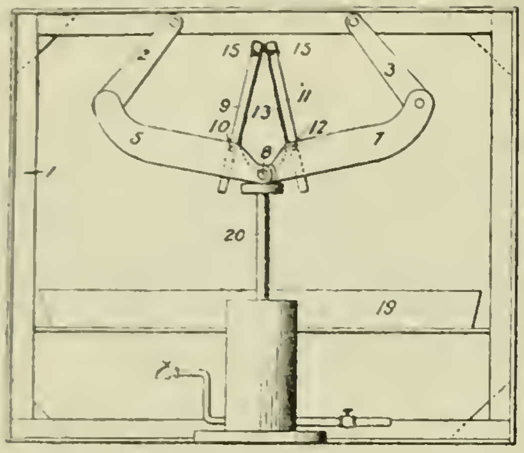
A gas furnace applicable for evaporating liquids such as sugar solutions or asphaltum or for melting metals is constructed with an annular heating chamber or flue surrounding a central heating chamber containing the gas burners, the annular chamber being provided with two or more outlets arranged symmetrically in order to ensure an even draught. To facilitate construction and repair, the annular flue is formed of a number of blocks or sections of similar shape. The inner walls of the heating chamber are sloped to fit a boiling pan, etc., and to protect the contents from burning, the part of the pan which projects above the top of the furnace is protected by a shield of asbestos. The temperature is regulated by adjusting the position of the burners. In an alternative construction, a series of vertical flues communicate with the heating chamber at the top and are connected at the bottom with a ring or circular flue communicating with the chimney, or a series of up-and-down flues as described in Eng. Pat. 30,287 of 1910 (this J., 1911, 962) may be used.—H. H.

Furnaces; Automatic charging apparatus for ——. Chemische Industrie Akt.-Ges. and L. Singer, Bochum, Germany. Eng. Pat. 6917, March 20, 1913. Under Int. Conv., March 22, 1912.

Receptacles open at the bottom are formed in the roof of the vertical cylindrical furnace near the axis, and a plate having an aperture is rotated beneath, so that the receptacles are alternately closed and opened at the bottom. The material is discharged by rotating rakes into the receptacles and when the aperture in the plate comes underneath the vessel, the charge falls into the furnace. —W. H. C.

Expressing liquids from solids; Apparatus for ——. J. J. Berrigan, Orange, N.J., U.S.A. Eng. Pat. 18,584, Aug. 13, 1912. Under Int. Conv., Aug. 22, 1911.

An apparatus for expressing liquids from solids and more particularly for treating slimes and the like, consists of two pressing members, 9, 11, pivoted at 10, 12, to two levers, 5, 7, and having latches, 15, by means of which they are connected together after the material to be filtered has been introduced into a filter-cloth bag, 13, between them. The levers, 5, 7, are hinged together at 8, and are supported by links, 2, 3, attached to a fixed framework, 1, and by a hydraulic ram, 20. When the ram is allowed to descend, the pressers, 9, 11, are slowly pressed together, the expressed liquid being collected in a tray, 19, beneath. It is advantageous to allow the pressing action to occur under the action of a weight, but auxiliary pressure from a ram or other mechanical device may be used if desired to force the apparatus downwards. The filtering medium preferably consists of cloth of differing degrees of fineness, the finer cloth being placed next to the working face of the pressing member, which is grooved to allow filtered liquid to escape.—H. H.



Separating solids and liquids; Dewatering device or means for ——. W. A. Hendryx, New York. U.S. Pat. 1,071,917, Sept. 2, 1913.

The semi-solid deposit is withdrawn from the bottom of a conical settling tank by an external, inclined screw conveyer, provided with a double-threaded screw at the lower end and rotating in a trough with an adjustable outlet.—W. H. C.

Evaporation of liquids; Apparatus for the fractional ——. R. N. Lennox, London. Eng. Pat. 19,573, Aug. 27, 1912.

An inclined tube set in a furnace and heated from below, the lower part of the inside being provided with a number of weirs or partitions, having notched overflows on alternate sides, in order to cause the liquid to take a tortuous path. The liquid to be evaporated is preheated by the vapours from the still in a counter-current preheater "resembling a Field tube," and enters the upper end of the inclined tube. The concentrated liquid flows from the lower end of the inclined tube through a U-shaped cooler.—W. H. C.

Evaporation. Method of —— and apparatus therefor. N. H. Hiller, Carbondale, Pa. U.S. Pat. 1,071,740, Sept. 2, 1913.

The apparatus comprises a boiler generating steam under pressure, an evaporator and a condenser connected together and adapted to work under pressure, a second evaporator, and the rectifier of an absorption refrigeration apparatus. Water in the first evaporator is heated under pressure by a steam coil, the steam is condensed by a cooling coil in the condenser, and the water from the condenser, together with that condensed in the steam heating-coil, passes into the second evaporator where it is evaporated by reducing the pressure. The cooling coil in the condenser receives the heated cooling water of the rectifier, and delivers the same, still further heated, as feed-water to the boiler, or to the first evaporator at a point near the steam-coil.—A. T. L.

Evaporating apparatus. D. P. J. Burguieres, C. L. Corne and G. E. Marshall, New Orleans, La. U.S. Pat. 1,072,307, Sept. 2, 1913.

A cylindro-conical vessel, in which the liquid is heated by a series of radial manifolds, spaced apart vertically and provided with depending vertical radiator pipes. The heating medium is circulated through the manifolds and radiators.—W. H. C.

Non-conducting coverings for boilers, steam pipes and other surfaces; Method for producing ——. C. J. Cuthbertson, London. Eng. Pat. 27,851, Dec. 3, 1912.

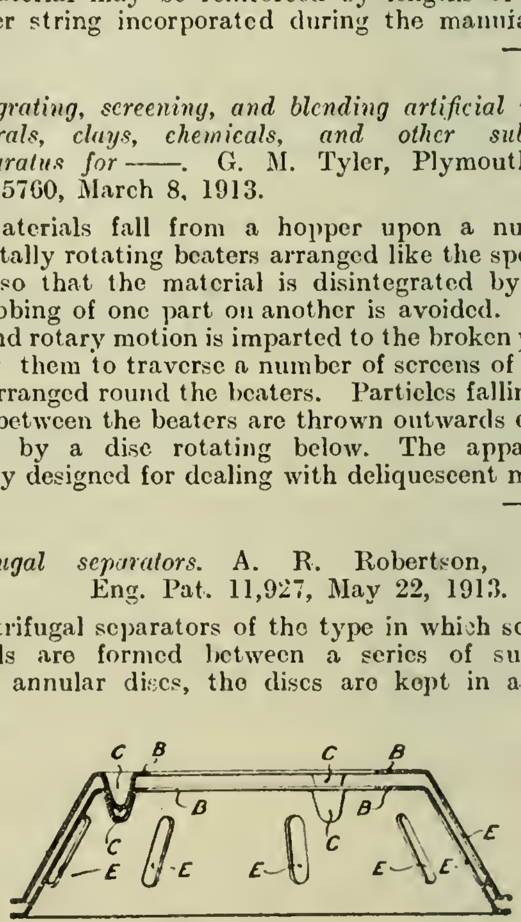
Sheets of non-conducting material are formed by alternately sifting asbestos fibre and spraying glue or other binder upon a flat surface until a sheet of the desired thickness is produced, and then passing the material through compression rollers having V-shaped ribs thereon which form grooves enabling the compressed sheet to be rolled upon a mandrel in cylindrical or tubular form. Alternatively the material may be built up on a revolving roller, mandrel or core similarly provided with ribs. The material may be reinforced by lengths of asbestos or other string incorporated during the manufacture. —H. H.

Disintegrating, screening, and blending artificial manures, minerals, clays, chemicals, and other substances; Apparatus for ——. G. M. Tyler, Plymouth. Eng. Pat. 5760, March 8, 1913.

The materials fall from a hopper upon a number of horizontally rotating beaters arranged like the spokes of a wheel, so that the material is disintegrated by impact, and rubbing of one part on another is avoided. An outward and rotary motion is imparted to the broken particles, causing them to traverse a number of screens of different mesh arranged round the beaters. Particles falling downwards between the beaters are thrown outwards on to the screens by a disc rotating below. The apparatus is specially designed for dealing with deliquescent materials. —H. H.

Centrifugal separators. A. R. Robertson, Glasgow. Eng. Pat. 11,927, May 22, 1913.

In centrifugal separators of the type in which separating channels are formed between a series of superposed conical annular discs, the discs are kept in alignment and spaced at the requisite distance by means of round bosses, C, formed in annular flanges, B, and adapted to fit one within the other. When slots such as E, are formed in the discs, these may be kept in alignment by providing say three bosses, C, and nine slots, E, in each disc, so that however the discs may be assembled the resulting arrangement of the slots is the same.—H. H.



Separators; Centrifugal liquid ——. J. Mélotte, Remicourt, Belgium. Eng. Pat. 13,598, June 12, 1913.

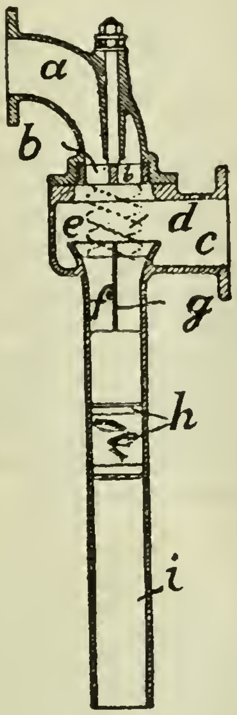
A disc having its outer edge curved downwards and inwards is arranged in the lower part of the centrifugal machine to receive the separated liquid, and to guide it into the collector. The rounded edge of the disc causes the liquid to break up into several streams and prevents different parts of the jets from meeting and producing froth.—W. H. C.

Ultra-filters of large capacity; System of ——. G. Malfitano and L. Michel. Fr. Pat. 456,334, April 4, 1913.

The filters are formed on a perforated plate or mandril support, by first forming a layer of colloidal filtering material of open texture, and subsequently forming upon this an extremely thin layer of very fine colloidal filtering material.—W. H. C.

Mixing liquids with gases or vapours; Device for ——. W. Krämer. Ger. Pat. 263,202, June 25, 1912.

The liquid enters the apparatus under pressure through *a*, and passes into the distributor, *b*, which is set in rotation, whereby a "liquid screw," *d*, is produced. The gas enters the mixing chamber, *e*, through *c*, and has free access on all sides to the surface of the "liquid screw," and hence fills the spaces between the convolutions. The ribs, *g*, in the receiver, *f*, cut the screw surface into separate parts and prevent the gas from returning to the mixing chamber. By means of baffles, *h*, a whirling motion can be imparted to the mixture of liquid and gas in the tube, *i*, whereby intimate mixing is ensured.—A. S.



Evaporating apparatus. J. A. Power, Babylon, N.Y., U.S.A. Eng. Pat. 1704, Jan. 21, 1913. Under Int. Conv., Jan. 27, 1912.

See U.S. Pat. 1,028,777 of 1912; this J., 1912, 627.—T.F.B.

Evaporator. G. W. Heisserman, jun. Fr. Pat. 455,377, Feb. 28, 1913. Under Int. Conv., Feb. 29, 1912.

See U.S. Pat. 1,045,023 of 1912; this J., 1913, 11.—T. F. B.

Interaction between liquids and gases or vapours; Apparatus for producing ——. J. A. Hart, Blackburn. U.S. Pat. 1,072,849, Sept. 9, 1913.

See Eng. Pat. 27,654 of 1912; this J., 1913, 817.—T. F. B.

Raising or forcing liquids; Method of ——. H. A. Humphrey, London, Assignor to Humphrey Gas Pump Co., New York. U.S. Pat. 1,072,852, Sept. 9, 1913.

See Eng. Pat. 7152 of 1910; this J., 1911, 524.—T. F. B.

Separating out liquids from vapours and gases; Apparatus for ——. P. Graefe, Mallmitz, Germany. U.S. Pat. 1,072,941, Sept. 9, 1913.

See Eng. Pat. 15,353 of 1912; this J., 1913, 408.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke; The moisture- and ash-content of ——. A. Wagener. Ferrum, 1913, **10**, 321—336, 353—369.

Present methods of sampling are criticised and the following method recommended. Three fork loads are taken from each waggon, the pieces being placed by hand on the fork, and the whole mixed, and broken down successively, with quartering, to pieces egg-size, walnut size, and grains of 10 mm. The workman taking the samples wears coloured spectacles, so that he cannot distinguish the dry from the damp pieces by their colour. During the crushing the coke may lose an appreciable quantity of moisture, and the most accurate results for the moisture estimation are obtained by breaking down the large sample as quickly as possible with a hammer to the size of the hand, and drying a portion weighing about 60 kilos. for 24 hours in a large drying cupboard heated to about 150° C. by superheated steam. In determining the ash, ignition at 750° C. gives the most accurate results; at 950° C. values about 0·2 per cent. lower are obtained, due chiefly to the loss of sulphur existing originally in the coke as ferrous sulphide, and to a less extent to the volatilisation of alkalis. Ashes obtained at both temperatures were found to contain a little carbon (about 0·05 per cent.), which possibly existed in the coke as silicon carbide. The method recommended is to ignite 1 grm. of the dried ground sample in a platinum crucible for 2 hours at 750° C., the crucible being placed in the cold muffle. Wet coke is not so strong as dry, the difference being greatest in those pieces which have been longest exposed to the action of water. No connection appears to exist between porosity and strength, and the inference that water acts on the coke material was confirmed by experiments which showed that solid matter, consisting chiefly of sulphates and carbonates, is removed in appreciable quantity after two days' immersion of coke in water.—T. St.

Gaseous mixtures; Combustion of —— *and temperatures of inflammation.* Taffanel and Le Floch. Comptes rend., 1913, **157**, 469—471.

Results are given showing that the temperatures of inflammation of mixtures of combustible gases with air vary according to the experimental conditions, being higher for example in small bombs than in those of larger capacity (see table).

Proportion of combustible gas in mixture.	Minimum temperatures of inflammation.			
	375 c.c. bomb.	275 c.c. bomb.	15 c.c. bomb.	9 c.c. bomb.
Firedamp (7 per cent.) ..	—	675°	735°	—
Hydrogen (15 per cent.)	590°	—	—	—
,, (20 per cent.)	—	—	—	625°
Carbon monoxide (20—70 per cent.)	610°	—	625°	700°

In the case of carbon monoxide inflammation occasionally occurred at about 375° C., probably owing to the presence of traces of carbon formed by dissociation of the monoxide. The minimum temperature of inflammation of mixtures of acetylene and air was 335° C. (40—55 per cent. C_2H_2), and the size of the bomb had no notable influence. In a bomb of 275 c.c. capacity, the following minimum temperatures of inflammation were observed: ethylene (4·5—6·5 per cent.) 487°, ethane (4—8 per cent.) 560°, pentane (2—3 per cent.) 512°, commercial benzene (5 per cent.) 578°, motor spirit (2·2 per cent.) 481°, denatured alcohol (27—38 per cent.) 450° C. In nearly all cases a more or less important lag in the inflammation could be detected (see this J., 1913, 646). Mixtures of coal dust and air gave temperatures of inflammation ranging from 590° to 670° C.—A. S.

Coal dust; Influence of gas upon the inflammability of —— *in air.* W. M. Thornton. Brit. Assoc., 1913. Sect. B. [Advance proof.]

Curves are given showing the effect of the presence of quantities of Newcastle coal gas up to 2 per cent. (by vol.) in the air on the least electric current capable of igniting a cloud of coal dust (see also this J., 1910, 868), when the current circuit is momentarily broken. 0·25 per cent. of gas had little or no effect, but higher percentages caused a rapid increase in sensitiveness. Pit gas gave similar results; methane was somewhat less active than coal gas. With a voltage below 200 the ignition of the dust cloud was very difficult even in presence of 2 per cent. of gas, and this may be regarded as about the highest voltage which is relatively safe in a "gassy" and dusty atmosphere where the percentage of gas is not above 2 and where very large open flashes are not possible. Coal dust is relatively more dangerous than gas in regard to the overheating of safety lamps and risk of ignition of dust clouds (see also Ashworth, Iron and Coal Trades Rev., May 23, 1913).—A. S.

Hydrogen nitrogen and methane; Determination of —— in gas by combustion in a quartz tube. Mathers and I. E. Lee. J. Gas Lighting. 1913, **123**, 832—833. (See also this J., 1912, 1153.)

An apparatus is described in which very accurate results are obtained by passing the gas, together with oxygen, over heated scrap platinum in a quartz tube. The tube was 30·5 cm. long and 3·38 mm. bore and was packed with 11·189 grms. of flattened out small pieces of platinum wire. The tube was arranged between a mercury pipette and a water-jacketed burette. The quartz tube was heated by a Bunsen burner and the gas passed slowly through it twice. The percentage of carbon dioxide found in the gas after combustion was corrected for that left in the quartz tube, and air was passed through the tube between successive experiments.—A. T. L.

Naphthenic acids and their applications. E. Schmitz Bull. Soc. Ind. Mulhouse, 1913, **83**, 373—389. (See also this J., 1908, 799, 1054; 1911, 498, 1041.)

After a general résumé of our knowledge of the naphthenic acids, the author describes their various applications, the most important of which is in the manufacture of soap, especially in Russia. Other applications include use as an antiseptic (*e.g.*, in timber preserving), as a solvent for vulcanised rubber, on which there is a devulcanising action, as a solvent for resins (*e.g.*, copal), and as a substitute for Turkey red oil in dyeing Para Red. The sulphonaphthenic acids have also been proposed for use in Turkey red dyeing. The aluminium salts are the most interesting of the metallic salts. Solubility in benzene, ether and turpentine distinguishes them, and the solution in the last solvent leaves on evaporation a colourless elastic film capable of wide application, *e.g.*, in the preparation of plastic masses, impregnation of leather, cloth, etc., and in the rubber and linoleum industries. The alkaline earth salts are soluble in vegetable oils and can be used as thickeners, while the lead and manganese salts are siccatives. The copper salts give a beautiful green solution in oils and could be used as colouring-matters. The chromium and iron salts might find application as tanning agents or mordants. The glycerides resemble the natural fatty glycerides. "Naphthenic acid" is identified by the intense green colour of the solution of its copper salt in petroleum spirit (see this J., 1910, 650; 1912, 601, 804), but the test preferred by the author is the characteristic odour of the methyl or ethyl ester. A method of analysis is described which depends on the solubility of the lead naphthenates in ether. The solution of soap is precipitated with lead acetate and the dried precipitate extracted with ether, which also dissolves lead oleate. After evaporating off the ether the residue is converted into the free acid which is weighed, the proportion of oleic acid present being calculated from the iodine value. Naphthenic acid absorbs no iodine. In the petroleum refining works the quantity of naphthenic acid in wash liquors, etc., is determined by acidifying the soap, extracting the free acid with benzene or ether, evaporating the extract and titrating the residue in alcoholic solution with caustic soda. The alkali in the soap liquor is determined at the same time.—J. B.

PATENTS.

Briquette; Coal —— and process of making same. B. Gratz. Fr. Pat. 455,348, March 10, 1913. Under Int. Conv., Nov. 19, 1912.

Fluxes are added to the binding material in order to prevent the formation of a very light ash that would be carried forward with the products of combustion. Aluminium sulphate is a suitable flux.—A. T. L.

Fuel [briquettes]; Manufacture of agglomerated ——. L. Martel. Fr. Pat. 456,061, March 27, 1913.

In making briquettes with a binder consisting of dry pitch together with a small quantity of tar, the tar is finely sprayed into the mixer containing the fuel and pitch, by means of compressed air or steam.—A. T. L.

Fuels, especially those of a fine-grained nature; Gasification of ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 3035, Feb. 5, 1913. Under Int. Conv., Feb. 13, 1912.

The process is suitable for making tar-free producer-gas from fuels such as slack coal, breeze, peat-dust, sawdust, etc. The producer is worked with a down-draught, gas being drawn by an exhauster from an outlet beneath the grate. The grate is first covered with pieces of clinker, on which rests a layer of incandescent fuel about 4 ins. in thickness. The draught is then started and the fresh fuel is distributed as evenly as possible over the incandescent fuel in a thin layer, the charging being as nearly continuous as possible. The working is continued until the bed of clinker has increased to say 1 m. in thickness, when the producer is emptied and the process started afresh.—A. T. L.

Gas producer for all classes of fuel; Double-zone ——. L Carretero. Fr. Pat. 455,518, March 13, 1913. Under Int. Conv., March 14, 1912.

The producer comprises a central chamber having walls of refractory material, which is surmounted by a charging hopper and is always filled with fuel. The lower part of the cylindrical wall of the hopper is formed by a perforated ring which can be moved upwards when required so as to allow some of the fuel to fall outside the central chamber into an outer furnace chamber. This part of the fuel is burned by an up-draught and maintains the lower part of the central chamber at a high temperature. The products of combustion, which contain an excess of air, are drawn by a steam-jet from the outer compartment into the upper end of the central chamber and pass downwards to a gas outlet near the lower end. The hot gases pass up through a pipe in the central chamber, or through the heating tubes of a boiler forming the producer casing, and the sensible heat is utilised in generating the steam required for the jet. The bottom of the central chamber is closed by a grate which can be lowered and raised for the discharge of ashes.—A. T. L.

Gases; Apparatus for purifying ——. J. Forder, Aachen, Germany. Eng. Pat. 3876, Feb. 14, 1913. Under Int. Conv., Feb. 17, 1912.

An apparatus for removing dust from gases comprises a rotary drum, the curved surface of which constitutes the filtering material, and an outer casing having an inlet for the gas to be filtered at the top and outlets for the filtered gas at the sides opposite the ends of the drum. The dust which collects on the filter is removed from time to time by means of a jet of air from a flat nozzle, which is loosely suspended from the drum spindle in such a manner that it hangs vertically as the drum rotates and blows the dust into a collector at the bottom of the casing.—H. H.

Gaseous fuels; Combustion of ——. C. D. McCourt, Streatham Common, Surrey, Radiant-Heating Ltd., London, and R. Schnabel, Berlin. Eng. Pats. 19,490, Aug. 26, 1912, and 5114, Feb. 28, 1913.

The invention relates to the process of burning an explosive mixture of fuel (coke-oven gas, blast-furnace gas, producer gas, coal gas, oil, etc.) and air within a bed of refractory material as described in Eng. Pats. 25,808 and 29,430 of 1909 (this J., 1910, 1448), and has for its object the prevention of backward propagation of the flame. The passages leading the explosive mixture from the supply chamber to the combustion zone are made narrow or of such shape that one of the dimensions of the cross-section is small, so that the cooling action of the walls quenches any flame and dissipates the heat. These passages are formed in a member made of very refractory material at the combustion end and of good heat-insulating material at the supply end. There may also be good heat-conducting material behind the refractory material at the combustion end, in order to lead away the heat passing by conduction through the refractory material. In the constructions described, the passages for the explosive mixture may consist of the interstices between a bundle of small rods, or they may be small circular or other passages formed in a block of suitable material. There may also be passages in the block for the circulation of air for cooling.—A. T. L.

Mineral oil ; Apparatus for converting —— into volatile spirit. The New Oil Refining Process, Ltd., London, and R. G. Neilson, Glasgow. Eng. Pats. 20,074 and 20,075, Sept. 3, 1912.

The inventions relate to apparatus for treating oil by passing the vapour together with steam over iron in a highly heated retort as described in Eng. Pat. 13,765 of 1908 (this J., 1909, 133). (1) One or more tubes or retorts are arranged in a furnace with a slight fall from the feed end to the outlet end, and the outlet ends are connected, by conduits inclined downwards, with a dephlegmator, from which the vapours are led to a condenser, and heavy or unconverted oil is led back to the crude-oil tank. The dephlegmator forms the heating jacket of a scrubber-still in which the oil from the condenser is redistilled, a further heavy fraction being separated and mixed with the crude oil. (2) A vertical tube or retort is arranged within a furnace and a vapour outlet from the upper end of the retort is connected with a condensing chamber, and a vapour outlet from this chamber is connected with a second condenser. The oil condensed in the first chamber is led back to the retort, and the heavy oil which is not vaporised in the retort is drawn off from the lower end so that the formation of pitch or coke in the retort is avoided.—A. T. L.

Burner system, particularly applicable to apparatus for purifying oils. R. A. Dornès. Fr. Pat. 456,007, June 7, 1912.

The apparatus is intended primarily for use in carrying out the process of purifying crude oil described in Fr. Pat. 448,658 of 1911 (this J., 1913, 415), and comprises means for separating solid impurities and tar from crude oil, vaporising the oil and generating superheated steam, mixing the vapour and steam and heating the mixture so as to obtain a fixed gas for heating the oil-purifying apparatus. This gas is burned beneath a nest of horizontal serpentine tubes in which the several steps of the process of making gas are effected. The tubes for vaporising the oil run from the front to the back of the apparatus and, returning to the front, discharge downwards into wide vertical tubes, in which a separation of lighter and heavier constituents takes place, the lighter vapours from the top of each vertical tube passing into the next horizontal vaporising tube of the series and thence to the next vertical tube. Superheated steam, generated in another horizontal serpentine tube, is injected into the oil vapour in the last of the vertical tubes referred to, and the mixture passes through a similar series of horizontal heating tubes and vertical separating tubes, successive heating tubes being at higher temperatures. In this way a fixed gas is generated, and this is led to the burners which heat the apparatus, an auxiliary oil burner being used until gas is being made. The whole apparatus is mounted on a wheeled base and is arranged beneath the retort and steam-generator of the oil-purifying apparatus. The burner apparatus is withdrawn more or less in order to regulate the heating, the burner orifices which are not required being closed. The movement is effected automatically and is controlled by the pressure of steam in the generator of the purifying apparatus.—A. T. L.

Coal ; Method of and apparatus for draining or freeing —— from water. C. Simon, Essen-Ruhr, Germany. Eng. Pat. 20,078, Sept. 3, 1912.

See U.S. Pat. 1,063,296 of 1913 ; this J., 1913, 743.—T.F.B.

Chamber-oven. A. Gohmann, Assignor to Stettiner Chamotte-Fabrik Act.-Ges. vorm. Didier, Stettin, Germany. U.S. Pat. 1,072,223, Sept. 2, 1913.

See Fr. Pat. 439,178 of 1912 ; this J., 1912, 631.—T. F. B.

Gas-furnace. P. A. J. Cousin, Nord, France. U.S. Pat. 1,072,578, Sept. 9, 1913.

See Fr. Pat. 438,873 of 1912 ; this J., 1912, 626.—T. F. B.

Gas-producer. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 1,072,098, Sept. 2, 1913.

See Fr. Pat. 431,327 of 1911 ; this J., 1911, 1367.—T. F. B.

Acetylene and other gases ; Process and product for purifying ——. P. J. Granjon, Marseilles, France. Eng. Pat. 19,838, Aug. 30, 1912. Under Int. Conv., Sept. 12, 1911.

See Fr. Pat. 434,137 of 1911 ; this J., 1912, 220.—T. F. B.

Petroleum, its heavy lubricating distillates, lubricating mineral oils, paraffin, and ceresin ; Process for treating and refining crude ——. G. Petroff, Kuskowo, Russia. Eng. Pat. 19,676, Aug. 28, 1912.

See Fr. Pat. 448,207 of 1912 ; this J., 1913, 415.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patents.

Distillation of materials containing cellulose ; Process of destructive ——. Holzverkohlungs-Industrie Akt.-Ges. Fr. Pat. 455,345, March 10, 1913. Under Int. Conv., May 24, 1912.

The yield of products especially of acetic acid, is augmented by increasing the quantity of heat supplied to the still during the period of carbonisation proper, when the known exothermic reaction takes place.—W. H. C.

Peat ; Treatment of ——. Wetcarbonizing, Ltd. Fr. Pat. 455,896, Feb. 26, 1913. Under Int. Conv. Feb. 26 and July 26, 1912.

In the wet carbonisation of peat (see Fr. Pat. 332,600 of 1903 ; this J., 1903, 1238) the peat pulp is passed at a high speed through a concentric tubular heat-interchanging apparatus, and is heated by the heat contained in the treated material, both before it enters the filter presses and by the hot filtrate. On leaving the heat-interchanger, the peat pulp passes at a reduced speed through an agitator, in which it remains long enough for the reaction to be completed.—W. H. C.

Electrode for arc lamps. Gebr. Siemens und Co. Fr. Pat. 456,042, March 27, 1913. Under Int. Conv., March 28, 1912.

In order to ensure a steady arc, carbon electrodes are made with an admixture of fluorspar together with a borofluoride, silicofluoride, tantalofluoride or titanofluoride of an alkali metal, potassium silicofluoride or titanofluoride being preferred. For lamps with enclosed arc, a tungsten compound such as calcium tungstate is also added. An alkali carbonate may be included to protect the globe from the action of fluorine compounds. —A. T. L.

III.—TAR AND TAR PRODUCTS.

Patents.

Aminoanthraquinonesulphonic acid ; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 15,028, June 30, 1913.

The acid sulphate of β-aminoanthraquinone, prepared by drying a mixture of the aminoanthraquinone with slightly more than the theoretical quantity of dilute sulphuric acid, is converted into 2-aminoanthraquinone-3-sulphonic acid in very good yield by heating, preferably in a vacuum. For example, the heating may occupy 10 hours at a temperature of 220°—250° C. in a vacuum.—T. F. B.

Bromo-aminoanthraquinone ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 263,395, Jan. 13, 1911.

1-Bromo-aminoanthraquinonesulphonic acids which contain a bromine atom, an amino group, and a sulphonic group in the same benzenoid nucleus (with the exception of 1-bromo-2-aminoanthraquinone-3-sulphonic acid) are treated with agents which will eliminate the sulphonic group.—T. F. B.

Hydrocarbons ; Process for simultaneously oxidising and evaporating ——. Soc. Anon. "Cava," Montegnée-lez-Liège, Belgium. Eng. Pat. 29,897, Dec. 28, 1912. Under Int. Conv., Dec. 30, 1911.

See Fr. Pat. 452,344 of 1912 ; this J., 1913, 649.—T. F. B.

Pitch ; Composition containing ——. J. Radcliffe, East Barnet. U.S. Pat. 1,071,792, Sept. 2, 1913.

See Eng. Pats. 4859 and 20,635 of 1911 ; this J., 1912, 325.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Patents.

Azo dyes ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,843, Aug. 30, 1912.

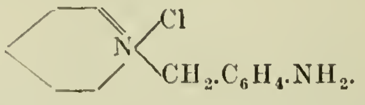
A diazo compound (*e.g.*, that of β-naphthylamine) is combined with a derivative of 2-amino-5-naphthol-7-sulphonic acid which contains in the heteronuclear side-chain diazotisable amino-groups, and the intermediate compounds are diazotised and combined with resorcinol, or the intermediate dyes from the above-mentioned 2.5.7-aminonaphtholsulphonic acid derivatives and resorcinol are combined with diazo compounds. The following derivatives of aminonaphtholsulphonic acid may be used :—*m*- or *p*-aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid, aminophenyl-1.2-naphthiminazole-5-hydroxy-7-sulphonic acid, 5-hydroxy-1.2-aminophenylnaphthotriazine-7-sulphonic acid, and similar compounds.—T. F. B.

Cotton [azo] dyestuffs ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,217, May 26, 1913. Under Int. Conv., May 25, 1912.

The tetrazo compound of *m*- or *p*-diaminodiphenylurea is combined with one mol. of a monosulphonic acid of the benzene or naphthalene series capable of further diazotisation after being combined, and the compounds thus produced are diazotised and combined with two mols. of resorcinol, *m*-aminophenol, or *m*-phenylenediamine, or their substitution products, or mixtures of these compounds. The following may be used as middle components :—1.6- or 1.7-naphthylaminesulphonic acid, 2.8.6- or 2.5.7-aminonaphtholsulphonic acid, acetyl-1.3-phenylenediamine-4-sulphonic acid. The resulting dyestuffs dye cotton directly reddish-brown to violet-brown shades, which are rendered fast to washing by subsequent treatment with formaldehyde.—T. F. B.

Azo dyestuffs ; Process for producing basic ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 456,236, April 1, 1913. Under Int. Conv., April 4, 1912.

Dyestuffs which dye cotton directly from alkaline baths yellow to orange shades, fast to washing, and similar shades on artificial silk, fast to water, are obtained by treating with phosgene the aminoazo compounds produced by combining aromatic amines with the diazo derivatives of basic compounds, such as *m*-aminophenyltrialkylammonium chlorides, $NH_2.C_6H_4.NR_3Cl$, or their homologues, or the chlorides of *p*-aminobenzylpyridonium of the constitution,



—T. F. B.

Azo dyestuffs for cotton ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 455,774, March 21, 1913. Under Int. Conv., April 6 and 25, 1912.

A monoacidylbenzidinesulphonic acid is diazotised and combined with a substance capable of combination, such as an amine, phenol, or azo compound. The products may be further diazotised, if they contain free amino groups, and converted into polyazo dyestuffs. In any case, the acidyl group is eliminated, producing dyestuffs capable of further development on the fibre. The shades obtainable vary from orange and red to violet and blue, according to the components used ; they are stated to be very fast. —T. F. B.

Direct [azo] dyestuffs ; Manufacture of ——. Read Holliday and Sons, Ltd. Fr. Pat. 455,802, March 22, 1913.

A series of direct dyestuffs which dye brown shades fast to light on vegetable fibres, is obtained by combining tetrazotised benzidine, tolidine, or dianisidine with one mol. of salicylic acid and then with one mol. of 1.6- or 1.7-naphthylaminesulphonic acid ; the products are again diazotised and combined with one mol. of aminonaphtholsulphonic acid G or J.—T. F. B.

Wool [azo] dyestuff ; Red —— and process of making same. H. Wagner and J. Kohlhaas, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,071,833, Sept. 2, 1913.

See Eng. Pat. 21,729 of 1912 ; this J., 1912, 1174.—T. F. B.

Azo dyestuffs insoluble in water ; Yellow —— and process for producing them. Act.-Ges. f. Anilinfabr. Fr. Pat. 455,312, March 8, 1913. Under Int. Conv., May 25, 1912.

See Eng. Pat. 6779 of 1913 ; this J., 1913, 905.—T. F. B.

1.4-*Diaminoanthraquinone compounds and their sulphonic derivatives ; Process for making* ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 456,155, June 11, 1912.

See Eng. Pat. 13,019 of 1912 ; this J., 1913, 528.—T. F. B.

Vat [indigoid] dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 455,629, March 17, 1913. Under Int. Conv., March 27, 1912.

See Ger. Pat. 258,258 of 1912 ; this J., 1913, 529.—T. F. B.

Trisazo dyestuffs ; Process for preparing ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 456,232, June 12, 1912.

See Eng. Pat. 14,125 of 1912 ; this J., 1913, 745.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Rag flock ; Determination of chlorine in ——. J. W. Black. Analyst, 1913, 38, 409—413. (See also this J., 1913, 402—407.)

The author has found the following process of extraction satisfactory : 40 grms. of the flock are treated with 500 c.c. of water and the pulp allowed to stand for some hours, preferably overnight. It is then transferred to a Buchner funnel and pressed to a hard felt; 250 c.c. of water are next poured on and, after a few minutes, the mass is again pressed. The operation is repeated, the washings being made up to 1 litre. For the determination of the chlorine, the most convenient method is Volhard's (addition of excess of silver nitrate and titration with thiocyanate). 500 c.c. of the extract are used and before titration are concentrated to about 100 c.c., a few drops of Merck's perhydrol (hydrogen peroxide) being added before evaporation to discharge the colouring matters. Variations in the chlorine content of different bales of rag flock are very large, and a satisfactory comparison with the present standard can only be obtained when every bale of a consignment is sampled and analysed separately.—J. F. B.

Melanin [Pigmentum nigrum]; Studies on ——. V. Comparison of certain nitrogen ratios in black and white wool from the same animal. R. A. Gortner. J. Amer. Chem. Soc., 1913, **35**, 1262—1268.

Comparative determinations of the nitrogen in different forms of combination were made with black and white wool taken from the same animal. The only substantial differences established were an excess of 3·45 per cent. of humin nitrogen in the black as compared with the white wool and a deficiency of 2·50 per cent. in the amino-nitrogen in the filtrate from the bases. The excess of humin nitrogen is due to the presence of pigment: there is however no necessary relationship between the lack of amino-nitrogen in the filtrate from the bases and the excess of humin nitrogen. The total nitrogen in the white wool was 16·27 per cent., that in the black being only 15·11 per cent. The low percentage of nitrogen in the black wool is probably due to the presence of melanin which contains less nitrogen than the keratin structure. The nitrogen of the melanin which appears in the humin fraction can only be a portion of the true melanin nitrogen present in the wool. Apparently, therefore, hydrolysis with strong acids breaks down the melanin molecule; this is in agreement with previous work.—J. F. B.

Cellulose from wood and textile fibres; Manufacture of —— and utilisation of the waste liquors. J. König, J. Hasenbäumer and M. Braun. Z. angew. Chem., 1913, **26**, 481—485.

The disintegrated wood or other fibrous material is steamed with 4—5 times its weight of a 3—5 per cent. solution of ammonia under a pressure of 2—3 atmos. for 5—6 hours. The liquor is removed by pressing and the residue is washed with boiling water, the ammonia being recovered by distillation of the liquors, with the addition of lime, if necessary; resins and tannins are obtained from the residue from distillation. The digested material is next steamed in a similar manner with 4—5 times its weight of 0·4—0·6 per cent. sulphuric acid for 6—8 hours under a pressure of 1—2 atmos. The liquors from this treatment contain sugars, the products of the hydrolysis of hemicelluloses and pentosans. These liquors are neutralised either with the lime employed for the recovery of the ammonia or else with powdered limestone and evaporated. The syrup obtained is separated from the calcium sulphate and mixed with dry fodder, chopped hay, brewers' grains, bran, etc., and fed to cattle. An alternative process consists in steaming with sodium carbonate solution instead of ammonia in the first stage and with hydrochloric acid in the second stage, and mixing the waste liquors from each process so that they neutralise each other; the sodium chloride thus formed is not injurious to the use of the evaporated syrup as a fodder. The exhaustive alkaline and acid treatments do not remove the lignin from the wood, and the residue still contains over 25 per cent. of lignin. This, however, is in a form which is readily oxidisable by hypochlorite bleach liquor and the fibre is treated in stages, preferably with dilute sodium hypochlorite, until a residue of bleached cellulose is obtained. It is estimated that 100 kilos. of wood yield 3 kilos. of resin (or 1—2 kilos. of tannic acid), 25 kilos. of fodder-extract rich in sugars and 30—45 kilos. of bleached cellulose.—J. F. B.

Cotton cellulose; Intermediate products of the hydrolysis of —— by means of sulphuric acid. C. G. Schwalbe and W. Schulz. Z. angew. Chem., 1913, **26**, 499—501.

Guignet's cellulose is prepared by triturating 5 grms. of air-dry cotton wool in a mortar with 85 c.c. of 62·5 per cent. sulphuric acid for 15 minutes, digesting the mass at the ordinary temperature for 5 hours, diluting with 175 c.c. of water, filtering off on a cloth and washing the precipitate by decantation until free from acid. It gives colloidal solutions which are stable on boiling and may be re-constituted after evaporation to dryness, but which are coagulated by small quantities of acids and salts, also on the addition of alcohol. It is distinguished by its low hydrolysis value (Schwalbe); it is only coloured blue by iodine solution in presence of sulphuric acid, whereas vegetable parchment gives a blue colouration direct.

Flechsig's amyloid is prepared by treating 5 grms. of cotton with a cooled mixture of 30 grms. of 92 per cent. sulphuric acid and 10 grms. of water. The acid is allowed to act for 1—2 hours at a temperature between 6° and 30° C. The sticky mass is coagulated by dilution and washed free from acid. The washed product can be dried at 95° C. without decomposition but not at 105° C. It is coloured blue by iodine in presence of sulphuric acid. It possesses colloidal properties, but in a less pronounced degree than Guignet's cellulose; it has higher copper value, hydrolysis value and solubility in alkali than Guignet's cellulose.

Parchmentised cellulose is prepared by immersion for 10—30 seconds in 78 per cent. sulphuric acid. The properties vary according to whether loose cotton or filter-paper is treated. Parchmentised cotton wool, when boiled with 10 per cent. sodium hydroxide for 15 minutes, is dissolved to the extent of 70 per cent., but filter-paper similarly treated loses only 18 per cent. It absorbs cupric hydroxide from Fehling's solution and the last traces are removed only with difficulty by acid; the hydrolysis value is high, the copper value is relatively low. It is stained blue by iodine without the intervention of sulphuric acid.

Ekström's acid cellulose is prepared by treating 5 grms. of cotton in a mortar with 18 grms. of 78 per cent. sulphuric acid for 45 minutes, then diluting with 29 c.c. of water and pressing the product between cloths. On stirring the residue with a little water a colloidal solution is obtained, but with much water the product is parchmentised. It is coloured blue by iodine without sulphuric acid. It has high copper and hydrolysis values and is completely soluble in alkali.—J. F. B.

Rosin in paper; Determination of ——. C. F. Sammet. J. Ind. Eng. Chem., 1913, **5**, 732—735.

The disadvantages of the current methods for the determination of rosin in papers are pointed out and a method is described which is stated to give results concordant to within 0·20 per cent. 5 grms. of the paper, cut into strips and folded, are extracted with a mixture of 100 c.c. of 95 per cent. alcohol and 15 c.c. of dilute acetic acid (5 c.c. of glacial acid to 100 c.c. of water) in a Soxhlet apparatus. The extract is concentrated, treated with 25 c.c. of ether and shaken with 150 c.c. of water in which a small quantity of sodium chloride has been dissolved to prevent the formation of an emulsion. The separated aqueous layer is washed with another 25 c.c. of ether, and the combined ethereal extracts are washed twice with water, evaporated to dryness, the residue dried for 1 hour at 98°—100° C., and weighed.—A. S.

Patents.

Washable material; Preparation of ——, which is combustible with difficulty. A. Eichengrün. Fr. Pat. 455,811, March 22, 1913. Under Int. Conv., April 9, 1912.

The material, such as all kinds of fibrous substances, papers, etc., is treated simultaneously or successively with substances which diminish its combustibility, and with solutions of esters of cellulose with fatty acids, preferably mixed with softening materials which are non-inflammable or which diminish the combustibility, such as zinc chloride, boric acid, etc.—B. N.

Fibres and analogous substances from liquids ; Apparatus for separating and recovering ——. E. V. Chambers and T. C. Hammond. Fr. Pat. 455,686, March 19, 1913. Under Int. Conv., March 22, 1912.

See Eng. Pat. 7060 of 1912 ; this J., 1912, 837.—T. F. B.

Ethers of cellulose, its conversion products and derivatives ; Process for the manufacture of ——. L. Lilienfeld, Vienna. Eng. Pat. 12,854, May 31, 1912.

See Fr. Pat. 447,974 of 1912 ; this J., 1913, 420.—T. F. B.

Cellulose esters soluble in ethyl acetate ; Manufacture of ——. Verein f. Chem. Industrie in Mainz, Mainz, Germany. Eng. Pat. 3849, Feb. 14, 1913. Under Int. Conv., Feb. 29, 1912.

See Fr. Pat. 455,117 of 1913 ; this J., 1913, 865.—T. F. B.

Paper ; Manufacture of —— *[from waste paper]*. J. Schimek, Berlin, and L. Kienzle, Trieben, Austria. Eng. Pat. 19,697, Aug. 28, 1912. Under Int. Conv., Nov. 14, 1911.

See Fr. Pat. 446,095 of 1912 ; this J., 1913, 133.—T. F. B.

Paper, cardboard, and their equivalents ; Process and apparatus for treating —— *with a waterproofing agent.* A. Stephen. Fr. Pat. 455,871, Jan. 11, 1913. Under Int. Conv., June 18, 1912.

See Eng. Pat. 14,246 of 1912 ; this J., 1913, 748.—T. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Dyeworks effluents ; Purification of —— *by means of colloidal clay.* H. Polz. Färber-Zeit., 1913, 24, 395—396.

A trial on the large scale of Rohland's method of purifying dyeworks effluents by means of colloidal clay emulsions and milk of lime (compare this J., 1908, 34 ; 1911, 150) showed that apart from its prohibitive cost, the results obtained by the method were unsatisfactory both as regards the decolourisation and deodourisation of the effluents. The greatest disadvantage of the process, however, lay in the immense volumes of slimes which were produced, rendering continuous operations quite unworkable.—O. R.

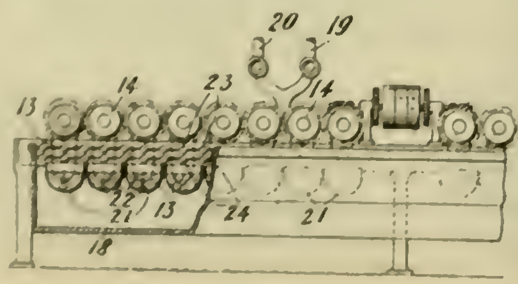
Patents.

Bleaching piece goods, Machines employed for ——. W. T. and L. J. Craven, C. H. Young, F. H. and W. S. Cliffe. Fr. Pat. 455,744, March 20, 1913.

The machine comprises guiding and compression cylinders for maintaining the material in tension during the treatment with caustic soda. The cylinders may be grooved and provided with elastic envelopes.—B. N.

Silk ; Weighting of ——. F. J. Knibichler. Fr. Pat. 456,206, March 31, 1913.

The silk is treated in a bath of tin chloride, drained, then well washed, and finally treated with water containing reagents producing a partial fixation of the salt. The series of operations may be repeated after another draining, and at the end or between the operations the material may be treated with a phosphate bath. For the weighting operation, the material is rolled on a roughened horizontal tube, which may be rotated, and for the washing operation it is passed between tubes which project water in a series of jets on to each side of the material above a bath of water, and through which the material also passes. It is then again washed between a second set of tubes, and afterwards passes through a bath and between tubes projecting the liquid containing the reagent for partial fixation. In an alternative form the material, 13, is hung on rotating rollers, 14, and passes through the liquid in small baths, 21, under each roller. Water may be supplied through the tube, 19, to the tubes, 23 and 24, for projection on to the material. After stopping the supply of water, the baths, 21, are emptied through the openings, 22, into the larger bath, 18, and the water containing the fixing agent is then supplied in a similar manner through the tube, 20.—B. N.



Dyeing-machine ; Circulating ——. W. W. Sibson and T. Allsop, Assignors to The Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,072,662, Sept. 9, 1913.

The material is contained in a cage divided into compartments by one horizontal and several vertical screen partitions. The cage is placed in the dye-vat and the dye-liquor is circulated by means of propellers mounted rigidly on a horizontal shaft disposed in a chamber at one end of the vat. This chamber is formed by partitions extending across the vat but not reaching to the top and bottom ; one of the partitions is hinged in order to afford access to the chamber for cleaning. Discharge openings are provided in the walls forming the top and bottom of the propeller-chamber, and these openings are controlled by swing valves which are held open alternately ; in the open position the valves serve to deflect the dye-liquor and assist in producing uniform circulation. Near each end of the propeller-chamber and adjacent to the propellers are intakes communicating with the passage in the rear of the chamber, *i.e.*, between this and the end wall of the vat. The shaft carrying the propellers projects through the wall of the vat, and the operating gear is located outside.—A. S.

Dyes capable of being discharged ; Process for producing on cotton ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 455,493, March 12, 1913. Under Int. Conv., April 11, 1912.

The process consists in developing on the fibre by means of nitraniline the colouring matters obtained by the combination of tetrazotised diamines with two molecules of an amino-1-arylpyrazolone or its sulphonic or carboxylic acids ; or one molecule of the latter or its derivatives may be employed, and the intermediate product combined with a molecule of another azo component.—B. N.

Dyeing of vegetable fibres. Read Holliday and Sons, Ltd. Fr. Pat. 455,803, March 22, 1913.

The cotton, dyed with direct cotton dyes, such as Titan Black or Chlorazol Black, is treated in the presence of an oxidising agent with *p*-phenylenediamine, *p*-amino-*p*-hydroxydiphenylamine, *p*-aminophenol, *o*-aminophenol, or their derivatives or condensation products. The material is worked in the bath for several minutes in the cold, and afterwards carried gradually to a temperature of 40° C. during a period of about half-an-hour, or the operation may be conducted entirely in the cold or at the boiling point.—B. N.

Fastness to light of vegetable fibres or other tissues dyed with substantive dyestuffs ; Process for improving the ——. Read Holliday and Sons, Ltd. Fr. Pat. 455,804, March 22, 1913.

The material, after dyeing, is treated with a solution of a soluble thiosulphate.—B. N.

Textile materials ; Wet treatment [Dyeing] of ——. A. M. Scheid. Fr. Pat. 455,917, March 11, 1913.

The bath is provided with two partitions, forming an inner compartment for containing the material, and the base of this compartment, which receives a reciprocating motion, is furnished with valves. The latter open and close during the downstroke and upstroke, respectively, of the base, so that the dye-liquor is given a circulatory motion, upwards through the inner compartment and downwards in the outer bath. In an alternative form, a single partition divides two compartments, which receive the reciprocating motion. Each compartment is provided with valves in the base, one set of valves opening and closing during the down and upstroke, the other set, in the compartment where the liquor travels from the top to the bottom, being maintained continually open by mechanical means.—B. N.

Dyeing furs, hairs, feathers, etc. ; Process for ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 262,692, Oct. 20, 1912. Addition to Ger. Pat. 255,858 (see Fr. Pat. 445,880 of 1912 ; this J., 1912, 1176).

1-Nitro-2.4-phenylenediamine is applied to the mordanted or unmordanted goods to be dyed, in aqueous solutions or suspensions containing oxidising agents. —T. F. B.

Dyeings and printings ; Production of fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 263,005, July 11, 1911.

Fibres dyed with diazotisable dyestuffs are diazotised and developed with derivatives of β-ketone-aldehydes in which the aldehydic hydrogen is replaced by an alkyl, aryl, alkyloxy, or arylido group, or the fibre is impregnated with solutions of these substances and developed by means of diazo compounds.—T. F. B.

Washing, rinsing and removal of acid from textile materials ; Machine for ——. A. Louis. Fr. Pat. 455,570, March 14, 1913. Under Int. Conv., Feb. 12, 1913.

The material is submitted to the action of rakes taking an elliptical or other appropriate path, the perforated sheets forming the false bottom of the bath presenting a curvature similar to the trajectory described by the lower extremities of the agitators.—B. N.

Fabrics ; Process for waterproofing ——. H. Oliver, London, and G. T. Oliver, Walthamstow, Essex. Eng. Pat. 21,697, Sept. 24, 1912.

The fabric is coated successively with a solution containing equal parts of gum-tragasol and water and $1\frac{1}{2}$ per cent. of glycerin, a solution of 16 grains of borax in 1 gallon of water, and an elastic varnish, preferably made by boiling gum arabic with linseed oil to a creamy consistence, being dried after each coating operation.—O. R.

Textile materials impermeable ; Process for rendering tissues and other objects made of ——. L. Poutrel née Louvet. Fr. Pat. 456,265, April 2, 1913.

The material is treated in two baths successively, the first containing aluminium sulphate or an alum, and the second a mixture of an alkali carbonate, ozokerite and stearine.—B. N.

Soapy liquors from laundries ; Treating waste —— to enable them to be used again. E. W. Lucas, Ealing, Middlesex. Eng. Pat. 10,280, May 1, 1913.

The hot waste liquor is treated with a decolourising and purifying agent, such as potassium permanganate, filtered, and afterwards again used for cleansing purposes.—B. N.

Dyeings fast to washing and capable of being discharged ; Process for producing on the fibre ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 455,304, March 8, 1913. Under Int. Conv., April 18, 1912.

See Ger. Pat. 258,384 of 1912 ; this J., 1913, 531.—T. F. B.

Machine for treating [textile and other] products or articles by means of a liquid. F. Schubert. Fr. Pat. 455,627, March 17, 1913.

See Eng. Pat. 4569 of 1913 ; this J., 1913, 908.—T. F. B.

Discharging by means of sulphoxylates ; Process for ——. L. Cassella und Co., G. m. b. H. Fr. Pat. 456,158, June 11, 1912.

See Ger. Pat. 259,699 of 1912 ; this J., 1913, 654.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphuric acid ; Mechanism of the formation of —— in lead chambers. E. Briner and A. Kuhne. Comptes rend., 1913, **157**, 448—450.

When pure dry sulphur dioxide and nitrogen peroxide are led into the lower part of a glass vessel, the lower half of which is immersed in a bath kept at 60 ° C., a white deposit of pure sulphuric anhydride appears on the walls of the upper cooler part of the vessel. Nitrogen peroxide is thus capable of oxidising sulphur dioxide directly to sulphuric anhydride (see also Reynolds and Taylor, this J., 1912, 367), and the authors consider that in the lead chambers the reaction takes place mainly in the gaseous phase. The oxidation of the sulphur dioxide is strongly accelerated by the water introduced into the chambers, because this combines with the sulphuric anhydride and thus removes it from the gaseous phase. The formation of sulphur-nitrogen compounds in the chamber only occurs when the reaction proceeds abnormally, owing to excess or deficit of water.

Nitrogen peroxide is also capable of oxidising carbon monoxide to carbon dioxide.—A. S.

Sulphur in burnt pyrites ; Rapid method of determining ——. L. Sznajder. Chem.-Zeit., 1913, **37**, 1107.

The finely powdered material (2·5 grms.), mixed with sodium carbonate (1 grm.) and zinc oxide (4 grms.), is maintained at a red heat for half-an-hour, in an open iron crucible, the mixture being occasionally stirred, and, after cooling and treating with boiling water, the whole is made up to 250 c.c. Then 200 c.c. of the filtered solution are neutralised (boiling) with dilute hydrochloric acid, in presence of phenolphthalein, 30 c.c. of $N/5$ barium chloride solution are added, whilst stirring, and the mixture is titrated hot with $N/5$ sodium carbonate solution (which has itself been standardised at about 80° C. against the barium chloride solution, with phenolphthalein as indicator). For x c.c. of carbonate solution used, the percentage of sulphur is $0·16\ (30—x)$.—F. Sodn.

Formic acid as a solvent. O. Aschan. Chem.-Zeit., 1913, **37**, 1117—1118.

Formic acid of 95 per cent. concentration can now be obtained at a price about one-half that of glacial acetic acid, and the author recommends its use as a solvent. In many cases it has greater solvent power than acetic acid and is superior to the latter also in regard to differences of solubility in the hot and in the cold. The ease with which it is oxidised and with which it esterifies alcohols are disadvantages. It is reduced by sodium iodide, with liberation of iodine, but not by potassium iodide. The solubilities of a considerable number of inorganic and organic substances in formic acid are tabulated. Inorganic salts are mostly somewhat less soluble in formic acid than in water. Some organic compounds, such as terephthalic acid, indigo, uric acid, and alizarin, which are practically insoluble in the usual solvents, dissolve to a not inconsiderable extent even in cold formic acid : in boiling formic acid the solubilities of the compounds mentioned are 3·02, 0·16, 0·16, and 0·82 grm. respectively in 100 c.c. of solution.—A. S.

Tungstic acid ; Quantitative precipitation of —— by aromatic amines. E. Kafka. Z. anal. Chem., 1913, **52**, 601—606.

Cumidine, tetramethyl-*p*-diaminodiphenylmethane, and tetramethyldiaminobenzophenone behave like benzidine, a-naphthylamine, etc. (this J., 1908, 812; 1909, 545), in quantitatively precipitating tungstic acid, in combination with the amine; with rosaniline hydrochloride, precipitation is incomplete. With 50 c.c. of a solution containing 0·25 grm. of sodium tungstate, 15 c.c. of pseudocumidine solution (5 grms. dissolved in 10 c.c. of water with 5 c.c. of strong hydrochloric acid and diluted to 100 c.c.) or 10 c.c. of solution of the diphenylmethane derivative (6 grms. dissolved in 4 c.c. of strong hydrochloric acid and diluted to 100 c.c.) or of the phenone (7·5 grms. in 10 c.c. of hydrochloric acid and made up to 100 c.c.) are added, the mixture is repeatedly stirred and allowed to settle for ½—1 hr., the precipitate washed with the diluted reagent (1 : 20), and ignited in a platinum crucible to constant weight.—F. Sodn.

Sodium hypochlorite; Production of —— with cooled anodes. P. H. Prausnitz. Z. Elektrochem., 1913, **19**, 676—680.

By using a platinum anode cooled internally by a stream of water a considerable advantage is gained in the electrolysis of 5*N* sodium chloride with the electrolyte at a temperature of 20° C. and a current density of about 1·25 amps. per sq. cm. In the author's apparatus the concentration increased from 41·6 grms. of available chlorine per litre under ordinary conditions to 90 grms. per litre with the anode at 15° C. and 100 grms. per litre with the anode at 3°—4° C. The current yield is remarkably high in the earlier stages and diminishes slowly as electrolysis proceeds. Apparently the cooled anode is not favourable to the discharge of ClO′ ions. It is found that when there is no cooling and the electrolyte is at 20° to 25° C., the anode temperature rises to just over 40° C. with a current density of 1·25 amps. per sq. cm. If the electrolyte be warmed to 47° to 48° C., but the anode kept at about 20° C. by internal cooling, a high concentration of hypochlorite (70 grms. of available chlorine per litre) may be obtained with a 50 per cent. current yield and a 20 per cent. diminution in the voltage of the cell. In this way it may be possible to reduce considerably the expenditure of energy required in industry to produce a concentrated bleaching liquor. In *N*/1 sodium chloride the effect of the cooled anode is almost unnoticeable, and with lower current densities in 5*N* sodium chloride the effect is much less. When the anode is platinised and cooled it is possible to obtain 60 grms. of available chlorine per litre at a current density of 0·47 amp. per sq. cm. from 5*N* sodium chloride. The current yield in this case is about 75 per cent., so that the results are somewhat better than the best previously recorded for this current density using Turkey red oil and chromate at a platinised electrode. They are no better, however, than those which can be obtained at a smooth electrode with a higher current density (1·25 amp. per sq. cm.).
—W. H. P.

Copper sulphate; Preparation and properties of a basic ——. E. Pozzi-Escot. Bull. Soc. Chim., 1913, **13**, 816—817.

A basic copper sulphate, $CuSO_4,CuO$, can be readily obtained, in considerable quantities, by adding, with agitation, potassium bisulphite to a hot saturated solution of copper sulphate in commercial formalin holding some copper sulphate in suspension. A greenish white precipitate is formed which can be dried *in vacuo* at 50° C. When exposed to the air the compound absorbs moisture, becoming greener, and is finally converted into the corresponding hydrated salt, $CuSO_4,Cu(OH)_2$. It is insoluble in cold and slowly decomposed by hot water. When heated it becomes yellow, then melts to a red liquid.—A. S.

Zinc, copper and nickel; Action of a soluble ferrocyanide in excess on solutions of —— and volumetric methods based on same. R. Meurice. Ann. Chim. Analyt., 1913, **18**, 342—345.

The formula, $Zn_3K_2Fe_2(CN)_{12}$, for the precipitate obtained on adding excess of a solution of potassium ferrocyanide to a solution of a zinc salt has been verified by adding a solution of zinc chloride containing a known amount of zinc to excess of a standard solution of potassium ferrocyanide, ammonium sulphate being also added to facilitate the settling of the precipitate. After allowing the latter to settle an aliquot portion of the clear supernatant liquor was removed and the excess of ferrocyanide determined by titrating against standard potassium permanganate in presence of considerable excess of dilute sulphuric acid. The solution must be very dilute in order that the yellow colour of the ferricyanide produced may not interfere. Under similar conditions, using a considerable excess of ferrocyanide, nickel can also be determined, the precipitate having the composition, $NiK_2Fe(CN)_6$. In the case of copper, the precipitate obtained with excess of ferrocyanide is of varying composition.—T. C.

Aluminium hydroxide; Precipitation of —— and separation of the same from chromium. W. Jakób. Z. anal. Chem., 1913, **52**, 651—657.

Aluminium hydroxide is quantitatively precipitated in a very compact form by adding freshly prepared sodium hydroxide solution (5 per cent.), drop by drop, to a solution containing aluminium (0·1—0·2 grm. Al_2O_3 in 70—100 c.c.), until the precipitate formed redissolves, heating to boiling, and adding excess of saturated bromine water, avoiding any fall of temperature. The reaction may be applied to the separation of aluminium from chromium, by adding 20 per cent. pure sodium hydroxide solution, and when the precipitate is redissolved, introducing saturated bromine water, in the cold, until the solution is yellow. The mixture is then heated to boiling and further bromine water added to precipitate the alumina, after which the supernatant liquid is decanted, the precipitate boiled for some minutes with water containing ammonia and ammonium nitrate, to free it from accompanying chromate, and the precipitate finally washed with the same solution. Sulphates and borates should not be present.—F. Sodn.

Felspar; Decomposition of —— and its use in the fixation of atmospheric nitrogen. W. H. Ross. J. Ind. Eng. Chem., 1913, 5, 725—729.

When a mixture of felspar and carbon is ignited in a current of nitrogen at 1400° C., only a very small proportion of nitrogen is fixed, but if calcium carbonate or lime be added to the mixture, the potash of the felspar is liberated and volatilised and a much larger proportion of nitrogen is fixed. For example, using a mixture of 4 grms. of felspar, 2 grms. of carbon, and 4·3 grms. of calcium carbonate, and heating at about 1400° C., the whole of the potash was volatilised and 6·10 per cent. of nitrogen (reckoned on the weight of felspar) was fixed in 1 hour and 7·44 per cent. in 2 hours. This is a larger proportion of nitrogen than corresponds with the aluminium of the felspar, assuming the nitrogen to be fixed as aluminium nitride. The reaction product evolves ammonia very slowly when boiled with water and only slowly even when boiled with sodium hydroxide solution.—A. S.

Thorium; Production of radio-active substances from ——. F. Glaser. Chem.-Zeit., 1913, **37**, 1105—1106.

The precipitation of thorium X from a thorium solution obtained from monazite sand with sulphuric acid (this J., 1913, 485) is conditioned by the presence of lead which, as lead sulphate, adsorbs thorium X, and thorium X may be separated from any thorium solution containing sulphuric acid by the addition of a little lead acetate. Other lead salts do not behave like lead sulphate in this respect, so that by treating the radio-active lead sulphate with sodium carbonate solution, dissolving the washed residue in hydrochloric acid, and precipitating with hydrogen sulphide, the lead may be separated as sulphide, leaving thorium X in solution.—F. Sodn.

Bromine; Characteristic and delicate reaction for ——. III. I. Guareschi. Z. anal. Chem., 1913, **52**, 607—616.

In continuation of work already published (this J., 1912, 1149), bromine has been detected, by means of magenta decolourised by sulphur dioxide, in the purest commercial magnesium chloride and potassium chloride and in the ash of many plants. The author's reaction has served to demonstrate the decomposition of metallic bromides (even the most stable) on heating and the liberation of bromine from many organic derivatives on heating or exposing to light, as also the replacement of bromine by iodine in bromates and bromides. Hydrobromic acid, even in presence of iodine, gives only a trace of bromine on heating. Hypobromites, when acidified, behave towards the reagent like bromine.—F. Sodn.

Air to be liquefied; Drying of —— by refrigeration. G. Claude. Comptes rend., 1913, **157**, 466—469.

For the removal of moisture by refrigeration from air which is to be liquefied, the author recommended previously (this J., 1910, 24) the addition of a small quantity of alcohol in order to prevent the water from freezing. A method has now been devised whereby the moisture can be removed without addition of any other substance. The compressed air is circulated around the outside of the tubes of the heat-exchanger of the liquefying apparatus, instead of inside as formerly, and the expanded air passes through the tubes. The compressed air enters the lower part of the apparatus and passes gradually upwards, being caused to take a sinuous course by suitable baffles. The moisture is condensed partly as liquid which flows downwards and is run off periodically, and partly as hoar frost on the tubes of the exchanger. At intervals, before the deposit of hoar frost is sufficient seriously to impair the efficiency of the apparatus, the exchanger is replaced by a fresh one. It is stated that in this way, for an apparatus with a capacity of 50 cb. m. of oxygen per hour, it is necessary to increase the working pressure by only 1 atmosphere in order to dry the air. The principle is being applied to plants now in course of erection in Austria, Canada, United States, and Japan for the production of pure nitrogen for the manufacture of calcium cyanamide.—A. S.

Hydrolytic processes as causes of error in the determination of iodine and bromine in mineral deposits and waters. Kaschinsky. *See* XXIII.

Recovery of iodine [sodium iodide] from residues. Gill. *See* XXIII.

Patents.

Ammoniacal liquor or other fluids; Still for the distillation of ——. G. Pettigrew, Thornaby-on-Tees. Eng. Pat. 24,267, Oct. 24, 1912.

Steam is passed through the liquor contained in a series of enclosed, shallow trays, resting one on the top of another; each tray is composed of two parts, the one covered by a hood forming passages for ammonia and steam, and the other, which is uncovered, being in the form of a dish-shaped trough with sides falling away from the hoods and gas passages. The sludge formed by the deposition of solid matter in the liquor, falls to the bottom of the troughs, whence it is transferred, as required, through suitable plug and socket valves, to a sludge-cock at the bottom of the still. The valves are operated by a series of metal rods, each of which passes through all the trays and through a stuffing-box on the cover of the still.—O. R.

Zinc salts from zinc sulphite solution; Recovery of ——. W. D. Jones, Swansea. Eng. Pat. 4454, Feb. 21, 1913.

Zinc bisulphite solution is made to flow over a series of steps which form the floor of a chamber sloping at an angle of 40°. The steps may be of fireclay or iron and are covered with loose cast iron troughs; they are evenly heated by means of hot gases passing below through a separate chamber running parallel with the first. The deposited zinc salts are removed through doors in the roof of the chamber.—F. Sodn.

Barium sulphide from barium sulphate; Manufacture of ——. G. von Staszewski, Saarbrücken, Germany. Eng. Pat. 17,104 of 1913, date of Appl., Aug. 31, 1912. Under Int. Conv., Sept. 2, 1911.

Hot furnace gases are passed over a mixture of barium sulphate and coal, travelling down a rotary, cylindrical furnace in the same direction as the furnace gases, a part of the carbon monoxide, which is generated, being returned to the furnace and consumed.—O. R.

Sulphur and iron; New industrial process or particular combination of —— obtained from pyrites and capable of allowing the sulphur of the said pyrites to combine with hydrogen. Production of hydrogen sulphide. W. A. Hall. Fr. Pats. 455,474 and 455,475, May 24, 1912, and 455,905, June 4, 1912.

(1) Pyrites is heated to 500°—800° C. with 5—20 per cent. of lime, or other alkaline earth, an alkali, alkali salt, charcoal, sawdust, or other substance, whereby a molecular change is induced in the pyrites, which renders its contained sulphur reactive towards hydrogen when the material is treated with a dilute acid or steam. (2) The product obtained as described above is treated with a dilute acid, with steam, or with a mixture of steam and reducing gases at a temperature not exceeding 800° C. (3) Pyrites is subjected to the combined action of a reducing flame and steam in an ordinary roasting furnace.—O. R.

(1) *Atmospheric air; Process of oxidation of —— by means of the electric arc.* (2) *Process of concentration of dilute nitric acid.* (3) *Process for the concentration of nitric acid by means of dehydrating agents, sulphuric acid for example.* C. Rossi. Fr. Pats. 455,530, 455,531, and 455,532, Mar. 11, 1913. Under Int. Conv., Mar. 12, 1912.

(1) Atmospheric nitrogen is oxidised through the agency of electric arcs formed between electrodes (which may be dissimilar) of aluminium, zinc, or other metals capable of emitting ultra-violet rays or electrons. By covering the walls of the apparatus with zinc, the emission of electrons may be increased. (2) Dilute nitric acid is brought into contact with heated air, in such manner that the temperature of the air and vapours leaving the apparatus is below 100° C. A 75—80 per cent. yield of 60 per cent. acid may be obtained in a single operation. (3) The acid to be concentrated, together with a dehydrating agent (such as sulphuric acid), is made to travel, in suitable apparatus, in a direction opposite to that of a mixture of steam and air. A relatively small proportion of sulphuric acid is sufficient (1·5 parts per part of nitric acid), and very pure acid of any strength, up to 99·8 per cent., may be produced.—F. Sodn.

Nitrogen; Fixation of ——. J. E. Bucher. Fr. Pat. 455,799, Dec. 24, 1912.

Atmospheric nitrogen is passed over a heated mixture of alkali carbonate, carbon, and iron, the latter acting as a catalyst, at a temperature preferably above 780° C. and below the eutectic point of iron and carbon. The iron and carbon are used in a fine state of division and spread over a large area, so as to offer ample contact surface to the nitrogen and the alkali metal, which is formed in an intermediate stage of the reaction, the final product being alkali cyanide. Using sodium carbonate, the process may be used for the continuous production of ammonia from atmospheric nitrogen, by first preparing sodium cyanide as above, then cooling down to a suitable temperature and passing steam over the cyanide which has been formed. The products of the last-named reaction are sodium carbonate, ammonia, carbon monoxide, and hydrogen. The two last gases may be burnt, and the carbon dioxide formed, together with the residual nitrogen and the ammonia of the previous operation, may be passed into sodium chloride solution to form sodium carbonate by the Solvay process, the escaping nitrogen being then pure enough to be used in the first cycle of operations. —O. R.

Calcium carbonate; Manufacture of pure ——. E. R. Cordurié. Fr. Pat. 456,056, Mar. 27, 1913.

Lime, washed free from soluble impurities, is brought into contact with a solution of a neutral ammonium salt, and the resulting liquor containing calcium salt and free ammonia is separated from excess of lime and impurities (magnesia, silica, etc.), and treated with carbon dioxide. Pure calcium carbonate is thus precipitated, and the ammonium salt is regenerated.—F. Sodn.

Aldehydic derivatives [formaldehyde-sulphoxylates]; Preparation of ——. Fabrique de Prod. Chimiques, Rohner et Cie. Fr. Pat. 456,151, Mar. 25, 1913.

A mixture of formaldehyde-zinc bisulphite, zinc formate, and zinc chloride is heated to a temperature, above 100° C., depending on the proportion of zinc chloride used; for example, 280 parts of formaldehyde-zinc bisulphite, 320 of zinc formate, 130 of zinc chloride, and 300 of water are heated at 124° C. The salts of the aldehyde derivatives produced are less soluble than the corresponding formaldehyde bisulphites.—F. Sodn.

Sodium sulphite and ammonium chloride; Preparation of ——. R. Friedrich and F. Hirsch. Ger. Pat. 263,244, July 5, 1912. Addition to Ger. Pat. 228,538.

In the preparation of sodium sulphite by the interaction of sodium chloride, dissolved or suspended in water, with sulphur dioxide and ammonia, as described in the chief patent (see Eng. Pat. 11,123 of 1909; this J., 1909, 1034), the ammonia gas may be replaced partly or completely by ammonia solution of sp. gr. 0·910 or 0·886, the heat of the reaction being sufficient, it is stated, not only to cause the separation of anhydrous sodium sulphite but also to evaporate the water of the ammonia solution.—A. S.

[*Boron.*] *Refractory materials; Process and apparatus for sintering* ——. G. Weintraub and H. Rush, Lynn, Mass., Assignors to General Electric Co., New York. U.S. Pat. 1,071,488, Aug. 26, 1913.

Particles of boron are placed in a strong container provided with a lining composed of refractory material of high electric insulating properties An electric current sufficient to soften the particles is then passed through the boron, and at the same time pressure is continuously applied. The boron is thus sintered into a solid homogeneous mass of high density, and having the shape of the container.—T. St.

Liquefaction and separation of difficultly condensable gaseous mixtures, especially air, by means of an expansion valve, which is as adiabatic as possible, with counter-current cooling of the gases entering the apparatus by those leaving; Process for the ——. R. Mewes. Fr. Pat. 456,027, March 26, 1913.

The mixture of compressed gases, *e.g.*, air, enters the fractionating column at a point intermediate between the top and the bottom and undergoes repeated fractional distillation, so that the more easily condensable gas, *i.e.*, oxygen, in the case of air, collects in the lower part of the apparatus, and the more difficultly condensable gas, *i.e.*, nitrogen, collects in an almost pure state in the expansion chamber.—W. H. C.

Hydrogen; Preparation of ——. A. Messerschmitt. Ger. Pat. 263,391, July 26, 1912.

In the manufacture of hydrogen by the oxidation of iron with steam, with subsequent reduction of the iron oxide by reducing gases, the reaction is carried out in a furnace, in the walls of which, at different heights, heating channels are provided; the gas and air-nozzles are so disposed that the heating gases are discharged tangentially into the furnace, whereby local overheating of the iron is avoided. The oxidised iron in the different zones of the furnace is successively reduced and heated, the waste gases from one zone being burned by the aid of a blast of air in a higher zone.—A. S.

Alkali-metal hydroxides; Process of producing —— *directly from alkali-metal chlorides.* J. Kersten, Delbrück, Germany. U.S. Pat. 1,072,010, Sept. 2, 1913.

See Ger. Pat. 255,688 of 1911; this J., 1913, 424.—T. F. B.

Cyanogen compounds and the like; Process of producing ——. C. E. Acker, Ossining, N.Y., Assignor to The Nitrogen Co., New York. U.S. Pat. 1,072,373, Sept. 2, 1913.

See Fr. Pat. 425,699 of 1910; this J., 1911, 956.—T. F. B.

Lime cartridges used in working mines, quarries, etc. H. L. Storey and J. Parkinson. Fr. Pat. 455,442, March 11, 1913. Under Int. Conv., May 2, 1912.

See Eng. Pat. 10,442 of 1912; this J., 1912, 922.—T.F.B

Mercuric chloride from chlorine and mercury; Continuous process and apparatus for preparing ——. Saccharin-Fabrik A.-G. vorm. Fahlberg, List und Co. Fr. Pat. 455,585, Oct. 8, 1912.

See Eng. Pat. 19,601 of 1912; this J., 1912, 1125.—T.F.B.

Hydrogen or mixtures of hydrogen with other gases; Process for obtaining pure ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 455,658, May 29, 1912.

See Eng. Pat. 13,049 of 1912; this J., 1913, 278.—T. F. B.

Sulphur: Process for preparing reversible [colloidal] ——. Aktiebolaget Kolloid. Fr. Pat. 456,058, March 27, 1913. Under Int. Conv., March 30, 1912.

See Eng. Pat. 7238 of 1913; this J., 1913, 791.—T. F. B.

Process and product [decolourising carbon] for the purification of liquids [sugar juice]. Fr. Pat. 455,408. *See* XVII.

Process for working-up wine lees and recovery of the potash. Ger. Pat. 263,394. *See* XVIII.

VIII.—GLASS; CERAMICS.

Report of Principal Chemist of Government Laboratory. [Lead glazes and leadless glazes.] *See* XXIV.

Patents.

Glass absorbing ultra-violet rays and process for manufacturing it. Sanoskop Glas Ges. Fr. Pat. 456,294, April 3, 1913. Under Int. Conv., April 4, 1912.

Light waves of length less than 350 $\mu\mu$ are injurious to the eye and epidermis. Most heavy metals absorb the ultra-violet rays but modify the chemical and mechanical properties of glass too much to be capable of use. The rare earths (cerium, thorium, etc.) are therefore employed for absorbent purposes, and heavy metals added as decolourising or colouring materials.—H. H. S.

Kilns or ovens for firing earthenware, china, and the like articles. S. Bevington, Hanley. Eng. Pat. 4337, August 21, 1912.

A firing chamber surrounded by a flue space is enclosed by a double casing, between the parts of which is packed a filling of non-conducting material (preferably coal ash). The chamber and inner casing are built of refractory slabs placed together without binding means, the top of the chamber being composed of curved members, each forming a complete arch, whilst the parts of the outer casing are firmly jointed together; thus by reason of the packing and of spacing pieces between the chamber and inner casing, the parts of these latter are held in place. Double doors allow the gases from the furnace to pass in front,

as well as at the back and sides of the chamber. The construction allows of rapid heating and drawing.
—F. Sodn.

Kilns for burning or firing bricks, tiles or other earthenware, fireclay or like goods ; Continuous ——. J. W. Bottomley, Leeds. Eng. Pat. 24,921, Oct. 31, 1912.

The saturated products of combustion from the chambers containing the green bricks are separated from the drier gases from the chambers in which the bricks are being burnt by the employment of two main flues. Each chamber of the kiln is provided with conduits controlled by a damper so that the gases may be made to pass into either main flue, the speed of exit being controlled by fans. The main flues communicate either with the atmosphere or with a drying tunnel.—H. H. S.

Ceramic and other surfaces ; Metallizing ——. Q. Marino, London. Eng. Pat. 12,642, May 29, 1912.

A solution of copper, tin, cadmium or cobalt or of more than one of these metals, in the form of fluoride, is applied to the prepared surface. Reduction is then effected by applying or blowing on an appropriate metallic powder, or by rubbing with a brush made of or coated with such a metal, or by a reducing atmosphere such as that of coal gas.—H. H. S.

Slag as material for ceramic and industrial pusposes. M. Chiapponi. Fr. Pat. 455,381, March 3, 1913.

Furnace slag, cooled suddenly from a temperature of 1000° C., furnishes an impermeable material resistant to heat, acids and alkalis, and a good thermal and electrical non-conductor.—H. H. S.

Enamels ; Production of white and opaque ——. Chem. Fabr. Güstrow, Hillringhaus, and Heilmann, Güstrow, Germany. Eng. Pat. 11,749, May 20, 1913. Under Int. Conv., June 1, 1912.

A mixture of 1 part by weight of titanium dioxide and 3 parts by weight of zirconium oxide, or of materials containing the corresponding quantity of zirconium oxide, is used for the production of white and opaque enamels.
—O. R.

Enamels ; Materials for producing opacity in the manufacture of white ——. Vereinig. Chem. Fabriken Landau, Kreidl, Heller und Co. Fr. Pat. 456,335, April 4, 1913. Under Int. Conv., May 14, 1912.

Oxides or silicates of tin, zirconium and other bases used as materials for producing opacity are compounded with phosphoric acid or other analogous acid, the latter being present in very small molecular quantities. The effect of these products can be greatly augmented by combination with water of hydration or with alkalis or alkaline earths. With a decreasing content of phosphoric acid, the hydration or alkali content should be increased. If both combined water and alkali be present, it is best to reduce phosphoric acid and alkali, and increase hydration.
—H. H. S.

Glass absorbing the ultra-violet rays and process for producing it. Sanoscop-Glas-Ges. m. b. H., Berlin. Eng. Pat. 7864, April 3, 1913. Under Int. Conv., April 4, 1912.

See Fr. Pat. 456,294 of 1913 ; preceding.—T. F. B.

Tiles, pottery, and other similar products ; Furnaces for use in making —— and for other purposes. C. Dressler. Fr. Pat. 456,319, April 4, 1913. Under Int. Conv., April 4, 1912.

See Eng. Pat. 8228 of 1912 ; this J., 1913, 792.—T. F. B.

Obtaining photographic enamels on glass, opaline, and similar supports. Fr. Pat. 455,885. *See* XXI.

IX.—BUILDING MATERIALS.

Concrete ; Action of various substances on ——. R. K. Meade. J. Ind. Eng. Chem., 1913, **5**, 723—725.

Experiments with test-briquettes prepared from cement-sand (1 : 3) mixtures are described, which show that the addition of barium compounds or iron compounds (red brick dust, etc. ; see this J., 1909, 6) are ineffective for preventing or appreciably retarding the disintegrating action of magnesium salts and sulphates on concrete. Disintegration is retarded somewhat by application of various waterproofing materials, especially lime soap and lime soap and alum. Cements of low alumina-content withstand the action of magnesium sulphate solution much better than those containing more alumina. Experiments with mineral oils showed that no destructive action is likely to take place where cement is used for floors in machine shops and engine rooms.—A. S.

Patents.

Limestones ; Method of burning or calcining low percentage ——. G. von Staszewski, St. Johann, Germany. Eng. Pat. 19,911, Aug. 31, 1912. Under Int. Conv., Sept. 2, 1911.

See Fr. Pat. 448,718 of 1912 ; this J., 1913, 428. The material and the calcining gases are passed through the kiln in the same direction.—T. F. B.

Cement ; Apparatus for burning ——. J. W. Dreisbach, S. E. Flexer and E. A. Slagle, Union Bridge, Md. U.S. Pat. 1,071,303, Aug. 26, 1913.

A rotary cylindrical kiln, slightly inclined to the horizontal, is closed at the lower end by a stationary hood, through which hydrocarbon fuel and a limited amount of air are admitted. The cement material is supplied at the upper end, which is in communication with a draught-inducing flue. Intermediate between the ends are radial tuyères through which additional air is forced, the tuyères discharging towards the upper end of the kiln.—T. St.

Lime, cement, etc. ; Kiln for burning ——. A. Anker. 1st Addition, dated March 8, 1913, to Fr. Pat. 443,745, May 13, 1912. (See this J., 1912, 1034.)

Instead of the circulation of the air in the furnace being regulated by registers affixed to each pipe, the chimney is disposed in the centre of the kiln, the opening being adjustable by means of a plug.—H. H. S.

Cement or hydraulic lime from plaster ; Manufacture of ——. L. P. Basset. 1st Addition, dated Oct. 21, 1912, to Fr. Pat. 455,062, May 11, 1912. (See Eng. Pat. 12,027, May 21, 1912, this J., 1913, 793.)

The process described in the original patent is carried out in two phases, the first being the formation of calcium silico-aluminate, the second the addition of more lime to this. The waste heat from the second firing evaporates the water used in mixing the components for the first phase.—H. H. S.

Cooler for cement and other rotary kilns. Nouvelle Soc. Anon. des Ateliers, Forges et Fonderies de Moustier-sur-Sambre. Fr. Pat. 455,985, March 25, 1913. Under Int. Conv., March 27, 1912.

The clinker is made to follow a spiral path round the kiln, and the air for combustion traverses the same route in the opposite direction.—H. H. S.

Cement ; Application of by-products from preparation of caustic soda to manufacture of ——. J. M. Viélajus. Fr. Pat. 456,020, March 26, 1913.

The calcium carbonate obtained after causticising sodium carbonate with lime is mixed, either by wet or dry methods, with clay in the proportions of 21 per cent. of clay to 78 per cent. of chalk. The product after milling and firing is suitable for use as cement.—H. H. S.

Wood: Process of impregnating ——. L. Dautreppe. Fr. Pat. 455.556, Mar. 14, 1913. Under Int. Conv., Mar. 18, 1912.

Wood, previously heated to 60° C. for 1—3 hours under reduced pressure, is successively impregnated in three separate autoclaves with alkali silicate solutions of 15° B. (sp. gr. 1·116), 30°—35° B. (sp. gr. 1·15—1·175), and 40°—45° B. (sp. gr. 1·2—1·225) strength respectively, at a temperature of 30° C. and at a pressure of 8—12 kilos. per sq. cm., each treatment lasting about 24 hours. The material is then dried in a series of chambers at temperatures increasing progressively from 30° to 100° C., subjected to the action of carbon dioxide at a pressure of 5 kilos. per sq. cm. for 24 hours in an autoclave, and finally washed and dried. The fibres of the wood become covered with a deposit of silica and a certain amount of alkali bicarbonate, being thereby rendered proof against fire, decay, and insects. In the case of resinous woods, the alkali silicate solution, which becomes saturated with resins after the first impregnation, is recovered and used as a fireproof paint.—O. R.

Wood articles; Process for the preservation and restoration of ——. S. Endrödi. Fr. Pat. 455,751, Mar. 21, 1913. Under Int. Conv., Aug. 19, 1912.

Wood articles, previously dried and heated, are introduced into a bath of molten waxes; the bath is heated for some time to 100° C., allowed to cool and solidify, re-heated to the point of liquefaction and the wood articles removed and freed from adhering wax by means of a solvent. A suitable mixture of waxes consists of 100 parts by weight of paraffin, m.pt. 40° C., 5—20 parts by weight of paraffin, m.pt. 74° C., and 5—10 parts by weight of Japan wax. Suitable cleansing solvents are carbon tetrachloride, trichlorethylene, chloroform, and ether.—O. R.

Artificial stones and plates of fibrous matter and hydraulic binding agent; Process for making ——. J. A. Lucardi. Fr. Pat. 455,913, March 10, 1913.

See Eng. Pat. 6445 of 1913; this J., 1913, 793.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Phosphorus in steel; Volumetric determination of —— *by Macagno's method.* H. Wdowiszewski. Chem.-Zeit., 1913, 37, 1069—1071.

Macagno's method (see Blair's "Chemical Analysis of Iron") for estimating phosphorus in steels, as at present carried out, gives only approximate results owing to incomplete removal of nitric acid from the phosphomolybdate precipitate and to the incomplete reduction of the molybdic acid by metallic zinc, as well as to re-oxidation by the air before titration with permanganate. The author has obtained reliable results by working as follows. 2 grms. .of metal are dissolved in 30 c.c. of boiling nitric acid (sp. gr. 1·2), with the addition of 5 c.c. of 4 per cent. permanganate solution. The solution is boiled until a precipitate of manganese dioxide is formed, which is then redissolved by the addition of 1 c.c. of saturated solution of ammonium oxalate. The flask is cooled and 8 c.c. of strong ammonia added with gentle shaking. Then 25 c.c. of nitric acid (sp. gr. 1·2) are added and the liquid boiled till the ferric hydroxide is dissolved, when the phosphorus is precipitated with 50 c.c. of ammonium molybdate solution. After standing in a warm place for 10 min. the precipitate is filtered off, washed with 1 per cent. nitric acid till free from iron, and then with cold water till all the nitric acid is removed. Unless this is done the nitric acid is subsequently reduced to nitrous acid and affects the permanganate titration. The precipitate is dissolved on the filter in dilute ammonia, and the filter well washed with hot water. 80 to 100 c.c. of dilute (1 : 4) sulphuric acid and 10 grms. of pure granulated zinc are now added to the filtrate, and the whole is kept at about 100° C. for 45—50 minutes. This completely reduces the molybdate to green sesquioxide. The solution is poured off from the zinc into an excess of standard permanganate, the flask and the residual zinc being washed with dilute (1 : 10) sulphuric acid. The excess of permanganate is then titrated back with oxalic acid. In this way the molybdic acid is completely reduced, re-oxidation is avoided, and the results obtained compare satisfactorily with those given by the gravimetric method. If any attempt is made to remove the zinc by filtration, the molybdenum sesquioxide will rapidly absorb oxygen from the air and become brown, and the subsequent titration will give a low result.—W. H. P.

Vanadium in steel; [Determination of ——*] by the hydrogen peroxide colour method.* C. R. McCabe. J. Ind. Eng. Chem., 1913, 5, 736—737.

For steels containing titanium or molybdenum, or a small amount of vanadium in presence of much chromium, the method previously described (this J., 1911, 1316) must be used, but for many commercial vanadium steels, the following simplified methods may be used:—*In absence of chromium.* 2 grms. of the steel are dissolved in 40 c.c. of nitric acid of sp. gr. 1·2, the solution is digested for 2 mins. with 0·1 grm. of potassium permanganate, treated with sufficient dilute ammonium bisulphite to render the liquid clear, heated till all sulphur dioxide is expelled, and cooled. 2 grms. of a steel free from vanadium are treated in a similar manner. The two solutions are brought to the same volume, each is mixed with 1 c.c. of 3 per cent. hydrogen peroxide, and a standard vanadium solution (1 c.c. = 0·0002 grm. V) added to the control solution until its colour matches that of the test solution, the latter having been diluted with a similar volume of water. *In presence of chromium.* 2 grms. of the chrome-vanadium steel and 2 grms. of a carbon steel plus a quantity of potassium bichromate solution corresponding to the chromium content of the other steel are each heated with 80 c.c. of sulphuric acid (1 : 3), and solution completed by adding 25 c.c. of strong nitric acid and heating for a further 10 mins. After bringing the solutions to the same volume and comparing to make sure that the tints correspond, the determination is completed just as when chromium is absent.—A. S.

Cobalt and uranium in steel; Determination of ——. H. König. Chem.-Zeit., 1913, 37, 1106—1107.

Cobalt. 1 grm. of the steel is treated with *aqua regia*, any tungstic acid separated, the chlorides converted into sulphates by evaporating with sulphuric acid, and iron, cobalt, and nickel are deposited together electrolytically from ammonium oxalate solution and weighed. The deposit is dissolved in hot dilute sulphuric acid and the iron titrated with permanganate, nickel sulphate being added to mask the rose colour due to cobalt. Nickel is determined by treating a further 2 grms. of steel: tungstic acid is separated, most of the iron removed by shaking with ether, the residual ether evaporated, the solution reduced with sulphurous acid, excess of this boiled off, the solution neutralised with potassium hydroxide, a 5—10 per cent. solution of potassium cyanide added, and the whole diluted to 200 c.c. and filtered; 100 c.c. of the filtrate are boiled, allowed to cool, and treated with bromine water; the precipitated nickelic hydroxide is filtered off, washed, dissolved in dilute hydrochloric acid, chlorine boiled off, and the nickel precipitated with dimethylglyoxime in the usual way. The weight of cobalt is then obtained by difference. *Uranium.* 2 grms. of steel are treated for the separation of tungstic acid, the hydrochloric acid filtrate evaporated with sulphuric acid, the residue treated with hot water and some dilute sulphuric acid, the excess of acid neutralised by ammonia, and iron deposited electrolytically from ammonium oxalate solution, electrolysis being continued until the excess of ammonium oxalate is decomposed. The solution is concentrated to 100 c.c., filtered, and the precipitate washed with water containing ammonium chloride. The precipitate is dissolved in dilute hydrochloric acid, adding a little alcohol to reduce any chromic acid present, the solution oxidised with nitric acid, and the faintly acid liquid treated cold with an excess of ammonium carbonate. Ammonium sulphide is added and the mixture allowed to stand for 12 hours in a closed flask, after which it is filtered, the filtrate acidified with acetic acid, boiled, and the precipitated vanadium sulphide filtered off. The filtrate is again oxidised with nitric acid, heated to boiling, and the uranium precipitated with ammonia. The precipitate is washed with water containing ammonium chloride, and finally ignited to the oxide, U_3O_8, or, in hydrogen, to the dioxide.—F. Sodn.

Gold and silver ; Retarding effects on the dissolving of —— in aqueous cyanide solutions. J. J. Andrejew. Z. Elektrochem., 1913, **19**, 667—672.

In a 0·25 per cent. solution of potassium cyanide the rate of solution of gold is increased by very dilute ozone (electrolytic), but is markedly decreased by more concentrated (3 to 4 per cent.) ozone. The cause of the decrease is the formation of a visible layer of oxide. A similar phenomenon is exhibited by hydrogen peroxide, although a large excess of peroxide or a mixture of the two oxidising agents increases the rate of solution. This increased rate is accompanied however by a decomposition of the oxidising agent with evolution of oxygen. In more dilute cyanide solutions (0·01 to 0·05 per cent.) even atmospheric oxygen will produce the film of oxide and cause the rate of solution to be much lower than would otherwise be the case. In the case of silver there is no reduction in the rate of solution, but a steady rise to a maximum as more hydrogen peroxide is added. Ozone alone has a very slight effect, but in combination with hydrogen peroxide it increases the effect of the latter.—W. H. P.

Aluminium ; Chemical analysis of ——. J. Czochralski. Z. angew. Chem., 1913, **26**, 501—503.

Lead, arsenic, tin, manganese and magnesium are rarely present in metallic aluminium and then only in traces ; copper is often present, iron and silicon always. For the analysis of aluminium or an alloy rich in aluminium, 2 grms. of the metal borings are dissolved in a mixture of 40 c.c. of water, 40 c.c. of concentrated sulphuric acid and 2 c.c. of nitric acid (sp. gr. 1·48), 300 c.c. of water are added, the solution is digested at 80° C. for some time, and the silica is filtered off, incinerated, weighed, then tested with hydrofluoric and sulphuric acids. If arsenic and bismuth are present, the metals of the hydrogen sulphide group must be separated in the usual way, otherwise, the copper and traces of lead are determined by electrolysis. To the filtrate from this group, 20 grms. of ammonium tartrate, dissolved in 100 c.c. of water, are added and the liquid is made alkaline with ammonia, and colourless ammonium sulphide added. The filtrate from this is concentrated, made strongly ammoniacal, and the magnesium is precipitated by sodium phosphate and ammonium chloride. The ammonium sulphide precipitate is ignited, dissolved in strong hydrochloric acid, the solution oxidised by bromine and the iron, nickel and manganese precipitated by sodium hydroxide. The filtrate is acidified with hydrochloric acid, boiled and made alkaline with sodium hydroxide ; 1—2 grms. of potassium cyanide are added and the zinc precipitated electrolytically in a copper-plated platinum dish. The precipitate from the sodium hydroxide is dissolved on the filter with hot dilute sulphuric acid, oxidised by bromine and the iron and manganese precipitated by ammonia ; the filtrate from this is acidified, boiled, treated with ammonia and ammonium sulphate and the nickel deposited electrolytically. For the determination of silicon, iron and zinc only, the metal may be slowly dissolved in sulphuric acid without nitric acid, the iron titrated by permanganate, the silica filtered off and the zinc precipitated as sulphide from the filtrate nearly neutralised by ammonia.—J. F. B.

Suspended solids ; Distribution of —— between two liquid phases, and its practical importance. W. Reinders. Chem. Weekblad, 1913, **10**, 700—709. Chem. Zentr., 1913, **2**, 1097—1098.

In the experiments a liquid holding a solid substance in suspension was shaken with another immiscible liquid, the systems studied being water-paraffin oil, water-amyl alcohol, water-carbon tetrachloride, water-benzene, and water-ether, and the solid substances kaolin, calcium fluoride, calcium sulphate, barium sulphate, magnesium, lead oxide, malachite, zinc blende, galena, mercuric iodide, graphite, selenium, and sulphur. The results of the experiments are tabulated. The tendency of the solid to pass from the water into the second liquid increased in the direction kaolin to sulphur and ether to paraffin oil in the case of the systems studied. Salts and oxides of the light metals appear to be readily retained by water, only small quantities, at the most, being found at the surface of contact between the two liquids. Compounds of heavy metals, especially the sulphides, and also non-metallic elements (sulphur, selenium, and carbon) pass readily from water to the non-aqueous liquid or to the surface of contact between the two liquids. The bearing of the results on ore-flotation processes, on the preparation of white lead, and on the detergent action of soaps is pointed out.—A. S.

Seamless zinc pipes for water supply. Wittus. *See* XIXb.

Erratum.

This Journal, Sept. 30, 1913, p. 912, col. 2, line 36 from bottom, *for* "15 mins." *read* "15 mm."

Patents.

Iron ; Alloy of ——. J. R. Speer, Trappe, Md., and W. L. Forster, Rochester, Pa., Assignors to Pittsburgh Iron and Steel Foundries Co., Midland, Pa. U.S. Pat. 1,071,364, Aug. 26, 1913.

The alloy contains : Si 0·1—2 (preferably 0·70), S not more than 0·5 (0·033), P not more than 0·12 (0·04), Mn not more than 0·45 (0·25), total C 1·25—3·50 (1·88), Ni 0·25—1·00 (0·50), Cr 0·5—1·5 (0·90), and Fe approximately sufficient to complete the 100 per cent.—T. St.

[*Iron and steel.*] *Metal ; Process for surface-hardening ——.* J. H. McCormick, Columbus, Ohio. U.S. Pat. 1,071,937, Sept. 2, 1913.

Iron or steel of suitable carbon content is exposed to a flame of sufficient intensity to heat the surface of the metal rapidly to the hardening temperature, "before the sub-surface metal has been so affected," the surface being then rapidly chilled.—W. E. F. P.

[*Iron and steel.*] *Case-hardening, etc.* A. W. Machlet, Elizabeth, N.J. U.S. Pat. 1,072,134, Sept. 2, 1913.

The articles are charged into the projecting end of a horizontal retort, the latter being disposed within a furnace and provided, at the opposite end and outside the furnace, with a closed, rotary drum for receiving the finished products ; the feeding device is operated by the rotation of the drum.—W. E. F. P.

Steel ; Case-hardening of ——. Case-hardened steel. A. F. Shore, New York. U.S. Pats. 1,072,660 and 1,072,661, Sept. 9, 1913.

A steel plate comprising a face portion of greater hardness and less thickness than the body, and with the two portions having interlocking spaced sections extending one into the other, is produced by subjecting a number of relatively small areas of the surface of the steel to direct shallow carburisation and the remainder of the surface to deep carburisation and then hardening the carburised layer. For example, carburisation may be effected in two stages, in one of which portions of the surface are covered with carbon-resisting material and in the other they are not so covered.—A. S.

Steel ; Manufacture of ——. Rombacher Hüttenwerke and J. I. Bronn. Fr. Pat. 455,399, Dec. 2, 1912.

In order to introduce a special element such as vanadium, manganese, carbon, etc., into a charge of Thomas, Bessemer, or Martin steel, the necessary amount of the element is first introduced into a relatively small quantity of iron of great purity, melted separately, in a small furnace. The resulting alloy is then run into a ladle and added in the molten state to the main steel charge.—T. St.

Carbon : Rapid method and apparatus for the determination of the content of —— in charges of steel and iron alloys during manufacture, with the object of controlling the carbon content of the final product. E. Szász. Fr. Pat. 455,738, March 20, 1913. Under Int. Conv., April 15, 1912.

Drillings of the sample are burnt in a current of oxygen in a combustion tube in which the free space is reduced to the greatest possible extent. The carbon dioxide formed, together with oxygen, is passed first through a tube cooled by water, and then into a measuring burette, a total volume of about 200 c.c. being collected. The carbon dioxide is then absorbed in an absorption pipette and the remaining oxygen again measured. It is stated that a determination can be made in 8 to 12 minutes. —T. St.

Cast iron of high tensile strength ; Production of ——. C. Henning. Ger. Pat. 262,083, Nov. 30, 1911.

Instead of using white iron or steel for mixing with ordinary cast iron in order to obtain iron of high tensile strength, iron which has been subjected to a decarburising and oxidising process until for example its carbon content has been reduced to 0·2 per cent. or lower is used. This iron may be mixed with the iron in the hearth of the blast-furnace, being applied in a manner similar to that adopted in lining the hearth.—A. S.

Tin, gold and other ores ; Saving or recovery of ——, from sand or other ore-bearing ground. T. H. Martyn, Bodmin, Cornwall. Eng. Pats. 19,346, Aug. 23, 1912, and 4187, Feb. 18, 1913.

Alluvial, dredgings or other material is subjected to "wet" concentration in an apparatus consisting of a number of inclined saving-tables or shallow, open-topped boxes each subdivided or not into narrow compartments and provided with one or more rakes adapted to agitate only the surface of the charge. Two series of saving-tables may be arranged one on each side of a rotary screen beneath which a saddle-like deflector is situated and to which water is supplied.—W. E. F. P.

Tin ; Process and apparatus for extracting —— from its ores and drosses. J. C. Villemin. Fr. Pat. 456,380, April 7, 1913.

The material is subjected to the reducing action of an electric arc (formed between two adjustable electrodes) in a closed, graphite vessel provided with a vertical condenser (for volatilised metal) and with openings for tapping the slag and metal separately.—W. E. F. P.

Tin ; Recovery of —— from tinned scrap. W. Tatarinoff. Fr. Pat. 456,310, June 14, 1912.

The material is heated, out of contact with air, flame or products of combustion, to a temperature above the melting point of tin and subjected to centrifugal action. —W. E. F. P.

Aluminium ; Alloys of ——. T. A. Bayliss, Warwick, and B. G. Clark, London. Eng. Pat. 19,452, Aug. 24, 1912.

Claim is made for malleable Al-Zn-Cd alloys of the following percentage compositions :—(*a*) (general) Al 80—99, Zn 0·001—19·999, Cd 0·001—10 ; (*b*) Al 91, Zn 8, Cd 1 ; (c) Al 88, Zn 10, Cd 2.—W. E. F. P.

Aluminium alloy. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,072,017, Sept. 2, 1913.

The alloy consists of Al 25 parts, Zn 5, and Cu 1 part, by weight.—W. E. F. P.

Aluminium ; Manufacture of —— from its compounds [alumina] by reduction with carbon, preferably in a vacuum. G. Giulini. Fr. Pat. 456,290, April 3, 1913. Under Int. Conv., May 3, 1912.

The mixture of alumina and carbon is heated to a temperature sufficient to effect the distillation of the reduced metal, and under conditions (reduced pressure) ensuring the continuous removal of the gaseous products of the reaction ; by this means, it is claimed, the secondary formation of carbide and oxide of aluminium is obviated. —W. E. F. P.

Alkali metals ; Production of —— by the electrolysis of molten alkali compounds. G. W. Johnson, London. From Deutsche Gold und Silber-Scheide-Anstalt, vorm. Rössler, Frankfort-on-Maine, Germany. Eng. Pat. 1933, Jan. 23, 1913.

For the production of alkali metals in the Castner apparatus, the collecting vessel is provided with a coating of a material capable of resisting the action of chlorine. This may consist of asbestos rope, soaked with a thin pulpy mixture of water-glass and asbestos meal, the prepared rope being wrapped round the vessel.—B. N.

Furnaces particularly applicable for metal heating and metallurgical purposes. J. A. Hill, Sheffield. Eng. Pat. 2489 of 1913, date of appl., May 24, 1912.

The furnace is provided with two combustion chambers, the first being adapted for the direct admission of air heated in the crown of the furnace, whilst the second, which opens directly from the first and is also adapted to serve as a heating chamber, is provided with transverse projections across its base and roof ; a second heating chamber extends from and below the second combustion chamber and is provided with a roof adapted to deflect the heated gases upon the material under treatment. —W. E. F. P.

Crucible and melting-pot furnaces. L. F. Tooth, London. Eng. Pat. 8474, April 10, 1913. Addition to Eng. Pat. 30,287, Dec. 30, 1910 (this J., 1911, 962).

The furnace, fired tangentially by one or more burners, is composed of concentric, cylindrical members spaced apart by ribs. Claim is also made for modifications in the arrangement of the flues with a view to rendering the latter accessible for cleaning purposes and facilitating rapid heating of the crucible chamber.—W. E. F. P.

Roasting-furnace. F. A. Curnow, Pittsburg, Kans. U.S. Pat. 1,072,920, Sept. 9, 1913.

In a roasting furnace in which the ore is stirred and withdrawn by a rake operated mechanically, means are provided whereby the rake is stopped automatically and then started again after a predetermined interval.—A. S.

Wire ; Annealing and winding fine ——. G. H. May, Glasgow. Eng. Pat. 11,938, Jan. 1, 1913.

A number of the wires are passed together through a long heated tube the bore of which is no larger than necessary. Before entering the tube (which is heated for about three-quarters of its length) the metal is sprinkled with talc for the purpose of decreasing the air-space and preventing the heated wires from adhering together. —W. E. F. P.

Electroplating hollow tapes, ribbons or bands ; Process and apparatus for producing and ——. F. A. Feldkamp, Newark, N.J., Assignor to Electrolytic Products Co. U.S. Pats. 1,071,036 and 1,071,037, Aug. 26, 1913.

(1) Hollow tapes, ribbons or bands, provided with tubular staying studs, are produced by passing a perforated band of readily-fusible metal through an electrolyte in a tank. Wires, acting as the anodes, are passed into and through the electrolyte on opposite sides of the band and in reverse directions. A shell of metal is thus deposited electrolytically upon the exposed surfaces of the band of fusible metal which forms the cathode. The electroplated band is withdrawn from the opposite end of the tank, severed into sections, and the fusible metal removed from the inside of the shell by fusion. The anode and cathode are moved into, through, and out of the tank at different speeds. (2) The electrolytic tank is divided by a partition into longitudinal compartments, communicating at the ends, and adapted to contain an electrolyte, with agitating

devices located therein for continuously circulating the electrolyte. Means are provided for drawing the cathode band and anode wires continously into, through, and out of the tank, and a cutting means is provided for severing the electroplated band into sections.—B. N.

[*Tungsten.*] *Refractory metals ; Process of working* ——. M. von Pirani, Wilmersdorf, and H. Pohl, Charlottenburg, Germany, Assignors to General Electric Co., New York. U.S. Pat. 1,071,174, Aug. 26, 1913.

Sufficient nickel is added to tungsten to render the mass workable, and the alloy is then drawn through a succession of dies, until a fine wire is obtained. The material is heated as it enters each die, sufficiently to expel a portion of the nickel, so that the final wire consists of tungsten only.—T. St.

Tungsten ; Manufacture of homogeneous masses of pure metallic —— of any desired shape. O. Voigtländer. Fr. Pat. 455,313, March 8, 1913. Under Int. Conv., March 23, 1912.

A mixture of tungstic oxide and aluminium in a container of the desired shape, is heated in a furnace. The heat of the reaction combined with the heat of the furnace, causes the separation of molten tungsten, thus yielding a homogeneous mass having the shape of the container.
—T. St.

Ore-pulps, slimes, and the like ; Apparatus for treating ——. B. MacDonald, Guanajuato, Mexico. U.S. Pat. 1,071,447, Aug. 26, 1913.

The pulp is contained in a tank, inside which, near the walls, are vertical pipes, extending from the bottom of the tank to above the surface of the pulp. The pipes are open at both ends, and means are provided for forcing the pulp into and up the pipes. The pulp is discharged from the upper ends of the pipes in a direction substantially parallel to the walls of the tank, and a helical whirling motion is thus imparted to the contents of the tank.—T. St.

Slag ; Treatment of ——. G. L. Danforth, jun., Chicago, Ill. U.S. Pat. 1,071,605, Aug. 26, 1913.

Sufficient molten slag is poured into a receptacle to form a thin layer, and a cooling liquid is then added which cools and disintegrates the slag. Successive layers are added and disintegrated in the same manner.—T. St.

Ore-treating process. T. J. Lovett, Assignor to Copper Process Co., Chicago, Ill. U.S. Pat. 1,071,763, Sept. 2, 1913.

Ore (in lumps) containing ductile metal in fine particles is subjected to a prolonged, "rub-rolling action," in changing directions and under progressively increasing pressure (in the presence of flowing water or not) with the object of disintegrating the gangue and converting the metal into "slugs" or pellets which can be readily concentrated.—W. E. F. P.

[*Silver, etc.*] *Ores ; Process of treating* [*chlorinating*] ——. F. W. Pugsley, Pittsford, N.Y. U.S. Pat. 1,071,791, Sept. 2, 1913.

The finely divided ore, suspended in an inert liquid, is subjected to chemical action and mechanical agitation by fine streams of chlorine gas under pressure, whereby the precious metals are converted into insoluble and the base metals into soluble compounds.—W. E. F. P.

Metal-bearing solutions ; Treatment of ——. [*Extraction of zinc.*] E. A. Ashcroft, Balestrand, Norway. U.S. Pat. 1,071,856, Sept. 2, 1913.

Calcium cyanamide is added to liquors containing zinc, and the mixture is heated under pressure, whereby the zinc is obtained in the form of an insoluble compound.
—O. R.

Zinc ; Method of avoiding the formation of fumes in the smelting of —— in vertical muffles. A. Roitzheim. Fr. Pat. 455,726, March 20, 1913. Under Int. Conv., April 15, 1912.

A water- or steam-cooled metal-receiver is suspended so as to form a prolongation of the lower end of the muffle. The incandescent residues are discharged through the receiver, and thus become cooled to such an extent before coming into contact with the air, that no oxidation of zinc, sulphur, or lead. takes place, and consequently no fumes are formed.—T. St.

Zinc vapour ; Process for liquefying —— in zinc furnaces. C. V. Thierry. Fr. Pat. 456,180, Mar. 31, 1913. Under Int. Conv., July 19, 1912.

The bottom of the closed electric or reverberatory zinc furnace is composed of bricks clamped together, but not cemented, the interstices serving as outlets for the gaseous products and as a condenser for the zinc vapour.
—W. E. F. P.

Copper ; New process of refining molten ——. Comp. Française pour l'Exploit. des Proc. Thomson-Houston. Second Addition, dated Mar. 14, 1913, to Fr. Pat. 422,441, Oct. 26, 1910, (this J., 1911, 553).

Boric anhydride is employed instead of the boron used in the original process.—W. E. F. P.

Ores ; Flotation separation of —— under the action of a gas. K. Takeda. Fr. Pat. 455,430, March 11, 1913.

The powdered ore is intimately mixed with an oil and with an alkali carbonate, and the mixture is then immersed in a dilute solution of sulphuric or sulphurous acid, which is heated and agitated by steam. The bubbles of carbon dioxide attach themselves selectively to the particles of ore having a metallic lustre, which thus rise and become separated.—T. St.

Ores ; Agglomeration of —— in the rotary furnace. F. L. Smidth & Co. Fr. Pat. 455,644, March 18, 1913. Under Int. Conv., May 23, 1912.

Friable iron ores and blast-furnace dust are mixed with 10 to 12 per cent. of coke, and heated in an enlarged portion of a rotary furnace to about 800° to 900° C. On passing from the enlarged zone, the charge is met by a heated current of air, which rapidly oxidises the reduced particles of iron. The heat of the reaction causes the material to soften, and bind into lumps, and at the same time supplies heat to the furnace, so that it is only necessary to employ fuel for periods of about half an hour, at intervals of four to six hours.—T. St.

[*Lead, zinc, etc.*] *Sulphides ; Process for the treatment and separation of complex ——, contained in ores.* T. R. Forland. Fr. Pat. 456,063, Mar. 27, 1913. Under Int. Conv., Mar. 29, 1912.

The ore is heated in a current of chlorine to produce volatile metallic chlorides, the latter being either formed separately in order of decreasing volatility or produced together and separated by fractional condensation.
—W. E. F. P.

Iron and steel ; Refining process for —— by means of ferrochromium alloy. J. Büchel, Wengern-Ruhr, Germany. U.S. Pat. 1,071,873, Sept. 2, 1913.

See Eng. Pat. 8479 of 1912 ; this J., 1913, 368.—T. F. B.

Iron surfaces ; Process for protecting —— from corrosion. S. O. Cowper-Coles, Westminster. U.S. Pat. 1,072,091, Sept. 2, 1913.

See Eng. Pat. 26,484 of 1911 ; this J., 1913, 238.—T. F. B.

Iron, steel, or the like ; Rust-proofing ——. A. Bontempi, Assignor to Bontempi Rust Proofing Co., New York. U.S. Pat. 1,072,904, Sept. 9, 1913.

See Fr. Pat. 434,780 of 1911 ; this J., 1912, 341.—T. F. B.

Zinc; Process for extracting —— from residues containing zinc, especially slag, in reverberatory furnaces. A. H. Desgraz, Hanover, Germany. U.S. Pat. 1,072,209, Sept. 2, 1913.

See Ger. Pat. 248,179 of 1911; this J., 1912, 823.—T. F. B.

Roasting furnace, especially for roasting ores. Nichols Copper Co. Fr. Pat. 455,609, March 15, 1913. Under Int. Conv., April 12, 1912.

See U.S. Pat. 1,066,110 of 1913; this J., 1913, 794.—T.F.B.

Metallurgical furnaces. The Morgan Crucible Co., Ltd. Fr. Pat. 455,930, March 12, 1913. Under Int. Conv., March 19, 1912.

See Eng. Pat. 6808 of 1912; this J., 1913, 492.—T. F. B.

Furnace for heating copper ingots and for similar purposes. R. Masters. Fr. Pat. 455,974, March 25, 1913. Under Int. Conv., March 25, 1912.

See Eng. Pat. 7203 of 1912; this J., 1913, 294.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Production of sodium hypochlorite with cooled anodes. Prausnitz. *See* VII.

Patents.

Electric conductivity of liquids; Apparatus for measuring the ——. M. Coplans, Leeds. Eng. Pat. 19,113, Aug. 21, 1912.

The electrodes of the apparatus are movable, the movements being controlled by the temperature of the liquid to be tested so that if the temperature is higher or lower the electrodes are respectively separated or brought closer together. The variations in temperature may also be recorded, and the time of such variations indicated.—B. N.

Oil employed as transformer oil and the like for use for electrical purposes: Regeneration of ——. Siemens-Schuckert Werke, G. m. b. H., Berlin. Eng. Pat. 8130, April 7, 1913. Under Int. Conv., April 6, 1912.

The oil is shaken with acetone, and the lower layer of regenerated oil with some dissolved acetone is distilled to separate the latter.—B. N.

Electrodes; Electrolytic ——. Schott und Gen., Jena, Germany. Eng. Pat. 17,759, Aug. 2, 1913. Under Int. Conv., Aug. 21, 1912.

The metallic conductor, connected with a carbon electrode, is covered with glass whilst the latter is in the soft state, so that the protecting glass body engages with a recess in the electrode, the recess being so formed that the two bodies are inseparably connected together.—B. N.

Electrodes for electrolysis. Soc. d'Electro-Chimie. First Addition, dated Mar. 18, 1913, to Fr. Pat. 453,172, Jan. 14, 1913 (this J., 1913, 758).

The metallic casing is made independently of the electrode and fixed subsequently. It is also extended to the upper part of the electrode and makes direct contact with the source of current.—F. Sodn.

Ozoniser. E. C. Spurge, Niagara Falls, N.Y. U.S. Pat. 1,071,476, Aug. 26, 1913.

The ozoniser comprises a casing which constitutes one of the electrodes and is made in two separable hollow parts, through which water is passed. A "unitary structure," which consists of another electrode sealed in between dielectrics, is clamped and spaced between the parts of the casing, so as to provide discharge gaps on each side of the "unitary structure," thus supplying an air space within which the ozone may be generated.—B. N.

Electrochemical process [for the treatment of gases]. J. L. R. Hayden, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,072,945, Sept. 9, 1913.

The process consists in producing a chemical change in a gaseous mixture by passing it, preferably at low pressure, through a short low-temperature, low-voltage arc produced between an anode and an easily vaporizable cathode, *e.g.*, through a mercury arc.—A. S.

Accumulators; Chemical compositions for ——. The Cook Railway Signal Co. Fr. Pat. 455,955, March 20, 1913.

See U.S. Pat. 1,060,832 of 1913; this J., 1913, 611.—T. F. B.

Electric arcs for treating gaseous substances at high temperatures; Process for producing long ——, and apparatus (furnace) for use therewith. F. H. A. Wielgolaski. Fr. Pat. 456,227, April 1, 1913.

See U.S. Pat. 1,061,892 of 1913; this J., 1913, 665.—T. F. B.

Treatment of hides and skins prior to and during tannage. Eng. Pat. 19,239. *See* XV.

[Electrolytic] process and apparatus for purification and sterilisation of faecal matters. Fr. Pat. 455,327. *See* XIXb.

Preparing dihydroxydicarboxylic acids. Fr. Pat. 455,972. *See* XX.

Preparing glyoxylic acid or glyoxylates. Fr. Pat. 456,156. *See* XX.

XII.—FATS; OILS; WAXES.

Hickory nuts and hickory nut oil. G. O. Peterson and E. H. S. Bailey. J. Ind. Eng. Chem., 1913, 5, 739—740.

Shellbark hickory nuts (*Carya ovata*) yielded 15·8 per cent. of oil by cold pressing and a further 2 per cent. on pressing after heating to 50°—60° C. Swamp hickory nuts (*C. amara*) yielded 22·1 and 3·8 per cent. of oil under similar conditions. The oils from the two species are practically identical, and are very similar to cottonseed oil. The characters are: Sp. gr. at 24° C., 0·9119; refractive index, 1·4699 at 20° C.; iodine value, 106; saponification value, 190; Reichert-Meissl value, 0·48; Hehner value, 95·7. The oil retains the flavour of the hickory nut, and could be used as an edible oil. Large quantities of the nuts of *C. amara* and *C. porcine* (pig nuts) are at present not utilised except as food for hogs and squirrels.—A. S.

Wood [tung] oil; Examination of ——. [Detection of gurjun balsam and sesamé oil.] Utz. Farbenzeit., 1913, 18, 2531—2533. Chem. Zentr., 1913, 2, 1170.

For the detection of gurjun balsam in tung oil, 5 drops of the sample are dissolved in 5 c.c. of glacial acetic acid and shaken vigorously with 2 c.c. of stannous chloride solution. In presence of as little as 5 per cent. of gurjun balsam a pink to red colour is quickly produced. In presence of sesamé oil a red colour is produced only if, after addition of the stannous chloride and allowing to settle, the containing tube be placed in a boiling water bath so that only the stannous chloride solution is heated.—A. S.

Glycerol esters of benzoic and myristic acids and partial saponification of triglycerides. A. Lipp and P. Miller. J. prakt. Chem., 1913, 88, 361—394.

The authors prepared the pure mono-, di-, and tri-glycerides of benzoic and myristic acids and treated the triglycerides in alcoholic, acetone, and aqueous media with a quantity of alkali insufficient for complete saponification;

in the experiments in alcoholic solution, the quantity of alcoholic alkali used was such that the unsaponified glyceride was not completely converted into the ethyl ester. In all cases conclusive evidence was obtained that the saponification proceeds in stages with intermediate formation of the mono- and di-glycerides; in most cases both the mono- and di-glycerides were isolated from the reaction products. The monoglyceride of benzoic acid was separated by the aid of its solubility in water, and the monoglyceride of myristic acid by its sparing solubility in cold petroleum spirit. The di- and tri-glycerides were separated by fractional crystallisation from alcohol in both cases. The tri-glyceride of benzoic acid melts at 76° C., and the lower melting points cited by other workers are those of mixtures of the triglyceride with small quantities of diglyceride. The mono-, di-, and tri-glycerides of myristic acid, crystallised from a solvent, melt at 68°, 64·5°, and 56·5° C. respectively.—A. S.

Distribution of suspended solids between two liquid phases. Reinders. *See* X.

Patents.

Fats of all kinds; Process for bleaching solid and semi-solid ——. Process for purifying and bleaching wax of all kinds. F. Richter, Frankfort, and L. von Orth, Berlin. U.S. Pats. 1,072,034 and 1,072,035, Sept. 2, 1913.

See Eng. Pats. 20,649 and 20,650 of 1910; this J., 1911, 1222.—T. F. B.

Manufacturing margarine or other alimentary fats. Fr. Pat. 455,781. *See* XIXa.

Process for hydrogenising unsaturated compounds. Eng. Pat. 28,754. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Distribution of suspended solids between two liquid phases. Reinders. *See* X.

Patents.

Lead oxides; Production of ——. O. W. Brown and A. R. Nees, Bloomington, Ind. U.S. Pat. 1,072,205, Sept. 2, 1913.

Red lead or orange mineral, of low specific gravity and amorphous nature, is produced by heating the "starting material" for 3—3½ hours at 325°—440° C.—O. R.

Resinous compositions. Resinous condensation products. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pats. 23,776, Oct. 17, and 24,059, Oct. 21, 1912.

(1) The infusible resinous condensation product of phthalic anhydride and a polyhydric alcohol, such as glycerol (see Watson Smith, this J., 1901, 1075), is comminuted, caused to swell by absorption of a suitable volatile liquid (acetone or chloroform), the resulting soft flexible material moulded under pressure, and the volatile liquid evaporated by a current of hot air or the like. (2) A fusible resinous condensation product, soluble in acetone, is produced by heating together equimolecular proportions of camphoric acid and glycerol. The acetone solution may be used for impregnating fibrous material such as tapes or the like for electrical insulation, and the product may be mixed with the similar condensation product of malic acid and glycerol (see following abstract). By heating the fusible condensation product for some time below its melting point, it is rendered infusible and insoluble. Similar products may be obtained by using glycol, mannitol and other polyhydric alcohols in place of glycerol.—A. S.

Resinous or gummy compounds; Synthetic ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 24,060, Oct. 21, 1912.

Malic acid is heated with a polyhydric alcohol, such as glycerol, in substantially equimolecular proportions, until a product melting at about 100° C. is obtained. An infusible insoluble condensation product is produced by continuing to heat the material at a temperature below its melting point. The product may be employed for electrical insulation by impregnating fibrous material, such as tape, and may be mixed with the resinous condensation product of glycerol and phthalic acid (see preceding abstract).—B. N.

Colour lakes [from azo dyestuffs]. H. Wagner and J. Kohlhaas, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,071,832, Sept. 2, 1913.

See Eng. Pat. 23,427 of 1912; this J., 1913, 97.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc in raw rubber; Determination of ——. R. Marquis and F. Heim. Bull. Soc. Chim., 1913, **13**, 862—866.

One grm. of the rubber, after extraction of the resin, is dissolved in chloroform, the solution made up to 100 c.c., and 50 c.c. withdrawn by decantation or filtration, and agitated vigorously with 8 grms. of concentrated sulphuric acid for 3—5 minutes. The resulting clear yellow solution is poured into 200 c.c. of alcohol, and the flocculent white precipitate produced is filtered off with the aid of suction, washed with alcohol and dried at 100° C. Its weight is stated to correspond exactly to the weight of pure caoutchouc in the 50 c.c. of solution, differences ranging from —0·25 to —0·56 per cent. being found in test experiments with pure caoutchouc. The constitution of the precipitate has not yet been definitely settled, but the substance is free from sulphur and the analytical figures for carbon and hydrogen agree approximately with the formula, $(C_{10}H_{16})_{10}.H_2O$.—A. S.

Sulphur in rubber; Determination of ——. E. Deussen. Z. angew. Chem., 1913, **26**, 494—496.

The extremely delicate test for sulphur previously described (this J., 1910, 979) may be applied colourimetrically for quantitative estimations, *e.g.*, in the case of rubber, after treating the substance with specially purified nitric acid. About 0·03—0·05 grm. of the finely chopped sample is treated with 40 drops of nitric acid free from sulphur in a porcelain crucible covered with a watch-glass. The mixture is heated to 40° C. to start the reaction and the temperature is later raised to 60° and finally 80° C. until no more red fumes are produced. The excess of nitric acid is evaporated off at 60° C. until only traces remain and the contents of the crucible are treated with 6—8 c.c. of water and 0·2 grm. of sodium carbonate; afterwards 0·2 grm. of small fragments of pure filter paper is added. In two other crucibles, two equal quantities of dilute standard solution of sodium sulphate are similarly treated with the same amounts of water, sodium carbonate and filter paper and all three are heated at about 90° C. until the contents are dry. The contents of each separately are then mixed with a further 0·1 grm. of dry sodium carbonate and transferred to a strip of filter paper 10 cm. long. The whole is rolled up into a packet and wrapped round with nickel wire. Each packet is then incinerated in the inner flame of a soldering lamp, charged with pure benzene, to incipient fusion. The packet containing the caoutchouc nitrosite must be ignited gradually. The melts are dissolved in water and the solutions filtered into graduated test-tubes, being diluted to a definite volume (15 or 18 c.c.). The solutions are treated with alkaline lead solution (0·5 grm. of lead acetate and 5 grms. of potassium hydroxide in

50 c.c.). In the first place, measured quantities of the two standards are thus tested after dilution with water, and if they are not equivalent then the one which gives the darker colour is employed for exact comparison with the solution from the rubber, a yellow to brownish-yellow tint being the most suitable.—J. F. B.

Patent.

Rubber waste; Process for reclaiming vulcanised ——. C. S. Heller, Barberton. Assignor to The Moore Architectural and Engineering Co., Akron, Ohio. Reissue No. 13,613, Sept. 9, 1913, of U.S. Pat. 978,584, Dec. 13, 1910.

See this J., 1911, 99.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning extracts; The rendering soluble of —— *by means of sugar and sodium bisulphite.* E. O. Sommerhoff. Collegium, 1913, 484—487.

The author has found that quebracho extract may be rendered soluble by the same methods as used for the purpose on fruit-pulp, dextrin, celluloses and albumin in the manufacture of preserved fruit. A quebracho extract treated with a warm concentrated solution of sugar is more soluble than in pure water but much darker in colour. The sugar solution has a swelling effect on green hide so is not suitable for use in quick drum-tanning, but in preliminary tanning where a strong swelling of the hide is desirable, the addition of a small quantity of molasses to a quebracho extract may be made. The action of sugar is intermediate between that of acids and alkalis. A good quebracho extract may be compared with a freshly-reduced basic salt solution of a metal. In order to prevent a too sudden colloidal precipitation of the basic metal salt in mineral tanning or to hasten the diffusion into the hide, a crystalloid is added, *i.e.*, an easily diffusing electrolyte without strongly swelling properties such as sodium chloride. Sodium chloride in mineral tanning plays the same part as sodium bisulphite in quebracho tanning. In the old tanning processes, using very weak liquors, the electrolytes were supplied by the magnesium and calcium salts in the water; according to this theory a pure soft water is not the most suitable for tannery use. The sulphites in quebracho extract prevent oxidation and a fundamental reaction takes place between them and the quebracho. It is not known how far the quebracho is able to reduce the sulphite to colloidal sulphur but the author has shown that part of the tanning action of sulphite-cellulose liquors is due to colloidal sulphur. By mixing freshly precipitated sulphur with quebracho extract and warming, the solubility of the extract was improved. After boiling for a long time sulphur dioxide was evolved and on standing in the cold, hydrogen sulphide was produced, probably owing to reaction between the sulphur and the tannin. No sulphur is produced on treating bisulphites with a reducing acid such as lactic acid, but the conditions are different in the concentrated colloidal quebracho solution. Sodium bisulphite may act in three ways on the system quebracho extract-hide: (1) as an electrolyte assisting the diffusion process in the hide and acting similarly to the sodium chloride in mineral tanning, (2) as a sulphite containing sulphur which increases the attraction of the hide for tannin, (3) as a preserving and decolourizing agent for the extract, due to its reducing properties. Leather tanned by the old slow process in cold liquors, in which the oxidation is very slow, is distinguished from leather tanned quickly in warm liquors made from sulphited quebracho extract by showing a much more shining or almost glassy section.—D. J. L.

Neradol D; The solvent effect of —— *on phlobaphenes.* G. Grasser. Collegium, 1913, 478—481.

When Neradol *D* is added in progressively increasing quantities to quebracho extract, the content of tannin in the solution, as determined by the "shake method," is greater than that calculated from the tannin contents of the two materials separately. The increase of tannin (calculated to 100 grms. of quebracho extract) was 11·8 per cent. in a mixture containing 50 per cent. of Neradol D and can only be due to the solution of the phlobaphenes of the quebracho extract; the maximum increase (15·6 per cent. in a mixture containing 70 per cent. of Neradol D) corresponded almost exactly with the percentage of insoluble matter in the original extract. The same effect was found in mixtures containing sulphite-cellulose liquor, which generally has the effect of lessening the tannin in mixtures by precipitation. In one case in which the tannin in a mixture had been diminished by 9·3 per cent. by the addition of sulphite-cellulose liquor, the addition of Neradol D had the effect of increasing the tannin by 17·3 per cent., which was equivalent to a total gain of 26·3 per cent. of tannin. The effect was a combination of the action of the two properties of Neradol of dissolving phlobaphenes and preventing precipitation of tannin by sulphite-cellulose. By the use of Neradol D, completely soluble liquors may be made with raw Argentine quebracho extract, 20—40 per cent. of the former being required. A cheaper method would be to render the extract soluble in the usual way with sulphite and to neutralize the sulphite with Neradol D, in which case only a small quantity of the latter would be necessary. An analysis of leather tanned with Neradol D alone gave the following result:—water 15·5, ash 0·9, fat 1·2, extractable matter 0·0, tannin 36·9 and hide substance 45·3 per cent., yield-value 220 and density 0·642.—D. J. L.

Sulphur in leather; Determination of "free" —— *by the process of Balland and Malijean.* Jalade. Ann. Falsif., 1913, **6**, 435—446.

The so-called "free sulphur" in leather, *i.e.*, that which may give rise to the formation of sulphuric acid, is usually determined by some modification of the method of Balland and Malijean (this J., 1895, 496), but conflicting results are frequently obtained by different workers. The author examined the influence of varied conditions on the results, and found that it is possible to obtain concordant results if the method of preparing the sample and the volume of potassium carbonate solution be standardised. The process recommended is as follows: 5 grms. of leather cut into thin pieces by means of a plane, dried, and, if necessary, freed from fat, are treated in a dish of 8 cm. diameter with 40 c.c. of a 1 per cent. solution of potassium carbonate, and evaporated to dryness on the water-bath. After drying at 110° C., the residue is incinerated by leaving the dish for about 30 mins. in a gas muffle near the mouth. The sulphur in the residue is determined as barium sulphate.—A. S.

Patents.

Hides and skins; Treatment of —— *prior to and during tannage.* L. A. Groth, London. Eng. Pat. 19,239, Aug. 22, 1912.

Hides and skins are washed, sterilized, softened, limed, unhaired, delimed and plumped by suspending them in suitable solutions and keeping them in horizontal edgewise and reciprocating motion, and the processes may be accelerated or perfected by the aid of electricity. Tanning is carried out in the same way by electrically combining two or more tanks into "batteries" and the "batteries" into "blocks" and when used on the same circuit, electrically connecting the tanks in series. The batteries and blocks may be placed in parallel, enabling the current to pass from tank to tank, preferably entering the tank containing the weakest liquor and the raw hides or skins and offering the greatest resistance. The hides or skins are fastened to metal frames or chains and hooks, the chains being threaded on metal rods which are in direct contact with the source of electricity. The current is passed by the combined means of fluid and solid conductors, passing from one electrode through the preparing or tanning liquor and through the hides to the second electrode and thence to the return circuit.—D. J. L.

Alumgallins; Manufacture of —— and their industrial application. E. Kohn dit. Kohn-Abrest. Fr. Pat. 455,670, March 18, 1913.

The preparation of alumgallins (see this J., 1913, 800) and their use as tanning or loading materials or for mordanting or dyeing are claimed. Example: 20 litres of an aqueous extract of chestnut wood containing about 460 grms. of dissolved matter are subjected to the action of plates of activated aluminium until all the tannin is precipitated. The precipitate is dried at 40° C. and treated with 405 grms. of sulphuric acid of 65·9° B. (sp. gr. 1·84) diluted in 1500 c.c. of water. After evaporation a mass weighing 1050 grms. is obtained, of the following composition: Al_2O_3 13·4, SO_3 30·0, tannin 37·6 and H_2O 18·9 per cent. The product is almost completely soluble in water and behaves like a tannin solution towards ferric chloride.—D. J. L.

Quebracho extract and other substances; Apparatus for dissolving ——. C. Friz et Cie. Fr. Pat. 455,734, March 20, 1913.

The apparatus consists of an open vat on the bottom of which rests a heating coil to which steam is admitted through the centre and escapes with the condensed water at the periphery. The material to be dissolved is placed in two perforated metal baskets which are suspended in the water in the upper part of the vat. Solution is aided by circulation of the water effected by a revolving central screw bearing paddles at different heights.—D. J. L.

Leather; Manufacture of artificial ——. L. Lilienfeld. Fr. Pat. 456,261, April 2, 1913. Under Int. Conv., April 6, 1912.

Textile tissues or paper are coated with a mixture of nitrocellulose, celluloid or their equivalents with phenol esters which remain liquid at 0° C. The layers may be alternated with coatings of a mixture of products prepared with Chinese wood oil and aromatic amines mixed with crude or purified viscose in the presence of a condensing agent. Other materials may be incorporated for the purpose of softening, agglomerating, filling and colouring the product.—D. J. L.

Glues and animal gelatins; Product for rendering insoluble —— and method of obtaining and using the same. C. P. Heidenger. Fr. Pat. 456,182, March 31, 1913.

The wood, bark or green outer shells of the nuts of the walnut tree are finely divided and extracted in a closed vessel at a temperature of 13°—25° C. with chloroform, ether, benzene or other hydrocarbons for 18—30 hours and the extract filtered clear with the aid of kieselguhr or the like. The articles impregnated or coated with glue or gelatin are immersed in the extract, whereby the glue is rendered insoluble without losing its flexibility. The liquid may also be used to render cinematograph films non-inflammable.—D. J. L.

XVI.—SOILS; FERTILISERS.

Basic slag; Determination of the citric-acid-soluble phosphoric acid in ——. M. Popp. Chem.-Zeit., 1913, 37, 1085—1087.

Determinations of the soluble phosphoric acid in a number of slags were made by the direct method, by the "new iron citrate" method (see this J., 1912, 831 and 941), and by removing silica. The results showed that when to 100 parts of soluble silica, more than 50 parts of soluble iron are present, the direct method is satisfactory. Other comparative determinations by different methods showed that together with the Naumann method, and the silica-separation method, the "new iron citrate" method gives the most reliable results.—T. St.

Calcium pyrophosphate. [Manufacture of superphosphate. A. Menozzi. L'Ind. Chim., 1913, 13, 261—262.

According to a process being tried by the Soc. Anon. E. Giana, tricalcium phosphate (phosphorite) is heated with moist sulphur dioxide in presence of air, whereby it is converted into a fine white powder consisting of a mixture of calcium sulphate and pyrophosphate: $Ca_3(PO_4)_2+SO_2+O=CaSO_4+Ca_2P_2O_7$. The product is slightly alkaline, practically insoluble in water, and contains 26·5 per cent. P_2O_5. The solubility in 2 per cent. citric acid is about 3·3 per cent. P_2O_5, but this is increased to over 6 per cent. if the product be first subjected to prolonged treatment with water saturated with carbon dioxide. It is stated that when used directly as a fertiliser the product gives results equal to those given by ordinary superphosphate and by basic slag. It is proposed, however, to convert the pyrophosphate into superphosphate by treatment with about one-quarter of its weight of sulphuric acid. The product thus obtained contains 20·4 per cent. of total P_2O_5, 15·35 per cent. soluble in water, 15·4 per cent. soluble in citric acid, and 18·75 per cent. soluble in ammonium citrate solution. The chief difference from ordinary superphosphate is the lower degree of acidity, corresponding to 150 c.c. of $N/1$ alkali per 100 grms. —A. S.

Report of Principal Chemist of Government Laboratory. [Examination of fertilisers, etc.] *See* XXIV.

Patents.

Manure from house, town and other refuse; Manufacture of ——. A. D. Furse, Beckenham. Eng. Pat. 5847, March 10, 1913.

The refuse, which may be mixed with other fertilizing ingredients before treatment, is passed through a series of centrifugal disintegrators each of which is fitted with a screen having holes or slots smaller than those of the previous one. The product obtained consists of a fine uniform fertilizing powder containing little or no moisture, with powers of ready assimilation, and leaving no residue to be disposed of by burning.—D. J. L.

Fertiliser [and pest preventive]; Manufacture of a ——. P. C. Berthon. Fr. Pat. 455,732, March 20, 1913.

Lime is slaked with a solution of iron and copper sulphates, then sifted, and intimately mixed with flowers of sulphur. The product is styled "Engrais Forézien."—F. Sodn.

Phosphatic fertilisers; Production of enriched —— starting with phosphates poor in phosphoric acid. H. Naegeli. Fr. Pat. 455,926, March 12, 1913. Under Int. Conv., April 26 and Oct. 29, 1912.

Natural low-grade phosphate minerals are treated with volatile dissolving agents, such as a solution of sulphurous acid, which dissolves the calcium phosphate while exercising little or no influence on the impurities present, and the solution is so treated, preferably by boiling under reduced pressure, that the sulphur dioxide is recovered and bicalcium phosphate precipitated. The precipitate, after heating at a low temperature under oxidising conditions, may then be converted into monocalcium phosphate by reaction with sulphuric acid (1 equivalent). The bicalcium phosphate obtained as above contains at first little admixed sulphite, but complex compounds of bicalcium phosphate and calcium sulphite (soluble in citrate) are deposited on further boiling the mother liquors (not necessarily under reduced pressure) until sulphur dioxide is eliminated, and these may be converted into monocalcium phosphate by treating with chlorine in the presence of water. Any phosphate material containing more than 3 mols. of calcium oxide per mol. of phosphoric acid may be used for the preparation of the double salts.—F. Sodn.

Fertilisers; Processes for making ——. O. K. Slater. Fr. Pat. 456,215, April 1, 1913.

See U.S. Pat. 1,067,224 of 1913; this J., 1913, 836.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Diffusion battery ; Return of the waste waters to the —— [in beet sugar manufacture]. H. Claassen. Deutsch. Zuckerind., 1913, **38**, 815—818.

In order to avoid difficulties involved in the disposal of the diffusion waste waters (drainage and press liquors) of the beet sugar factory, the author has devised a system of utilising these by returning them to the battery in place of fresh water for extraction (this J., 1906, 328 : 1907, 704 ; and 1910, 228). Replying to criticisms made by Möller and others, he maintains that under equal conditions as to the amount of diffusion juice drawn off, the loss of sugar is not higher, nor the efficiency of the battery less, than in the ordinary procedure. Experiments by Battut and Köhler have shown that in the Claassen process the juices are denser and purer than in the usual method. If a diminution in the efficiency of the battery is observed, this can always be traced to some mechanical defect, as, for example, a decrease of pressure due to the presence of fine pulp in the liquors. It is necessary in the new system to draw off somewhat more juice than formerly, and the volume should not be less than 105 litres per 100 kilos. of roots sliced. Under the new conditions fermentation does not occur, the greater amount of acids formed originating from the action of water on the fibre of the fine beet pulp. The iron parts of the vessels may be attacked to some extent owing to the higher acid content of the returned water, but this trouble can be obviated by making the exposed parts of bronze or of brass, and by neutralising with lime. Experience in the Dormagen factory has shown that the quality of the finished sugar is not impaired, the colour and grain of the granulated sugars both remaining satisfactory.—J. P. O.

Granulated sugar ; Manufacture of —— from cane juice and raw sugar by the Weinrich dry lime process. J. J. Eastick and J. P. Ogilvie. Intern. Sugar J., 1913, **15**, 409—412.

If lime, preferably in the form of powdered quicklime, be added to a concentrated solution of a sugar product, such as a syrup or molasses, a much more energetic clarification is attained than when a dilute solution is used. In applying this principle according to the Weinrich process, raw sugar is employed, the presence of the crystals being immaterial, and about 80 per cent. of the colour and 50 per cent. of the impurities are removed without destroying any of the "glucose." The method is most suitable for factories making white granulated sugar. The second and third products obtained from the syrup are incorporated in a suitable mixer with cane juice and caustic lime, the lime being added before it has completely slaked. This magma is discharged into a carbonatation tank, in which some raw juice has already been placed. Carbonatation is commenced soon after the magma begins to flow into the tank, after which the procedure is the same as in the beet sugar factory. It is estimated that for a mill working 1000 tons of cane per day, the total value of the products when making raw 96° sugar by the ordinary defecation process would be £1,687 5s. 10d., whilst when using the Weinrich process for the production of granulated sugar, the corresponding value would be £1,947 18s. 4d., so that allowing £58 8s. 9d. for the greater working costs of the Weinrich process, the net advantage of the latter would be £202 3s. 9d. per 1000 tons of cane.—J. P. O.

Maple products ; Analysis of ——. I. An electrical conductivity test for purity of maple syrup. J. F. Snell. J. Ind. Eng. Chem., 1913, **5**, 740—747.

The determination of the electrical conductivity of a mixture of the syrup with twice its volume of water is recommended as a rapid method of detecting adulteration of maple syrup with commercial pure cane sugar. Experiments with a large number of genuine maple syrups showed that the conductivity of a mixture of 1 vol. of syrup with 2 vols. of water ranges from 110 to 200, and samples giving values outside these limits may be at once rejected. Samples giving a normal conductivity value must, however, be subjected to further examination, as syrups may be prepared from partially refined cane sugar giving values within the limits for genuine maple syrups.—A. S.

Starch ; Demineralisation and solution of ——. M. Samec and F. von. Hoefft. Kolloidchem. Beihefte, 1913, **5**, 141—210.

A comprehensive comparison of demineralised starch prepared by the methods of Wolff and Fernbach (compare Tanret, this J., 1909, 847) and Malfitano and Moschkoff (this J., 1910, 506, 1402) showed that the properties of these starches correspond closely with those of a solution of ordinary starch modified by "ageing." The facts afford strong additional confirmation of the view that the characteristic properties of starch are due to the presence of an amylophosphoric acid or analogous complex compound (see this J., 1913, 102), probably of the type, $R{\cdot}CH_2O{\cdot}PO(OH)_2$. In agreement with this conception the transformations of starch may be explained as follows : The raw starch granule contains a certain quantity of amylophosphate and possibly also free amylophosphoric acid (the amylopectin of Maquenne and Roux and Gruzewska ; this J., 1905, 630 ; 1906, 192 ; 1908, 415). In the technical preparation of starch, the amylophosphoric acid is partially neutralised, with formation of primary and secondary amylophosphates, and sparingly soluble secondary and tertiary phosphates may be precipitated within the starch granule. Prolonged dialysis with distilled water can, at the most, only remove a part of these precipitated phosphates. Treatment with hydrochloric acid brings any insoluble phosphates into solution and liberates the amylophosphoric acid or converts secondary amylophosphate into the primary salt ; acid also strongly accelerates the decomposition of amylo phosphoric acid in solution, so that solutions of Wolff and Fernbach's demineralised starch soon become quite free from amylopectin, and gradually acquire the properties of soluble starch. The sudden increase of electrical conductivity when a starch granule becomes "swollen" in water, indicates that the phenomenon is due to the amylophosphate, and solution of the starch is accompanied by gradual hydrolysis of the amylophosphoric acid or its salts, with consequent decrease of viscosity and increase of electrical conductivity. In the ageing of starch solutions both the amylphosphate and the remaining constituents of the starch (amyloses) play a part. The amyloses formed by the hydrolysis of the amylophosphate, and other amyloses already present, tend to flocculate and precipitate, and carry down amylopectin with them, whilst on the other hand the amyolopectin acts as a protective colloid ; conditions of temperature and concentration mainly determine which action predominates. In the diastatic degradation of starch, saccharification takes place only after decomposition of the amylophosphoric acid.—A. S.

Patents.

[*Sugar.*] *Separating apparatus ; Centrifugal ——.* H. Edenborough, London. Eng. Pats. 21,947, Sept. 26, and 28,729, Dec. 13, 1912.

The inner surface of the basket of a continuously acting centrifugal machine is constructed so that it is "paraboliform" in vertical section, and the liquid-discharge openings in the basket are formed as a continuous spiral or as a number of annular slots of adjustable width. The object is to facilitate the passage of the massecuite over the inner surface of the basket. The massecuite is delivered into the bottom of the basket, which can be rotated at different speeds as desired ; the molasses passes through the apertures in the sides and the sugar crystals rise up within the basket and are finally discharged over its upper edge. They are washed as they pass upwards by jets of steam and fine water spray.—W. H. C.

Liquids [sugar juice] ; Process and product [decolourising carbon] for the purification of —— and method of preparing the product. R. H. McKee. Fr. Pat. 455,408, March 11, 1913. Under Int. Conv., March 27, 1912.

The insoluble residue, consisting chiefly of carbon, which is obtained when "black-ash" is extracted with water, may be employed as a decolourising agent for sugar liquors, etc. Before use, however, the residue must be extracted with hot dilute hydrochloric acid, and then heated to redness in a closed vessel.—W. P. S.

Sugar juices; Process of combined sulphitation within definite limits, for purifying and decolourizing ——. J. Weisberg. Fr. Pat. 455,936, June 5, 1912.

Prior to defecation with lime and carbonatation, the raw juice is treated with sulphur dioxide; the alkalis present in the juice are thus converted into sulphites which prevent colouration of the juice during concentration and promote crystallisation of the sugar. If the raw juice is deficient in alkali, the requisite quantity is added before sulphitation. The process may also be applied in working up second jet sugars and mother syrups.—L. E.

Sugar; Process for purifying and decolorising solutions of ——. F. Tiemann, Berlin. Eng. Pat. 22,048, Sept. 27, 1912. Under Int. Conv., Dec. 12, 1911.

See Fr. Pat. 448,842 of 1912; this J., 1913, 441.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Fermentation; Researches on the organisms of ——. *I. Some new species of Pichia, and observations on specific descriptions of the Saccharomycetes in general.* A. Klöcker. Comptes rend. Trav. Lab. Carlsberg., 1913, **10**, 207—226.

The author describes the characters of four new species of *Pichia* yeasts, *viz.*, *P. suaveolens*, *alcoholophila*, *polymorpha* and *calliphoræ*, the first three of which were found in Danish soil and the fourth in a fly (*Calliphora erythrocephala*) caught in the Carlsberg gardens. When cultivated in liquid media under suitable conditions, they all produce surface films and "yeast-rings": they ferment dextrose more or less, but maltose and lactose scarcely or not at all. The following are their most distinctive characters:—*P. suaveolens* produces a fruity odour during fermentation, and its spores frequently assume the shape of a segment of a sphere: it appears therefore to be a transitional form between the genera *Pichia* and *Willia*. *P. alcoholophila* does not form a film on wort free from alcohol unless air has very free access (see below). The cells of *P. polymorpha* assume a great variety of forms. The author discusses in turn the most important characters which serve to distinguish different species of yeasts, *viz.*, formation, shape and germination of spores, temperature limits of sporulation, shape of cells, temperature limits of vegetative growth, formation of surface films, appearance of giant colonies, and action on various sugars. Absence of fermenting power and formation of hemispherical spores should no longer be classed among the strictly generic characters of the *Pichia* yeasts (see this J., 1912, 404). The formation of a film on sugared culture liquids is common to *Pichia* and *Willia* yeasts, but certain species do not readily produce a film on alcohol-free liquids except in presence of a large volume of air. When film tests are carried out in small vessels such as Freudenreich flasks, the wort employed should be treated with 2—4 drops of alcohol per 10 c.c., as this greatly facilitates film formation in the case of certain yeasts.—J. H. L.

Alcoholic fermentation; Influence of respiration-chromogens on ——. W. Palladin and S. Lvoff. Z. Gärungsphysiol., 1913, **2**, 326; Woch. Brau., 1913, **30**, 511—512.

The fermentation of expressed plant juices by dead yeast (zymase) in presence of air is accompanied by oxidation of respiration-chromogens ("*Atmungschromogene*") to pigments, which influence adversely the fermentative action of the zymase, possibly by oxidising the hydrogen required for one of the final steps in the fermentation process (cp. Kostytschew, this J., 1913, 207). In boiled juice, where the conversion of pro-chromogens to chromogens and oxidation of the latter to pigments can no longer take place, fermentation proceeds vigorously. In the manufacture of wine, the interaction of various products formed on the one hand by the yeast and on the other by the natural enzymes of the must, may give rise to substances which, especially in presence of oxygen, retard fermentation, and some of which may be responsible for the colour, aroma and flavour of the wine.—J. H. L.

Brewery mashes; Use of Bacillus Delbrücki for the acidification of ——, *and the influence of acidification on the composition of the wort.* W. Windisch and J. Klein. Woch. Brau., 1913, **30**, 501—504.

The authors investigated the effects of acidification of mashes by *Bac. Delbrücki* before and after saccharification. The acidity aimed at was about 1·1 grm. (reckoned as lactic acid) per 100 grms. of extract, and was attained by inoculating the mashes with a small quantity of a specially prepared "acid mash" and then maintaining the temperature for about 2½—3½ hours at 45°—50° C. It was found that acidification prior to saccharification (1) did not unduly retard the latter process, (2) raised the percentage yield of extract from the malt by 1·5—2 per cent., and (3) increased the proportion of nitrogen in the wort from 0·099 to 0·11 per cent. Acidification after saccharification had no influence on the nitrogen-content of the wort, and only raised the yield of extract by less than 0·5 per cent. Within practical limits, acidification had no influence on the degree of attenuation of the fermented wort. The author concludes that *Bac. Delbrücki* is well suited for systematic use in breweries for conferring the right degree of acidity on mashes. The organism grows well in unsaccharified mashes, and the control of the degree of acidity produced offers no difficulty. Particulars are given respecting the cultivation of the organism and the preparation of the "acid mash," and further experiments on a technical scale are promised.—J. H. L.

Beer; Changes in the constitution of the protein in ——, *produced by heating and by cooling.* O. Fürnrohr. Z. ges. Brauw., 1913, **36**, 429—431, 438—439.

When beer is pasteurised the protein undergoes more or less change; it becomes "denatured" and under certain conditions precipitated. These changes occur more readily in faintly acid than in strongly acid liquids, and in some cases may be brought about simply by shaking or by the action of salts derived from beer bottles during pasteurisation. The "denaturing" of the protein, whether caused by heating or by strong cooling, is associated with a diminution of the acidity of beers. Thus, the acidity of a pale beer was reduced from 0·0918 grm. (calculated as lactic acid) per 100 c.c., to 0·0882 grm. by pasteurisation; precisely the same effect was produced by cooling to —1° or —2° C., and in this case subsequent pasteurisation further reduced the acidity to 0·0844 grm. Determinations of the amounts of protein precipitable (1) by zinc sulphate (albumoses), (2) by phosphotungstic acid (albumoses and peptones), and (3) by boiling (coagulable protein), showed that the most pronounced changes occurred in the coagulable protein, which was increased by pasteurisation from 6·17 to 11·1 per cent. of the total protein present. Cooling to —1° or —2° C. raised it from 6·17 to 8·33 per cent., and subsequent pasteurisation further increased it to 8·8 per cent. The chilling of beer, prior to pasteurisation, is therefore a partial safeguard against the formation of protein turbidity.—J. H. L.

Report of the Principal Chemist of Government Laboratory. [Examination of beer, brewing materials, methylated spirit, etc.] *See* XXIV.

Patents.

Drying kilns and the like [for hops, etc.]. R. Tanner and H. Biggleston, Canterbury. Eng. Pat. 21,039, Sept. 16, 1912.

Hops, etc., are supported above the floor of a drying chamber by a frame adapted to be raised at any desired period of the drying operation, in such a way as to distribute the hops uniformly and loosely on the drying floor beneath. After being raised horizontally some distance above the drying floor, and after the whole of the hops have passed through, the frames are folded back on hinges at the sides so that they lie against the walls of the drying chamber, thus leaving a clear outlet for moisture, and easy access to the drying floor.—H. H.

Fermentation; Process for assisting —— and apparatus therefor. W. Scott, Birmingham. Eng. Pat. 21,491, Sept. 21, 1912.

The apparatus for rousing, or rousing and aerating liquids in fermentation consists of a closed pressure vessel connected with a supply of compressed air or carbon dioxide; this is worked in combination with one or more closed fermenting vessels with a pipe extending from the top of the fermenting vessel to the pressure vessel and another pipe leading from the bottom of the pressure vessel to the bottom of the fermenting vessel, the arrangement being such that the yeast rises from the fermenting liquid through the first pipe and is collected in the pressure vessel, being subsequently transferred by means of air pressure through the pipe leading to the bottom of the fermenting vessel.—J. F. B.

Fermentation vat. O. Wehrle. Fr. Pat. 455,451, March 12, 1913.

Claim is made for a jointless, iron fermentation vat of approximately rectangular shape, the corners being rounded and the walls and bottom slightly curved outwards. The upper edges of the walls are curved over to form a rim, the vat thus being rendered more rigid.—L. E.

Fermentation and distillation of molasses and other fermentable liquids. A. Molhant. Fr. Pat. 455,483, May 25, 1912.

The use of sulphuric acid for acidifying molasses, etc., prior to fermentation, leads to incrustation of the evaporating apparatus. According to the present invention, the molasses is neutralised or slightly acidified with hydrochloric acid, danger of infection with foreign organisms being prevented by the use of yeast which has been successively cultivated in media containing formaldehyde and hydrochloric acid respectively.—L. E.

Maize, Process of treatment of —— in the distillery, with rational utilisation of all by-products. E. A. Barbet. Fr. Pat. 456,153, June 11, 1912.

Coarsely ground maize is boiled for 2½—3 hours with water or vinasse acidified with 5—6 per cent. of hydrochloric acid, and the product is filtered through metal sieves. The whole of the starch is thus rendered soluble, and the maize germs are thoroughly disintegrated and pass through the sieves, carrying with them the whole of the maize oil. The spent grains can be utilised as fodder directly. The filtered syrup is boiled under a pressure of about 3 kilos., neutralised, diluted, fermented, and distilled. The oil is extracted by suitable means from the dried press-cake obtained from the distillery vinasse, and the residual cake serves as fodder. The glycerin may be recovered from the filtered, concentrated vinasse by the process described in Fr. Pat. 449,961 of 1912 (this J., 1913, 503). A variant of the process consists in filtering the boiled and neutralised syrup first obtained, the press-cake being then suspended in clear vinasse or water to extract the sugar, and filtered again. In this case, the liquors sent to the fermentation vat being perfectly clear, pressed yeast of excellent quality may be obtained. Fully half of the distillery vinasse may be used for extracting the press-cake, the volume of vinasse from which the glycerin is to be recovered being thus considerably reduced.—L. E.

Distillery vinasses; Extraction of glycerin and other useful products contained in ——. G. P. Guignard, Melun, and H. L. A. M. Watrigant, Lille, France. Eng. Pat. 27,300, Nov. 27, 1912. Under Int. Conv., Aug. 21, 1912.

The vinasse is evaporated to dryness and treated with a quantity of sulphuric acid sufficient to liberate the organic acids, particularly malic acid, from their salts. The mass is then extracted with strong alcohol or other solvent of glycerin, and the insoluble matter, consisting mainly of sulphates and nitrogenous substances, is separated. From the soluble portion, consisting of glycerin, malic acid and soluble nitrogenous bodies, the malic acid is precipitated as calcium malate and the alcohol is recovered by distillation. The glycerin residue is dissolved in water and employed for the treatment of further masses of vinasse until it becomes sufficiently enriched, when the glycerin is finally extracted by absorbing it in hot amyl alcohol, which is then separated from the glycerin by cooling.—J. F. B.

Wine lees; Process for working-up —— and recovery of the potash. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 263,394, Aug. 11, 1910.

Wine residues are mixed with a sufficient amount of alkaline-earth to combine with the tartaric acid, and the mixture is treated with carbon monoxide under pressure at a high temperature, *e.g.*, 100°—150° C. The product is filtered, the residue is treated with dilute sulphuric acid to recover the tartaric acid, and the potassium acetate is separated from the filtrate.—T. F. B.

Hops; Method of leaching —— in the production of beer. H. Schneider, Essen on Ruhr, Germany. Eng. Pat. 9146, April 18, 1913.

See Fr. Pat. 447,382 of 1912; this J., 1913, 248.—T. F. B.

XIXa.—FOODS.

Manufacture of cellulose from wood and textile fibres, and utilisation of the waste liquors. König and others. *See* V.

Report of the Principal Chemist of Government Laboratory. [Examination of dairy products, feeding stuffs, etc.] See XXIV.

Patents.

Tea leaf; Drying of ——. J. N. F. and A. F. Grieg, Aberdeen. Eng. Pat. 19,195, Aug. 22, 1912.

Hot furnace gases pass through a casing surrounding a rotating inclined cylinder containing the leaves; the latter then pass directly into the centre of a second-stage dryer and thence fall on to the surface of a rotating cylinder through which cold air passes to the furnace-heater. This air, when heated, is conducted through the second dryer and then through the first dryer.—W. P. S.

Food products; Predigested —— and processes for producing the same. H. Watkins-Pitchford, Weybridge, Surrey. Eng. Pat. 19,431, Aug. 24, 1912.

Finely-divided lean meat is extracted with water or dilute alkali solution, and, after the extractives have been thus removed, is submitted to digestion at 40° C. with papaïn (the ferment present in papaw fruit, *Carica Papaya*) in the presence of very dilute hydrochloric acid. Equal parts by weight of the meat fibre, fruit pulp, and dilute hydrochloric acid (a few drops of the acid per 10 lb. of water) may be employed. At the end of about 3 hours, the mixture is heated to boiling, filtered, and the filtrate concentrated to a syrup, or dried completely to form a powder.—W. P. S.

Flour and bread; Manufacture of ——. C. W. Chitty, Dover, W. Jago, London, and Woodlands Ltd., Dover. Eng. Pats. 21,012, Sept. 14, 1912, and 5953, March 10, 1913. Additions to Eng. Pat. 2778, Feb. 3, 1911 (this J., 1912, 251).

The flour or dough is mixed with a small proportion of potassium persulphate and sodium thiosulphate or sulphite. Trithionic or tetrathionic acids or their salts, or mixtures of the same, may also be employed either alone or in admixture with persulphate, sulphate, thiosulphate, sulphite, and malt preparations.—W. P. S.

Flour; Method of improving the condition of ——. J. A. Wesener, Chicago, Ill. U.S. Pat. 1,071,977, Sept. 2, 1913.

The flour is brought into intimate contact with anhydrous chlorine gas diluted with an inert gas: 1 lb. of chlorine is used per 5000 to 10,000 lb. of flour.—W. P. S.

Food commodities; Method of freezing or refrigerating easily damaged ——. A. J. A. Ottesen, Thisted, Denmark. Eng. Pat. 24,244, Oct. 23, 1912.

The freezing or refrigerating is effected by means of a cooled liquid, *e.g.*, brine, containing ice. It is claimed that in this way penetration of salt into the material being refrigerated is prevented.—A. S.

Protein compounds from fish; Process for the manufacture of soluble ——. Naamlooze Vennootschap Algemeene Uitvinding Ezploitatie Maatschappij, Amsterdam. Eng. Pat. 7700, April 1, 1913. Under Int. Conv., Nov. 6, 1912.

One hundred kilos. of cleaned fish are boiled in water for 3 hours, then washed with hot water, and ground in a mill with lime sludge (about 10 kilos. of calcium oxide slaked to a thick sludge). The mixture is stirred occasionally for about 48 hours, or until the largest possible quantity of soluble protein has been formed, then diluted with 500 litres of water and, after the addition of 500 c.c. of 40 per cent. ammonia, carbon dioxide is passed into the liquid until the lime is precipitated completely as calcium carbonate. The whole is now heated to boiling, filtered, and the filtrate concentrated under reduced pressure to a syrupy consistence, the syrup being then dried completely in a suitable vacuum apparatus.—W. P. S.

Coffee substitute; Process of producing a ——. A. M. S. Dannebjerg, Hφjslev, Denmark. Eng. Pat. 9970, April 28, 1913. Under Int. Conv., May 1, 1912.

A mixture of grains (for instance, 1 part of wheat and 2 parts of rye), is heated to 100° C. in a closed vessel for some hours until a "brown coloured aromatic fragrant fluid or film" is formed on the surface of the grains. The mixture is then cooled in the vessel, and roasted, preferably after the addition of sugar and a small quantity of raw or half-roasted coffee berries. The powder obtained on grinding the roasted grains may be mixed with a small amount of cocoa or coffee substitute.—W. P. S.

Milk and other liquids; Process and apparatus for the sterilisation of ——. H. Dolter. Fr. Pat. 455,694, March 19, 1913.

The liquid is conducted under pressure through a spiral tube arranged in a steam-heated vessel, having received a preliminary heating in a spiral which is surrounded by another spiral serving for the discharge of the hot liquid leaving the main heating spiral. Electrically controlled valves are fitted on both the inlet and outlet of the apparatus so that the flow of liquid is interrupted should the temperature or pressure diminish during the operation. Means are also provided for passing a current of sterilised water under pressure through the apparatus before it is used.—W. P. S.

Margarine or other alimentary fats; Process of manufacturing ——. A. Kaufmann Söhne. Fr. Pat. 455,781, March 21, 1913.

A quantity of less than 0·5 per cent. of a fruit acid, such as citric acid, is added to the fat or to the milk with which the fat is churned, or to a mixture of the fat and milk. —W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Water; Determination of the hardness of —— *by Blacher's method.* W. Pflanz. Mitt. Kgl. Landesanst. f. Wasserhyg. zu Berlin-Dahlem, 1913, [17], 141—148. Chem. Zentr., 1913, 2, 1164—1165.

In using potassium palmitate solution for the determination of the temporary hardness of water (this J., 1912, 555; 1913, 158), it is not necessary to use dimethylaminoazobenzene as indicator, for although in presence of humic substances it is difficult to get a sharp colour change with methyl orange, satisfactory results can be obtained by adding a slight excess of N/10 acid in presence of methyl orange and then titrating back with N/10 potassium hydroxide in presence of phenolphthalein. The alcoholic solution of potassium palmitate may be replaced by an aqueous one. In order to obtain stable solutions the palmitic acid must be free from stearic acid; the commercial pure acid should be crystallised a few times from alcohol before use. Potassium palmitate solution may be used for the determination of magnesia in the final liquors from the manufacture of potassium salts: 1 c.c. of the liquor is diluted with 400 c.c. of water; the degrees of hardness (German) found, when divided by 1·4 give the quantity of magnesium oxide in 1 c.c. of the liquor. Blacher's method is capable of such wide application that it will, in the author's opinion, eventually completely displace the soap solution method.—A. S.

Hydrogen sulphide in natural waters; Determination of small quantities of ——. L. W. Winkler. Z. anal. Chem., 1913, 52, 641—645.

The reagents necessary are (*a*) a solution of 10 grms. of crystallised sodium potassium tartrate, 10 grms. of ammonium chloride, and 0·1 grm. of lead acetate in sufficient 5 per cent. ammonia to make 100 c.c. and (*b*) a freshly prepared solution made by dissolving pure sodium sulphide (0·1 grm. per 100 c.c.) in concentrated sodium nitrate solution, with the addition of a little ammonia. A stoppered flask (about 100 c.c.) is filled with the water to be examined, 5 c.c. of reagent *a* are introduced by means of a long-stemmed pipette reaching to the bottom of the flask, and, the flask being closed, the whole is well mixed. The colour is then matched by adding the sodium sulphide solution from a burette to a mixture of 100 c.c. of distilled water and 5 c.c. of reagent *a*. 1 grm. of sodium sulphide ($Na_2S,9H_2O$) corresponds to 92·26 c.c. of hydrogen sulphide at 0° C. and 760 mm. A control experiment is made in which the volume of sulphide solution already found is at once introduced below the surface of the mixture of distilled water and reagent *a* in a flask similar to that containing the natural water. The determination should be made as rapidly as possible.—F. Sodn.

Lithium in mineral waters; Determination of ——. L. W. Winkler. Z. anal. Chem., 1913, 52, 628—640.

Lithium chloride is readily soluble in primary isobutyl alcohol, and for the separation of lithium from sodium and potassium this solvent is to be preferred to the more disagreeable amyl alcohol used in Gooch's method. The correction to be made in the ultimate weight of sulphate obtained, due to the slight solubility of sodium and potassium chlorides, is 0·5 mgrm. for 10 c.c. of the alcohol employed. The water to be examined is diluted, if necessary, so as to reduce the "lime-hardness" to 100°, and calcium, magnesium, etc., are then precipitated by adding alkali hydroxide and carbonate. The precipitate thus obtained always contains a portion of the lithium, and it is therefore dissolved in hydrochloric acid, the solution made up to the original volume, and the precipitation repeated. A preliminary concentration of lithium in the alkali chloride residue obtained by evaporating the combined filtrates with hydrochloric acid is effected by treating this with absolute alcohol. The lithium chloride is finally converted into sulphate by repeated evaporation with ammonium sulphate solution, the residue each time being gradually heated to redness. —F. Sodn.

Zinc pipes; Seamless —— *for water supply.* Wittus. J. Gasbeleucht., 1913, 56, 936—937. (See also this J., 1912, 508.)

The pipes are made from pure, "hard" zinc and have a diam. up to 80 mm. They can be tin-lined if required. Two pipes can be joined in the usual manner by widening the end of one and inserting the end of the other, or by covering the adjacent ends with a sleeve, and soldering.

Tin solder is used, preferably with a stearine flux. The manufacture of the pipes is simple, and their bending is easy. The pipes are as useful for water supply as lead pipes and have the advantage of being much safer from a hygienic standpoint, as no injury has been found to arise from the traces of zinc which are dissolved by water. Zinc is cheaper than lead for this purpose, and on account of its lightness the pipes do not require such strong wall supports as lead pipes. A pressure of 500 atmospheres is required to burst the pipes. These pipes cannot be used for a hot water supply on account of the great expansion of zinc.—J. H. J.

Colloids in effluents ; Colourimetric method for the determination of ——. P. Rohland. Z. anal. Chem., 1913, **52**, 657—660.

The author's method (this J., 1913, 209) is applicable to the determination of colloids in the waste water of towns and in factory-effluents.—F. Sodn.

Purification of dyeworks effluents by means of colloidal clay. Polz. *See* VI.

Hydrolytic processes as causes of error in the determination of iodine and bromine in mineral deposits and waters. Kaschinsky. *See* XXIII.

Patents.

Settling or clarifying basins or the like for the purification of waste water, with or without the recovery of grease or the like. E. Seubert, München, Germany. Eng. Pat. 26,362, Nov. 16, 1912.

The settling chamber consists of a spiral channel situated over a sediment chamber; the walls forming the spiral rest on an inclined bottom, slits being provided in the walls and bottom for the passage of the sediment into the chamber below. These slits may be placed in the inclined bottom in front of the spiral walls, angle-iron guards placed below the slits preventing the caked sediment from rising into the spiral chamber. An annular grease catcher and channel may surround the spiral chamber, and a swinging rake may be fitted in contact with the inclined bottom.—W. P. S.

Water ; Purification of ——. L. Drevet and A. Lebigre, Paris. Eng. Pat. 9199, April 19, 1913. Under Int. Conv., April 23, 1912.

The water is first heated by means of steam jets and then passes into a cylindrical vessel from which it is siphoned periodically. The action of the siphon operates ball-floats and valves by means of which a definite quantity of a "correcting solution" is mixed with the water. The treated water passes through mixing and settling tanks and a series of filters.—W. P. S.

Alumino-silicate compounds for the purification of water ; Process of manufacturing ——. P. de Brünn. Fr. Pat. 455,391, March 10, 1913. Under Int. Conv., Sept. 27, 1912.

A solution of sodium silicate is added to a solution of sodium aluminate containing sodium chloride, sulphate, and phosphate, the mixture is boiled, and the precipitate which forms is collected, washed, dried, and calcined. —W. P. S.

Faecal matters ; [Electrolytic] Process and apparatus for the purification and sterilisation of ——. L. C. L. Queunié and M. Andreson. Fr. Pat. 455,327, May 21, 1912.

One-third of the effluent obtained on submitting the faecal matter to treatment in a septic tank, or to nitrification, is passed through a series of electrolytic cells contained in a suitable casing. Each cell consists of a wall which forms the anode, the cathodes being suspended within a porous vessel in the cell. The porous vessel may be made of carbon and itself serve as the cathode, in which case pressure is applied above the surface of the liquid in the anode compartment. After electrolysis, the acid liquid is removed from the anode compartment and mixed with the portion of the effluent which has not been subjected to electrolysis.—W. P. S.

Disinfectants ; Method of producing solid ——. Chem. Fabr. "Vahrenwald," Hanover, Germany. Eng. Pat. 19,368, Aug. 23, 1912.

See Fr. Pat. 453,923 of 1912; this J., 1913, 882. The use of mixtures of phenol or cresol with sulphuric acid, and not phenol- or cresol-sulphonic acids, is here claimed. —T. F. B.

Water sterilised by means of halogens or salts of hypohalogen acids ; Process for rendering tasteless and odourless ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 455,350, March 10, 1913. Under Int. Conv., March 14, 1912.

See Ger. Pat. 260,653 of 1912; this J., 1913, 840.—T. F. B.

Apparatus for determining the amount of poisonous or inflammable gases in the air. Addition to Fr. Pat. 437,585. *See* XXIII.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Alkaloids in plants ; Formation of ——. G. Ciamician and C. Ravenna. Chem.-Zeit., 1913, **37**, 1156—1157.

By inoculating tobacco and Datura plants with different organic substances the alkaloid content of the plants can be considerably increased (see this J., 1911, 1029). The normal content of nicotine in the green tobacco plants used in the experiments was about 0·15 per cent., and after inoculation with different substances this was increased as follows: with pyridine tartrate, 0·22 per cent.; asparagine, 0·25; dextrose, 0·215; and with benzoic acid and quinol, up to 0·4 per cent.—A. S.

Belladonna-root analysis. J. C. Umney. Chem. and Drug., 1913, **83**, 436.

In the sale of belladonna-root according to the results of analysis, discrepancies of 0·1 per cent. (corresponding to a difference in value of about 20 per cent.) are quite common, and greater differences are sometimes met with. This is probably due to inefficient sampling. In view of the great variation in alkaloidal value of belladonna-root, it is recommended that in the case of a shipment say of 10 bales, a sample of several pounds at least should be taken from different parts of each bale.—A. S.

Gentiana acaulis L. ; Application of the biochemical method to the study of ——. *A new glucoside, gentiacaulin.* M. Bridel. J. Pharm. Chim., 1913, **8**, 241—250.

The entire plant *Gentiana acaulis* L. was extracted with alcohol. When the extract was subjected to the action of invertase and emulsin, changes were produced in the optical rotation indicating the presence of a glucoside, which was afterwards separated in a pure condition. *Gentiacaulin* has a strong yellow colour and the composition $C_{47}H_{60}O_{29}$. It is readily soluble in water, but dissolves with difficulty in alcohol. In aqueous solution it has $[a]_D = -63·84°$, and 1 grm. has the same reducing power towards Fehling's solution as 0·2779 grm. of dextrose. It is not hydrolysed by emulsin. When heated with dilute sulphuric acid, *gentiacaulein*, and a pentose, probably xylose, are produced. The former substance crystallises from alcohol and water in yellow needles, is phenolic in character, and melts at 177° C.—F. Shdn.

Patents.

Hydrogenising unsaturated compounds ; Process for ——. A. Skita, Karlsruhe, Germany. Eng. Pat. 28,754, Aug. 19, 1912. Addition to Eng. Pat. 18,996 of 1912, dated Sept. 18, 1911.

In the examples of the process described in the principal patent (see Fr. Pat. 447,420 of 1912; this J., 1913, 253) the use of a small quantity of dilute acid is mentioned. This is not always necessary, since in many cases the reaction can be carried out by passing hydrogen through a mixture of the substance to be reduced and a solution of the salt.—T. F. B.

Calcium salt of acetylsalicylic acid; Process for the manufacture of a ——. N. V. Koninklijke Pharmaceutische Fabriek, voorheen Brocades en Stheeman, Meppel, Holland. Eng. Pat. 390, Jan. 6, 1913. Under Int. Conv., Nov. 12, 1912.

When acetylsalicylic acid is treated with calcium hydroxide in presence of water, at low temperatures, a calcium salt of acetylsalicylic acid separates from the liquid. After drying and powdering, a product containing about 5 per cent. of water and 13 to 13·5 per cent. of calcium oxide is obtained; it is nearly odourless, and possesses a slightly acid reaction.—T. F. B.

Diethylbromoacetylurea; Process for producing ——. F. Hefti, Altstetten, Switzerland. Eng. Pat. 13,433, June 10, 1913. Under Int. Conv., Aug. 23, 1912.

Diethylbromo-acetylcyanic acid is obtained by the action of mercury or silver cyanate on a halogenide of diethylbromo-acetic acid, *e.g.*, by heating in presence of benzine: it is converted directly into diethylbromo-acetylurea by treatment with ammonia.—T. F. B.

Betaine hydrochloride; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,161, July 1, 1913. Under Int. Conv., Oct. 16, 1912.

The hydrochloride of the methyl ester of aminoacetic acid is converted into betaine hydrochloride by heating with methyl alcohol.—T. F. B.

Esters of polyhalogen compounds with therapeutically-active acids. R. Wolffenstein, Berlin. U.S. Pat. 1,072,289, Sept. 2, 1913.

The trichlorobutyl ester of salicylic acid is produced by heating salicylic acid chloride with tertiary trichlorobutyl alcohol, treating the product with dilute soda solution and with petroleum spirit, and allowing the ester to crystallise. It is a crystalline compound of m.pt. 81°—82° C., b.pt. 170° C. with slight decomposition, soluble in alcohol, ether, and petroleum spirit, and sparingly soluble in water.—T. F. B.

Acetaldehyde from acetylene; Process for preparing ——. Consort. f. Elektrochem. Industrie G. m. b. H. Fr. Pat. 455,370, Feb. 22, 1913.

The most favourable condition for the formation of acetaldehyde from acetylene, mercuric oxide, and sulphuric acid is found to be attained if the sulphuric acid is employed in the dilute state, and not concentrated, as formerly supposed. The liquid should contain not more than 60 grms. of SO_4 per litre, and the temperature should be kept above the boiling point of the aldehyde, *e.g.*, about 70°—80° C. The yield is stated to be almost quantitative, whilst the mercury is recovered in the form of metal, and can be converted, after the reaction, into oxides by anodic oxidation in an alkaline electrolyte; the mixture of oxides thus formed is treated with dilute sulphuric acid and used for a fresh operation.—T. F. B.

Dihydroxydicarboxylic acids; Process for preparing ——. Royal Baking Powder Co. Fr. Pat. 455,972, June 6, 1912.

The reduction of glyoxylic acid or a glyoxylate to a dihydroxydicarboxylic acid (tartaric or racemic acid) is effected electrolytically, in a cell in which the anode and cathode compartments are separated by a porous diaphragm. The solution in the cathode compartment is neutral or alkaline, and may contain besides the glyoxylic acid, other electrolytes of higher conductivity, *e.g.*, potassium sulphate. The solution in the anode compartment contains an inorganic compound, preferably an acid or salt, such as a chloride. The reduction is effected at temperatures not exceeding 40° C., and an energetic circulation of the liquid should be maintained. Relatively dilute solutions of glyoxylate should be used, containing, for example, 10 to 20 per cent. of potassium glyoxylate.
—T. F. B.

Glyoxylic acid or glyoxylates; Process for preparing ——. Royal Baking Powder Co. Fr. Pat. 456,156, June 11, 1912.

Oxalic acid or an oxalate is reduced to glyoxylic acid or a glyoxylate by means of an amalgam of an alkali or alkaline-earth metal, which may be produced electrolytically in one compartment of a cell and used in the other. Sodium or potassium amalgam appears to give the best results. The process may be carried out in presence of free acid. It is advisable that the temperature should not exceed 20° C., and that the concentration of the solution should not be greater than 25 grms. of oxalic acid per 100 c.c.; it is also advantageous to circulate and agitate the mixture during the reaction. *Example:* 800 c.c. of a solution containing 90 grms. of anhydrous oxalic acid and 100 grms. of sulphuric acid is introduced into the reduction cell; 400 c.c. of a solution of a potassium compound (*e.g.*, 150 grms. of potassium hydroxide) is introduced into the electrolytic cell and submitted to a current of about 12 ampères. The amalgam formed is caused to circulate towards the reduction chamber, where the oxalic acid is rapidly reduced; the reaction is complete in about 5½ hours.
—T. F. B.

4-*Ketones of the quinoline series; Process for obtaining* —— A. Kaufmann. Fr. Pat. 456,254, April 2, 1913.

When 4-cyanoquinoline or a derivative thereof is treated with Grignard's reagent (organo-magnesium iodide), a violent reaction takes place; the products are decomposed by water, ammonia being liberated and a quinoline-4-ketone produced. The preparation and properties of 4-methylquinolylketone, 4-phenylquinolylketone, and 4-methyl-6-methoxyquinolylketone are described.
—T. F. B.

Amines from the corresponding nitro compounds; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 263,396, March 29, 1912.

Vapours of the nitro compound to be reduced are passed, together with hydrogen or a gas containing hydrogen, over a catalyst consisting of silver or gold, either alone or mixed, or in mixtures with other metals, with or without the use of a contact support. By using the metals in a finely divided condition, it is stated that reduction can be effected at a lower temperature (*e.g.*, 200°—250° C.) than with copper, for example. The yield of pure amino compound is said to be almost quantitative.—T. F. B.

Compounds containing antimony and glycollic acid; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 263,455, Jan. 27, 1911.

Compounds containing about 30 per cent. of antimony are obtained by evaporating to dryness or crystallising the solutions produced by the action of aqueous solutions of glycollic acid or its salts on antimony and its compounds.—T. F. B.

Allyl compounds; Process for preparing ——. Chem. Fabr. auf. Actien, vorm. E. Schering. Ger. Pat. 263,456, June 20, 1912.

A mono- or diglyceride of the type, $C_3H_5(OH)_2.OAc$, or $C_3H_5(OH)(OAc)_2$, where Ac represents an acid residue, is treated with formic acid, preferably in presence of a catalytic agent, such as oxalic acid or ammonium chloride. The acidic groups are partly or wholly eliminated, according to the amount of formic acid used. When the product is heated, allyl formate, or a mixture of allyl formate with the ester of allyl alcohol corresponding to the acyl group in the glyceride, is obtained: allyl alcohol itself may also be present in the distillate, the constituents of which can be separated by fractionation.—T. F. B.

3·3′-Diamino-4·4′-dihydroxyarsenobenzene ; Preparation of neutral derivatives of —— soluble in water. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 263,460, April 2, 1912. Addition to Ger. Pat. 245,756 (see this J., 1912, 604).

3-Nitro- or 3-amino-4-hydroxybenzene-1-arsinic acid is heated in aqueous solution with the amount of formaldehyde-sulphoxylate necessary for the reduction and for the formation of the sulphoxylate derivative : hydrosulphite may also be added. By this modification the separation of the easily decomposed diaminodihydroxyarsenobenzene is avoided.—T. F. B.

Dihydroxydicarboxylic acids and their compounds ; Production of ——. Janson Cobb, Pearson and Co., London. From A. Cox, New York. Eng. Pat. 12,467, May 25, 1912.

See Fr. Pat. 455,972 of 1912 ; preceding.—T. F. B.

Glyoxylic acid and its salts ; Production of ——. Janson Cobb, Pearson and Co., London. From A. Cox, New York. Eng. Pat. 12,468, May 25, 1912.

See Fr. Pat. 456.156 of 1912 : preceding. Reference is directed in pursuance of Sect. 7, Sub-Sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 3090 of 1896. —T. F. B.

Alkaloids of the opium group ; Process for the manufacture of hydro halogen acid double salts of ——. R. C. Ade, and The Hoffmann La Roche Chemical Works, Ltd., London. Eng. Pat. 3402, Feb. 10, 1913.

See U.S. Pat. 1,069,954 of 1913 ; this J., 1913, 925.—T.F.B.

Pharmaceutical [copper-lecithin] compound. M. von Linden, Bonn, E. Meissen, Hohenhonnef, and A. Strauss, Barmen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,072,745, Sept. 9, 1913.

See Eng. Pat. 3950 of 1913 ; this J., 1913, 672.—T. F. B.

Albumin-iron-phosphorus compounds and a process of making same. E. Preiswerk, Assignor to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 1,072,989, Sept. 9, 1913.

See Eng. Pat. 13,866 of 1912 ; this J., 1913, 108.—T.F.B.

Nitriles ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 456,086, March 28, 1913. Under Int. Conv., April 4, 1912.

See Ger. Pats. 259,363 and 259,364 of 1912 ; this J., 1913, 673.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic enamels on glass, opaline, and similar supports, especially on convex surfaces ; Process for obtaining ——. E. P. Rouanet. Fr. Pat. 455,885, Feb. 23, 1913. Under Int. Conv., Feb. 23, 1912.

The photograph is printed in the usual manner on a flat glass or other support coated with bichromated gum, and after development is dusted with enamel colours and vitrified as usual ; the support is then transferred to a suitable mould, where it is heated to nearly its melting point and moulded to the desired shape.—T. F. B.

Photographic papers and the like. A. W. Mathys, London. From W. C. Renfrow and F. G. Wilcox, Kansas City, Mo., U.S.A. Eng. Pat. 2675, Feb. 1, 1913.

See Fr. Pat. 454,229 of 1913 ; this J., 1913, 885.—T. F. B.

Photographic images on silver salt papers ; Toning bath containing selenium for ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 455,883, Feb. 19, 1913. Under Int. Conv., Oct. 3, 1912.

See U.S. Pat. 1,064,379 of 1913 ; this J., 1913, 712.—T.F.B.

XXII.—EXPLOSIVES ; MATCHES.

Patents.

Explosives ; Manufacture of primary ——. R. Calvet, Barcelona, Spain. Eng. Pat. 9597, April 23, 1913. Under Int. Conv., June 11, 1912.

The detonating composition consists of potassium chlorate or perchlorate ($2\frac{1}{2}$—3 parts) and a sulphocyanogen compound (1 part). The following compounds are mentioned :—Persulphocyanic acid, disulphocyanic acid, or suitable derivatives, such as the copper or lead salts. —G. W. McD.

Explosive. J. F. O'Brien, Chicago, Ill. U.S. Pat. 1,071,949, Sept. 2, 1913.

Claim is made for the following mixture :—Potassium chlorate (87 parts), naphthalene ($6\frac{1}{2}$), asphalt ($6\frac{1}{2}$), crude oil distillate ($1\frac{1}{2}$), and silica (44 parts). Powdered charcoal and potassium ferrocyanide may also be added. —G. W. McD.

Priming or fulminating compositions ; Preparation of ——. C. Claessen. Fr. Pat. 455,369, Feb. 21, 1913.

Nitrogen sulphide is used alone, or in combination with oxidising substances such as potassium chlorate, lead peroxide, barium nitrate, lead nitrate, potassium permanganate, etc., in primers and percussion caps.—T. St.

Match-boxes ; Manufacture of the coating for the striking surfaces of ——. J. Nartowski. Fr. Pat. 455,578, March 15, 1913.

Claim is made for the following compositions :—(1) For matches with red phosphorus and with "nitromanite" ; potassium chlorate 4, catechu 2, emery 2, finely powdered bearberry leaves 1, water about 30 parts. (2) For all matches without red phosphorus ; potassium chlorate 4, catechu 2, emery 2, red antimony sulphide 1, finely powdered bearberry leaves 1, red phosphorus 0·55, water about 30 parts. In both compositions the catechu may be replaced by an equivalent amount of logwood extract. —T. St.

Explosives. H. P. Bostaph, Detroit, U.S.A. Eng. Pat. 8583, April 11, 1913. Under Int. Conv., April 11, 1912.

See U.S. Pat. 1,038,275 of 1912 ; this J., 1912, 955.—T.F.B.

Explosive. F. Raschig, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,072,032, Sept. 2, 1913.

See Eng. Pat. 29,696 of 1912 ; this J., 1913, 454.—T. F. B.

Explosive. F. Raschig. Fr. Pat. 455,902, March 5, 1913.

See Eng. Pat. 29,696 of 1912 ; this J., 1913, 454.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Iodine and bromine in mineral deposits and waters ; Hydrolytic processes as causes of error in the determination of ——. P. Kaschinsky. Z. angew. Chem., 1913, 26, 492—494.

In the analysis of mineral waters containing iodides and bromides in presence of magnesium salts, a considerable or even total loss of these halogens may occur during the ignition of the dried residue owing to the hydrolysis of the magnesium salt thus : $MgX_2+2H_2O=Mg(OH)_2+2HX$. This fact has been confirmed by the author who has studied the results obtained under different conditions of heating. It is necessary therefore to remove the magnesium by precipitation before proceeding to the determination of the iodine and bromine. Two litres of water were treated before evaporation with a quantity of potassium hydroxide more than sufficient for the complete precipitation of the magnesia. The water was evaporated to a volume of 50—100 c.c., then filtered, the precipitate washed, and the filtrate and washings evaporated until a solid deposit began to separate, then treated with two or three times its volume of 95 per cent. alcohol and allowed to stand for about 12 hours; the deposit filtered off and washed with alcohol. The filtrate and washings were evaporated and the precipitation with alcohol repeated five or six times, 5 drops of 20 per cent. potassium hydroxide solution being added each time before evaporating the alcohol. When the residue finally obtained was gently ignited no acid fumes were evolved, as was the case when the magnesia had not been previously separated, and normal values for iodine and bromine were obtained.—J. F. B.

Iodine [sodium iodide]; Recovery of —— from residues. H. W. Gill. Analyst, 1913, **38**, 409.

If sodium iodide be used instead of potassium iodide in preparing iodine solutions for iodometric analysis, the whole of the iodine present as sodium iodide can subsequently be recovered by evaporating to dryness and extracting the dried residue in a Soxhlet apparatus with absolute alcohol, in which sodium iodide is soluble.—A. S.

Palladium; Separation of —— from gold, platinum, rhodium and iridium. Applicability of dimethylglyoxime. M. Wunder and V. Thüringer. Z. anal. Chem., 1913, **52**, 660—664. (See also this J., 1912, 663, 920; 1913, 111.)

From hydrochloric acid solution gold is completely precipitated in the metallic state by boiling with dimethylglyoxime. It may be separated from palladium by adding ammonium oxalate to the chloride solution, warming for some hours at a temperature not above 60° C., adding dilute sulphuric acid, and filtering off the precipitated gold. The filtrate, after neutralising with ammonia, is acidified with hydrochloric acid, heated to boiling, treated with dimethylglyoxime, and allowed to cool, the precipitate being then washed with warm water, and the palladium reduced in a current of hydrogen and allowed to cool in a current of carbon dioxide. Platinum is separated from palladium by evaporating the solution, containing no free acid, to small bulk, saturating with ammonium chloride, allowing to stand for two days, and washing the precipitate with saturated ammonium chloride solution; palladium is then precipitated as before in the filtrate. A solution containing palladium and rhodium or iridium, as chlorides, is treated with a little hydrochloric acid, heated to boiling, and treated with dimethylglyoxime to separate the palladium; the filtrate is then evaporated to small bulk, treated with hydrochloric acid and a little sodium chlorate, to decompose excess of the glyoxime, and reduced with magnesium. Dimethylglyoxime is far more sensitive than ammonium chloride as a reagent for platinum; even with traces, it gives, on boiling, a characteristic bronze-coloured flocculent precipitate.—F. Sodn.

Mercury; Determination of small quantities of —— in organic substances. S. Lomholt and J. A. Christiansen. Biochem. Zeits., 1913, **55**, 216—223.

The method consists in decomposing the organic matter, precipitating the mercury as sulphide in the presence of copper salts, dissolving the mixed sulphides, and electrolytically depositing the mercury on gold-foil. Solid organic substances are destroyed by treatment with fuming nitric acid; when much fat is present, the mixture may be cooled, the liquid portion separated from the fatty layer and the oxidation completed by means of permanganate. The clear oxidised solution is neutralised partially with ammonia, 0·05 grm. of crystallised copper sulphate is added, and the solution is saturated with hydrogen sulphide. The mixed sulphides are collected on an asbestos filter, washed, and dissolved in hydrochloric acid containing a small quantity of nitric acid. After washing the asbestos filter from which the sulphides have been dissolved, the solution, measuring about 40 c.c., is submitted to electrolysis. The anode consists of a platinum wire and the cathode of a piece of gold-foil 1 by 2 cm. in area; a current of 1·5 volts and 1 milliampère is employed and the electrolysis is continued for about 18 hours. The gold cathode is then rinsed with water, dried over sulphuric acid, and weighed; it is next heated strongly in a glass tube in a current of hydrogen (to prevent oxidation of traces of copper which are deposited), cooled, and again weighed. The difference between the two weights gives the quantity of mercury present.—W. P. S.

Moisture and ash content of coke. Wagener. *See* IIA.

Determination of hydrogen, nitrogen, and methane in gas by combustion in a quartz tube. Mathers and Lee. *See* IIA.

Determination of chlorine in rag flock. Black. *See* V.

Determination of rosin in paper. Sammet. *See* V.

Rapid method of determining sulphur in burnt pyrites. Sznajder. *See* VII.

Quantitative precipitation of tungstic acid by aromatic amines. Kafka. *See* VII.

Action of a soluble ferrocyanide in excess on solutions of zinc, copper, and nickel, and volumetric methods based on same. Meurice. *See* VII.

Precipitation of aluminium hydroxide and separation of the same from chromium. Jakob. *See* VII.

Characteristic reaction for bromine. Guareschi. *See* VII.

Volumetric determination of phosphorus in steel by the method of Macagno. Wdowiszewski. *See* X.

[Determination of] Vanadium in steel by the hydrogen peroxide colour method. McCabe. *See* X.

Determination of cobalt and uranium in steel. König. *See* X.

Analysis of aluminium. Czochralski. *See* X.

Examination of wood [tung] oil. Detection of gurjun balsam and sesamé oil. Utz. *See* XII.

Determination of caoutchouc in raw rubber. Marquis and Heim. *See* XIV.

Determination of sulphur in rubber. Deussen. *See* XIV.

Determination of the citric acid soluble phosphoric acid in basic slag. Popp. *See* XVI.

Analysis of maple products. I. An electrical conductivity test for purity of maple syrup. Snell. *See* XVII.

Determination of the hardness of water by Blacher's method. Pflanz. *See* XIXB.

Determination of small quantities of hydrogen sulphide in natural waters. Winkler. *See* XIXB.

Determination of lithium in mineral waters. Winkler. *See* XIXB.

Colourimetric determination of colloids in effluents. Rohland. *See* XIXB.

Belladonna-root analysis. Umney. *See* XX.

PATENTS.

Oxygen in a gaseous mixture; Methods and apparatus for ascertaining the proportion of ——. J. Calafat y Leon, Madrid. Eng. Pat. 4141, Feb. 18, 1913.

Use is made of the fact that the temperature of a flame is dependent on the proportion of oxygen in the air supporting combustion. A thermometer of special form is employed, the bulb being surrounded by spongy platinum wires, which act as the burner. The air is passed over wool, and pumice saturated with methyl alcohol, and combustion commences when it comes in contact with the spongy platinum.—G. W. McD.

Optical pyrometers. F. Lagoutte, Brussels. Eng. Pat. 16,711, July 21, 1913. Under Int. Conv., July 22, 1912.

INSTEAD of having the translucent discs mounted in a telescope they are mounted on a movable carrier attached to a lamp, so that any desired plate can be illuminated by the lamp. The worker can thus watch the pyrometer and the furnace at the same time.—G. W. McD.

Poisonous or inflammable gases in the air; Apparatus for determining the amount of ——. A. Guasco. First Addition, dated Feb. 12, 1913, to Fr. Pat. 437,585, Nov. 22, 1911 (this J., 1912, 560).

THE differential thermometer is arranged so that when the bulbs are at the same temperature the indicating liquid is wholly within the bulb coated with catalytic material, and the graduated scale begins at the connection of this bulb with the capillary tube. By this means, should the heating be sufficient to drive the whole of the liquid into the cooler bulb, the liquid will always return to the initial position when the bulbs are at the same temperature. In a modified construction which effects the same object, the scale begins at an enlargement of the capillary tube which normally contains the whole of the indicating liquid, and a second enlargement is provided beyond the scale, of sufficient capacity to contain the whole of the liquid.—A. T. L.

Density of gases; Process and apparatus for determining the ——. F. E. Wolf. Fr. Pat. 456,295, April 3, 1913. Under Int. Conv., April 15, 1912.

THE density is determined by measuring the pressure required to force a given volume of gas through an orifice in a given time, or the volume of gas which flows through the orifice in a given time under a given pressure. The pressure or volume measured is proportional or inversely proportional to the density, and the apparatus is calibrated with hydrogen or other gas of known density. In the form of apparatus described, two gases whose densities are to be compared are forced in equal quantities, by two similar pumps driven from the same shaft, through separate reservoirs having discharge orifices of equal size. The reservoirs are connected with a differential pressure gauge which indicates the difference in the pressures required to discharge the gases at the same rate.—A. T. L.

Rapid method and apparatus for the determination of carbon in steel and iron alloys. Fr. Pat. 455,738. *See* X.

XXIV.—MISCELLANEOUS ABSTRACTS.

Enzyme-content of the leaves of Salix caprea. I. Bolin. Z. physiol. Chem., 1913, **87**, 182—183.

LEAVES of *Salix caprea*, gathered in 1912, were found capable of hydrolysing amygdalin and salicin but neither α- nor β-methylglucoside, whereas leaves from the same trees in 1911 hydrolysed all except α-methylglucoside. The author concludes that (1) the leaves may contain at least three enzymes, *viz.*, amygdalase, salicase and an enzyme capable of decomposing β-methylglucoside, (2) salicase is a specific enzyme, and (3) the enzyme-content of the leaves may differ from year to year. (Cp. Armstrong and others, this J., 1912, 958).—J. H. L.

Government Laboratory; Report of the Principal Chemist of the —— *on the work of the Laboratory for the year ended March* 31, 1913. [Cd. 7001.]

THE total number of samples analysed and examined in the two branches of the Government Laboratory during the year was 209,502, against 195,170 for the preceding year. In addition, 145,257 samples were dealt with at the Chemical Stations in the provinces.

Beer, materials used in brewing, etc. Ninety-one samples of beer were examined as to the presence of saccharin, saponin, and like substances, but no deleterious or illegal substance was detected in any of the samples. Out of 815 samples of beer and brewing materials examined, only 16 were found to contain arsenic in excess of the limits laid down by the Royal Commission on Arsenical Poisoning; of 434 samples of malt and sugar, 2 contained an excess of arsenic, the amounts being one-fiftieth and one-eightieth of a grain per gallon, respectively. The limit was exceeded in 5 out of 242 samples of wort and beer, but in no case was the amount of arsenic more than one-forty-fifth of a grain per gallon. In the case of 9 miscellaneous samples, the excess of arsenic was, with one exception, comparatively small. Many so-called non-alcoholic ciders were found to be entirely free from fermented apple juice and to consist of solutions of sugar which had been aerated, flavoured, and coloured. The use of any name for such beverages, which suggests that they consist of fermented apple juice or cider, is an infringement of the Merchandise Marks Act.

Methylated spirit. The number of samples of wood naphtha submitted during the year for approval was 881, and, with 2 exceptions, all were approved as suitable for methylating purposes. Of 209 samples of mineral naphtha for use in conjunction with wood naphtha for denaturing, only 2 were regarded as unsuitable. The quantity of petroleum spirit used in mixtures of methylated spirit for the manufacture of felt hats showed a decided reduction during the year, only 57 samples, representing 3245 galls., being submitted as against 93 samples, representing 3806 galls., in the preceding year. With the object of preventing the illegal use of methylated spirits in making tinctures, essences, perfumes, etc., 49 samples of these preparations were examined in addition to those taken under the Tincture Regulations. For the purpose of controlling the use of methylated spirits in connection with manufacturing operations, 200 samples of spirits recovered from operations where the use of stills is permitted, 59 samples of preparations made with methylated spirits, and 57 samples of industrial and mineralised methylated spirits, finishes, and methyl alcohol, were sent for examination.

Imported dairy products. The following numbers of samples were examined: Milk, 79; condensed milk (sweetened, unsweetened, and powder), 137; butter, 1223; margarine, 598; cheese, 65. All the samples of fresh milk were genuine and were free from preservatives and colouring matters, but one sample of sterilised milk was deficient in fat and non-fatty solids. The butters were all genuine; 19 of the samples contained more than 16 per cent. of water. Five of the samples of margarine contained amounts of water in excess of the limit.

Lead glazes and leadless glazes. Fifty-eight samples of glazes were taken from works where lead poisoning had occurred, and in most of the samples practically the whole of the lead, frequently amounting to 30 per cent. PbO, was readily soluble in hydrochloric acid of a strength equal to that usually present in the gastric juices. "Leadless" glazed pottery frequently contains traces of lead, but in only a few of the samples purporting to be leadless was the amount of lead found in the glaze of the finished ware so great as to leave no doubt that ordinary lead glaze had been used in their manufacture.

Sale of Food and Drugs Acts. Ninety-two samples were referred by magistrates under the provisions of these Acts; the samples comprised milk (74); butter (8), ginger beer (3), vinegar (2), and brandy, cream, cream of tartar, flour, rice, and whiskey (1 sample of each). In five cases the results of the analysis in the Government Laboratory differed from those certified by the public analyst.

Fertilisers and Feeding Stuffs Act. Twenty-five samples were submitted by the Board of Agriculture and Fisheries in connection with applications for consent to take proceedings against the vendors. A sample described as "dissolved bone" was found to consist of mineral phosphates mixed with nitrates, whilst an article sold as barley meal contained a considerable proportion of ground weed seeds and seed husks; another sample of barley meal contained over 3 per cent. of sand. Several of the feeding meals were deficient in oil, and others contained an excess of sand and earthy matter.—W. P. S.

Books Received.

Lime Cultivation in the West Indies. Imp. Dept. of Agriculture for the West Indies. No. 72. Price 9d.

This pamphlet of 135 pp. (7¼ by 4½ ins.) replaces Pamphlet No. 53 now out of print. Part I. deals with the lime, its cultivation, pests and diseases, Part II. with lime products, the crop and methods of disposing of it, and the appendices with the limes required to produce a pipe of concentrated juice, the testing of lime juice, and the fuel. A small bibliography concludes the work. In Part II. will be found information of a precise character concerning the preparation of lime juice and citrate of lime.

Department of Agriculture. Federated Malay States:—*Bulletin No.* 15. Camphor from Cinnamomum Camphora. (The Japanese Camphor Tree.) Cultivation and Preparation in the Federated Malay States. By B. J. Eaton, F.I.C.

Bulletin No. 17. Preparation of Plantation Para Rubber. By B. J. Eaton, F.I.C. Kuala Lumpur, Federated Malay States. Feb., 1912. Malay States Information Agency, 88, Cannon Street, London, E.C. (Application for free copies of Bulletins to be addressed to the Director of Agriculture, F.M.S., Kuala Lumpur.)

Chemical Technology and Analysis of Oils, Fats, and Waxes. By Dr. J. Lewkowitsch, M.A., F.I.C. Fifth edition, entirely re-written and enlarged. In three volumes. Vol. I. Macmillan and Co., Limited, St. Martin's Street, London. 1913. Price 25s.

This volume (8⅝ by 6⅝ ins.) contains 668 pages of subject matter with 59 illustrations, and numerous tables. The subjects treated of in the various chapters, are as follow:—I. Classification of oils, fats, and waxes. Physical and chemical properties of oils, fats, and waxes. II. Saponification of fats and waxes. III. Constituents of fats and waxes. IV. Preparation of the fatty matter for examination. Preliminary tests. V. Physical methods of examining oils, fats, and waxes. VI. Chemical methods of examination. Quantitative tests. VII. Qualitative tests. VIII. Examination of mixed fatty acids. IX. Examination of unsaponifiable matter. X. Detection and quantitative determination of rosin. XI. Application of foregoing methods to the systematic examination of oils, fats, and waxes. XII. Examination by strictly scientific methods.

A Text-Book of Rand Metallurgical Practice (in two volumes, each complete in itself, and sold separately), by Ralph Stokes, Jas. E. Thomas, G. O. Smart, W. R. Dowling, H. A. White, E. H. Johnson, Dr. W. A. Caldecott, A. McArthur Johnston, and C. O. Schmitt. Charles Griffin & Co., Ltd., 12, Exeter Street, Strand, London, W.C. Vol. 1, price 21s. net. Vol. 2, price 21s. net.

Volume I, 466 pages, 8 in. by 5 in., containing 128 illustrations and 124 tables, deals with Introduction (The Witwatersrand and its Mines), Sorting and Breaking, Stamp-milling, Tube-milling, Treatment of Sand, Slime, Precipitation, Clean-up and Smelting, Assaying, Testing, and Chemistry of Banket-ore Treatment. Volume 2, 438 pages, containing 455 illustrations and 33 tables, deals with General Considerations, Plant for Sorting and Breaking, Crushing, Amalgamating, Mill Cleaning-up and Cyanide, Power Supply, Estimation, Costs, and Transport of Materials.

A Treatise on Quantitative Inorganic Analysis with special reference to the analysis of clays, silicates, and related minerals: being Vol. I. of a treatise on the ceramic industries. By J. W. Mellor, D.Sc. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1913. Price 30s. net.

Volume (9¼ by 6½ ins.), containing 736 pages of subject matter with 206 illustrations, and with indexes of names and subjects. The subject matter is subdivided and classified as follows:—I. General; referring to the general operations, methods and technique of quantitative inorganic analysis. II. Typical silicate analyses. Clays. III. Analysis of glasses, glazes, colours, and complex silicates. IV. Special methods. Bases. (i.) Special methods of determination of: molybdenum, tungsten, columbium, and tantalum. (ii.) Of gold, and selenium. (iii.) Of aluminium and beryllium. (iv.) Of iron compounds. (v.) Chromium, vanadium and uranium. (vi.) Zirconium, thorium, and the rare earths. (vii.) Barium, strontium, calcium, and magnesium. (viii.) Alkalis and their salts. V. Special methods. Acids and Non-metals. (i.) Carbon, free and combined. (ii.) Water. (iii.) Boron oxide. (iv.) Phosphorus. (v.) Sulphur. (vi.) Halogens. (vii.) Rational analysis of clays. VI. Appendix Tables. The library (set of suggested works most suitable for the library of a laboratory connected with the ceramic and silicate industries).

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*New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Arrowood*, M. W.: Refrigeration; a practical treatise on the production of low temperatures as applied to the manufacture of ice, and to the design and operation of cold storage plants. Chic. Am. Sch. Corr. c. 3+3+206+6 p. il. plans 8°. $1.

Ubbelohde, L.: Kombinierte Oel- u. Graphitschmierung (Oildag). [Aus: "Petroleum."] (2 S.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1913. M. 1.

IIA. *Brewer*, R. W. A.: Carburation in Theory and Practice, including a Criticism of Carburettor Development. 8vo, pp. 262. C. Lockwood. London. 1913. Net 5s.

Frentzel, Dr. A.: Die Erdöl-, Bitumen- u. Schwefellager v. Tetjuschi. [Aus: "Petroleum."] (8 S. m. 8 Abbildgn. u. 1 eingedr. Kartenskizze.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1913. M. 1.

Lewes, Prof. V. B.: Oil Fuel. Illustrated. 12mo, pp. 262. Collins. London. 1913. Net 1s.

Wiebe, Prof. H. F.: Die obere Brauchbarkeitsgrenze des Abel-Penskyschen Apparates u. seine Vergleichung m. dem Penskyschen Flammpunktprüfer. Mit e. Nachtrag. (Mitteilung aus der physikalisch-techn. Reichsanstalt.) [Aus: "Petroleum."] (3 S.) Lex. 8°. Berlin, Verlag f. Fachliteratur. 1913. M. 1.

Recktenwald, I. J.: Schlagender Wetter. (13 S.) gr. 8°. Kattowitz. Gebr. Böhm. 1913. 80 Pf.

Simmersbach, Prof. O.: Ueber den Schwefelgehalt amerikanischer Kohle. (10 S.) gr. 8°. Kattowitz. Gebr. Böhm. 1913. 75 Pf.

—— Die Verkokung der Steinkohle unter Kalksteinzusatz. (16 S. m. 1 Taf.). gr. 8°. Kattowitz. Gebr. Böhm. 1913. M. 1.20.

—— Ueber das Verhalten der flüchtigen Bestandteile der Kohle bein Erhitzen. (16 S. m. 1 Taf.). gr. 8°. Kattowitz. Gebr. Böhm. 1913. M. 1.20.

Werndl, F.: Die Naturgase in Wels Oberösterreich. (12 S.) gr. 8°. Kattowitz. Gebr. Böhm. 1913. 80 Pf.

V. *Schulz*, Ernst: Eine neuere Abwässerreinigungsanlage in der Textil-Industrie. [Aus: "Sozial-Technik."] (2 S. m. 1 Taf.) 31.5×23.5 cm. Berlin, A. Seydel. 1913. 30 Pf.

—— Neuere Entstaubungs-, Lüftungs- u. Heizungsanlagen in der Textil-Industrie. [Aus: "Sozial-Technik."] (4 S. m. 2 Taf.) 32×23.5 cm. Berlin, A. Seydel. 1913. 40 Pf.

VII. *Ebler*, E., u. W. *Bender*: Ueber die Behandlung der "Rohsulfate" bei der Fabrikation des Radiums u. des Mesothoriums. (12 S.) Sitzungsberichte der Heidelberger Akademie der Wissenschaften. Stiftung

Heinrich Lanz. Mathematisch-naturwissenschaftliche Klasse. Abtlg. A. Mathematisch-physikalische Wissenschaften. Jahrg. 1913. gr. 8°. Heidelberg, Carl Winter. 50 Pf.

Jenkin, C. F. and D. R. *Pye*: The Thermal Properties of Carbonic Acid at Low Temperatures (Royal Society). 4to, sewed. Dulau. London. 1913. Net 3s.

IX. *Vaubourg*, H.: Guide pratique du constructeur en ciment armé, 238 fig., in-8°. Ch. Béranger. Paris. 1913. Cloth 15 fr.

Zement- u. Beton-Adressbuch Deutschlands. 1. Tl.: Zementfabriken Deutschlands nebst ihren Fabrikmarken. 2. Tl.: Betonbaugeschäfte u. Zementwarenfabriken Deutschlands. (2 Tle. in 1 Bd.) (III, LXIX, 316 S. m. Abbildgn.) gr. 8°. Berlin, Tonindustrie-Zeitg. 1913. Cloth M. 10.

X. *Beringer*, C. and J. J.: A Text Book of Assaying for the use of those connected with Mines. 13th ed., revised. pp. 476. C. Griffin. London. 1913. 10s. 6d.

Griffiths, E. H. and E.: The Capacity for Heat of Metals at different temperatures. (Ex. Phil. Trans. Roy. Soc.). 4to, swd. Dulau. London. 1913. Net 3s. 6d.

Park, J.: The Cyanide Process of Gold Extraction. 5th English edition, revised and enlarged. Cr. 8vo. pp. 362. C. Griffin. London. 1913. Net 8s. 6d.

Primrose, J. S. G.: The Practical Metallography of Iron and Steel. 8vo. pp. 130, swd. Scientific Pub. Co. London. 1913. Net 3s.

Schömburg, W.: Beiträge aus der Praxis zur Kraftversorgung u. Antriebsfrage auf Hüttenwerken. (46 S. m. 3 Taf.). gr. 8°. Kattowitz. Gebr. Böhm. 1913. M. 2.50.

XI. *Spezial-Adressbuch* der elektrotechnischen Industrie v. Oesterreich-Ungarn. 3. Ausg. 1913. Hrsg.: Osc. Hirschfeld. (XXIII, 422 S.) gr. 8°. Wien, (Spielhagen & Schurich). Cloth M. 7.

XVI. *Lohnis*, F.: Laboratory methods in agricultural bacteriology; tr. by W. Stevenson and J. Hunter Smith. Phil., Lippincott. 186 p. pls. figs. 12°. $1.75.

Kahle, H.: Einführung in die anorganische Chemie. Für den Gebrauch bei Vorlesgn. an landwirtschaftl. u. Forstakademien zusammengestellt. (111 S.) gr. 8°. Eisenach, Hofbuchdruckerei Eisenach. 1913. M. 2.50.

XIXA. *Berg*, R.: Die Nahrungs- u. Genussmittel, ihre Zusammensetzung u. ihr Einfluss auf die Gesundheit, m. besond. Berücksicht. der Aschenbestandteile. (60 S.) gr. 8°. Dresden, Holze & Pahl. 1913. Cloth M. 3.40.

XIXB. *Saeger*, O.: Hygiene der Hüttenarbeiter, neubearb. v. Dr. E. Günther. (VI. u. S. 275—456, m. 111 Abbildgn.) Gewerbehygiene, bearb. v. Bluhm, A. u. a. VII Bd., 12 Lfg., 2 Abtlg. Lex. 8°. Leipzig. J. A. Barth. 1913. M. 8.75.

XX. *Bunge*, Prof. G. v.: Lehrbuch der organischen Chemie f. Mediciner in 17 Vorträgen. 2. verm. u. verb. Aufl. (VII, 288 S.) gr. 8°. Leipzig, J. A. Barth. 1913. Cloth M. 8.25.

Mirtl, Dr. K.: Ueber Radium-Emanation u. Radium-Therapie. Dargestellt f. Laien-Interessenten. (8 S.) 8°. Graz (Leuschner & Lubensky). 1913. 50 Pf.

XXI. *Bertillon*, A.: Photographie métrique, indentification judiciaire anthropologie, archéologie, architecture, reproduction documentaire, expertises, médecine légale, histoire naturelle, topographie. fig. In-8°. Paris. Lacour-Berthiot. 1913. 5 fr.

XXII. *Kolbe*, L.: Die Verwendung flüssiger Luft zu Sprengzwecken. Ausführlicher Bericht üb. das vor der Gesellschaft f. Sauerstoff- u. Stickstoff-Industrie in der Bergakademie am 28. 11. 1912 erstattete kurze Referat. [Aus: "Sozial-Technik."] (8 S. m. 3 Fig.) 31,5 × 24 cm. Berlin, A. Seydel. 1913. 35 Pf.

Molinari, E., e. F. *Quartieri*, : Notizie sugli esplodenti in Italia. (Pubblicazione della Società italiana prodotti esplodenti, Milano.) Milano, 4° fig., p. xx, 292, con 17 tav. e 18 facsimili. Lire 20.

XXIII. *Donau*, Dr. J.: Arbeitsmethoden d. Mikrochemie m. besond. Berücksichtig. der quantitativen Gewichtsanalyse (70 S. m. 35 Abbildgn). Handbuch der mikroskopischen Technik, hrsg. v. der Red. des Mikrokosmos. Lex. 8°. Stuttgart, Franckh. 1913. Cloth M. 2.80.

Tortelli, M.: Il libro degli assaggi chimici delle merci. Vol. I, parte I e II. Torino. 8°. p. viii, 798. Lire 10.

Weinland, Prof. R.: Anleitung f. das Praktikum in der Gewichtsanalyse. 2. Aufl. (VIII, 114 S. m. 2 Abbildgn.) gr. 8°. Tübingen, J. C. B. Mohr. 1913. Cloth M. 3.80.

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[*] Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Journal of the Society of Chemical Industry.

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SOME OBSERVATIONS ON THE ABEL HEAT TEST.

BY BERTRAM JAMES SMART, B.SC.

The widespread use of the Abel test as an indicator of the stability of explosives and the difficulty so often experienced in interpreting its results, have focussed attention on the mechanism of the test, and as a consequence many new facts have recently been brought to light.

The recent work of Egerton (this J., 1913, 331) is to be welcomed, since the author has brought a number of fresh facts and good reasoning to a subject much clouded in vague statements and illogical conclusions. In some details Egerton does not fully agree with the joint work of Robertson and Smart (this J., 1910, 130); but these points of difference in the writer's view may serve to elucidate further the working of the test.

The most important requirement of a good stability test is that it should be capable of affording information in a short time as to :—1. Whether a new explosive consists of stable material ; 2. How far decomposition has proceeded in an explosive after storage.

The Reaction.—One of the most important points to be remembered in the Abel test which distinguishes it from a true test for nitrous acid, is that iodine is liberated by a process of oxidation in accordance with the equation, $2KI+O+H_2O=2KOH+I_2$. This reaction, however, is complicated by a further reaction, $2KOH+I_2=KI+KOI+H_2O$ (Taylor, J. Chem. Soc., 1900, 77, 725; Foerster and Gyr. Z. Elektrochem., 1903, 9, 1). The latter reaction is a reversible one, and it is obvious that if the potassium iodide is oxidised sufficiently slowly, no iodine will be liberated. The reversible character of the reaction is shown by placing in an empty tube a paper coloured by the Abel test, when the iodine colour gradually disappears. For this reason the Abel test magnifies differences of concentration as shown by Egerton's curve III., which the writer has confirmed for several other indicators ; and with gelatinised explosives, as Egerton shows (Table 3), it gives a much wider range between good and bad.

Relation between concentration and time—The higher value for K obtained by Egerton in the equation, TC=K, is to be attributed to the size of the vessel. If the quantity of NO_2 absorbed by the indicator bears any significant relation to the total quantity present in the vessel, the concentration must fall all the time, and consequently in a small vessel the initial concentration will be higher than in a large vessel for the same test time. The large box was used after experimenting with 2, 4, and 20 litre vessels which always showed depletion.

The force of this argument is admitted by Egerton (this J., 1913, 337) in following Robertson and Smart's method for the estimation of the total quantity of NO_2 absorbed by the paper.

Moreover, the reactivity of the glass in small vessels cannot be neglected, since the exposed alkaline surface is proportionally much greater, and this will tend to increase the value of K.

Strictly speaking, with the Abel paper the curve cannot be a perfect hyperbola, since for very low concentrations the reaction outlined above shows that no colour will be produced. The true law would appear to be, $Tx(C-a)=K$, where a is a very small value representing the concentration which just liberates as much iodine as can be converted into hypoiodite in the same unit of time.

It should be noted from Egerton's curve III. the law for the naphthylamine drop is by no means hyperbolic.

Heat tests of guncotton.—Egerton asserts that it is in the form of nitric acid that guncotton absorbs "easily removable nitrogen peroxide." If this were so, such nitric acid would be exceedingly difficult to remove, and would catalyse the decomposition of the guncotton even in the Will test. Secondly, the water which nitrocellulose takes up is clearly constitutional, since the percentage depends on the nitrogen content, as shown by Will. On the contrary, the facts point to the probability that the NO_2 and water are eliminated together as vapour.

Continuous tests.—The behaviour of the naphthylamine drop in a continuous test cannot be considered without taking into account the vast difference between the reactions which underlie this as distinguished from the Abel test. In the latter the essential requirement is oxygen, and this can be furnished by either NO_2,N_2O_3, nitrous acid or nitric acid. Further, a small quantity of NO can act indefinitely as a carrier of oyxgen.

Although on the basis of a calculation Robertson and Smart showed that there was good agreement between the calculated and observed heat tests of guncotton, this only shows that the order of things is consistent with decomposition during the test. No one would assert that the reaction is one limited to NO_2, indeed Robertson has found that a fair portion of the NO_2 goes to oxidise the guncotton with liberation of NO. It is this very point which must cause a great difference between the behaviour of guncotton under the Abel test and the naphthylamine drop, the latter depending on the diazo reaction. If the nitrogen is eliminated as N_2O_3 then 2 molecules of nitrous acid are formed, whilst if it is eliminated as NO_2 the result is 1 molecule of nitric acid and 1 molecule of nitrous acid.

If great caution be observed a study of the two tests side by side should throw much light on the mechanism of decomposition.

The continuous tests given by Egerton prove that after several minutes heating the concentration of nitrous acid is not rising so rapidly as at the beginning of the test. This can be accounted for in two ways :—

1. Some removable nitrous acid was stored up in the guncotton, a possibility disposed of by Robertson and Smart.

2. The guncotton contains a small quantity of adherent material which is oxidised rapidly by NO_2, and for the first few minutes decreases the NO_2, and consequently increases the nitrous acid produced.

But although with the iodide paper this explanation may hold to a much smaller extent, there can be no doubt that drying of the paper plays a very important part.

Absorption of NO_2 by guncotton.—There is no contradiction in the two statements by Robertson and Smart, as asserted by Egerton (p. 335). By placing a little dry guncotton in an atmosphere of NO_2 it is easily shown that the guncotton is actually deliquescent to NO_2, the gas passing into solid solution, but of course in air containing no NO_2 such absorbed NO_2 must be easily removable.

In the case of nitroglycerin comminuted on silica wool it would appear that though the liquid may dissolve NO_2 its great surface will facilitate the evolution of the dissolved gas. The guncotton fibre is in a different physical state to liquid nitroglycerin spread out on silica fibres.

Equilibrium pressure.—Egerton's contention on page 339 that the conditions of the heat test are comparable with those of the dissociation pressure of copper sulphate is scarcely an exact statement of the case. If equilibrium were obtained on heating a tube of guncotton there could have been no liability to spontaneous ignition. Putting aside catalysis, the decomposition could proceed to completion in the heat test tube, whereas in the dissociation of copper sulphate and probably of copper nitroxyl the reaction is reversible, and ceases when the dissociation pressure is reached.

In the case of uncomminuted nitroglycerin, the heat test is a measure of the solution pressure, but even this must rise continually as decomposition proceeds.

In conclusion, it should once again be emphasised that in applying the Abel test to explosives the physical condition must never be lost sight of ; that with guncotton we have a solid fibrous substance containing water of constitution, that with nitrolgycerin we are dealing with a liquid which does not readily permit the dissolved gas produced by decomposition to be evolved, and that with gelatinised explosives we have solid bodies with only a limited surface, containing substances which react with NO_2, which may easily contain the accumulation of past decomposition, and which may decompose or partially volatilise during the process of preparation for the test.

If these points were constantly borne in mind, the so-called vagaries of the Abel test would cease to be a matter for surprise.

Communication.

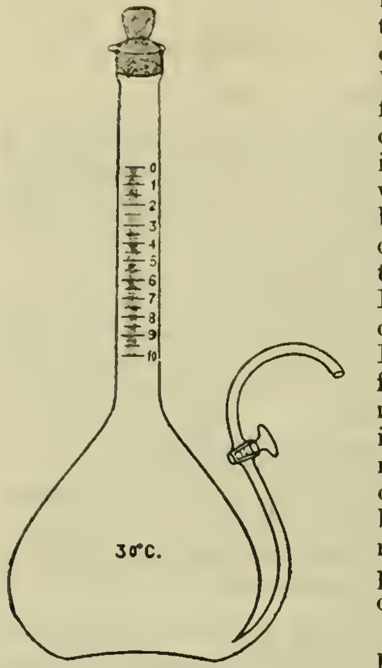
THE TAILAMETER: A SIMPLE APPARATUS FOR THE RAPID ESTIMATION OF VOLATILE OILS IN AROMATIC PLANTS, DRUGS, AND SPICES.

BY PROBODHA C. CHATTOPADHYAY, M.A.

The amount of volatile oil in a sample of aromatic drug or spice, or any other oil-bearing substance, is usually estimated by distilling a weighed quantity of it with steam (superheated or otherwise) and collecting the distillate, from which the oil is extracted by shaking with ether or other suitable solvent, the latter being afterwards removed, and the resultant product weighed. As this procedure takes a comparatively long time, and as it is somewhat expensive to extract the volatile oils by means of ether in tropical places (especially in India, where ether boils at the atmospheric temperature), I designed the present apparatus for quickly estimating the percentage of volatile oil in any sample without the use of ether, petroleum ether, or other volatile chemicals.

The construction of the apparatus is very simple. It consists of a long-necked flask, the neck of which is graduated into 10 c.c. in 1/10 divisions and to the bottom of which a swan neck with stopper is fused (see illustration).* The capacity of the flask, when the stopper is closed, is 500 c.c., including the 10 c.c. graduation on the neck. The apparatus has been named Tailameter, from Sanskrit *Taila*, oil, and *metre*, I measure.

The apparatus is used as follows. In the usual process of estimating the volatile oil by steam distillation, the distillate is collected in the Tailameter and the excess liquid, which may be collected separately, is allowed to run off through the bent tube by opening the stopcock. When the distillation is finished, the stopcock is closed and the oil collected in the apparatus is brought within the graduated part by the addition of more distillate, if necessary, and the volume of oil is noted. From this the percentage of oil is readily calculated. If 100 grms. were taken for analysis, then the reading on the instrument is the percentage. The result is correct to one place of decimals. If 1000 grms. be taken for analysis, the result will be correct to two places of decimals, and so on.



One source of error is possible, namely, that due to the solubility of the oil in water, but in the majority of cases this is so very slight that it can be neglected. In some cases, however, it may be appreciable, and then the solubility can be determined once for all, and the amount of oil dissolved in the total distillate, obtained by multiplying the total volume of distillate by a solubility factor, is added to the volume measured in the Tailameter to get accurate results.

This apparatus is especially useful for those who have to assay commercial samples of spices, etc., and report the oil-content in a comparatively short time. It will also be found to be useful in laboratories where routine work is carried out on the estimation of oils in sandalwood, ajwan (*Ptychotis*), cloves, etc.

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* The apparatus may be obtained from Messrs. A. Gallenkamp and Co., Ltd., of London, and from Mr. F. A. Kuehnlenz, of Frauenwald (Thuringia), Germany.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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German.—1 mark each with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Furnaces of the reversible regenerative type. A. Reynolds, London. Eng. Pats. 12,991, June 3, 15,688, July 4, and 16,546, July 15, 1912.

A gas-fired regenerative furnace is supplied with air by several valve-controlled reversible air systems, so arranged that highly heated air can be supplied to the gas inlet end of the working chamber, and less highly heated air to the gas outlet end to complete the combustion, and obtain the desired degree of heat in the regenerators. Or heated air may be admitted by one air system to the gas flue so that the gas is partly burned before it enters the working chamber.—W. H. C.

Kiln. C. Hook, Vigo, Ohio. U.S. Pat. 1,073,045, Sept. 9, 1913.

The floor of the kiln is built upon a system of flues, through which pass the hot gases from a series of furnaces situated without the kiln below the floor level. The gases pass from the flues into the body of the kiln, through apertures in the floor. A second series of furnaces built along the exterior of the kiln wall, above the floor level, communicate directly with the kiln. A series of stacks corresponding to the furnaces are built without the opposite wall of the kiln, each stack having two arched connections with the kiln, placed one above the other, above the floor level.—W. H. C.

Drying out solids held in suspension or solution; Method of——. F. E. Beeton, New Southgate. Eng. Pat. 13,505, June 8, 1912.

The liquid is sprayed into a chamber, which may have a conical shape to correspond with the diverging cone of spray, at such a rate that the solid particles are sufficiently dried before they touch the sides of the casing. A vacuum or partial vacuum is maintained within the chamber, which is heated either by a jacket or by coils of electrically heated wire. Superheated expanded steam or other vapour may be blown into the chamber to assist the drying, and the dried solid particles are withdrawn through a collecting chamber provided with means for preventing loss of vacuum.—W. H. C.

Dryer. E. B. Ayres, Assignor to The Philadelphia Textile Machinery Co., Philadelphia, Pa. U.S. Pat. 1,074,034, Sept. 23, 1913.

A casing is divided by a vertical partition into a heating and a drying compartment, and air is circulated from the heating compartment through the drying compartment by means of fans. The drying compartment is provided with an endless chain conveyor which runs in a series of vertical loops over wheels at the top and bottom of the compartment. The chain carries a number of trays pivoted to it so as to remain horizontal and the material is placed on these trays. For drying and smoking fish, there may be a firebox open to the interior of the casing. —A. T. L.

Absorber or separator for gases or vapours. J. Smith, H. L. Mitchell and W. H. Askham, Ravensthorpe, and H. Hey, Dewsbury. Eng. Pat. 28,510, Dec. 10, 1912.

In gas cleaning or absorbing apparatus a continuous relative reciprocating motion is imparted to the plates, between which the gas flows, or to the bells beneath which it bubbles through the washing liquid. This is effected by attaching one set of plates, or the bells, or the dishes. to the casing of the apparatus and the other set to a rotating or non-rotating shaft, to which a reciprocating movement is imparted by means of a cam.—W. H. C.

Drying apparatus for use with materials such as wood-chips, saw-dust, grain, peat, and the like. F. Sykes, Bideford. Eng. Pat. 20,448, Sept. 7, 1912.

See Fr. Pat. 453,328 of 1913; this J., 1913, 744.—T. F. B.

Separation of materials; Process for effecting the ——. R. Jaffé, Frankfort on Maine, Germany. Eng. Pat. 22,114, Sept. 28, 1912.

See Ger. Pat. 255,531 of 1911; this J., 1913, 351.—T. F. B.

Evaporators. C. F. Eckart and W. G. Hall. Honolulu, Hawaii. Eng. Pat. 26,558, Nov. 19, 1912.

See U.S. Pat. 1,053,017 of 1913; this J., 1913, 275.—T.F.B.

Decanting or settling liquids; Apparatus for ——. R. Körner, Niederlössnitz, Germany. U.S. Pat. 1,073,146, Sept. 16, 1913.

See Eng. Pat. 14,644 of 1912; this J., 1912, 949.—T. F. B.

Liquefying gaseous mixtures: Apparatus for ——. H. Blau, Augsburg, Germany. U.S. Pat. 1,074,094, Sept. 23, 1913.

See Fr. Pat. 433,948 of 1911; this J., 1912, 220.—T. F. B.

Fluid enveloped vacuum chambers for tanning hides, evaporating liquids, etc. Eng. Pat. 15,345. *See* XV.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Volatile constituents of ——. Part III. A. H. Clark and R. V. Wheeler. Chem. Soc. Trans., 1913, 103, 1704—1715. (See also this J., 1910, 1291, 1911, 606.)

The results of further experiments support the view put forward previously (*loc. cit.*) that coal is essentially a conglomerate of (1) degradation products of celluloses, and (2) partly changed resins and gums of the plants from which the coal was derived. The former yield hydrogen and the latter paraffins as the main gaseous product of thermal decomposition. Pyridine effects only a partial separation of the two constituents. The pyridine extract slowly yields about one-third of its weight to chloroform or benzene when treated therewith in a Soxhlet extractor. The substance removed is a sepia-coloured solid which softens at 90° and melts partially at 102° C. It contains 80 per cent. of volatile matter and on destructive distillation yields 43—64·5 per cent. of tar (mainly paraffin hydrocarbons) together with gases consisting chiefly of paraffin hydrocarbons and hydrogen. The portion of the pyridine extract insoluble in chloroform is similar in properties to the portion of the original coal insoluble in pyridine, and the authors consider that extraction with pyridine, followed by extraction of the pyridine extract with chloroform, will effect a complete or nearly complete separation of the resinous constituents from the degradation products of the celluloses. Russell (this J., 1908, 959) has shown that rosin has an action on the photographic plate in the dark and that coals have a similar action at about 50° C. It is now shown that whilst the portion of coal insoluble in pyridine and the portion of the pyridine extract insoluble in chloroform have no perceptible action on a photographic plate, the total pyridine extract produces a distinct image, and the portion of the pyridine extract soluble in chloroform produces a strongly marked image surrounded by an extensive halo.—A. S.

Coal; Volatile constituents of ——. Part IV. Relative inflammabilities of coal dusts. R. V. Wheeler. Chem. Soc. Trans., 1913, 103, 1715—1722.

The results of experiments are tabulated showing that there is a relation between the percentage of matter soluble in pyridine in a coal and the inflammability of the coal dust (see this J., 1912, 1170).—A. S.

Coal dust explosion tests; First series of —— in the experimental mine [*United States*]. G. S. Rice, L. M. Jones, J. K. Clement, and W. L. Egy. U.S. Dept. Interior, Bureau of Mines, Bull. 56, 1913, 115 pages.

The experimental underground mine is in the Pennsylvania coal district, and comprises two main parallel roads, about 700 ft. long, each 9 ft. wide, with a 41 ft. pillar of coal between them, and crosscuts between the roads every 200 ft.; a diagonal heading connects the air course with a third opening. No appreciable amount of methane was found in the mine, the maximum amount at the face of the heading being only 0·06 per cent. even after the mine had been sealed for 14 hours. In three experiments records were obtained of five pressure waves that were clearly "impulse" waves started by the igniting shot. Two of these were registered when no coal dust was in use. The average velocity recorded was 1120 ft. per sec. When a blown-out shot was fired the impulse waves raised the coal dust in the vicinity into the air and the flame ignited the dust. At first there seemed to be merely quiet combustion, but if the coal dust was inflammable, pressure was gradually developed and the pressure waves started. In one of the tests, the period of developing pressure, including the time of traversing the first 300 ft., occupied 2¼ secs. from the time of ignition. When the pressure wave reached the 300 ft. point it was far behind the shock wave caused by the blown-out shot. The manometers indicated a retardation between the stations at 600 ft. and 700 ft. from the origin. The records of flame velocity, in some of the tests, show that for the first 200 ft. the velocity is relatively low, averaging less than 200 ft. per sec. In the case of explosions showing the least violence, the velocity did not materially increase with distance, although, in one instance, it reached 400 ft. per sec. This velocity was attained about 60 ft. beyond the end of the coal dust zone, but, as a large amount of coal dust would be carried forward by the wave itself, there would be no lack of fuel for a considerable distance. In another of the tests the flame appeared to travel at the start more slowly than the front of the pressure wave. At 2·3 secs. after ignition the flame was 225 ft. behind the front of the pressure wave, at 2·4 secs. it was 250 ft. behind, and at this point it began to travel faster than the pressure wave. Two samples of afterdamp taken 15 minutes after an explosion at points 150 ft. and 200 ft. from the mouth of the main entry showed, as their main feature, a high ratio of carbon monoxide to carbon dioxide (1—1·51 and 1—1·36) which indicates that at the time of the explosion there was a great excess of carbon in the air. In nearly all the experiments a ventilating current of air with a velocity of about 100 linear feet per minute was employed, the current travelling in the same direction as the explosion. In most of the experiments the humidity of the air was high and the floor was kept moist in order to prevent the dust of the track ballast from being brought into the air and affecting the explosion. The coal dust in all cases was dry and had been placed in position on the shelves only a few hours previous to the experiment.—G. W. McD.

Coal; Oxygen absorption by ——. T. F. Winmill. Times Eng. Suppl., Oct. 1, 1913.

THE rate of oxidation of coal dust kept at 30° C. was determined by laboratory experiments with coal taken from different parts of the Barnsley seam. Very rapid oxidation of freshly got coal takes place during the first few hours, the amount absorbed being roughly proportional to the amount and character of carbonaceous matter in the coal. The rapid reaction ceases in 48 hours, when 0·1 c.c. of oxygen is absorbed by 100 grms. of coal per hour, but under certain conditions the temperature of the coal may be raised by this rapid initial oxidation so as to increase dangerously the velocity of the normal slower reaction. The initial oxidation cannot be stopped by merely reducing the percentage of oxygen in the air. The rate of oxidation was reduced only by 28 per cent. when coarser dust having only 1/400 of the surface was used for the experiments. The rate of oxidation increased rapidly with increasing temperature.—A. T. L.

Oil; Heavy —— as fuel for internal-combustion engines. I. C. Allen. U.S. Dept. Interior, Bureau of Mines, Technical Paper 37, 1913, 36 pages.

A REPORT, based on numerous recent publications, dealing with the available supply of heavy oils in America, the advantages of the heavy oil engine, more particularly of the Diesel type, the present development of these engines and the various kinds of oil which can be used in them. Tentative specifications are given for fuels and lubricants for these engines, but it is concluded that the engine is not yet fully developed, and that it is too soon to lay down definite specifications. The future of the engine and the utilization of asphaltum liquid fuels and of liquid fuels obtained as by-products from coal and wood are considered to be assured.—A. T. L.

Iron pentacarbonyl. Stoffel. *See* VII.

PATENTS.

Washing coal and the like; Apparatus for ——. Clifton and Kersley Coal Co., Ltd., H. V. Hart-Davis and J. Greenhalgh, Manchester. Eng. Pat. 12,913, June 4, 1913.

THE tailings from the usual vibrating screen are passed into a box containing a stationary screen; the lighter particles are carried over the edge by the pulsating movement of water in the box, whilst the heavier particles fall to the bottom and are removed by a scraper conveyor. —W. H. C.

Peat; Treatment of ——. J. S. Whitaker, Dumfries, and Wetcarbonizing Ltd., London. Eng. Pat. 19,847, August 30, 1912.

IN excavating peat as described in Eng. Pat. 13,391 of 1910 (this J., 1911, 1200), a machine for separating roots, branches, stones, etc., before the peat enters the disintegrator is carried on a pontoon in the bog and receives the peat direct from the excavator. It comprises a hopper beneath which are two parallel rotating shafts, each having four series of radial blades of T-section. The shafts are rotated in the same direction and the blades on one shaft pass between those on the other. Normally the peat passes between the blades of the two shafts and falls into the disintegrator. One shaft is driven from the other through a friction clutch so that when the movement of the one set of blades is obstructed by roots, etc. becoming jammed between the oppositely moving blades, the shaft remains at rest whilst the upwardly moving blades throw the obstruction out through a lateral door. In a modification the roots, etc. are ejected by the co-operation of stationary guide-bars with the rotating arms of a single shaft.—A. T. L.

Peat fuel; Mechanical process of making ——. F. T. Warburton, London. Eng. Pat. 29,429, Dec. 21, 1912.

MACERATED peat pulp is discharged into a box which rests on a plate forming a temporary bottom. The box is then moved laterally over a set of small moulds so as to fill them with the peat pulp. When the peat blocks are dry enough to stand alone, the moulds are lifted off by hand. For this purpose, a loose plate which forms the bottom of the set of moulds is withdrawn. This plate is normally secured to the moulds by right-angled clasps which can be readily removed.—A. T. L.

Combustion of coal, oil or similar fuels in a furnace system; Automatic means for securing the correct ——. A. Reynolds, London. Eng. Pat. 13,566, June 10, 1912.

THE supply of gaseous fuel (derived from coal, coke, etc.), to the furnace and of the correct amount of air for its combustion is controlled by a pair of valves coupled to act together and so loaded that the resistance offered by them completely masks any variation in resistance which may occur in the rest of the furnace system.—W.H.C.

Solid fuel; Process of burning ——. O. B. Evans, Lansdowne, Pa., Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,073,668, Sept. 23, 1913.

IN order to prevent the formation of clinkers when burning solid fuel with forced draught, the blast is admitted partly through the grate and partly at a higher level in the fuel column. The upper part of the fuel column forms the hotter zone, but agglomeration of fused ash in this zone is prevented by the presence of unburnt carbon, which is afterwards burnt away in the lower and cooler zone.—A. T. L.

Coke and gas; Apparatus for making ——. H. Nelsen, Essen-Rüttenscheid, Germany. Eng. Pat. 14,376, June 19, 1912. Under Int. Conv., June 26, 1911.

IN a coke-oven of the type in which the annular coke chamber is heated from both the outer and inner walls, the bottom of the chamber is closed by a sliding conical ring which makes a gas-tight joint when in its upper position and allows the free discharge of the contents of the retort when in its lower position. A layer of "pearl coke" or similar material is introduced at the bottom of the chamber before the latter is charged with coal, for the purpose of (1) preventing the sliding ring from being corroded by contact with the hot coke, (2) preventing the bottom layer of coal from being insufficiently heated by the hot gases, and (3) starting the sliding of the coke during the discharge of the oven.—H. H.

Gas producers and retort settings; Regulation of the air supply to ——. T. Brooke, Birmingham. Eng. Pat. 18,705, Aug. 15, 1912.

To maintain a regulated supply of air independently of variations due to changes in the direction and velocity of the wind, chimney draught, or in the amount of resistance to the passage of air through the fuel or flues, a vane is freely pivoted in a continuous length of the flue. An arm projects from the plane of the vane and is fitted with an adjustable weight, so that the size of the air opening and the amount of movement of the vane due to changes in pressure or vacuum can be adjusted at will. Excessive oscillation of the vane is prevented by a spring plate bearing on the back of the hinge.—H. H.

Gas producers. G. H. Bentley and E. G. Appleby, London. Eng. Pat. 20,615, Sept. 10, 1912.

THE charging hopper is carried by an annular plate mounted on ball bearings and rotating about the axis of the producer, leakage of gas being prevented by a water-seal. A number of vertical pokers are journalled in bearings on the rotating plate and are arranged to reach to different depths in the upper part of the fuel column, the shortest one serving as a spreader. Each of these pokers carries a gear wheel at the upper end engaging with a fixed internally-toothed wheel concentric with the axis of the producer, so that as the plate rotates and carries the pokers with it, the pokers are also rotated about their own axes. The producer is also provided with an eccentric conical grate which is rotated in the opposite direction, the motion being derived from the same driving shaft. The pokers may be hollow and water-cooled, the water supply and discharge being by way of fixed annular troughs.—A. T. L.

Vaporisers for suction gas producers. J. Dallas, Barrow-in-Furness, and I. H. Storey, Ambleside, Westmoreland. Eng. Pat. 2349, Jan. 29, 1913.

A float regulator, controlling the water supply, is placed in a small tank connected with the main vaporiser chamber by a pipe having a restricted passage, so that momentary changes of level in the vaporiser do not appreciably affect the level in the float chamber.—H. H.

Gas-producer. H. F. Wallmann, Chicago, Ill. U.S. Pat. 1,072,536, Sept. 9, 1913.

The producer has an upper distillation chamber and two lower combustion chambers. The fuel in the distillation chamber is distilled by the hot gas from one of the lower chambers, which passes through it, and carries the distillation products through the hot zone of the other combustion chamber. The course of the gas is reversed from time to time. The residue of distillation passes into one or other of the combustion chambers, which have upper and lower air-inlet ports and intermediate gas outlet and distillate entry ports.—W. H. C.

Gas producer. J. A. Herrick, New York. U.S. Pat. 1,073,124, Sept. 16, 1913.

The feed hopper is provided with a number of discharge orifices, the size of which can be regulated by an adjustable plate. A vertical rotating shaft passes axially through the hopper and is provided with an arm to break up any coal which lodges in the discharge orifices, and with a fuel-distributor which uncovers the discharge orifices in turn and deflects the greater part of the fuel towards the periphery of the fuel column.—A. T. L.

Gas-producer; Rectangular ——. R. B. Mildon, Wilkinsburg, Pa., Assignor to The Colonial Trust Co., Pittsburgh, Pa. U.S. Pat. 1,073,919, Sept. 23, 1913.

The producer works with an up-draught and comprises upper and lower sections, the upper section being of smaller area in plan. Two removable vaporizers are secured by flanges on the opposite sides of the lower section at its upper end, and the upper section is carried on the vaporizers.—A. T. L.

Carburetted water-gas; Generation of ——. J. Stephenson, Salisbury and Firth, Blakeley, Sons and Co., Ltd., Dewsbury. Eng. Pat. 26,916, Nov. 22, 1912.

The duration of the heating and gas-making periods is controlled automatically by means of continually rotating valves, which are geared together. The invention is described as applied to the water-gas process of Eng. Pat. 6849 of 1911 (this J., 1912, 377). The generator is charged at fixed intervals by a hollow plug-valve at the outlet of the feeding hopper, which measures the charge, and a sliding valve beneath it which is opened at the required time for say ½ minute by means of broken toothed gearing. A valve for admitting the air blast and a valve between the generator and the carburettor are rotated say once in 10 mins. and are open for 3 mins. during each rotation. About 10 secs. after these valves are opened, a second air valve admits air to the top of the carburettor so as to burn the carbon monoxide formed in the generator, and air is also admitted at the same time at the bottom of the superheater. When these valves have closed, the gas-making period of 7 mins. is begun. For this purpose steam is admitted to the generator from a valve which rotates once in 30 mins. and is open for the last 7 of each 10 mins.; the blast passes twice upwards and once downwards through the fuel, the corresponding gas outlets being controlled by a valve rotating once in 30 mins. During each gas-making period a rotating oil valve admits oil to the carburettor, the oil being sprayed by means of water-gas.—A. T. L.

Ammonia and sulphur compounds from [coal] gas; Process for the extraction of ——. J. W. Cobb, Leeds. Eng. Pat. 13,141, June 4, 1912.

Coal-gas, or gases from coke ovens, producers, blast-furnaces, and the like, containing ammonia and hydrogen sulphide, are treated with zinc and/or manganese sulphate at about 80° C., with the precipitation of the corresponding sulphides and the formation of ammonium sulphate. After filtration, the ammonium sulphate is crystallised out, and the separated sulphides are roasted at about 500° C. in a controlled current of air, with the production partly of sulphates and partly of an insoluble residue, which still contains sulphides. This residue is suspended in water and treated with air and the sulphurous gases of a previous operation for the regeneration of sulphates. —O. R.

Hydrogen sulphide from gases; Process for removing —— using alkali solutions as absorbents. K. Burkheiser. Ger. Pat. 263,593, Aug. 28, 1912. Addition to Ger. Pat. 262,979 (see Fr. Pat. 448,728; this J., 1913, 413).

The coal gas or other gas is passed through a suspension of ferric hydroxide in ammonia solution, the temperature of which is regulated in such a manner that it always contains a quantity of ammonia corresponding to the amount of hydrogen sulphide to be absorbed. A temperature of 40°—50° C. is generally suitable. The tar may be separated from the gases whilst hot, and the warm gas introduced into the purifier.—T. F. B.

Coal gas; Method of removing impurities from ——. G. H. Hultman, Stockholm, Sweden. U.S. Pat. 1,073,605, Sept. 23, 1913.

Sulphur compounds, benzene, naphthalene, etc., are absorbed by washing the gas with alcohol cooled to 0° C. —A. T. L.

Dust or other impurities from gaseous fluids; Apparatus for the extraction of ——. C. E. Jeffcock and W. H. Yardley, Sheffield. Eng. Pat. 21,000, Sept. 14, 1912.

An improved form of the apparatus described in Eng. Pats. 15,748 of 1907 and 22,184 of 1908. The heavier particles of dust are deposited in a preliminary cleaning chamber and the finer particles separated in a secondary chamber provided with a series of perforated baffle-plates. Strips of metal or other suitable material, twisted spirally, are passed through the aligned perforations in the plates. Water may be sprayed on to the metal strips.—W. H. C.

Blast-furnace and other gases; Purifying —— and freeing them from dust particles. A. H. Smith, D. Bagley, and M. E. Feilmann, London. Eng. Pat. 10,341, May 2, 1913.

Dust is separated from gases by means of bands of textile material circulating across the casing or flue at right angles to the direction of flow of the gas, and passing outside the flue through gas-tight slots into proximity with vacuum dust extractors which continuously remove the filtered dust from the bands. A magnetic separator may be combined with the apparatus for separating metallic particles before the gases pass through the filters.—H. H.

Gas-scrubbing apparatus. E. F. Lloyd, Detroit, Mich. U.S. Pat. 1,073,259, Sept. 16, 1913.

A vertical cylindrical casing with a gas inlet at the lower end and an outlet at the top, is divided into compartments by horizontal annular partitions forming liquor troughs. A rotating shaft passes up through the centre of the casing, and carries a non-perforated plate in each compartment with scoops for throwing the liquor upwards against the under sides of the partitions. An upwardly directed flange on each plate throws up the liquor which is projected outwards by centrifugal force, and a depending flange on each partition directs the liquor back on to a perforated outer portion of the plate.—A. T. L.

Gases; Process of burning natural and other ——. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co. U.S. Pat. 1,073,103, Sept. 16, 1913.

To obtain diffused heating with gases of high calorific ower, they are diluted with hot products of combustion, mixed with air, and the slow-burning flame of the diluted gases brought into contact with heated refractory material so as to ensure complete combustion.—A. T. L.

Petroleum ; Process of and apparatus for distilling ——. J. W. Van Dyke and W. M. Irish, Assignors to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,073,548, Sept. 16, 1913.

Petroleum containing at least 40 per cent. of a lubricant, or lubricant- and wax-yielding fraction, is heated above 450° F. (232° C.) so as to distil hydrocarbons with boiling points above the temperature at which cracking commences, and the vapours are cooled first to a temperature above 400° F. (204° C.) but more than 50° F. (28° C.) below the temperature of the oil in the still. The oil which condenses at this stage is returned to the still, and the vapours are then condensed separately. This process is continued until the oil in the still contains not less than 25 per cent. by volume of the lubricant, or lubricant- and wax-yielding fraction, after which a distillate is collected from each stage of the condensing process until a substantial quantity of oil is obtained having a high viscosity, *e.g.*, 65 secs. at 100°F. (37·8° C.) in Saybolt's viscosimeter (see Archbutt and Deeley, "Lubrication and Lubricants," 2nd edit. 1907, p. 149), the vapours forming this distillate having a temperature which is nearer to the temperature in the still than in the case of the first distillate.—A. T. L.

Mineral oils, coal tar hydrocarbons, and analogous products ; Process for obtaining solid substances which decompose when melted, from ——. J. Buraczewski and T. Kozniewski. Fr. Pat. 455,503, March 13, 1913. Under Int. Conv., March 15, 1912.

A mineral oil or hydrocarbon from coal or lignite is heated with concentrated sulphuric acid and then with formaldehyde solution, or first with formaldehyde and then with sulphuric acid, or with a mixture of the two : the amount of formaldehyde used should not exceed 15 per cent. of that of the sulphuric acid, whilst from 0·5 to 5 per cent. is sufficient in many cases. The products are solid and can be easily powdered : they decompose when fused. The waste sulphuric acid (from refining) may be used in the process. *Example :* 100 parts by volume of benzine is mixed with 100 parts of concentrated sulphuric acid, previously heated on the water-bath, and 15 parts of 40 per cent. formaldehyde solution is gradually stirred in. The product is treated with water and the solid substance filtered, washed, and dried ; the quantity obtained is said to be 50 per cent. or more of the weight of benzine used. —T. F. B.

Charge liquid particularly adapted for explosion-motors ; Process for obtaining a —— from liquid hydrocarbons. R. Hense, Charlottenburg, Germany. U.S. Pat. 1,073,233, Sept. 16, 1913.

See Fr. Pat. 384,946 of 1907 ; this J., 1908, 494.—T. F. B.

Illuminating liquefied gas and method of treating gases. H. Blau, Augsburg, Germany. U.S. Pat. 1,073,843, Sept. 23, 1913.

See Fr. Pat. 433,948 of 1911 ; this J., 1912, 220.—T. F. B.

Gas-producer. C. H. T. Alston, Chester, and P. T. Houston, London. U.S. Pat. 1,074,032, Sept. 23, 1913.

See Eng. Pat. 8056 of 1912 ; this J., 1913, 819.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patents.

Furnace gases ; Apparatus for treating —— and preparing fuel. [Carbonising peat or sawdust.] B. Loomis, Hartford, Conn., Assignor to Loomis Utilization Co. U.S. Pat. 1,066,296, July 1, 1913.

Peat or sawdust is charred in two chambers by passing through them in series hot blast-furnace gases, which are thereby freed from dust and enriched by the volatile products. When the volatile constituents have been driven off from the material, the blast-furnace gases are superheated and their direction of flow through the chambers is reversed. The charred product is suitable for smelting iron ore, or for briquette-making.—A. T. L.

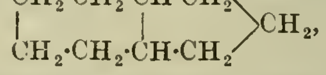
Filaments for electric lamps ; Manufacture of ——. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 27,433, Nov. 28, 1912.

Carbon filaments before "metallizing" by the process described in Eng. Pat. 6959 of 1904 (this J., 1905, 882) are soaked in a solution of a boron compound, instead of a metallic chloride as in Eng. Pat. 5416 of 1908 (this J., 1908, 1197). Preferably a solution containing 0·1 to 1·0 per cent. of sodium borate is used.—A. T. L.

III.—TAR AND TAR PRODUCTS.

Catalytic reactions at high temperatures and pressures. [Hydrogenation of indene.] W. Ipatiew. J. Russ. Phys.-Chem. Soc., 1913, **45**, 994—995.

Padoa and Fabris (this J., 1908, 1083) showed that at the ordinary pressure indene is not capable of combining with hydrogen in presence of reduced nickel at 300° C., but that at 250° C. two atoms of hydrogen are taken up, with formation of hydrindene and a small proportion of condensation products. The author finds that in presence of nickel oxide, indene unites with hydrogen at 250°—260° C. and 110 atmospheres, yielding the hydrocarbon indanoctohydrindene (or) octohydroindene,



$$\left.\begin{array}{l}CH_2\cdot CH_2\cdot CH\cdot CH_2\\ |\qquad\qquad\quad\ |\\ CH_2\cdot CH_2\cdot CH\cdot CH_2\end{array}\right>CH_2,$$

which is a liquid boiling at 165°—166° C.—T. H. P.

Patents.

Carbazolesulphonic acids ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. Eng. Pat. 9960, April 28, 1913. Under Int. Conv., April 27, 1912.

Products consisting substantially of monosulphonic acids are obtained by treating carbazole or its N-alkyl or N-aryl derivatives with sulphuric acid or chlorosulphonic acid in presence of an indifferent solvent or diluent, *e.g.*, nitrobenzene. The sodium salt of carbazolemonosulphonic acid is fairly easily soluble in water, from which it crystallises in the form of needles.—T. F. B.

1-Halogen-2.3-naphthisatins and their α-1′-halogen naphthalides ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,265, Aug. 10, 1912.

An αα′-dihalogen-ββ′-hydrocyancarbodinaphthylimine is treated with anhydrous aluminium chloride in presence of an indifferent solvent or diluent, the product is mixed with water, and the resulting α-1′-halogen-naphthalide of 1-halogen-2.3-naphthisatin is converted into the corresponding 1-halogen-2.3-naphthisatin, for example by heating with dilute acid.—T. F. B.

Obtaining solid substances from mineral oils, coal tar hydrocarbons, etc. Fr. Pat. 455,503. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

Indigo syntheses ; New ——. W. Madelung. Z. angew. Chem., 1913, **26**, 557.

The author describes the synthesis of indigo derivatives from indole and di-indyl, the latter substance being produced from oxal-o-toluide by the action of sodium ethylate or amylate through loss of 1 mol. of water

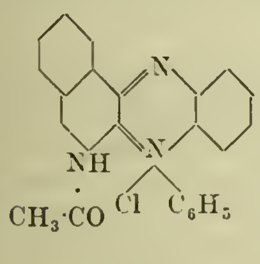
Di-indyl forms mono- and di-nitroso-compounds, which on reduction give mono- and di-aminoindyl. Indigodioxime is formed as an intermediate product in the reduction of the dinitroso-compound. Diaminoindyl gives on careful oxidation indigodi-imine, identical with the product obtained by treating indigo with zinc chloride and ammonia (this J., 1913, 782). Indigo is readily obtained from the di-imine by hydrolysis. β-Amino-indole (obtained by reducing the nitroso-compound) also gives indigodi-imine by oxidation, analogous to the formation of indigo by the oxidation of indoxyl.—J. B.

Azine dyestuffs ; Colour-salts of the ——. F. Kehrmann, E. Havas and E. Grandmougin. Ber., 1913, **46**, 2802—2808. (See also this J., 1913, 783.)

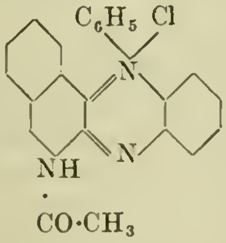
An investigation of the colour changes which take place during salt formation with different concentrations of acid, particularly in the safranine group, showed that the transformation of a basic amino group to the salt form is accompanied by a change of colour and the number of colours which a dyestuff can give corresponds to the number of amino groups present in the molecule, these groups apparently possessing different degrees of basicity, thus enabling the salt formation to proceed in phases. The explanation is the nullification or diminution of the auxochrome character of the amino group, which takes place when the nitrogen passes from the trivalent to the quinquevalent condition. In general it is found that the second salts of diamino-compounds have the same colour as the salts of the mono-amino-compounds, and, with a sufficiently high acid concentration, all the dyestuffs give the same red-brown colour of the di-salt of the parent substance, phenazine. This general rule makes it possible to determine with certainty the number of salt-forming groups and the order in which salt formation takes place, and it should be of use in the dyestuff classes of which the constitution is not certain (azoxines, thionines, pyronines, acridines, etc.). When the rule is not followed exactly, a change in constitution is indicated, as in the case of phenosafranine, the mono-salt of which appears to be *p*-quinonoid, corresponding in colour with the undoubtedly *p*-quinonoid Indamine. A noteworthy fact is the very low basicity of all the amino groups with the exception of the one which gives the normal salt. The formation of the higher salts only takes place in very strong acids. This is especially the case with amino groups para to the azine nitrogen (3- or 6-positions). An amino group in the 2-position (meta to the azine nitrogen), on the other hand, possesses strong basic properties.—J. B.

Rosinduline ; The sixteenth and seventeenth isomerides of ——. F. Kehrmann and M. Cordone. Ber., 1913, **46**, 2974—2979.

The acetyl compounds of these two isomerides have been obtained in 10 per cent. yield by acting on 3-acetylamino-1.2-naphthoquinone with phenyl-*o*-phenylenediamine :—



(1)

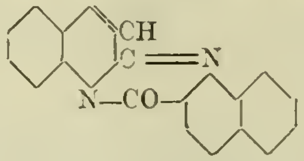


(2)

The compound (2) is easily saponified to form the yellowish green iso-rosinduline No. 16. It was not found possible to saponify compound (1) without its undergoing further change.—J. B.

Quinoline dyestuffs ; A new class of ——. E. Besthorn. Ber., 1913, **46**, 2762—2770.

The dyestuffs formed by the interaction of quinoline-*a*-carboxylic acid chlorides and quinoline compounds (this J., 1905, 724) might be represented by the type formula :—



assuming one of the nitrogen atoms to be quadrivalent. A symmetrical formula is inadmissible since the dyestuff produced from quinaldinic acid chloride and γ-phenylquinoline is different from that produced from γ-phenylquinaldinic acid chloride and quinoline. The dyestuffs of this class are the most sensitive to light of all known dyestuffs, being rapidly decolourised in benzene solution by sunlight, although the solution is quite stable in the absence of air. In the case of the dyestuff obtained from quinaldinic acid chloride and γ-phenylquinoline, γ-phenylcarbostyril was isolated from the decolourised solution.—J. B.

Quercetin ; Methylation of ——. A. G. Perkin. Chem. Soc. Trans., 1913, **103**, 1632—1638.

It is generally stated that on employing methyl iodide and alkali for the methylation of compounds containing hydroxyl groups, a hydroxyl adjacent to a carbonyl group is unaffected. The author finds that such compounds yield fully methylated derivatives when a considerable excess of methyl iodide and alkali is employed. Thus quercetin, prepared from quercitron bark, when heated with a considerable excess of methyl iodide and potassium hydroxide during two days, yielded quercetin pentamethyl ether, and a small quantity of methylquercetin tetra- and penta-methyl ethers.—G. H. F.

Quinone-benzidine and its transformation product. K. Brass. Ber., 1913, **46**, 2902—2906.

An addition product of 2 mols. of benzidine with 1 mol. of benzoquinone is produced on mixing hot solutions of the components in anhydrous toluene. It crystallises in bluish-black leaflets which melt at 118° C. On continuing the heating the product solidifies again and then decomposes, with sublimation of quinone. It decomposes on exposure to air or light and more rapidly on boiling with alcohol, benzidine being separated and a dark brown insoluble substance containing 1 mol. of benzidine to 1 mol. of quinone being formed. When heated this substance decomposes without melting. It gives with hydrosulphite an orange-yellow vat from which cotton is dyed in brown shades fast to washing. A condensation product of 2 mols. of benzidine and 2 mols. of chloranil can also be obtained by heating the components together in anhydrous toluene solution. It forms a greenish-yellow hydrosulphite vat, from which cotton is dyed in brown shades, fast to washing, and somewhat lighter than those produced by the quinone derivative.—A. S.

Anilidoquinones ; Oxidation of —— *to benzidine derivatives. II.* K. Brass. Ber., 1913, **46**, 2907—2912.

1-Anilidoanthraquinone can be oxidised with manganese dioxide and concentrated sulphuric acid in a similar manner to anilido-*a*-naphthoquinone (this J., 1912, 1023), yielding N,N′-bis-anthraquinonyl-1-benzidine, which forms a red hydrosulphite vat from which cotton is dyed in violet shades quite fast to washing : the colour becomes brighter on treatment with boiling soap solution. 1 Anthranilidoanthraquinone, when oxidised in a similar manner, yields N,N′bis-[anthraquinonyl-1]-benzidine-*o*-dicarboxylic acid, and when the latter is heated with concentrated sulphuric acid, ring-formation occurs and di-anthraquinone-2·1 acridone is produced. This gives a dark violet hydrosulphite vat, from which cotton is dyed in violet-brown shades perfectly fast to washing.—A. S.

Colouring rubber with organic dyes. Ditmar. *See* XIV.

Patents.

Indophenolsulphonic acids and leuco-compounds thereof ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 10,875, May 8, 1913. Under Int. Conv., May 8, 1912.

The monosulphonic acids of carbazole or of its N-alkyl or N-aryl derivatives (see Eng. Pat. 9960 of 1913 ; see page 972) may be condensed with *p*-nitrosophenol or *p*-aminophenol or a halogen derivative thereof to form indophenolsulphonic acids, which are converted into leuco-compounds by the usual reduction process. Similar products are obtained by treating with oxidising agents a mixture of such a monosulphonic acid and *p*-aminophenol or a halogen derivative thereof.—T. F. B.

Azo dye. P. Hauptmann, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,754, Sept. 23, 1913.

See Fr. Pat. 444,113 of 1912 ; this J., 1912, 1073.—T. F. B.

Azo dyes. P. Julius and C. Immerheiser, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,073,902, 1,073,903, 1,073,904, and 1,073,905, Sept. 23, 1913.

See Eng. Pat. 15,146 of 1912 ; this J., 1913, 480.—T. F. B.

Azo dye. L. Blangey, Mannheim, and C. Immerheiser, Assignors to Badische Anilin and Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,073,951, Sept. 23, 1913.

See Eng. Pat. 15,147 of 1912 ; this J., 1913, 593.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cellulose ; Methylation of ——. W. S. Denham and H. Woodhouse. Chem. Soc. Trans., 1913, **103**, 1735—1742.

"Madder bleached calico" wet beaten to a fine pulp and then dried, and cotton wool were used in the experiments. The cellulose was converted into alkalicellulose by treatment with rather more than 2 mols. of sodium hydroxide and was then treated with a considerable excess of methyl sulphate. The product was washed successively with water, very dilute alkali and acid and then again with water. Its composition corresponded with the formula $C_{12}H_{19}O_9.OCH_3$. On subjecting it to a second methylation in a similar manner, a product of the formula, $C_6H_9O_4.OCH_3$, was obtained, and a third methylation yielded a product of the composition, $C_{24}H_{35}O_{15}(OCH_3)_5$. The methylated celluloses are fibrous, but become more and more horny in appearance with increasing degree of methylation. The first product dissolves readily, the others less easily, in cuprammonium solution, and only the first appears to be soluble in a solution of zinc chloride in hydrochloric acid. They can all be acetylated, the acetyl derivatives being soluble in chloroform and bearing some resemblance to acetylcelluloses ; they contain less carbon, hydrogen and methoxyl than would correspond to completely acetylated derivatives of the methylated celluloses. The product, $C_6H_9O_4.OCH_3$, can be converted into a xanthate by means of sodium hydroxide solution and carbon bisulphide. The methylated cellulose regenerated from the filtered solution of the xanthate contains slightly less methoxyl than the original substance. (See also Fr. Pat. 447,974 ; this J., 1913, 420.)

Starch can be methylated in a similar manner.—A. S.

Cellulose in wood by Cross and Bevan's method ; Determination of ——. R. Sieber and L. E. Walter. Papierfabrikant, 1913, **11**, 1179—1183.

All the operations are carried out in a Gooch crucible having a closely fitting filter-plate sewn up between two layers of cotton fabric. The wood, finely rasped, is graded so that the particles pass through a No. 75 sieve but not through No. 110. About 1 grm. of wood is placed in the crucible and the latter is partially immersed in a bath of hot alcohol until the resin is extracted. The crucible is then mounted on a suction-flask and the contents are washed ; a rubber stopper with leading-in tube is fitted into the mouth of the crucible and dried air is aspirated through. When the fibre is semi-moist the leading-in tube is connected with a supply of washed chlorine gas. After chlorination and washing, the crucible is suspended, partially immersed, in a hot 3 per cent. solution of sodium sulphite and digested for 1 hour on the water-bath. The fibre is washed and chlorination repeated as before. Four chlorination treatments of 20, 15, 15 and 10 minutes' duration respectively, with intermediate extractions with hot sodium sulphite, suffice to give a cellulose free from lignin. The final product is bleached with permanganate, purified and dried. —J. F. B.

Wood pulps ; Strength values of —— and their alteration through bleaching. A. Frohberg. Wochenbl. Papierfab., 1913, **44**, 3599—3601.

Several samples of sulphite pulps, produced under different conditions, were treated for 15 minutes in a laboratory beater and made into sheets of paper on the hand mould. The same pulps were also similarly treated after bleaching with known quantities of bleaching powder. Sheets were then tested for tensile strength, stretch and resistance to folding. Taking the unbleached pulps it would appear that, other conditions being equal, a high percentage of calcium in the bisulphite liquor gives a stronger pulp than a more acid lye, but a tougher pulp may be produced by stopping the digestion at a less advanced stage, even when the percentage of calcium is low. The loss of strength produced even by normal bleaching is very considerable. The resistance to folding is most profoundly affected, being sometimes reduced by as much as 42 per cent. The tensile strength is also reduced, but in a less degree, viz., up to 11 per cent. A very slight over-bleaching, resulting from the consumption of only 2 per cent. of bleaching powder in excess of the normal quantity required, produces a still greater loss in resistance to folding, differences of 52 and 78·5 per cent. being shown between the folding qualities of normally bleached and over-bleached pulps ; the tensile strength is also materially affected by over-bleaching. The author proposes to utilise this result of over-bleaching for the manufacture of specially soft, opaque papers having a cotton-like character, by bleaching with about 2 per cent. excess of bleaching powder and raising the temperature slightly above the safe limit in order to promote its action. The weakening of the fibre, owing to the formation of oxycellulose, enables this particular type of soft paper to be easily manufactured. Where great resistance to folding is desired the digestion of the pulp should be stopped at an earlier stage than usual and bleaching only carried to a "three-quarters white."—J. F. B.

Maize starch in paper manufacture ; Application of ——. H. Wrede. Papier-Zeit., 1913 ; through Z. Spiritusind., 1913, **36**, 467.

For the engine-sizing of writing and printing papers the author recommends a mixture of starch and water-glass heated with water until incipient thickening occurs. When starch paste alone is treated with alum, it is not completely precipitated and when sodium silicate is treated with alum the precipitate, on drying, is readily friable. On the other hand, the compound paste of starch and silicate (see this J., 1912, 381), when treated with alum, gives a gelatinous precipitate enclosing the whole of the starch, and this precipitate dries to a horny mass. For writing papers, 20—30 kilos. of starch are swollen with 6—9 kilos. of water-glass ; for printing papers 20—30 kilos. of water-glass are employed with the same quantity of starch ; these amounts are heated with about 130 litres of water. For writing papers, it is necessary to employ a certain proportion of rosin size in addition to the starch-silicate paste. As a filling material for papers and boards the starch may be heated with water alone just to the point at which a few of the granules are burst, whilst the rest remain whole. As substitutes for glue in tub-sizing, special soluble (modified) starches are recommended. The solution is prepared by boiling a 5—7 per cent. suspension of starch in water until it becomes clear; this is mixed, to the extent of about one-third, with the usual glue and alum solution. Soluble starch is also employed as a total or partial substitute for casein in the preparation of surface-coated "art" papers. Ordinary and modified starches, also a form of starch soluble in cold water ("amidex"), are employed as adhesives in the manufacture of paste boards.—J. F. B.

Patents.

Wood-pulp, papier-maché or mixtures of wood-pulp and other fibrous material; Treating [impregnating] slabs and objects of ——. J. Feldschmid, Vienna. Eng. Pat. 3403, Feb. 10, 1913.

The slabs or articles are immersed for a few minutes in a boiling mixture of boiled oil and Syrian bitumen with an addition of about 10 per cent. of driers; then immediately dried at 100°—125° C. for at least 24 hours and pressed whilst warm. The proportions of boiled oil to bitumen may vary from 2 : 1 to 1 : 2, according to the degree of hardness required; a portion of the bitumen, up to one-half, may be replaced by colophony.—J. F. B.

Xyloline or textilose yarn or goods made thereof; Manufacture or treatment [softening] of ——. E. Claviez, Adorf in Vogtland, Germany. Eng. Pat. 11,000, May 9, 1913.

Yarn or fabrics of xyloline or textilose made from soda-cellulose papers are treated in a bath containing agents which dissolve the size from the paper and so make the goods softer and more voluminous; at the same time bleaching agents may be applied to improve the colour. A suitable bath for both purposes is composed of Castille soap, 500 grms.; calcined sodium carbonate, 200 grms., and barium sulphate, 500 grms., or china clay, 1 kilo. The goods are treated in the warm bath for 15—45 minutes, rinsed, wrung out, dried, calendered damp and then dried.—J. F. B.

Viscose; Production of artificial objects from ——. B. Borzykowski, Charlottenburg, Germany. Eng. Pat. 12,090, May 23, 1913. Under Int. Conv., Dec. 21, 1912.

Articles or threads are manufactured from viscose by coagulation in neutral or acid saline solutions containing in addition an organic nitroso-base, *e.g.*, *p*-nitrosodimethyl-(or diethyl-) aniline or their salts and subsequently treating the coagulated product with a weak alkaline solution, *e.g.*, sodium sulphide. A suitable precipitating bath consists of 100 parts of water containing 15 parts of sodium chloride, 10 parts of ammonium sulphate and 0·5 part of *p* nitrosodimethylaniline, the last being previously dissolved in sulphuric acid. The coagulated threads are transferred to a spool rotating in a solution containing 10 parts of ammonium sulphate and 0·5 part of sodium sulphide in 100 of water, heated at 60°—70° C.—J. F. B.

Acetylcellulose; Treatment of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin, and A. Loose, Hermsdorf, Germany. Eng. Pat. 2178, Jan. 27, 1913. Addition to Eng. Pat. 27,227, Nov. 26, 1912.

See Addition of Jan. 16, 1913, to Fr. Pat. 452,374 of 1912; this J., 1913, 784.—T. F. B.

Artificial lustrous threads, bands, and filaments; Process of manufacturing ——. F. Dietler, Assignor to Verein. Kunstseidefabriken A.-G., Kelsterbach on Maine, Germany. U.S. Pat. 1,073,891, Sept. 23, 1913.

See Fr. Pat. 438,718 of 1911; this J., 1912, 584.—T. F. B.

Cellulose esters; Articles composed of ——. H. S. Mork, Assignor to Chemical Products Co., Boston. U.S. Pat. 1,074,092, Sept. 23, 1913.

See Fr. Pat. 416,752 of 1910: this J., 1910, 1371.—T. F. B.

Water softening material from sulphate lyes. Eng. Pat. 9867. *See* XIXb.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing of silk with basic dyestuffs; Quantitative investigation of the ——. H. Salvaterra. J. prakt. Chem., 1913, **88**, 502—504.

Taking a series of closely related dyestuffs and dyeing them on silk under exactly the same conditions, the author finds that the amounts of colour taken up vary in the same manner as the molecular weights of the colour bases. This supports the theory of salt formation between the colour base and the silk. The following triphenylmethane dyestuffs were employed: *p*-Fuchsin, Fuchsin, New Fuchsin, Crystal Violet and New Solid Green 3B. The amount of dyestuff taken up was estimated by titrating the bath with titanous chloride before and after dyeing.—J. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Acetic acid; Displacement of —— *from solutions of its salts by carbon dioxide at high pressure.* W. Ipatiew. J. Russ. Phys.-Chem. Soc., 1913, **45**, 992—994.

The author has investigated the action of carbon dioxide under a pressure of 50 atmospheres on aqueous solutions of various acetates, both at the ordinary temperature and at 90° C. With a 12 per cent. solution of calcium acetate, crystalline calcium carbonate was precipitated in some cases but not in others; in one instance, 1 grm. of the carbonate was obtained from 50 c.c. of the acetate solution after 7 days at 90° C. In a similar manner barium acetate yields the carbonate and copper acetate the basic carbonate, $CuCO_3,Cu(OH)_2,H_2O$, but no precipitate was obtained from nickel acetate, even after several months.—T. H. P.

Nitrous acid; Simple method for the detection of —— *in presence of nitric acid.* A. Leclère. J. Pharm. Chim., 1913, **8**, 299.

Nitrous acid is liberated from its salts by the addition of a syrupy solution of citric acid, and detected by the formation of the brown ring at the surface of contact of a superimposed ferrous sulphate solution. Nitrates not being decomposed by citric acid do not respond to the test. —C. F. M.

Oxidation of nitrogen; Influence of various conditions on the —— *in the voltaic arc.* A. Saposchnikov, A. Goudima and V. Koutovski. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1076—1091.

Experiments with an arc passing between carbon electrodes show that, as the air-supply V (cub. metres per hour) is increased, the ratio of V to the power consumed, KW, also increases. The yield of nitric acid per kilowatt-hour at first increases to a maximum of 65·3 grms. for V : KW = about 1, then diminishes somewhat and finally increases again to 78 grms. per kilowatt-hour for a value 1·90 of the ratio V : KW. With both dry air and air saturated with moisture, the percentage of nitric oxide in the issuing gases increases to a maximum and then decreases as the air-supply is increased, but the moist air gives the higher yields in all cases, the difference in yield diminishing as the air-supply increases. Carbon electrodes are preferred. They give a very constant arc, require no cooling arrangement and allow of the ready introduction into the arc of extraneous substances; they burn away rapidly unless coated electrolytically with nickel, for instance. Of metallic electrodes, copper are the best, whilst platinum ones are not recommended. —T. H. P.

Nitric oxide; Action of finely-divided nickel on ——. R. S. Felgate. Chem. News, 1913, **108**, 178.

Nitric oxide was circulated through hot water containing, in suspension, finely-divided nickel prepared by reducing the dry precipitated hydroxide by hydrogen. The nickel was rapidly oxidised and nitrogen was formed. Colloidal nickel prepared by Bredig's method of electrical disintegration failed to produce a similar result.—A. S.

Kelp and other sources of potash. F. K. Cameron. J. Franklin Inst., 1913, **176**, 347—383.

A REVIEW of the prospects of the commercial production of potassium salts in the United States. The sources likely to prove of most importance are alurite (this J., 1912, 488, 1088), a deposit in California (this J., 1912, 431), felspar when used as a raw material for cement manufacture, the potash being recovered in the flue dust (this J., 1912, 1077), and kelp (this J., 1912, 227, 1177).—A. S.

Mercuric chloride; Reduction of —— by sodium formate. A. Findlay and M. J. P. Davies. Chem. Soc. Trans., 1913, **103**, 1550—1554.

LIEBEN (this J., 1894, 288) showed that the determination of formic acid and formates by reduction of mercuric chloride (Scala, this J., 1893, 69) is accurate only if five or six times the theoretical quantity of mercuric chloride be employed and the mixture heated for 6—8 hours on the water-bath. The complete reaction is represented by the equation: $2HgCl_2+HCO_2Na=2HgCl+NaCl+HCl+CO_2$, but determinations of the velocity of the reaction showed that it is bimolecular, and hence it must take place in stages.—A. S.

Mercuric oxide; Dissociation of ——. G. B. Taylor and G. A. Hulett. J. of Phys. Chem., 1913, **17**, 565—591.

THE decomposition of mercuric oxide is catalysed by platinum and certain metallic oxides (ferric oxide, cadmium oxide and manganese dioxide). Platinum occludes both mercury and oxygen so it cannot be used for quantitative experiments, but by using the metallic oxides as catalysts, the authors have been able to obtain measurements of the dissociation pressure of mercuric oxide at temperatures from 360° to 480° C., with the following results: 360° C., 30 mm.; 400° C., 77 mm.; 440° C., 214 mm.; 480° C., 527 mm. It can be calculated that the oxygen pressure at 200° C. would be 0·1 mm. and at 25° C. about $1·9\times10^{-8}$ mm., showing that the oxide is perfectly stable in the presence of a little mercury in air at these temperatures. Mercury can oxidise under atmospheric conditions, and the formation of oxide is merely a question of reaction velocity which is evidently markedly affected by catalysts. This fact is of importance in considering the "tailing" of mercury used for experimental purposes. The dissociation pressure of the yellow oxide is identical with that of the red form.—W. H. P.

Sulphur monochloride; Action of —— on certain minerals. H. S. Lukens. J. Amer. Chem. Soc., 1913, **35**, 1464—1469.

FINELY ground samples of the minerals, contained in a silica boat, were heated to temperatures up to 750° C. in a current of sulphur monochloride vapour. Of the minerals tried, viz., felspar, garnet, garnet (pyrope), zircon, sphene, tourmaline, hornblende, pyroxene, spinel, rhodonite, and pyromorphite, only those containing a considerable amount of elements of which the chlorides are volatile in sulphur monochloride vapour were acted upon to a notable extent. Garnet (pyrope), sphene, and pyromorphite were completely decomposed at 700° C., 550°—600° C., and 550° C. respectively. Iron was completely removed from zircon by heating in sulphur monochloride vapour at 700° C., and the method could be used for preparing pure zirconia from the mineral.—A. S.

Scandium in American wolframite. H. S. Lukens. J. Amer. Chem. Soc., 1913, **35**, 1470—1472.

MEYER (this J., 1909, 108, 543; 1910, 1008; 1912, 720; see also Crookes, this J., 1910, 1055) has shown that wolframite residues from the Zinnwald contained sufficient scandium to make them a productive source of this element. The author, following Meyer's methods, has succeeded in isolating pure scandium oxide from American wolframite residues from Colorado. About 1·6 grms. of crude scandium oxide were obtained from 3·2 kilos. of the residues.—A. S.

Radium and mesothorium; Application of calcium hydride to the "autogenous reduction" of "crude sulphates" in the preparation of ——. E. Ebler and W. Bender. Z. anorg. Chem., 1913, **83**, 149—158. (Compare Ebler; this J., 1913, 867.)

AN intimate mixture of the dry and very finely powdered "crude sulphates" with calcium hydride is pressed into a crucible and kindled as in the aluminothermic method (see this J., 1913, 789). The reaction occupies a few minutes, and the cooled product is finely powdered and introduced in portions, without delay, into hot dilute hydrochloric acid, the resulting hydrogen sulphide being expelled by boiling as quickly as possible. Any lead present remains insoluble as sulphide, together with silica, whilst barium, radium, calcium, and iron dissolve as chlorides. The whole of the radium is then separated as pure radium barium chloride by evaporating, if necessary, and treating with hydrogen chloride gas until about three-quarters of the barium has deposited (this J., 1913, 656). A total recovery of 75—86 per cent. of the radium is effected. Sufficient calcium hydride is employed to reduce the sulphates present, in accordance with the equation: $MeSO_4+4CaH_2=MeS+4CaO+4H_2$, a slight excess being allowed in the presence of much silica, which is attacked to a small extent. The reduction of the sulphates is very complete; it is probably brought about by the vapour of a hydride, CaH, more volatile than metallic calcium or the hydride, CaH_2 (Moldenhauer and Roll-Hansen; this J., 1913, 789).—F. SODN.

Hydrazine and its inorganic derivatives. I. Hydrazine nitrite and its decomposition products. F. Sommer. Z. anorg. Chem., 1913, **83**, 119—137.

NORMAL hydrazine nitrite, $N_2H_5NO_2$, has been prepared by the interaction of barium nitrite and normal hydrazine sulphate in ice-cold solution; it is a deliquescent crystalline solid which explodes on percussion and decomposes vigorously, but not explosively, when suddenly heated to 500° C. The decomposition of this compound does not follow the course indicated by Dey and Sen (this J., 1911, 1011), but proceeds in accordance with the equation: $N_2H_5NO_2=NH_3+N_2O+H_2O$. The reaction is catalytically accelerated by nitrous acid, in an enormous degree, and attempts to isolate the bisnitrite, $N_2H_6(NO_2)_2$, have failed. The bisnitrite yields a variable mixture of nitrous oxide and nitrogen, owing to the secondary formation and decomposition of some ammonium nitrite, and the method of Dey and Sen for the determination of nitrites (*loc. cit.*) is, therefore, incapable of giving accurate results; especially so since azoimide is also produced under the suggested conditions. Hydrazine may be determined in the presence of nitrous acid by titrating with iodine after adding bicarbonate, and the amount of nitrous acid may then be found by introducing potassium iodide, displacing oxygen by carbon dioxide, adding dilute sulphuric acid, and titrating with thiosulphate. The detection of nitrate in the presence of nitrite (Sen and Dey; this J., 1912, 205) gives reliable results only when, after destroying the nitrite, the excess of hydrazine is removed (*e.g.*, by permanganate in sulphuric acid solution) before testing with diphenylamine. Hydrazine nitrite is less stable than ammonium nitrite, but the reverse is true of their aqueous solutions, since, with the former, the ammonia produced by decomposition hinders the production of nitrous acid by hydrolysis. Normal hydrazine sulphate, $(N_2H_5)_2SO_4,H_2O$, has been prepared as a crystalline salt, perfectly stable in the air; contrary to previous statements, it forms well-defined alums. (See also Hodgkinson, this J., 1913, 519).—F. SODN.

Iron pentacarbonyl. A. Stoffel. Het Gas, 1913, 5, 193—198. Wasser und Gas 1913, 4, 21—22.

THE velocity of formation of iron carbonyl diminishes rapidly as the temperature rises above 40°—60° C. and very rapidly with diminution in partial pressure of the carbon monoxide. A small amount of carbon bisulphide in the carbon monoxide has a great retarding effect on the formation, and the presence of oxygen forms a coating of oxide and gradually renders the iron inactive. In addition to this the carbonyl itself forms a film on the iron which is not permeable to carbon monoxide, so that there is very little danger of the small amount of carbon monoxide in illuminating gas having any appreciable effect on iron distributing pipes. (See also this J., 1911, 1380.)—W. H. P.

Carbon ; Oxidation of —— at moderate temperatures. K. A. Hofmann, K. Schumpelt and K. Ritter. Ber., 1913, **46**, 2854—2864.

Amorphous carbon is readily attacked by a sodium chlorate solution which has been rendered active by a little osmium tetroxide. The reaction proceeds at 100° C., yielding carbon dioxide, mellogen and mellitic acid. It is accelerated by the addition of 1 per cent. of acetic acid or of mono-sodium phosphate. With sugar charcoal about 70 per cent. of the theoretical quantity of carbon dioxide is evolved along with appreciable quantities of carbon monoxide and formic acid. Calcium hypochlorite (Griesheim) in dilute aqueous solution also attacks amorphous carbon with similar results, and the evolution of carbon dioxide and steam is so violent that the authors suggest that it may be used as a source of mechanical power. Diamond is also attacked by the hypochlorite, yielding a white suspensoid. Amorphous carbon is readily attacked by caustic soda at 120°—150° C. in the presence of air yielding dark brown or red colloidal substances, then formate and oxalate and finally carbonate. Apart from certain differences in the initial velocities of reaction, all the various forms of amorphous carbon exhibit similar behaviour.—W. H. P.

Patents.

Salt ; Apparatus for dissolving —— and filtering or straining the solution. R. W. Curry, London. Eng. Pats. 20,066, Sept. 3, 1912 and 4682, Feb. 24, 1913.

An open barrel contains a detachable, perforated, earthenware diaphragm covered by a filtering cloth, and a draw-off tap below the diaphragm for the delivery of the filtered brine.—O. R.

Ammonium sulphite in solution ; Process of oxidising ——. E. Collett, Christiania, Norway. Eng. Pat. 3123, Feb. 6, 1913. Under Int. Conv., Feb. 6, 1912.

Ammonium sulphite solution is treated with oxidising gases in a tower, the oxidising gases and the liquor both traversing the tower in the same direction.—O. R.

Ammonium sulphate ; Production of ——. T. H. Easterfield, Wellington, New Zealand. U.S. Pat. 1,072,840, Sept. 9, 1913.

Ammoniacal liquor containing ammonium carbonate is treated alternately with calcium sulphate and with gases containing ammonia and carbon dioxide, the calcium carbonate precipitated after the first operation, being removed before proceeding with the second.—O. R.

Hydrosulphites ; Electrolytic production of ——. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 13,901, June 16, 1913. Under Int. Conv., July 6, 1912.

A solution of a bisulphite, to which a neutral salt, such as a sulphite, chloride, or sulphate has been added, is electrolysed at a low temperature, preferably below 15° C. Sulphur dioxide may be introduced into the cathode liquid at a rate corresponding with the reduction of the bisulphite, and the process may be made continuous by circulating the liquor through a supply tank and a number of electrolytic cells, the bisulphite consumed being regenerated as above, and the electrolysis continued until the liquor contains the desired proportion of hydrosulphite. To prevent losses of sulphite and hydrosulphite by migration of ions, it is advantageous to produce a flow of liquid through the diaphragms towards the cathodes.—O. R.

[Nitric oxide ; Production of ——, from atmospheric air.] Chemical reaction by means of an electric arc. J. L. R. Hayden, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,066,272, July 1, 1913.

In a process primarily intended for the production of nitric oxide from atmospheric air, the gaseous mixture (air) is caused to pass rapidly through an electric arc in a direction parallel to that of the arc stream, one of the two electrodes being hollow and provided with a funnel-shaped extremity through which the gaseous stream is passed (by suction or pressure) into a cooling-pipe (to prevent reversal of the reaction) and thence into a series of absorption chambers. By this means, it is claimed, a current of low voltage (50—150) may be employed and a high efficiency obtained.—W. E. F. P.

Potash salts from felspar ; Process of obtaining ——. H. P. Bassett, Assignor to The Spar Chemical Co., Baltimore, Md. U.S. Pat. 1,072,686, Sept. 9, 1913.

One part by weight of sodium chloride and two parts of felspar are heated to a yellow heat in the presence of air but without the addition of any calcium compound ; the hot mass is treated with water and potassium salts are recovered from the solution.—O. R.

Granular carbon ; Preparation of ——. J. C. Lee, Brookline, Mass. U.S. Pat. 1,071,442, Aug. 26, 1913.

An upper and a lower chamber are connected by a relatively narrow throat containing electrodes adapted to cause an electric current to act upon the carbon as it passes from the upper to the lower chamber, the length of time during which it is subject to the current being dependent upon the rate at which the granular carbon is discharged from an opening in the lower chamber.—H. H.

Sulphuretted hydrogen ; Process for the production of ——. W. A. Hall, New York. Eng. Pat. 20,757, Sept. 11, 1912. Under Int. Conv., June 4, 1912.

See Fr. Pat. 455,905 of 1912 ; this J., 1913, 943.—T. F. B.

Sulphurous acid ; Manufacture of ——. L. Nonnet, Brussels. Eng. Pat. 26,999, Nov. 23, 1912.

See Fr. Pat. 450,804 of 1912 ; this J., 1913, 602.—T. F. B.

Sulphate of ammonia from ammoniacal gases or vapours ; Process of producing ——. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 1,073,247, Sept. 16, 1913.

See Eng. Pat. 834 of 1913 ; this J., 1913. 791.—T. F. B.

Metallic salts ; Deposition of —— from solutions containing them. H. J. Rees, Llansamlet, Glamorgan. U.S. Pat. 1,073,363, Sept. 16, 1913.

See Eng. Pat. 25,919 of 1911 ; this J., 1913, 30.—T. F. B.

Fluorescent substances [basic zinc silicate] ; Process for the manufacture of ——. G. Rupprecht, Hamburg, Germany. U.S. Pat. 1,073,932, Sept. 23, 1913.

See Fr. Pat. 437,746 of 1911 ; this J., 1912, 535.—T. F. B.

Removing hydrogen sulphide from gases using alkali solutions as absorbents. Ger. Pat. 263,593. *See* IIa.

VIII.—GLASS ; CERAMICS.

Glass ; Contribution towards a bibliography of the art of ——. II. M. L. Solon. Trans. Eng. Ceram. Soc., 1913, **12**, 285—324. (See this J., 1913, 487.)

The present instalment deals with the technology, description and reproduction of painted and stained glass. —H. H. S.

Firebricks ; Specific heats of —— at high temperatures. S. T. Wilson, A. D. Holdcroft and J. W. Mellor. Trans. Eng. Ceram. Soc., 1913, **12**, 279—284.

The assumption of a constant 0·2 for specific heat in calculating the efficiency of ovens is not justified except over a narrow range of temperature. Glaser's electric furnace (Metallurgie, 1904, **1**, 105) for specific heats was used, and the data are summarised in the formula: mean specific heat $=0\cdot193+0\cdot00006t$. It is deduced from measurements that of 100 tons of coal consumed in firing a china biscuit oven, only 1·5 tons go to raising the temperature of the ware.—H. H. S.

Chromium red glaze; Study of ——. C. E. Ramsden. Trans. Eng. Ceram. Soc., 1913, **12**, 239—260.

Previous papers (see this J., 1912, 386 and 1913, 195) were concerned with the production of the most stable calcined stain of strong colouring power. The present communication deals with the best glaze, maturing at the desired temperature, which will develop and display the tint imparted by the stain. The presence of lime is essential to prevent decomposition of stain by glaze. Though excess of lime over 0·2 CaO is unnecessary, its content should never drop below 0·1 CaO. The basic oxides should consist largely of lead oxide, which helps to form a translucent yellow glass imparting a blood-red tint to the crimson stain. A small amount of alkali oxide is useful to produce translucency, but the proportion $R_2O:RO$ should not be greater than 1 : 4; the stain is soluble in alkaline silicates and borates; both potash and soda impart a violet or lilac tint. Alumina destroys the crimson colour if in greater proportion than 0·3 Al_2O_3. If not fritted with the glaze mixture, as much as 0·5 Al_2O_3 may be introduced to obtain a pink; any excess over 0·1 Al_2O_3 diminishes the red tint. Boric acid imparts translucency while possessing only a slight tendency to communicate a lilac shade; the most favourable quantity appears to be equimolecular with the lime content, the greater the lime the more boric acid being possible without attacking the stain. Zinc oxide brightens the surface, and may be introduced up to half the molecular content of lime. More than 0·3 BaO destroys the colour; 0·5 SrO impairs the tint; magnesia should be excluded entirely. Silica may vary from 1·5 to 2 equivs., according to the time and temperature of firing; glazes rich in silica tend to acquire a green tint. The author arranges oxides into two classes, according to their influence on the crimson glaze at cone 05 and in the order of their apparent effect on the colour, beginning with that having the greatest effect: *Favourable*—CaO, Bi_2O_3, PbO, B_2O_3, SiO_2, Na_2O, K_2O, Al_2O_5; *Injurious*—Sb_2O_3, MgO, P_2O_5, SrO, ZnO, BaO, Al_2O_3.—H. H. S.

Chrome-red glazes. A. Heubach. Sprechsaal, 1913, **46**, 597—599.

The basic portion was kept constant at 0·9 PbO, 0·1 CaO, reference being made to the previous work of Berge (this J., 1911, 1254) and of Büttner (J., 1911, 1386). Of each glaze, trials were fired at cones 010, 06 and 02. The glaze of composition: 0·9 PbO, 0·1 CaO, 0·3 Al_2O_3, 0·7 SiO_2, 0·05 Cr_2O_3, gave the best results at the highest temperature, cone 02, and was used for further trials in which the proportions of alumina and chromic oxide were varied. These resulted in the production of crystalline chrome-red glazes when the Cr_2O_3 was 0·02 and Al_2O_3 0·2—0·3. Büttner's statement that metallic lead separates out in glazes rich in alumina is not confirmed.—H. H. S.

Patents.

Refractory bodies required to withstand high temperatures. C. D. McCourt and Radiant Heating, Ltd., London, and R. Schnabel, Berlin. Eng. Pat. 21,345, Sept. 19, 1912.

A metallic skeleton of wire, wire gauze or netting, expanded metal or the like, constructed, for example, of iron or nickel, is formed into the shape of the refractory body desired, and then coated, plastered or otherwise covered with refractory material, consisting of a mixture of say 50 to 85 per cent. of finely ground bauxite, previously fused in an electric furnace, and 50 to 15 per cent. of unburnt, plastic fireclay, or with a mixture of finely ground burnt fireclay and unburnt fireclay.—W. C. H.

Silicon article. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,073,560, Sept. 16, 1913.

Claim is made for a cast article composed mainly of silicon, substantially free from silicon dioxide and from nitrogenous and oxygenous impurities, of a fine crystalline structure, and of practically uniform density throughout its mass.—A. S.

IX.—BUILDING MATERIALS.

Portland cement; Gripping power ["*Einschliesskraft*"] *of* ——. H. Luftschitz. Tonind.-Zeit., 1913, **37**, 1491.

The setting of Portland cement is assumed to be due to the formation of a gel, which ultimately stiffens to a lime-aluminate-silicate mass and forms a close-fitting network around any embedded inert material. With concrete, such a network surrounding angular gravel or sand would be stronger than one enclosing rounded grains, and the strength attained with washed sand would be greater than with unwashed, since, in the latter case, the intervening layer of soft clay prevents the surrounding network from directly gripping the grains of sand. Similarly with ferroconcrete, rust is detrimental as preventing close contact between the iron and surrounding gel.—F. Sodn.

Patents.

Plaster-cement; Manufacture of ——. W. Brothers, Whaley Bridge, Derby. Eng. Pat. 20,789, Sept. 12, 1912.

Calcium sulphate (gypsum) is heated with steam in a closed vessel at a pressure of about 100 lb. per sq. in. and a temperature of 328° F. (164° C.) with the production of a hard-setting plaster-cement. The apparatus used is the same as is described in Eng. Pat. 5853 of 1904 (this J., 1905, 443).—O. R.

Slag cement; Process for preparing ——. J. Elsner. Ger. Pat. 263,179, Sept. 7, 1911. Addition to Ger. Pat. 250,433.

Slag is finely ground and sifted, and mixed with an aqueous solution of a "contact salt" (*e.g.*, an alkali chloride, or an aluminium or magnesium salt), the amount of salt used being about 3 per cent. The pulp is then introduced into the kiln and burnt with a current of air at a temperature not exceeding 1000° C. When using highly sulphurous slags, steam may be introduced towards the end of the burning process to assist the removal of the sulphur.—T. F. B.

[*Concrete.*] *Transparent waterproofing.* A. C. Horn, New York. U.S. Pat. 1,073,129, Sept. 16, 1913.

Claim is made for a shaped mass of concrete or other masonry, a portion at least of the surface of which is coated with a continuous layer of a transparent waterproofing medium composed of aluminium stearate together with some "aluminium tungate." The appearance and porosity of the coated concrete are stated to be identical with those of ordinary concrete, but the coating being water-repellent, "the porous surface although seemingly of a capillary nature exerts no capillary action on water."—A. S.

Stone; Artificial —— *and the like.* W. Palmer, London. Eng. Pat. 21,161, Sept. 17, 1912.

A mixture of crushed shell (except mother of pearl) and cement (other than lime carbonate or lime sulphate waste) is formed into blocks of artificial stone, or may be used as a coating on a bed or core of Portland or other cement.
—W. C. H.

Wood; Process of bleaching ——. A. Franck-Philipson, Jackson, Mich., Assignor to Franck-Philipson and Co., Chicago, Ill. U.S. Pat. 1,068,580, July 29, 1913.

Wood is treated in a bleaching bath composed of water, 40 parts, 8-vol. hydrogen peroxide, 8 parts; dilute sodium silicate (1 : 3) 1 part, which is allowed to act, with moderate heating until the surface of the wood is penetrated and partially bleached. The formation of nascent oxygen is then accelerated by adding in small portions at a time one part of a 2 per cent. solution of potassium permanganate. The rate of liberation of oxygen and its influence on the wood is governed by the rate at which the permanganate solution is added. If desired, an excess of permanganate may be added continuously and the wood withdrawn before the action of the permanganate on the peroxide is complete, so that the formation of oxygen takes place outside the solution.—J. F. B.

Artificial stone ; Process of making ——. M. Hartung, Berlin. Eng. Pat. 13,564, June 10, 1912.

See Fr. Pat. 437,662 of 1911 ; this J., 1912, 538.—T. F. B.

Building cement ; Manufacture of ——. A. G. Bloxam, London. From H. F. Boersma, The Hague. Eng. Pat. 24,035, Oct. 21, 1912.

See Fr. Pat. 449,642 of 1912 ; this J., 1913, 489. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 12,353 of 1906 and 24,775 of 1911.—T. F. B.

Acid- and fire-proof bodies consisting of pure silicic anhydride ; Process of manufacturing ——. I. Schlossberg, Hamburg, Germany. Eng. Pat. 6949, March 20, 1913.

See Ger. Pat. 258,683 of 1911 ; this J., 1913, 605.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Copper precipitate ; Electrolytic refining of ——. W. F. Burns. Min. and Eng. World, Sept. 13, 1913, 469—470.

Anodes obtained by smelting copper precipitate in a reverberatory refining furnace average 99·4 per cent. Cu and 0·40 per cent. As+Sb ; the slag amounting to 46 per cent. of the charge and containing 16·86 per cent. Cu. Notwithstanding the high arsenic content of anodes and electrolyte (the latter being used until it contains 55 grms. As per litre) the resulting metal contains 0·003 per cent. As+Sb and is of wire-bar grade when using a current of 17—18 amp. per sq. ft. ; with a current density of 33—35 amp. a metal of 99·85 per cent. Cu and 0·006 per cent. As+Sb is obtained.—W. R. S.

Copper-antimony equilibrium : The ——. H. C. H. Carpenter. Int. Zeits. Metallog., 1913, 4, 300—322.

Although a considerable amount of work has been done on the alloys of copper and antimony (see this J., 1897, 506, 615 ; 1898, 1111 ; 1903, 744 ; 1904, 986), doubt exists as to the degree of mutual solubility of the two metals and the equilibrium conditions in alloys containing Cu 65—80 atoms per cent. The author's results differ in some important respects from those of Baikow (this J., 1903, 744 ; 1904, 986). The two eutectic points of the equilibrium diagram are at 646° C. (82·5 atoms per cent. Cu) and 530° C. (65 atoms per cent. Cu). There are five constituents, but one (β) exists only above 430° C., and undergoes a polymorphic transformation into γ at 450°—430° C. The boundaries of the phase fields and the nature of the constituents of the alloys, after annealing at 400° C., are shown in the following table :—

Constituent.	Constitution.	Colour.	Atomic percentage of copper.
α	Solid solution of Cu_3Sb in copper ..	Golden brown	100—96
$\alpha+\gamma$	——	——	96—81
γ	Mainly Cu_3Sb	Greenish grey	81—75
$\gamma+\delta$	——	——	75—66·6
δ	Cu_2Sb	Purple lilac	66·6
$\delta+\epsilon$	——	——	66·6 to about 1
ϵ	Nearly pure antimony..	White	Not more than 1

—A. S.

Bearing metals ; Electro-analysis of white ——. I. Compagno. Atti R. Accad. dei Lincei, Roma, 1913, 22, II., 221—223.

One grm. of the alloy is treated with 20 c.c. of nitric acid of sp. gr. 1·4, the solution diluted to 80—90 c.c., and the metastannic and metantimonic acids filtered off, and washed. The filtered solution is concentrated to 200 c.c. and should remain clear, otherwise the filtration must be repeated. Copper, lead, arsenic, iron, zinc, etc. in the solution are determined by known methods. The metastannic and metantimonic acids are removed from the filter, and dissolved by addition of a slight excess of sodium hydroxide, 80 c.c. of sodium monosulphide solution (sp. gr. 1·225) and about 0·5 grm. of potassium cyanide, the latter being for the purpose of keeping in solution the small quantity of copper always retained by the precipitate. After boiling for a few minutes the antimony (and copper) is deposited electrolytically (see this J., 1912, 495) ; the deposit is dissolved in dilute nitric acid containing tartaric acid, the solution evaporated, the residue treated with water and then with caustic soda, Rochelle salt, and dextrose, and the precipitated cuprous oxide separated, dissolved in nitric acid, and the copper determined electrolytically : the antimony is then obtained by difference. The liquid left after deposition of the antimony is heated to boiling and 120 c.c. of hydrochloric acid of sp. gr. 1·19 added gradually. After the tin sulphide is completely decomposed, the solution is concentrated, heated for a few minutes with one or two drops of hydrogen peroxide, treated with 20 grms. of oxalic acid, diluted to 500 c.c., and the tin deposited electrolytically at 60°—65° C. A simple form of apparatus, with rotating anode, is described.—A. S.

Alloys ; Thermal investigations on the transformations of easily fusible —— *in the solid state.* D. Mazzotto. Int. Zeits. Metallog., 1913, 4, 273—296.

The results of quantitative experiments on the evolution of heat which certain easily fusible alloys exhibit during transformations in the solid state (compare Stoffel, this J., 1907, 472 ; Mazzotto, this J., 1911, 1065) are given. In the case of four tin alloys (Bi 1, Sn 1 part ; Bi 1, Sn 4 ; Pb 2, Sn 1 ; and Sn 3, Tl 2 parts by weight), the phenomenon can be explained as being due to the separation of one component from a solid solution saturated at the eutectic temperature, the solution becoming supersaturated as it cools and separation taking place at a lower temperature. β-Tin has a lower solvent power than γ-tin for other metals, and the β-γ-transformation of tin is regarded as playing an important part in causing the phenomenon. In the case of the alloy Sn 1, Cd 1 part by weight, the effect is localised to a small temperature interval and is influenced but little by thermal treatment. This may be due to the solid solution not becoming supersaturated until the moment of the β-γ-tin transformation. The maximum heat evolutions observed were : Bi 1, Sn 1 part, 0·99 Cal. per kilo. ; Bi 1, Sn 4, 1·14 Cals. ; Pb 2, Sn 1, 1·87 Cals ; Sn 3, Tl 2, 1·47 Cals. ; and Sn 1, Cd 1 part, 1·16 Cals. per kilo. No evolution of heat after solidification could be observed with the alloys Bi 2·7, Tl 1 part ; Sn 2, Zn 3 ; Sn 3, Zn 2, and Bi 1, Pb 1 part by weight. —A. S.

Platinum ; Effect of ultra-violet light upon the catalytic activity of colloidal ——. C. J. Farmer and F. Parker, jun. J. Amer. Chem. Soc., 1913, 35, 1524—1527.

The catalytic activity towards hydrogen peroxide of colloidal platinum solution, prepared by Bredig's method of electrical disintegration, is increased by a short exposure to ultra-violet light (from a mercury vapour lamp), but is completely destroyed by a more prolonged exposure (varying according to the depth of the layer of liquid exposed to the light), the platinum being deposited as a black flocculent precipitate.—A. S.

Mercury ; Action of sulphides of the allyl group on lead amalgam and ——. *(Complete purification of mercury.)* M. N. Banerjee. Z. anorg. Chem., 1913, 83, 113—118.

Mercury is rendered entirely free from lead and other impurities by rubbing in a mortar with the juice of the garlic (*allium sativum*). The effect is due apparently to higher allyl sulphides; these convert any lead present into sulphide which adheres to the mortar.—F. Sodn.

Patents.

Cobalt, nickel, and silver; Process of treating ores and smelting products containing ——. Gebr. Borchers, Goslar am Harz, Germany. Eng. Pat. 18,276, Aug. 8, 1912. Under Int. Conv., Aug. 8, 1911.

Complex combinations of cobalt, nickel, and silver, are first treated with an alkali bisulphate at a temperature below 200° C., and then roasted at 600° to 700° C. in an oxidising atmosphere. The mass is allowed to cool, crushed if necessary, sprayed with sulphuric acid, and the treatment repeated until the metals have been sufficiently converted into soluble form. The mass is then drawn out of the furnace, allowed to cool, and lixiviated. Very refractory ores are first heated one or more times with carbon at below red heat, and in presence of enough air to burn the carbon. —T. St.

Metals; Electrolytic pickling of ——. P. Marino, London. Eng. Pat. 20,180, Sept. 4, 1912.

An electrolytic pickling bath particularly designed for iron or steel surfaces which are to be subsequently electroplated, is prepared by dissolving from one to three parts each of boron fluoride, potassium or sodium fluoride, and tin fluoride, in 100 parts of water and one to two parts of commercial hydrofluoric acid. The articles are first made to form the anode, and afterwards the cathode. A current density of 2 ampères per 15 sq. in., and 2 to 4 volts should be employed. As anodes the surfaces are freed from sand and films of oxide, and as cathodes they receive a firmly adhering coating of tin, which renders them suitable for subsequent treatment.—T. St.

Annealing furnaces. R. B. Thomas, Wimbledon, Surrey, and T. F. Davies, Abercarn, Mon. Eng. Pat. 22,144, Sept. 30, 1912.

The products of combustion from a fire-box are led into the annealing chamber (1) through openings at the fire-box end, and (2) through longitudinal and cross flues situated below the level of the floor of the chamber, by a series of openings in the floor, midway of the length of the chamber. The wall adjacent to the stack flue is provided with a number of "pigeon-hole"-like openings through which the hot gases pass out of the chamber. All the inlet and outlet holes are controlled by dampers, whereby the hot gases may be concentrated in any desired portion of the chamber.—T. St.

Furnace for annealing and tempering metals. C. J. Beaver, Hale, and E. A. Claremont, High Legh, Cheshire. Eng. Pat. 30,048, Dec. 31, 1912.

The annealing chamber is elongated and inclined downwards at both ends, the copper or other metal to be annealed being conveyed through the chamber by means of an endless band. Oxidation is prevented by keeping the chamber full of "steam or other non-oxidising gas." The outlet end is sealed by dipping into water or other suitable liquid, but the inlet end is open to the air, for convenience in feeding in the metal. The slight loss of steam by diffusion at the inlet end is made up by a slow stream fed into the chamber near the outlet end.—T. St.

Copper; Treatment of ——. J. Kich, Lyndora, Pa., U.S.A. Eng. Pat. 22,550, Oct. 3, 1912.

Very hard and dense copper is produced by melting about 81¼ parts of copper, and stirring in about 18¾ parts of a mixture, in equal proportions, of the following, finely ground and thoroughly mixed together:—"Welding compound," ferrous sulphate, powdered bones, ferrosilicon, potassium carbonate, and limestone. The "welding compound" consists of boric anhydride 50, iron oxide 15, sodium carbonate 15, and potassium carbonate 20 per cent. Other varieties of copper are obtained with (1), 87½ parts of copper and 12½ parts of a mixture of limestone 1, potassium carbonate 1, and ferrosilicon 2 parts; (2), 75 parts of copper and 25 parts of a mixture in equal proportions of "welding compound," ferrous sulphate, copper sulphate, ferrosilicon, potassium carbonate, limestone, ferromanganese, and yellow phosphorus; (3), 84¾ parts of copper and 15¼ parts of a mixture in equal proportions of ferrosilicon, potassium carbonate, yellow phosphorus, "welding compound," and limestone. —T. St.

Case-hardening materials; Method of preparing ——. H. Rodman, Edgewood, Pa., U.S.A. Eng. Pat. 8596, April 11, 1913.

Powdered carbonaceous matter, mixed with other materials, is moistened with a solution of molasses (or glucose or starch) in water, formed into small masses, and coked. The pebbles thus formed do not adhere to each other, and individually are structurally strong. The following mixtures are given:—(1), finely powdered coking coal 100, sodium carbonate 10, calcium carbonate 20 parts; (2), finely powdered coking coal 50, Portland cement 100, barium carbonate 20 parts. The second mixture, after wetting with molasses and water, is allowed to harden in large masses, which are then crushed and screened. Instead of using coking coal, dense molasses, asphaltum, or tar may be used with mixtures containing finely ground charcoal, to form both the initial and final bonds, as these materials coke when heated.—T. St.

Bullets and other projectiles. Kings Norton Metal Co., Ltd., T. A. Bayliss, and H. W. Brownsdon, London. Eng. Pat. 8820, April 15, 1913.

Bullets and the driving bands of projectiles are first roughened by sand-blasting, and then coated with a solution of sodium silicate in water containing kaolin powder in suspension. A hard cementitious coat is left on drying, which does not rub off on to the barrel of the fire-arm, nor prevent the projectile from taking the rifling. After the cement has dried on the bullets, these are given a protective coating of paraffin wax or shellac varnish. If in addition to the cement coating, the bullets receive a thin coating of a lubricant such as beeswax, the bores of rifles become, after continued firing, even more highly polished than a new barrel.—T. St.

Zinc oxide; Recovery of —— from zinciferous materials, especially slags. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 10,376, May 2, 1913. Under Int. Conv., May 6, 1912.

The zinciferous materials (slags from lead and copper furnaces, etc.) are melted in a cupola furnace on a layer of such materials as will cause or facilitate the liberation of zinc (carbon, lime, iron, etc.). The heating gases traverse the charge in a downward direction. The dezincing layer rests on a grate, which preferably consists of water-cooled pipes. The atmosphere is maintained as oxidising as possible, so that the heat required for reduction becomes practically nil, and separation of iron is prevented. Fuel may be added with the zinciferous materials, and air for its combustion introduced just above the dezincing layer. If, then, a part of the gases of combustion are led upwards, the charge becomes preheated before reaching the melting zone. In general working the methods are similar to those described in Eng. Pat. 5438 of 1913. (See also this J., 1913, 871.)—T. St.

[*Zinc, etc.*] *Ores; Furnace for smelting and refining* ——. W. M. Bowles and C. O. Allen, Shawnee, Okla. U.S. Pat. 1,073,468, Sept. 16, 1913.

The furnace is heated by a series of electric arcs, above which the ore is introduced, and communicates with an inclined condenser heated by means of an air-jacket. The condenser is provided with a screw conveyer by which the condensed product is scraped from the walls and discharged.—W. E. F. P.

Organic and inorganic materials; Process of treating ——. [*Preventing corrosion of metals.*] *Method of treating metals.* J. A. McLarty, Toronto, Canada. U.S. Pats. 1,072,751 and 1,073,076, Sept. 9, 1913.

(1) To harden, and prevent the corrosion of metals, these are subjected, in a closed vessel, to the action of the

gases and vapours evolved by heating, out of contact with air, a mixture including sawdust and crude petroleum, the mixture being also out of direct contact with the metals. (2) The metals are placed in a container capable of being closed, and, whilst maintained at a temperature below red heat, are exposed to the vapours formed by heating a mixture of water, an oily carbon compound, and a carbohydrate. After a period of such exposure, the vapours are ignited whilst still in contact with the metals, which are then left for a suitable time exposed to the gaseous products of the ignited vapours.—T. St.

Ores ; Process for treating ——. J. A. McLarty, Toronto, Canada. U.S. Pats. 1,072,752 and 1,072,753, Sept. 9, 1913.

(1) Ores and other substances containing metals are reduced by heating them to a temperature below red heat, out of contact with air, in a sealed container, and exposing them to the gases and vapours formed by heating a mixture of a hydrocarbon and a carbohydrate to a temperature materially below red heat, in a separate chamber. (2) The vapours and gases formed by heating a mixture of a hydrocarbon and a carbohydrate to about 100° C. are ignited, and the ore, which is contained, at a temperature materially below red heat, in a separate compartment, is treated with the products.—T. St.

Metals ; Electric deposition of ——, *by fusion.* A. P. Strohmenger, Assignor to Slaughter and Co., Ltd., London. U.S. Pat. 1,073,543, Sept. 16, 1913.

An electric arc is produced between the object under treatment and one end of a bar of the metal to be deposited ; the latter is coated with "insulating material adapted to form a slag when fused." The end of the bar from which the arc starts is pressed down upon the object during the passage of the current.—W. E. F. P.

Metallic alloy and method of its manufacture. H. O. Ormiston. Fr. Pat. 455,617, March 17, 1913. Under Int. Conv., Dec. 24, 1912.

Aluminium alloys possessing mechanical properties superior to those of aluminium, are prepared in the following manner: A mixture of borax 60, magnesium sulphate 5, copper sulphate 10, copper nitrate 7, mercury sulphate 1, cadmium sulphate 2, nickel sulphate 15 per cent., is heated in a crucible, and whilst ebullition is active, 3 parts of nickel and 3 of copper are added. When ebullition has ceased, Sn 3, Pb 1, and Al 90 parts, are added, and the mixture stirred. The alloy thus formed is the "stock" metal which is used as a basis for different alloys. Thus a soft, ductile alloy is obtained by melting together "stock" metal 20, Sn 9, Pb 2, Al 169 parts ; and a very hard alloy is obtained with "stock" metal 30, Cu 20, Al 50 parts. Another hard alloy is obtained by adding slowly to 100 parts of the above mixture of salts, during ebullition, Cu 5, and Ni 30 parts, and, when ebullition has ceased, adding Al 57, Sn 6, and Pb 2 parts. A solder suitable for use with these alloys is composed of one part of tinman's solder (Pb 66, Sn 34 per cent.) and two parts of one of the alloys described.—T. St.

Refractory metals and alloys ; Processes for the manufacture of articles of ——. P. Schwarzkopf, S. Burgstaller, and Wolfram-Laboratorium Dr. Ing. P. Schwarzkopf G. m. b. H., Berlin. Eng. Pat. 13,282, June 5, 1912.

See Fr. Pat. 448,229 of 1912 ; this J., 1913, 431.—T. F. B.

Gold alloys. A. G. Bloxam, London. From Dr. Richter und Co., Pforzheim, Germany. Eng. Pat. 21,164, Sept. 17, 1912.

See Fr. Pat. 448,407 of 1912 ; this J., 1913, 431.—T. F. B.

Sintering of metallurgical and similar products. J. Savelsberg, Papenburg, Germany. Eng. Pat. 24,565, Oct. 26, 1912. Under Int. Conv., Nov. 23, 1911.

See Fr. Pat. 449,896 of 1912 ; this J. 1913, 494.—T. F. B.

Casting ; Process of ——. H. Wade, London. From The Liquid Forged Steel Co., Cleveland, Ohio, U.S.A. Eng. Pat. 412, Jan. 6, 1913.

See U.S. Pat. 1,061,760 of 1913 ; this J., 1913, 662.—T. F. B.

Annealing apparatus. H. Hillebrand, jun., Werdohl, Germany. U.S. Pat. 1,073,235, Sept. 16, 1913.

See Ger. Pat. 257,716 of 1911 ; this J., 1913, 540.—T. F. B.

Electrolytes for use in the deposition of a metal or metallic alloy ; Process of preparing ——. P. Marino, London. U.S. Pat. 1,073,432, Sept. 16, 1913.

See Eng. Pat. 24,562 of 1911 ; this J., 1913, 93.—T. F. B.

Lead and zinc ; Process for the separation of ——. J. Babé, Honfleur, France. U.S. Pat. 1,073,461, Sept. 16, 1913.

See Fr. Pat. 428,707 of 1910 ; this J., 1911, 1167.—T. F. B.

Sulphide ores ; Process and apparatus for treating ——. E. E. Banes, Strathfield, N.S.W. U.S. Pat. 1,073,462, Sept. 16, 1913.

See Fr. Pat. 431,280 of 1911 ; this J., 1911, 1397.—T. F. B.

Sodium alloys ; Manufacture of ——. E. C. Rossiter, Birmingham, Assignor to The British Cyanides Co., Ltd., London. U.S. Pat. 1,073,523, Sept. 16, 1913.

See Eng. Pat. 14,254 of 1912 ; this J., 1913, 608.—T. F. B.

Siemens-Martin furnace. K. Albert, Wiesbaden, Germany. U.S. Pat. 1,073,653, Sept. 23, 1913.

See Fr. Pat. 451,797 of 1912 ; this J., 1913, 662.—T. F. B.

Crucible-furnace. H. Koch, Dietikon, Switzerland. U.S. Pat. 1,073,912, Sept. 23, 1912.

See Eng. Pat. 28,567 of 1911 ; this J., 1912, 994.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Influence of various conditions on the oxidation of nitrogen in the voltaic arc. Saposchnikow and others. *See* VII.

Electro-analysis of white bearing metals. Compagno. *See* X.

Electrolytic deposition of antimony. Chaney. *See* XXIII.

Patents.

Ozonisers. J. C. A. Henderson, London. Eng. Pat. 1156. Jan. 15, 1913.

The ozoniser is provided with an electrode composed of a sheet of expanded aluminium.—B. N.

Electrolysis of aqueous solutions. Ges. für Chemische Industrie in Basel, Basle, Switzerland. Eng. Pat. 11,872, May 21, 1913. Under Int. Conv., Dec. 9, 1912.

The cathode is enclosed in a comparatively narrow chamber constructed of a material permeable to the electrolyte, the upper part of the chamber being contracted. The escaping hydrogen produces on the surface of the electrolyte a froth consisting of bubbles of gas, enclosed in films of alkali, and the froth is delivered into a receiver in which the gas and alkali separate.—B. N.

Electrostatic separation of comminuted materials ; Progressive ——. H. M. Sutton, and W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 1,073,645, Sept. 23, 1913.

A device reciprocating across the normal path of the material is provided for establishing and subjecting the material to a series of electro-static fields of varying densities, with an arrangement for energising the reciprocating device during its movement in one direction, and de-energising in the reverse direction. The particles thus deviate from the line of normal movement according to their electrical susceptibilities, and are collected separately.—B. N.

Cell; Primary-battery ——. J. H. Gugler and G. W. Colles, Milwaukee, Wis. U.S. Pat. 1,073,677, Sept. 23, 1913.

The depolarising liquid contains a chlorate, and at or near the top of the liquid is a carrier of sheet metal with a perforated bottom, means being provided for raising and lowering the support. A quantity of fragmentary material rests on the carrier and supports a quantity of undissolved chlorate.—B. N.

Gases and vapours; Apparatus for the electrical treatment of ——. W. T. Hoofnagle, Glen Ridge, N.J., U.S.A. Eng. Pat. 20,950, Sept. 13, 1912.

See Fr. Pat. 448,519 of 1912; this J., 1913, 432.—T. F. B.

Synthesising gases; [Electrical] device for ——. W. Siebert, Rheinfelden, Assignor to Elektrochemische Werke G.m.b.H., Berlin. U.S. Pat. 1,073,823, Sept. 23, 1913.

See Addition of March 31, 1909, to Fr. Pat. 389,112 of 1908; this J., 1909, 1144.—T. F. B.

Ozone; Process of and apparatus for producing ——. J. Steynis, New York. Eng. Pat. 3769, Feb. 13, 1913. Under Int. Conv., Feb. 13, 1912.

See Fr. Pat. 451,484 of 1912; this J., 1913, 611.—T. F. B.

Electrolysis; Process of —— and apparatus therefor. K. S. Guiterman, New York. Eng. Pat. 8352, April 9, 1913.

See U.S. Pat. 1,062,966 of 1913; this J., 1913, 703.—T.F.B.

Electrolytic gases; Apparatus for the purification of ——. A. E. Knowles, Wolverhampton. U.S. Pat. 1,073,246, Sept. 16, 1913.

See Eng. Pat. 21,600 of 1911; this J., 1911, 1458.—T.F.B.

Electrolytic cell. E. A. and H. I. Allen, Assignors to Electron Chemical Co., Portland, Maine. U.S. Pat. 1,073,559, Sept. 16, 1913.

See Eng. Pat. 26,169 of 1912; this J., 1913, 833.—T. F. B.

Electrolytic apparatus. M Perreur-Lloyd, Boulogne-sur-Seine, France. U.S. Pat. 1,073,868, Sept. 23, 1913.

See Fr. Pat. 441,644 of 1912; this J., 1912, 932.—T. F. B.

Furnace; Electric ——. J. Hess, Assignor to Bosnische Elektricitäts-Act.-Ges., Vienna. U.S. Pat. 1,073,684, Sept. 23, 1913.

See Fr. Pat. 436,578 of 1911; this J., 1912, 499.—T. F. B.

Electrolytic production of hydrosulphites. Eng. Pat. 13,901. *See* VII.

Chemical reactions by means of an electric arc. [*Production of nitric oxide.*] U.S. Pat. 1,066,272. *See* VII.

Preparation of granular carbon. U.S. Pat. 1,071,442. *See* VII.

XII.—FATS; OILS; WAXES.

Linseed oil; Decrease of acidity on heating ——. W. Fahrion. Farbenzeit., 1913, **18**, 2111—2112. Chem. Zentr., 1913, **2**, 1259.

The fatty acids (iodine value 175, acid value 192·7, saponification value 195·2) separated from a commercial sample of linseed oil were heated in a closed tube for 10 hours at 200° C., whereby the iodine value fell to 166·6, the acid value to 163·6, and the saponification value to 172·1. A small quantity of fatty acid esters of phytosterol was formed, but the decrease of acidity must be due mainly to some other cause. The transformation can be reversed by treatment with hydrochloric acid. The change appears to be due in some way to the phytosterol, possibly acting as a catalyst, for it is produced only to a very slight extent in the case of linseed oil fatty acids free from phytosterol.—A. S.

East Indian beeswax. H. Fischer. Z. öffentl. Chem., 1913, **19**, 354—358.

Certain misprints and errors which occurred in a previous article (see this J., 1913, 665) are corrected. The supposition that the figures for genuine East Indian beeswax must fall between the limits of 5 and 7·5 for acid value and 86 and 92 for saponification value is now shown to be incorrect. Analyses by Schulten of 24 commercial samples of pure wax showed the following variations—acid value 6·3—6·7, saponification value 93·9—103·1, ratio number 13·0—15·1; Weinwurm test (this J., 1897, 939) negative in all cases. Analyses of 50 samples of adulterated wax are also given; in all cases except one these gave a positive result in the Weinwurm test; the one sample which gave a negative result in this test gave such abnormal analytical figures as to leave no doubt that it was adulterated. The most common adulterant is paraffin wax; vegetable fats and Japan wax are also used, less often tallow or animal fats are added.—R. G. P.

Biochemical studies of cholesterol. Hepburn. *See* XX.

Patent.

Hydrogenating unsaturated substances [*fats, etc.*]. Eng. Pat. 16,283. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Rinman's green. A. Hedvall. Arkiv för Kemi, Min. och. Geol., **5**, No. 6, 27 pages. Chem. Zentr., 1913, **2**, 1274—1275. (See also this J., 1912, 732.)

Further experiments have shown that the composition of Rinman's green varies according to that of the charge used, and that the product is a solid solution of the two components, cobalt oxide and zinc oxide. The pigment is produced even at a red heat, but much more rapidly at higher temperatures. The presence of a flux (potassium chloride) is not essential and the production of the pigment without a flux affords a good example of rapid diffusion of solids.—A. S.

Patents.

Paints, enamels, varnishes, and the like and their manufacture. J. B. Gall, Eltham Park, Kent. Eng. Pat. 20,206, Sept. 5. 1912.

The oil or other paint vehicle is emulsified with water containing one or more metallic salts or compounds in solution or in the form of a precipitate, or in both forms. The neutral or slightly alkaline aqueous solution or mass constitutes about one-third of the finished product and contains 10—25 per cent. of its weight of the metallic salts or compounds. For example lead chromate is produced by using solutions of lead acetate and potassium bichromate, or a mixture of barium sulphate and iron oxide by using solutions of baryta and iron sulphate. The vehicle is preferably emulsified successively first with one and then with the other solution. Owing to the fine state of division of the precipitated pigment, a paint of superior covering power is said to be produced.—A. S.

Paint composition and process of making the same. A. S. B. Little, Nashville, Tenn. U.S. Pat. 1,072,476, Sept. 9, 1913.

A solution, in 50 lb. of turpentine, of 5 lb. of red lead and 5 lb. of litharge which have been heated with 50 lb. of linseed oil until the mass solidifies on cooling, is added to a solution of 50 lb. of rosin in 50 lb. of benzine. A pigment, together with a quantity of a metallic chromate (zinc chromate given as example) forming about 4 per cent. of the entire mixture, may also be added.—E. W. L.

Paints and products with an aluminium red [" *minium d'aluminium* "] *base.* L. L. Allegre. Fr. Pat. 455,764, June 1, 1912.

Aluminium red has the following average composition :—alumina, 52 ; iron oxide, 30 ; silica, 3 ; titanic acid and other impurities not determined, 3 ; and loss on ignition, 12 per cent. Paints prepared with this pigment as base offer certain advantages over red lead and iron oxide paints, amongst which are their permanency under atmospheric influences, and their non-poisonous nature. By subjecting the aluminium red to a preliminary treatment with hydrochloric acid and potassium ferrocyanide a range of colours from green to blue may be obtained in place of the original reddish-brown. 800 grms. of aluminium red are heated with 1600 grms. of water and 300 grms. of hydrochloric acid (22° B., sp. gr. 1·18) on a water bath for about an hour. A solution of 80 grms. of potassium ferrocyanide in 400 grms. of water is then added and stirring continued for a quarter of an hour. The green precipitate obtained is separated and washed by decantation, dried, ground and sifted. By varying the proportions of the reagents the tint of the pigment may be varied between green and blue.—E. W. L.

Pigment ; White —— to replace white lead and its substitutes, and method of manufacture. H. Callewaert and Co-operative Patents Ltd. Fr. Pat. 455,909, Mar. 6, 1913.

The pigment consists of a mixture of zinc sulphide, barium carbonate, and double silicate of aluminium and barium, the proportion of double silicate varying between 25 and 30 per cent. It is prepared by precipitating zinc sulphide from a solution of zinc chloride by means of barium sulphide, and adding to the suspension of zinc sulphide in barium chloride solution, sodium carbonate and sodium silicate, subsequently adding aluminium silicate, obtained by the action of aluminium sulphate on sodium silicate in hot solution. The quantities of the reagents are calculated so as to produce a pigment of the following composition : zinc sulphide, 30 ; barium carbonate, 35 ; and double silicate of aluminium and barium (containing 10 per cent. of aluminium silicate) 35 per cent. The absence of barium sulphate from the pigment prevents the formation of barium sulphide by reduction on exposure to sunlight, and the consequent darkening in colour of the paint.—E. W. L.

White pigment. E. Reinié. Fr. Pat. 457,630, July 17, 1912.

A white paint, " *Blanc de Norvège*," is prepared by mixing 2 parts of zinc oxide, 1 part of " sulphides and silicate of zinc," and 7 parts of alabaster and plaster of Paris, with boiled linseed oil.—A. S.

Blue pigment not attacked by acids and only slightly attacked by alkalis ; Manufacture of a ——. A. Caubel and P. Gounon. Fr. Pat. 457,884, July 23, 1912.

(1). Ten parts of ferric chloride, 2 parts of cobalt chloride, and 1 part of stannous chloride are dissolved in 500 parts of water, and the filtered solution is triturated with 250 parts of kaolin which has been passed through a No. 180 sieve. The mixture is heated to boiling for 20—30 minutes, with the addition of more water, if necessary, then a solution of 8 parts of alkali ferrocyanide and 5 parts of alkali ferricyanide in 500 parts of water is added, and a vigorous current of air is passed through the mixture until the desired blue tint is produced. The resulting pigment is stated to be a combination of an alumino-ferric silicate with a complex ferrocyanide of iron, cobalt and tin. A specimen has withstood, without alteration, the action of 30 per cent. sulphuric acid for 2 months. (2). Fifty parts of lithia mica (lepidolite) passed through a No. 200 sieve, and 1 part of cobalt nitrate or chloride are mixed to a paste with water, dried, and heated to about 1500° C., with access of air and with agitation, until a violet tint is produced. The product forms a good substitute for ultramarine. It is not affected by most chemicals, but is attacked by fused alkalis and alkali carbonates.—A. S.

Linseed oil or oil varnish ; Process of obtaining a substitute for ——. W. Kaempfe. First Addition, dated April 1, 1913, to Fr. Pat. 445,565, June 29, 1912 (see Eng. Pat. 15,965 of 1912 ; this J., 1913, 801).

Fish oil is subjected to fractional hydrolysis by heating with water, with or without addition of a small quantity of manganese sulphate, under pressure in an autoclave, and then the saturated and unsaturated acids are immediately distilled over by means of superheated steam, with or without the use of a vacuum, as described previously (*loc. cit.*).—A.S.

Resinous matters ; Process for the extraction of —— contained in the waste products or residues from the distillation of resins or turpentines. C. Granel. First Addition, dated March 25, 1913, to Fr. Pat. 453,881, April 15, 1912 (this J., 1913, 876).

Solvents other than those mentioned in the principal patent, viz., carbon bisulphide and carbon tetrachloride, may be used for the extraction of the resinous matters. Such solvents are alcohols, benzol, light petroleum, essential oils, etc. A separation of the different resins may be effected by taking advantage of their different solubilities in these solvents. For example, pale yellow colophanes which are soluble may be separated from the accompanying red or brown resins which are insoluble in light petroleum. By carrying out this separation at a temperature below the melting-point of the dark-coloured resins, and by the employment of a vacuum, the separation of the pale resins is rendered more efficient.
—E. W. L.

Condensation products [*from phenols and formaldehyde*] ; *Process for the manufacture of insoluble ——.* F. Pollak, Berlin. Eng. Pat. 18,287, Aug. 8, 1912. Under Int. Conv., Dec. 6, 1911.

See Fr. Pat. 447,969 of 1912 ; this J., 1913, 436.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Caoutchouc ; Detection of a C_8-ring in normal kinds of ——. C. Harries. Ber., 1913, **46**, 2590—2595.

The assumption of the presence of a C_8-ring in normal kinds of caoutchouc has hitherto been based only on physico-chemical data. The author has now succeeded in confirming this assumption by chemical means. The caoutchouc regenerated from the halogen-addition compounds of natural caoutchouc by means of pyridine (this J., 1913, 372) was ozonised, and the ozonide decomposed. Examination of the decomposition products showed that the regenerated caoutchouc was a mixture of at least three different kinds. The abundant formation of lævulinic aldehyde and acid shows that a large portion of the caoutchouc is regenerated in its original form, but other decomposition products are also formed, of which the most important is cyclo-octanedione-(1.5), accompanied by formic acid.—A. S.

Rubber ; Colouring —— with organic dyes. R. Ditmar. Z. angew. Chem., 1913, **26**, 563—565.

The author tested a large number of organic dyes with regard to their suitability for use as colouring materials in rubber mixings. A standard rubber mixing composed of Ceylon Para rubber, 25·6 kilos. ; *magnesia usta*, 4·3 kilos. ; zinc sulphide, 58·8 kilos., and sulphur, 11·4 kilos., was used, and vulcanisation was effected at pressures up to 7 atmospheres for 1½ hours. Most of the dyes failed completely to withstand the vulcanisation conditions, but satisfactory results were obtained with vat dyes, anthraquinone dyes, and other dyes possessing similar properties, *e.g.*, high molecular weight and consequent tendency to form colloidal solutions, sparing solubility, high resistance to chemical action, etc. The stability of organic dyes in rubber mixings is diminished when factis (rubber substitute) is present. As examples it is stated that a blue rubber can be obtained with Indanthrene Blue, Ceres Blue V base, and Ceres Violet base, a bluish-grey with Indanthrene Blue BS, a violet-blue with 1.8-dianilidoanthraquinone, a red with Thioindigo Scarlet R, a pink with Algol Brilliant Orange FR, diaminoanthraquinone, and "Stammalgolrot," a yellow with 1-pyridone-4-bromoanthraquinone, a reddish-brown with 1-*p*-toluidoanthraquinone, a brownish yellow with Pyranthrone, a yellowish brown with Sirius Yellow, and a green with Indigo K.2B.—A. S.

[*Rubber.*] *Protective coating for the hulls of ships, which after penetration by projectiles will close against the inrushing water.* R. Ditmar. Z. angew. Chem., 1913, **26**, 565.

It is stated that coatings composed of rubber mixings (raw or semi-vulcanised) prepared from low-grade rubbers rich in resin, and preferably containing large proportions of factis (rubber substitute) and inorganic fillers, when pierced by a projectile will close over the hole and so prevent the inrush of water. The coating may be made more resistant to water by the addition of tar. It is laid on or cemented to the hull of the ship and painted in order to protect it from attack by marine animals.—A. S.

Rubber mixings; Determination of filling materials in ——. H. Loewen. Gummi-Zeit., 1913, **28**, 7.

In estimating filling materials by extraction with hot paraffin oil, too high results were obtained for certain white mixings. This was found to be due to the separation of rubber in the insoluble form, on heating its solution. Experiments on pure Crêpe rubber showed that the rubber separated completely from a solution in paraffin oil after heating to 230° C. for a few hours. Considering that camphor oil, when used as a rubber solvent, can dissolve certain fillers, the author concludes that results obtained by the method of extraction with a very hot rubber solvent are probably only accurate in many cases through compensation of the above errors.—H. E. P.

Patents.

Rubber; Apparatus for coagulating, smoking and manufacturing ——. H. Hawthorn, East Sheen, Surrey. Eng. Pat. 20,049, Sept. 3, 1912.

Latex is allowed to flow from reservoirs, in which it can be heated by means of steam coils to 95°—113° F. (35°—45° C.), down a fan-shaped shoot on to a steam-heated revolving cylinder, contained in a closed chamber into which smoke is passed from a smoke-producing furnace. This first cylinder acts as a drying roller, and from it the rubber passes on to a parallel collecting roller on which it is gradually built up into a thick sheet, the ends of the roller travelling on "bogeys" so as to allow for the increasing thickness of the sheet of rubber between the two rollers. The whole apparatus comprises a series of such chambers, and each chamber may contain several pairs or sets of rollers. Means are provided for removing the cylinder of rubber from the chamber when it has reached the desired size.—E. W. L.

Rubber; Process for reclaiming —— from waste. E. Zappert, London. Eng. Pats. 25,055, Nov. 1, 1912, and 4913, Feb. 26, 1913.

(1) Comminuted rubber waste, with or without fabric, is heated in a closed vessel with approximately equal quantities by volume of sulphuric acid and a solvent oil, for from 6 to 12 hrs. at a temperature of 310° F. (154° C.). Suitable solvent oils are the distillates from vegetable products, wood and the like. The product is drained or pressed, and washed, and forms an almost sulphur-free substance of sp. gr. 1·150 to 1·004. (2) It is claimed that the oil of sp. gr. 0·92 to 0·95 obtained by distillation from the wood or needles of conifers, and freed from resin and turpentine by prolonged distillation at a temperature above 150° C., removes a much higher percentage of combined sulphur from the rubber than any other known solvent.—E. W. L.

Rubber; Process of autogenous welding of —— and its applications. A Pidoux and P. de Carsalade. Fr. Pat. 456,104, Mar. 29, 1913. Under Int. Conv., May 11, 1912.

The edges of the pieces of rubber to be united—such as a pneumatic tyre and a patch—are cleaned, bevelled and buffed; they are then moistened with a terpene hydrocarbon solvent, such as pinene or turpentine, or with a volatile hydrocarbon such as xylene or toluene, and the joint is gripped in the jaws of a vice, the temperature being preferably raised to 60°—100° C. for 10—20 minutes. A steam jet or a current of hot air or oxygen may be applied with advantage.—E. W. L.

Rubber-like substances; Production of ——. D. Spence, A. P. Clark, and The Diamond Rubber Co., Akron, Ohio, U.S.A. Eng. Pat. 21,173, Sept. 17, 1912.

See Fr. Pat. 448,520 of 1912; this J., 1913, 437.—T.F.B.

Caoutchouc substance and process of making same. C. Harries, Kiel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,116, Sept. 16, 1913.

See Eng. Pat. 1125 of 1911; this J., 1912, 241.—T. F. B.

Elastic plastic composition; Process for producing an ——. T. S. Wennagel, and The Wenjacit-Ges. m. b. H., Hamburg, Germany. Eng. Pat. 20,986, Sept. 14, 1912.

See Fr. Pat. 448,330 of 1912; this J., 1913, 438.—T. F. B.

Rubber; Substitute for ——. J. B. Scammell, Assignor to Rubber Substitute (1910) Ltd., London. U.S. Pat. 1,073,527, Sept. 16, 1913.

See Eng. Pat. 9635 of 1910; this J., 1911, 437.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Patents.

Tanning hides, evaporating liquids, etc.; Fluid enveloped vacuum chambers for ——. J. Dennis and W. L. Fidler, Sydney, N.S.W. Eng. Pat. 15,345, July 1, 1912.

A reinforced concrete chamber is fitted with a removable door secured by means of a clamping screw, in connection with a bridge-piece suspended by supporting hangers; the joint is sealed by a flexible strip fitting in channel iron, against which the door flange is held by means of the screw. Pipes enter the chamber for the purpose of (1) supplying and removing tanning liquid, etc., (2) creating and maintaining a vacuum, and (3) heating the liquid by means of a steam coil. All joints are surrounded by liquid with the object of preventing ingress of air during exhaustion. The flange joint of the door is surrounded by a flexible containing vessel for this purpose.—E. W. L.

Plastic material for the preparation of moulded objects, Manufacture of a ——. Naaml. Venn. "Hollandsche Proteïne Mij." Fr. Pat. 457,130, April 25, 1913. Under Int. Conv., May 2, 1912.

Moulded objects prepared as described in Fr. Pat. 431,052 of 1911 (see Ger. Pat. 236,908 of 1910; this J., 1911, 1050) are difficult to dry, and the traces of alkali retained by them have a prejudicial effect. These disadvantages are overcome by incorporating with the protein used as raw material, after treatment with ammonia, oxycellulose prepared by the action of dilute nitric acid on cellulose.—A. S.

XVI.—SOILS ; FERTILISERS.

Patent.

Superphosphate ; Process of producing enriched or concentrated ——. H. G. C. Fairweather, London. From H. V. Dunham, Bainbridge, N.Y., U.S.A. Eng. Pat. 13,350, June 6, 1912.

A "set" superphosphate is leached with water, and the resulting solution of monocalcium phosphate is concentrated to a sp. gr. of about 1·35, and mixed with low grades of superphosphate or other inert material, whereby soluble di-calcium phosphate is produced.—O. R.

XVII.—SUGARS ; STARCHES ; GUMS.

Sulphites ; Transformation of —— *into sulphates* [*in sugar manufacture*]. E. Saillard. Circ. hebd. Syndic. Fabr. sucre, No. 1279, September, 1913.

In the sulphitation of juices or syrups, the amount of sulphurous acid oxidised does not depend solely upon the percentage of air present in the sulphur-burner gases. The rate of oxidation decreases as the concentration of sucrose increases, and is directly proportional to the temperature. Hence, sulphitation should always be carried out before heating when sulphur burner gases are used. Invert sugar, asparagine, aspartic acid, glutamic acid, and potassium lactate all decrease the rate of oxidation in direct proportion to the amount present, which bears out the experience that molasses is the most stable product in the factory in this respect. —J. P. O.

Lead ; Quantity of —— *remaining in solution in impure beet or cane sugar liquors after treatment with basic or normal lead acetate* [*for polarimetric analysis*]. H. Pellet. Sucr. Belge, 1913, **42**, 3—10.

To 50 c.c. of a normal sugar weight solution of beet or cane molasses different amounts of basic or normal lead acetate solution were added, the volume made up to 100 c.c., and the lead remaining in the filtrate determined. After the precipitation of all the impurities capable of being removed in this way, it was found that the amount of lead remaining in solution, expressed as a percentage of that added, was with (*a*) basic lead acetate (French Codex), and (*b*) normal lead acetate (300 grms. per litre) as follows : for beet molasses (*a*) 55, (*b*) 88·3 ; and for cane molasses (*a*) 44, (*b*) 69·3 per cent. To eliminate all impurities capable of being precipitated, the volume of basic lead acetate necessary averages 33 c.c. for beet molasses, and 100 c.c. for cane molasses per 100 grms. of the sample. When using the double polarisation method, if 5 c.c. of concentrated hydrochloric acid (sp. gr. 1·188) are employed for the inversion of 50 c.c. of a normal sugar weight solution of beet molasses defecated with basic lead acetate at the rate of 33 c.c. per 100 grms. of sample, there remains only 1·6 c.c. of free hydrochloric acid, since 1·9 c.c. is neutralised by the lead, and 1·5 c.c. by the salts in solution. Under the conditions prescribed by Herzfeld this amount of acid is sufficient for the complete hydrolysis of all the sucrose that may be present. In the case of cane molasses, however, defecation must be at the rate of 100 c.c. per 100 grms. of sample, and the lead remaining in solution neutralises 4·6 c.c. of the hydrochloric acid used for inversion. Consequently in the analysis of the cane product care must always be taken to work with a lesser concentration than the normal sugar weight, 6·5 grms. per 100 c.c. being a convenient amount to employ.—J. P. O.

Molasses ; Extraction of l-glutimic acid from ——, *and a contribution to the knowledge of the acids of molasses.* V. Stanek. Z. Zuckerind. Böhm., 1913, **38**, 1—7.

In a former paper (this J., 1912, 1001) the presence of *l*-glutimic acid was shown only indirectly, the acid being much more slowly extracted by ether than other acids present. This property has now been utilised for its extraction, after removing the readily soluble acids in presence of sulphuric acid by a relatively short extraction. The residue was subjected to prolonged extraction with ether, acid being added only in small portions to avoid hydrolysis. The barium salt from the final extract was converted into the zinc salt which was obtained in crystals after concentration *in vacuo*. The zinc salt gave $[\alpha]_D =$ —20·8 and m.pt. 162°—163° C., and, on elementary analysis, results corresponding to the formula $ZnC_{10}H_{12}N_2O_6,2H_2O$. The acid prepared from this salt melted at 162°—163° C. after recrystallisation from alcohol. The molasses used contained 2·29 per cent. of nitrogen, 1·48 per cent. was found in the residue and 0·726 per cent. in the extracts, the remainder, 0·084 per cent. being due to experimental errors, and partly to nitrates.—L. J. de W.

Starch ; Chemistry of ——. *Schardinger's crystalline dextrins. II.* H. Pringsheim and F. Eissler. Ber., 1913, **46**, 2959—2974. (See this J., 1911, 439 ; 1912, 1001.)

Particulars are given of a third crystalline dextrin, formed together with dextrins (α and β) but in smaller quantities, by the action of *Bac. macerans* on starch. It was obtained by Schardinger (this J., 1911, 439) as a paste of fine crystals. When acetylated it yields, like dextrin-α, a diamylose hexa-acetate. It resembles dextrin-α rather than dextrin-β. These three dextrins are interconvertible, *e.g.*, dextrin-α is partially transformed into the other two, when heated in a glycerin solution for ½ hour at 200° C. If in the acetylation of dextrin-α or -β, sulphuric acid is used as catalyst instead of zinc chloride, and the temperature rises to 115° C., acetates are obtained which on hydrolysis yield "isodiamylose" and "isotriamylose." These, unlike the isomeric di- and tri-amylose (see this J., 1912, 1001), reduce Fehling's solution. They are converted into dextrose by emulsin but are not attacked by diastase or yeast. Di- and tri-amylose are not attacked by maltase, ptyalin, pancreatin, or emulsin, but takadiastase transforms them into dextrose. Attempts to obtain dextrin-α and -β by the direct acetylation of starch were unsuccessful, but a non-reducing compound $(C_6H_{10}O_5)_{12}$, was prepared which on further acetylation gave rise to reducing substances. *Bac. macerans* acts on the amylopectin and amylose of Maquenne and Roux (see this J., 1905, 630) producing dextrins (α and β) from both in approximately the same proportions. Possibly in all cases dextrin-β is formed first and dextrin-α is a secondary product.—J. H. L.

XVIII.—FERMENTATION INDUSTRIES.

Barley ; Proteins of ——, *in the grain itself and during the brewing processes. III. Transformation of the proteins during mashing, boiling of wort, and fermentation.* H. Schjerning. Comptes rend. Trav. Lab. Carlsberg, 1913, **9**, 237—396. (See also this J., 1906, 1109 ; 1910, 583.)

The following are some of the conclusions drawn from experiments described in this, the third and last memoir of the series. Transformation of the proteins of barley takes place chiefly during germination, and a deficiency at this stage cannot be completely rectified during mashing. The brewing value of barley depends on the facility with which proteolysis proceeds during germination, but this facility is by no means in inverse proportion to the nitrogen-content of the grain. Protein transformation during mashing is only slightly affected by the degree of fineness of the malt grist. The concentration of the mash exerts a marked influence on the quantitative composition of the extract, since the maximum formation of extract (transformation of carbohydrates) is obtained at a concentration of about 1 part of malt in 6 parts of water, whereas the maximum solution of nitrogenous matter takes place at a concentration of about 1 part of malt in 2 parts of water. As the mash concentration is diminished, the quantity of protein dissolved diminishes almost in proportion, albumin conversion (*i.e.*, albumin II. to albumin I.), peptic action (conversion of albumin I. into denuclein, proteose and peptone) and tryptic action (conversion of denuclein, proteose and peptone into amine-amide compounds diminish rather more markedly, whilst there is also a slight falling off in the facility of clarification of the wort, and the rate of running-off. The following temperature optima were deduced :—transformation of carbohydrates, about 65° C. ; transformation of mineral constituents 45°—55° ; formation of acid, solution of protein and conversion of albumin II. into albumin I., 45° ; peptic action 55° ; tryptic action 45° ; peptide cleavage 38°—45° ; peroxydase action 20° ; catalase action 10°—45° C. All the protein transformations nearly attain their maxima after 30 mins. mashing at 45° C. Salts present in the mashing water have little influence on proteolysis except as they modify the acidity or the concentration of hydrogen ions. The latter factor may affect to a considerable extent all the proteolytic changes except the production of ammonia ; the maximum effect requires a concentration of hydrogen ions superior to $0{\cdot}122 \times 10^{-5}$ and the minimum effect requires one inferior to $0{\cdot}122 \times 10^{-6}$. As regards the boiling of wort, the maximum precipitation of protein is attained after 4 hours, and the wort then clarifies well. There is no considerable coagulation of albumin II. or conversion into albumin I. during boiling with or without hops. Albumin I. is partly coagulated and partly decomposed into peptic products (denuclein, proteose, peptone). The amount of peptic products almost always decreases because tryptic cleavage is more intense than peptic. Hops promote coagulation of albumins, peptic cleavage, and precipitation of peptic products, but diminish albumin conversion (II. to I.) and tryptic cleavage ; they do not affect the liberation of ammonia. The action of hops on proteins is greatest at a pressure of 1 atm. (101° C.), so far as coagulation, precipitation and peptic cleavage are concerned ; but tryptic cleavage and liberation of ammonia become more marked at higher temperatures. The action of oxygen during boiling improves clarification, and tends to promote coagulation and precipitation (of peptic products by hop tannins) and to check the peptic and tryptic decompositions, whilst it does not affect the liberation of ammonia. Different kinds of hops do not differ much in their influence on proteolysis. Transformations of protein during fermentation are determined by the following processes :—coagulation of albumins I. and II. ; condensation of tryptic to peptic products (tryptic condensation) and of the latter to true albumins (peptic condensation) ; cleavage, partly of a peptic and partly of a tryptic nature ; liberation of ammonia from amine-amide compounds ; assimilation, in which ammonia contained in the cell produces nitrogenous organic compounds ; peptide cleavage, consisting in one or more peptide linkages in the molecules of nitrogenous matter being broken. Fermentation experiments were carried out with *S. Carlsbergensis*, *S. Pastorianus I.*, *S. apiculatus*, *Torula B* (*Brettanomyces*) and *Monilia candida*. These organisms behave very differently towards nitrogenous matters and probably produce cleavage of different linkages in the molecules. The oxygen of the air favours the vegetative propagation of the aerobic organisms and impairs the vital or chemical power of the cell ; it also tends to promote all the protein transformation processes. Vegetative propagation may take place even if the nutrient liquid does not contain any such nitrogenous substances as can be used by the organism for nutrition ; in this case the newly formed cells contain a protoplasm practically free from nitrogen, and are incapable of inducing alcoholic fermentation. The influence exerted by secondary fermentation upon the composition of beer is inconsiderable. The amount of alcohol and the acidity increase slightly at first, and later there occurs a noticeable formation of esters. The amount of peptide-bound nitrogen increases a little.—J. H. L.

Yeasts and other budding fungi ; Influence of esters on ——. H. Will and R. Heuss. Centr. Bakt., 1913, II, **36**, 513. Allgem. Z. Bierbrau. u. Malzfabr., 1913, **41**, 499—504. (See this J., 1912, 353.)

EXPERIMENTS with wort cultures of 23 organisms showed that above a certain concentration (usually about 2 per cent.), ethyl acetate has a pronounced inhibitive action, which increases in proportion to the concentration. Very small quantities of the ester, on the other hand, appear rather to have a stimulating effect ; in some cases slight inhibition was followed by stimulation, as if the organisms became adapted to the presence of the ester. In general, those organisms which themselves produce esters are less sensitive than others, but the quantities produced are much too small to have any injurious action on other yeasts, and the authors conclude that ester formation cannot in such cases be protective. Amyl acetate behaves very similarly to ethyl acetate but is more toxic ; at a concentration of 1 per cent. it arrests completely the growth of most yeasts. In the absence of other sources of carbon, both esters may be assimilated by all the organisms studied except the *Apiculatus* forms; however, growth is not vigorous under these circumstances, and the organisms are more readily injured by the esters than when cultivated in wort.—J. H. L.

Betaine ; Biochemical transformation of —— *into glycollic acid.* F. Ehrlich and F. Lange., Ber., 1913, **46**, 2746—2752.

NEITHER brewery- nor distillery-yeast assimilates betaine, but film-forming races and many mould fungi decompose it readily in a manner analogous to the conversion of simple amines into alcohols by the same organisms (see this J., 1912, 506). For the study of this decomposition *Willia anomala* was employed in a liquid containing ethyl alcohol as source of carbon. Of the two primary products of the decomposition, glycollic acid and trimethylamine, only the former was detected in the fermenting liquid, and that not in large quantities because it is assimilated by *Willia anomala*. The trimethylamine appears to have been decomposed at once into methyl alcohol and ammonia and the latter employed in protein synthesis, for neither of these nitrogenous products could be detected.—J. H. L.

Amylases. V. Purification of the amylase of malt. H. C. Sherman and M. D. Schlesinger. J. Amer. Chem. Soc., 1913, **35**, 1617—1623.

THE essential features of the method of purification were as follows : The ground malt was extracted at about 10° C. with 2½ times its weight of cold water, dilute alcohol, or a very dilute sodium monophosphate solution, the filtered extract was dialysed, again filtered, treated with an equal volume of alcohol or acetone, the precipitate separated, and the solution treated with a further quantity of alcohol or acetone so as to bring the concentration up to 65—70 per cent. The precipitate thus obtained was dried in a partial vacuum over sulphuric acid at 10° C. Of a number of specimens of malt amylase prepared in this way, 13 had diastatic powers of 800—1200 on the authors' scale (this J., 1910, 1173), corresponding to 1200—1800 on Lintner's scale, and 7 gave values corresponding to 1800—2300 on Lintner's scale, these values being much higher than the highest hitherto recorded for malt amylase (Osborne, this J., 1896, 44), but lower than that of purified pancreatic amylase (this J., 1911, 973). The purified malt amylase is a yellowish- white substance which shows the typical protein reactions and has the appearance of a colloid under the ultramicroscope. It coagulates when heated in aqueous solution : the coagulum gives a violet-blue, and the solution a rose-red, biuret reaction. In general the more active preparations have higher nitrogen contents : the most active specimens contained about 14 per cent. N.—A. S.

Beer ; Production of —— *with artificial acidification of the mash by Bacillus Delbrücki.* W. Windisch. Woch. Brau., 1913, **30**, 521—524. (See this J., 1913, 955.)

ACIDIFICATION of the mash by means of *Bac. Delbrücki* (*loc. cit.*), has been applied with success on a technical scale. In one case, immediately after mashing in, the mash was inoculated with a small quantity of "acid mash" (prepared by 8 hours cultivation of *Bac. Delbrücki* in a sterile mash) and maintained at 50° C. for 2½ hours. During this time the acidity of the mash reached 0·18 per cent., and the mashing process was then proceeded with. The running-off of the wort occupied rather longer than usual and the first portions did not run quite clear, owing to the presence of dead bacilli in suspension. This drawback was largely remedied by use of a mash filter. In all other respects, however, the wort and the beer produced from it were much more satisfactory than when acidification of the mash was omitted, and the yield of extract was higher by 1·8 per cent. Very good results were obtained also, by inoculating about ⅓ of the main mash with "acid-mash," and leaving it for 24 hours, by which time it had developed such an acidity (about 1 per cent.) that when added to the main mash no further development of the bacilli was necessary, and mashing was conducted as usual, after a short "rest" at 50° C. for proteolysis. In this case the yield of extract was 0·9 per cent. higher than in similar brews without acidification, and the running-off of the wort was rather more satisfactory than in the case mentioned above.—J. H. L.

Chemistry of starch. Schardinger's crystalline dextrins. II. Pringsheim and Eissler. *See* XVII.

Patents.

Malt liquors; Production of ——. G. L. Mackeson, Hythe, Kent. Eng. Pats. 20,183, Sept. 4, 1912, and 5318, March 3, 1913.

Whey, concentrated whey, whey powder or "synthetic whey" is added to malt liquors at a suitable stage of their manufacture when there is water present, or it is added to the water used for mashing. The "synthetic whey" is prepared by mixing the constituents of whey in such proportions that the finished malt liquor may contain any desired relative quantities of these constituents.—J. H. L.

Acetone and higher alcohols; Fermentation processes for the production of —— from starch, sugars and other carbohydrate materials. A. Fernbach, Paris, and E. H. Strange, London. Eng. Pat. 21,073, Sept. 16, 1912.

A mash is made of 25 lb. of potato meal with 1000 lb. of water and to it is added a quantity of modified yeast extract containing ½ lb. of nitrogenous matter not capable of precipitation by tannin. The mixture is sterilised by digestion under a steam-pressure of 40 lb. per sq. in. for 4 hours and is then cooled to 30°—35° C. The sterile mash is sown with a pure culture of the butylic bacillus of Fitz, *tyrothrix tenuis*, fermentation being carried out in absence of air. The vessel is connected with an exhausting apparatus so that the pressure is reduced to such a degree that the acetone and a portion of the higher alcohols are distilled over during fermentation and condensed. The extract of yeast may be prepared by digesting yeast with water at 150° C. for 24 hours or by the action of the tyrothrix bacillus for a long period.—J. F. B.

Glycerin from vinasses; Process for extracting ——. Watrigant Frères et Cie., Lille, France. Eng. Pat. 21,060, Sept. 16, 1912. Under Int. Conv., Sept. 16, 1911.

See Fr. Pat. 445,895 of 1911; this J., 1912, 1196.—T. F. B.

XIXa.—FOODS.

Wheat flour; Conditions which affect the activity of the amylolytic enzymes in ——. C. O. Swanson and J. W. Calvin. J. Amer. Chem. Soc., 1913, 35, 1635—1643.

Experiments were made to determine the most favourable conditions for the saccharification of the starch of wheat flour when the flour is digested with water. These conditions were found to be: temperature, about 65° C., and the use of 4—10 parts of water to 1 part of flour. The transformation takes place mainly during the first hour, more than two-fifths of the weight of the flour being converted into reducing sugars (reckoned as maltose). Addition of small quantities of sulphuric acid, sodium hydroxide, dipotassium phosphate and sodium chloride to the water showed that the amylolytic power of the flour is injured by all these substances above certain concentrations; hydroxyl ions have a relatively greater effect than hydrogen ions, and lower grade flours are less affected than those of higher quality.—A. S.

Patents.

Cocoa and by-products; Preparation of ——. K. B. Edwards, Berkhamsted, Herts. Eng. Pat. 8805, April 15, 1913.

The whole beans are freed from fat by means of solvent, and then subjected to the action of superheated steam, in order to render them digestible and destroy the spores of fungi, winnowed to remove shells and germs, and roasted without alkali. The roasted nibs are ground and sifted. The fat extracted by the solvent is heated to 150° C. to remove traces of solvent and to destroy fungus spores, and then refined. The yield of fat is increased by this process and the cocoa is produced at a less cost than by the methods in use.—J. H. J.

Cocoa derivative and process of separating constituents of the cacao-bean. R. N. Riddle, Rahway, N.J., Assignor to H. A. Loeb, New York. U.S. Pat. 1,073,441, Sept. 16, 1913.

A roasted and ground cacao mass is mixed with hot water, moulded into suitable shapes, dried, and the fat and alkaloids extracted by means of a solvent, *e.g.*, chloroform, which is subsequently recovered from the extract. —A. S.

Cream separators; Centrifugal ——. H. Tödt, Lensahn, Germany. Eng. Pat. 15,946, July 10, 1913.

To prevent the formation of froth in the skimmed milk discharged from the tubes in the head of the centrifugal drum, a disc is attached to the top of this head, having passages which form continuations of the tubes for the skimmed milk, the passages leading to a peripheral recess on the disc into which the skimmed milk is conducted. Thence it is withdrawn by means of a scoop-like tube dipping into the recess but fixed on the stationary part of the apparatus; this tube is provided with a non-return valve.—J. F. B.

Dairy residues; Manufacture of a salutary drink from ——. A. Jolles, Vienna. U.S. Pat. 1,073,135, Sept. 16, 1913.

Whey or other milk residue is treated cold first with an acid, *e.g.*, hydrochloric acid, capable of sterilising it, then with wood charcoal and bone black, filtered, and the clear liquid treated with sodium carbonate.—A. S.

Fodder and method of making same. V. Christensen, Mexico. U.S. Pat. 1,073,591, Sept. 23, 1913.

The concentrated saccharine juice of the *Agave* is mixed with nitrogenous and cellulose substances, and the mixture dried and ground to form a "conservable complete fodder." —J. H. J.

Beans; Decaffeinating natural ——. N. Rosewater, Cleveland, Ohio. U.S. Pat. 1,073,929, Sept. 23, 1913.

The beans are sterilised by dry heat and at the same time agitated with one another, whereby they are decorticated: then they are macerated first in cold water several times, and afterwards in hot water to extract the caffeine and other xanthines, dried, made to absorb the cold water extract obtained in the preceding treatment, and finally again dried.—J. H. J.

Flour; Method and apparatus for treating ——. C. Herendeen, Chicago, Ill. U.S. Pats. 1,073,985 and 1,073,986, Sept. 23, 1913.

The flour is temporarily suspended in a finely-divided condition in the atmosphere, and while in this condition is subjected to the action of steam. Afterwards the flour is pressed.—J. H. J.

Soup or broth-like substances of liquids; Production of ——. G. Braun, Munich, and H. V. Luithlen and W. Neumann, Andernach, Germany. U.S. Pat. 1,073,392, Sept. 16, 1913.

See Eng. Pat. 22,052 of 1912; this J., 1913, 621.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Lead from water ; Process for removing ——. P. Schmidt. Arch. Hyg., 1913, **80**, 62—73. Chem. Zentr., 1913, **2**, 1258.

The lead contained in tap water is present as hydroxide or basic carbonate in the form of a suspension or colloidal solution. On standing for a few days in tall cylinders, the upper layers of the water are found to be richer in lead. In the case of water which has been boiled for a long time, the lower layers become richer in lead on standing. On dialysis of water containing lead, no lead can be found in the outer water even in presence of excess of carbon dioxide. In accord with these facts showing that lead is present in the form of colloidal solution, it has been found that the lead can be completely removed by passing the water through a Berkefeld filter or through a rapid filter of porous porcelain (" candle filter ").—A. S.

Patents.

Sulphate lyes ; Water softening material from ——. W. Günther, Kassel, Germany. Eng. Pat. 9867, April 26, 1913.

The waste lye is evaporated at a low temperature and in thin layers in a vacuum, with the result that the organic substances are not destroyed and the proportions of the original substances are maintained. The stability of the dry product is increased by fixing the free alkali, preferably before evaporating, by means of carbon dioxide, either that in the air or that in hot gases.—J. H. J.

Water sterilised by means of halogen or salts of hypohalogenous acids ; Process for rendering —— *tasteless and odourless.* Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. Eng. Pat. 3529, Feb. 11, 1913. Under Int. Conv., March 14, 1912.

See Ger. Pat. 260,653 of 1912 ; this J., 1913, 840.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Morphine : Causes of error in the determination of ——. Débourdeaux. J. Pharm. Chim., 1913, **8**, 301—304.

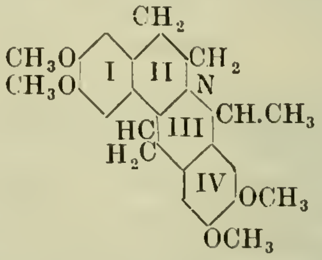
The following external factors are given as influencing the result of morphine determinations in preparations of opium : (1) If the preparation contain alcohol, then, after the addition of the lime, more ammonium chloride will be needed for the complete precipitation of morphine than would be required if the alcohol were previously removed. (2) The presence of notable quantities of added starch in opium extracts causes, in presence of excess of lime, a considerable amount of morphine to be mechanically retained. This must be separated from the starch by washing with dilute acid. Sugars and gums act in a similar manner. (3) Acid preparations of opium after the addition of excess of lime require more ammonium chloride for the complete precipitation of the morphine than neutral preparations, the addition of the usually specified quantity giving low results. (4) The temperature affects the result owing to the varying solubility of morphine. A standard temperature of 15° C. is suggested. —G. F. M.

Opium extract ; The resin of ——. P. Carles. J. Pharm. Chim., 1913, **8**, 250—253.

The " resin " is the insoluble matter left when the soft opium extract is treated with ten times its weight of cold water as prescribed by the French Codex. This resinous matter is an oxidation product for if in the preparation of the extract, concentration be effected at 40°—80° C. under diminished pressure, the resulting extract is practically free from insoluble matter, whereas the extract prepared in the usual way contains a quantity of " resin " (dried) equal to 1·75 per cent. of the original opium. The " resin " carries down with it a considerable quantity of morphine and narcotine.—A. S.

Tetrahydropapaverine ; Action of acetal upon ——. A. Pictet and S. Malinowski. Ber., 1913, **46**, 2688—2697.

A solution of tetrahydropapaverine in hydrochloric acid was heated in a reflux apparatus, small portions of acetal being added from time to time. Condensation took place with the formation of two bases structurally isomeric with corydaline. *α*-Coralydine, which is produced in larger amounts, crystallises from alcohol in lustrous leaflets, m. pt. 148° C. Its hydrochloride melts at 254° C., and the picrate at 134° C. When heated on the water-bath with an alcoholic solution of iodine, dehydrocoralydine is produced, of which the hydriodide melts at 263° C. and the hydrochloride at 230° C. *α*-Coralydine was oxidised with permanganate with the formation of *m*-hemipinic acid only, showing that this base has the constitution :



differing from that of corydaline only by the position of one of the methoxyl groups in the ring IV. *β*-Coralydine melts at 115° C. after crystallising from alcohol and yields dehydrocoralydine when oxidised by means of iodine.—F. Shdn.

Gitonin, a new Digitalis glucoside. A. Windaus and A. Schneckenburger. Ber., 1913, **46**, 2628—2633.

Specimens of digitonin obtained from *Digitalinum germanicum* and on the market were found to contain a new glucoside, *gitonin.* It was separated from digitonin by means of its smaller solubility in 95 per cent. alcohol. It decomposes at 272° C., and has $[\alpha]_D = -50{\cdot}69°$ in pyridine. When hydrolysed by treatment with acids, *gitogenin*, galactose, and a pentose are produced. Gitogenin, $C_{26}H_{44}O_4$ or $C_{26}H_{42}O_4$, melts at 272° C., and forms a diacetyl compound melting at 243°—244° C.—F. Shdn.

Iron in Syr. Ferri Phosph. Co. and other pharmaceutical preparations ; Determination of ——. N. Evers. Analyst, 1913, **38**, 447—449.

The iron present in pharmaceutical preparations containing organic matter which interferes with the usual volumetric or gravimetric methods can frequently be determined colourimetrically with sufficient accuracy as thiocyanate. For the total iron, a portion of the diluted syrup is oxidised with nitric acid, whilst for the ferric iron, the colourimetric comparison is made directly with the diluted syrup, the amount of iron (as thiocyanate) necessary to match the slight tint due to cochineal being determined in a control test.—A. S.

Pine needle oil ; Examination of ——. H. Helch. Z. angew. Chem., 1913, **26**, 579—580.

On distillation, pine needle oil should not yield more than 10 per cent. boiling below 165° C. The optical rotation of 5°—10° as required by the British and Swiss Pharmacopœias is somewhat too stringent, as many genuine commercial specimens show higher rotations. The optical rotations of the original oil and of the fraction boiling below 165° C. should be alike with a pure oil. The content of bornyl acetate and esters should be utilised in judging the genuineness. The bromine value is influenced by the terpene content, but is too small to be of use for testing purposes.—F. Shdn.

Ravensara oil ; Essential ——. Ferrand and Bonnafous. Bull. Sci. Pharmacol., 1913, **20**, 403—405. Chem. Zentr., 1913, **2**, 1302—1303.

The leaves and young twigs of the tree, *Ravensara aromatica* J. F. Gmel., *Lauraceae*, which grows in Madagascar, yield an essential oil having an odour similar to that of eucalyptus oil. The oil distils mainly between 170° and 175° C., the chief constituent being a terpene, $C_{11}H_{20}$, b. pt. 171°—172° C., sp. gr. 0·8809 at 15° C., $n_D^{22}=1{\cdot}4616$. A small portion of the oil distils between 260° and 280° C. This has a green fluorescence and a pronounced eucalyptus-like odour.—A. S.

Proteins; Soluble metallic compounds of sulphurised —— especially copper compounds. R. Uhl. Z. physiol. Chem., 1913, **84**, 478—496.

The proteins (Witte peptone, casein, etc.) were converted into sulphur compounds by treatment in alkaline solution with carbon bisulphide (see Ger. Pats. 192,344 and 238,843) and were then treated with an ammoniacal solution of copper acetate, an ammoniacal silver solution, or an alkaline potassium-mercuric iodide solution. Clear solutions were obtained, from which metallic compounds of the sulphurised protein were precipitated by acetone. The products are soluble in water or in very dilute alkali and do not respond to the ordinary reactions for the metal (copper, silver, mercury) ions. They have a very faint taste, at first bitter, afterwards sweetish. They will not diffuse through an animal membrane, and are decomposed with difficulty by proteolytic enzymes *in vitro*. The copper compound has a relatively slight toxic action. Its bactericidal action on *Staphylococcus pyogenes aureus* is considerably greater than that of mercuric chloride.—A. S.

Cholesterol; Biochemical studies of ——. J. S. Hepburn. J. Franklin Inst., 1913, **176**, 405—452.

The paper is accompanied by a bibliography and includes a review of previous work on cholesterol in addition to the author's own results. Pure cholesterol was prepared from sheeps' brains and from gall stones, and different specimens and mixtures of the same all melted between 147·4° and 149·1° C., showing the identity of the cholesterol from the two sources. Cholesterol cannot be estimated volumetrically by the iodine absorption method: the iodine values obtained vary within wide limits according to the experimental conditions and are always higher than the theoretical value of 65·7, assuming one double linkage in the molecule. Of the gravimetric methods in which cholesterol is determined as the free alcohol, Cappenberg's process (this J., 1909, 1100) is the best, the different modifications of Ritter's method (this J., 1901, 1147; 1902, 643; 1912, 239, 826) yielding discordant and inaccurate results. Determination as cholesteryl benzoate (Roy. Soc. Proc., 1908, **B80**, 227) gives low results. The most accurate and satisfactory method is that of Windaus, (Z. physiol. Chem., 1910, **65**, 110), the cholesterol being determined as digitonin cholesteride: the results corresponded to from 93·63 to 103·02 (average 97·37) per cent. of the cholesterol taken.—A. S.

Nitroform; Preparation of ——: a caution. A. K. Macbeth. Chem. World, 1913, **2**, 328.

Nitroform (trinitromethane) is prepared by adding a thin paste of sodium ethylate and alcohol, in small portions, to tetranitromethane, the latter being cooled by shaking the containing vessel in cold water. In the author's experiment the reaction proceeded normally at first, but after one of the intervals of cooling which followed each addition of sodium ethylate paste, a very violent explosion took place on the next addition of a small quantity (about 0·5 grm.) of the paste.—A. S.

Mercury compounds of ethylene and carbon monoxide; Complex ——. W. Schoeller, W. Schrauth, and W. Essers. Ber., 1913, **46**, 2864—2876.

When a solution of mercuric acetate in methyl alcohol is shaken with ethylene, the latter is absorbed with the formation of mercuric acetate ethylmethyl ether, $CH_3{\cdot}COO{\cdot}Hg{\cdot}CH_2{\cdot}CH_2{\cdot}O{\cdot}CH_3$, and free acetic acid. After distilling off the alcohol and acetic acid under reduced pressure, the residue can be crystallised from light petroleum in the form of white needles, m.pt. 42° C. The corresponding chloride can be formed by the careful addition of hydrochloric acid, but excess of acid causes the liberation of ethylene. The substance is stable towards the oxygen acids and alkalis, but is decomposed by ammonium sulphide and stannous chloride. The bromide melts at 58° C. Mercuric acetate diethyl ether, $CH_3{\cdot}COO{\cdot}Hg{\cdot}CH_2{\cdot}CH_2{\cdot}O{\cdot}C_2H_5$, is produced by carrying out the above reaction in ethyl alcohol in place of methyl alcohol. It melts at 36° C. The corresponding chloride is formed by treatment with sodium chloride in methyl alcoholic solution, and crystallises from light petroleum in white needles, m.pt. 92° C. Carbon monoxide is absorbed by a solution of mercuric acetate in methyl alcohol with the production of the methyl ester of mercuric acetate formic acid, $CH_3{\cdot}COO{\cdot}Hg{\cdot}CO{\cdot}OCH_3$. After crystallising from chloroform and light petroleum, it melts at 110° C. with decomposition. The substance dissolved in methyl alcohol was treated with sodium chloride, when the methyl ester of mercuric chloride formic acid, $HgCl{\cdot}CO{\cdot}OCH_3$, separated, m.pt. 110° C. The bromide melts at 127°—128° C. The ethyl ester of mercuric acetate formic acid decomposes completely at 125° C., and the chloride melts at 88° C. When the acetate compounds are treated with iodine, esters of chloroformic acids are formed, together with mercuric iodide. The ethyl ester of formic acid was obtained by reducing the ethyl ester of mercuric acetate formic acid by means of aluminium.—F. Shdn.

Patents.

Medicinal preparations for human use [from casein glycerophosphate and hydroxyquinolines]. H. Belart, Huddersfield. Eng. Pat. 23,097, Oct. 10, 1912.

Glycerophosphates of casein or other albuminous substances are combined with a hydroxyquinoline or a mixture of two or more hydroxyquinolines, or a derivative thereof. Combination may be effected by condensation with mineral acid.—T. F. B.

Reduction of organic compounds. E. B. Higgins, Wallasey. Eng. Pat. 23,377, Oct. 12, 1912.

The catalytic reduction of organic compounds is effected by using a reagent which itself contains the hydrogen necessary, and at the same time serves as the catalyst or source of the catalyst: for example, salts of formic acid or other organic acid may be used for the purpose. When nickel formate is used, it serves both as reducing agent and as catalyst; with zinc formate, addition of a known catalyst, such as palladium chloride, is desirable. The temperature used is preferably about 20° C. below that at which the formate would decompose into the oxalate at the pressure existing during the operation.—T. F. B.

Hydrogenised organic substances or compounds; Manufacture of ——. Verein. Chininfabr. Zimmer und Co., Frankfort on Maine, Germany. Eng. Pat. 10,204, April 30, 1913. Under Int. Conv., May 9, 1912.

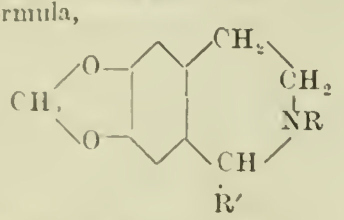
Hydrogenation of organic compounds may be effected by adding a finely divided metal of the platinum group to a mixture of the organic compound with formic acid. By using palladium black, for instance, decomposition of the formic acid commences at once, carbon dioxide being liberated. *Example:* 100 parts of 2 per cent. formic acid solution is added to 20 parts of quinine bisulphate, and then 0·4 part of palladium black is introduced. When evolution of carbon dioxide has ceased, the liquid is filtered and neutralised with ammonia; hydroquinine sulphate separates from the solution on cooling.—T. F. B.

Hydrogenating unsaturated substances; Process for ——. A. Skita, Karlsruhe, Germany. Eng. Pat. 16,283, July 15, 1913. Under Int. Conv., July 15, 1912.

Colloidal solutions of hydroxides of metals of the platinum group, obtained by treating a solution of a salt of the metal with sodium carbonate in presence of gum arabic, are found to be efficient hydrogen carriers in the hydrogenation of unsaturated compounds, the reaction being possible even in neutral solutions. In this manner it is stated that α- or β-ionone is readily reduced to tetrahydro-ionone, quinine is converted into dihydroquinine, and unsaturated fatty acids or fats can be hydrogenated to any degree. For example, a hard fat is obtained by passing hydrogen at a pressure of seven atmos. into a mixture of 50 grms. of arachis oil and 60 grms. of a colloidal solution of palladous hydroxide, containing about 0·07 grm. of the hydroxide, at a temperature of 60° C.—T. F. B.

Norhydrohydrastinine ; Manufacture of N-homologues and derivatives of N-homologues of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,504, Dec. 21, 1912.

Homologues of norhydrohydrastinine or their derivatives of the general formula,



where R represents alkyl and R′ hydrogen, alkyl, or aryl, are obtained (1) by alkylating norhydrohydrastinine or its substitution products; (2) by alkylating the primary condensation products of homopiperonylamine with aldehydes, and converting the products into the N-homologues of norhydrohydrastinine or of its derivatives, *e.g.* by treatment with 20 per cent. hydrochloric acid; (3) by condensing alkylated homopiperonylamine with aldehydes and converting the primary condensation products into the N-homologues of norhydrohydrastinine or its derivatives.—T. F. B.

Betaine or its salts ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,162, July 1, 1913. Under Int. Conv., Oct. 24, 1912.

A quantitative yield of betaine is said to be obtained by the action of trimethylamine on an alkali salt of monochloroacetic acid, preferably in aqueous or alcoholic solution and under pressure. The product may be evaporated to dryness and the betaine extracted from the residue by means of absolute alcohol. To prepare a salt of betaine, the necessary acid is added to the liquid before or during evaporation.—T. F. B.

Betaine salts ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 16,710, July 21, 1913. Under Int. Conv., Jan. 30, 1913.

The methyl ester of dimethylaminoacetic acid is converted by treatment with a methyl halide into the methyl ester of the corresponding halogen salt of betaine. When this ester is saponified by heating its aqueous solutions, either alone or in presence of a mineral acid, the corresponding betaine salt is obtained in nearly quantitative yield. The first stage of the process may be carried out in presence of benzene or other solvent.—T. F. B.

Chlorides of the oxy-acids ; Process for the production of ——. E. Kopetschni, Mannheim, and L. Karczag, Berlin. Eng. Pat. 20,359, Sept. 6, 1912. Under Int. Conv., Sept. 8, 1911.

See Fr. Pat. 450,227 of 1912 ; this J., 1913, 507.—T. F. B.

Isoprene ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 976, Jan. 13, 1913.

See Addition of Feb. 19, 1913, to Fr. Pat. 440,132 of 1912 ; this J., 1913, 884.—T. F. B.

Erythrene ; Process for producing ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2777, Feb. 3, 1913.

See Ger. Pat. 263,016 of 1912 ; this J., 1913, 924.—T. F. B.

Pharmaceutical compound [*amides of di-iodo fatty acids*]. W. Hiemenz and L. Taub, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,855, Sept. 23, 1913.

See Eng. Pat. 18,813 of 1911 ; this J., 1912, 701.—T. F. B.

Pharmaceutical product [*mercury-phenol compounds*]. L. Taub, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,942, Sept. 23, 1913.

See Ger. Pat. 250,746 of 1911 ; this J., 1912, 1054.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Gelatinous reliefs ; Production and treatment and use of ——. F. W. Kent, Clapham. Eng. Pat. 20,555, Sept. 9, 1912.

A silver image on a non-pigmented gelatin support is treated with a dilute (*e.g.* 3 to 5 per cent.) solution of a soluble chromate or bichromate to render insoluble the gelatin which is in intimate admixture with the silver image; the soluble portions of the gelatin are now removed by treatment with a concentrated (saturated) solution of sodium bichromate at a low temperature, and the silver is dissolved, locally or entirely, from the film by means of sodium thiosulphate, alone or mixed with ferricyanide. The clear gelatin relief prints thus formed may be stained with a dye or coloured by local staining, with or without the use of a mordant. The coloured reliefs may be used for preparing cinematograph films or for colour printing, whilst the clear relief pictures may find a use as resists in sand blasting or etching.—T. F. B.

Diapositives or katapositives ; Producing and combining colour elements for ——. F. W. Kent, Clapham. Eng. Pat. 20,556, Sept. 9, 1912.

A silver print is produced and toned on a flexible base saturated or surfaced with resin, rubber, ozokerite, or like material impervious to water and softened by heat or by a solvent. The print is now cemented to a final support of glass, celluloid, etc., which may also hold a gelatin relief obtained as described in Eng. Pat. 20,555 of 1912 (see preceding abstract) and the flexible base is removed. When several transfers are to be superimposed, they are cemented together by means of a mixture of water-glass and albumin.—T. F. B.

Colour photography. O. S. and H. E. Dawson, Wanstead, and Cinema Halles, Ltd., London. Eng. Pat. 6903, March 20, 1913.

A "photographic base" for use in colour photography is obtained by producing on the sensitive coating of a film, plate, etc., different physical states by two separate operations, which may be performed either simultaneously or consecutively; thus, the two operations may consist of simultaneous or consecutive exposures of unequal time through two screens or negatives, or two separate exposures through one negative. The photographic base thus produced is selectively coloured. Colour transparencies may be produced by first making a colour screen positive transparency, and then building on this, one by one, the colours of the multicolour screen by means of the working screens or their replicas used for making the multicolour screens. In making colour transparencies from continuous tone negatives or positives, a sensitive film or plate is given unequal exposures through two such negatives or positives and then selectively coloured. To produce colour prints on opaque bases, the sensitised base is given two unequal exposures through two continuous tone negatives or two printing screens, and then selectively coloured. Three-colour photographs are produced by re-sensitising a two-colour base obtained as above, and selectively colouring with the third colour. —T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Black powder and dynamite ; Analysis of ——. W. O. Snelling and C. G. Storm. U.S. Dept. Interior, Bureau of Mines, Bull. 51, 1913. 80 pages.

Descriptions of the methods of sampling and analysis of dynamites and black powder used by the U.S. Bureau of Mines. *Dynamite:—Gravimetric density.* Determined by the displacement method using sand which has been sifted through a 60-mesh sieve as medium. *Exudation.* In addition to the test in which the explosive is kept at 40° C. for six days, a centrifugal test is used. 8 grms. of the sample are placed in each of two Gooch crucibles suspended above two non-perforated crucibles in which cotton is placed. The crucibles are rotated around a spindle at a speed of 600 revolutions per minute for 5 mins. at 20° C., the circle of rotation of the bottoms of the crucibles being 14 cm. in diam.; the loss of weight should not exceed 5 per cent. *Stability.* The Abel heat test is used (see Storm, this J., 1910, 177). Methods are given for the determination of the constituents of dynamite, gelatin-dynamite, ammonia-dynamite, low-freezing dynamite, granulated nitroglycerin powder, and black powder. Moisture in black powder is determined by drying a 2-grm. portion of an 80-mesh sample for 3 hours in a sulphuric acid desiccator.—A. S.

Nitrocelluloses; Examination of —— in the polarisation-microscope. H. Ambronn. Kolloid-Zeits., 1913, 13, 200—207.

The results of the examination of nitrocelluloses of different degrees of nitration in the polarisation-microscope are given. It is shown that with rising nitrogen content the double refraction, at first positive, diminishes to zero, and then again increases but is now negative in relation to the longitudinal direction of the fibre. With monochromatic light of wave-length 435 $\mu\mu$, the character of the double refraction changes at about 11·8 per cent. N, and at somewhat higher nitrogen contents for light of greater wave length. Examination of individual fibres showed that the nitration was uniform throughout the length of the fibre, but the several fibres in a sample of the same material sometimes exhibited differences indicating that some fibres were nitrated to a greater extent than others. These results, showing that there is a relation between the nitrogen content and the optical properties of nitrocelluloses, indicate that the use of the polarisation-microscope may prove of great service in the nitrocellulose industry.—A. S.

Cellulose nitrate solutions; Viscosity of ——. F. Baker. Chem. Soc. Trans., 1913, **103**, 1653—1675.

The author determined the viscosities of solutions of nitrocelluloses, mostly of concentrations not exceeding 2 per cent., in different solvents. The nitrocelluloses used were selected samples of products prepared on a large scale, *viz.*, (*a*) blasting soluble nitrocellulose, as used in the manufacture of blasting gelatin, 11·85 per cent. N, completely soluble in ether-alcohol; (*b*) highly soluble nitrocellulose, as used in ballistite, 12·38 per cent. N, solubility in ether-alcohol, 97·4 per cent.; (*c*) guncotton prepared for the manufacture of cordite, 12·98 per cent. N, solubility in ether-alcohol, 9·6 per cent. The solvents were acetone, ethyl formate, methyl, ethyl, propyl, and amyl acetates, ethyl butyrate, acetoethyl-*o*-toluidide, ethyl-*o*-tolylethylcarbamate, ethyl phthalate, alcohol-ether, methyl alcohol-ether, benzylalcohol-ether, and methylalcohol-anisole. The ethyl-*o*-tolylethylcarbamate (tolylethylurethane) was prepared by the action of ethyl-*o*-toluidine on ethyl chloroformate: it is a colourless oil boiling at 257° C. at 755 mm. Phenylethylurethane (b. pt. 249° C. at 760 mm.) was prepared in a similar way. Both compounds readily dissolve the "soluble" kinds of nitrocellulose. The viscosities were determined in a series of viscometers of the Ostwald-Poiseuille type and the results are given in tables. The variation of viscosity with the concentration of the solution is shown to follow the law: $\eta=\eta_0(1+ac)^k$, where η and η_0 are the viscosities of the solution and the solvent respectively, c is the concentration, and a and k are constants depending on the nature both of the solute and the solvent. For comparing different solvents the value of $\frac{d \log \eta}{dc}$ was found most convenient. The variation of this constant with different solvents, using the same nitrocellulose, indicated that the better the solvent the lower the viscosity of the solution. Nitrocelluloses prepared from mercerised cellulose have a much lower viscosity than those from normal cellulose, and the similarity of the viscosities of cuprammonium solutions of mercerised cellulose and normal cellulose respectively, observed by Ost (this J., 1911, 1247) cannot be due to chemical identity of the two products, as suggested by him, but probably to a change in normal cellulose preceding or accompanying its solution in cuprammonium.—A. S.

Explosion of detonator composition; Circumstances attending an —— which occurred at the factory of Messrs. Kynoch, Ltd., at Holford Mills, near Birmingham, Staffs, on July 29, 1913. Major T. H. Crozier, H.M. Inspector of Explosives. [Cd. 7090.]

The first explosion appears to have occurred at the priming machine, and was probably caused by some action of the workwoman in connection with this apparatus. It was possible that a small quantity of fulminate composition might have adhered to the underside of the plate, or the guides for the block, and that it might have been fired by the action of sliding the block into position. The camel's hair brush used for spreading the composition over the tray was a flat one with a light wooden handle. The metal socket holding the hair was bound round carefully with indiarubber tape, and the brush had been in use nearly a fortnight. It was perhaps possible that a blow from the wooden handle might be sufficient to explode a thin film of fulminate composition. The second explosion was caused by the first, which shook down the cement lining, bringing with it a cupboard containing a bowl of fulminate composition, and this bowl exploded on, or near, the floor below the position of the cupboard. The inspector considers that the explosion was entirely accidental and that no blame could be attached to any person in connection with it. Work was proceeding in a regular manner and the only suggestion made is that the brush employed for spreading the composition on the tray of the priming machine should have some form of handle other than wood. A handle either of buff leather or indiarubber would be preferable.—G. W. McD.

Coal dust explosion tests in the experimental mine [*U.S.A.*]. Rice and others. *See* IIa.

Patents.

Explosives. F. L. Nathan, W. Rintoul, and F. Baker, Ardeer, Scotland. Eng. Pats. (1) 12,742 and 12,744, (2) 12,743, (3) 12,745, and (4) 12,746, May 30, 1912.

Claim is made for the replacement of the 5 per cent. of mineral jelly (vaseline) added as a stabilising agent to cordite, by certain organic compounds which possess the property of combining or reacting with the decomposition products of nitric esters, and thus preventing them from having any accelerating influence on the decomposition of these esters. The substances of which the use is claimed in the several patents are: (1) Simple or mixed non-volatile ethers containing an aromatic radical, *e.g.*, diphenyl ether, phenylbenzyl ether, ethyl-β-naphthyl ether and phenanthryl-methyl ether. (2) The esters of substituted carbaminic acids containing one or more aromatic radicals, such as methyl-phenyl-urethane. (3) Derivatives of urea in which one, two, or three of the hydrogen atoms are replaced by an organic radical of which at least one is an aromatic radical, such as ethyl-phenyl-urea. (4) Derivatives of organic acid amides in which one of the hydrogen atoms of the NH_2 group is replaced by an aromatic radical, such as phenylacetanilide. (Reference is directed to Eng. Pat. 17,456 of 1888; this J., 1890, 105.)—G. W. McD.

Liquid explosives; New and useful system or arrangement for elevating and transporting —— from one operating place to another. S. Viesi. Dinamita, Mexico. Eng. Pat. 10,895, May 8, 1913.

The nitroglycerin is drawn by suction from the filter tank to a receptacle on top of the mound, from which it flows, by gravity, to the other houses. The filter tank and the other houses can consequently be on the same

level and communicating tunnels between the filter tank and the other buildings are dispensed with.
—G. W. McD.

Explosive. J. F. O'Brien, Chicago, Ill. U.S. Pat. 1,073,279, Sept. 16, 1913.

A MIXTURE of potassium chlorate and sodium nitrate (60 parts), liquid dinitrotoluene (15), and sawdust (5 parts).
—G. W. McD.

Priming composition. M. R. Swope, Aiton, Ill. U.S. Pat. 1,073,941, Sept. 23, 1913.

A MIXTURE of 20 parts of guncotton and 5 parts of amorphous phosphorus, both dry, is mixed with 37·5 parts of potassium chlorate and 37·5 parts of antimony sulphide.—B. N.

Hexamethylene-triperoxide-diamine ; Process for preparing ——. C. F. von Girsewald. Ger. Pat. 263,459, Sept. 14, 1912.

A GOOD yield of hexamethylenetriperoxide-diamine, $N(CH_2.O.O.CH_2)_3N$, is obtained by the action of hydrogen peroxide on a salt of hexamethylenetetramine with an organic or inorganic acid (*e.g.*, citric acid), in concentrated solution. The yield may be increased by addition of organic solvents or other substances which prevent decomposition of the hydrogen peroxide.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Fluorine ; Volumetric determination of ——. A. Greeff. Ber., 1913, **46**, 2511—2513.

THE method depends on the fact that when a neutral aqueous solution of ferric chloride is added to a solution of alkali fluoride, a white precipitate of a composition analogous to that of cryolite is produced, *e.g.*,

$$6NaF + FeCl_3 = Na_3(FeF_6) + 3NaCl.$$

0·5 grm. of substance is dissolved in 25 c.c. of hot water, the cooled solution (which must be neutral to phenolphthalein) is treated with 20 grms. of sodium chloride and 5 c.c. of potassium thiocyanate solution (100 grms. dissolved in 500 c.c. of water) and titrated with a standardised solution of ferric chloride (100 c.c. = about 1 grm. NaF) till a yellow colour is produced. 10 c.c. of alcohol and 10 c.c. of ether are now added, the whole shaken vigorously, and the titration continued until the ether layer is permanently coloured red. In the case of commercial sodium fluoride, which usually contains some acid fluoride and silicofluoride, these are converted into fluoride by titration with alkali in presence of phenolphthalein, and then the total fluoride is determined as described above. The acid fluoride is determined alone by titrating with alkali a portion of the sample in aqueous alcoholic solution, in presence of potassium chloride, which converts the silicofluoride into insoluble potassium silicofluoride.—A. S.

Radium in radioactive substances ; Determination of ——. A. L. Fletcher. Phil. Mag., 1913, **26**, 674—677.

A SMALL fragment (0·01—0·0001 grm.) of the mineral or salt is placed in a hollow in a thin rod of arc carbon clamped between terminals connected with a source of electric current. The rod is disposed inside a closed chamber provided with inlet and outlet tubes. It is heated by passage of a current of about 10 ampères per sq. mm. of cross-section to 2000°—3000° C. for 10—30 seconds and the emanation is transferred, by way of tubes containing calcium chloride, soda-lime, phosphorus pentoxide and cotton-wool, to an electroscope which has been exhausted, re-filled, observed, again exhausted, and then placed in communication with the heating chamber. Concordant results are obtained. In the case of solutions, an accurately measured small quantity of the relatively concentrated solution is placed on the carbon rod, and the determination made after 1 month. Experiments with pitchblende showed that the emanation was evolved only very slowly up to about 750° C., after which the amount liberated increased rapidly with rise of temperature.—A. S.

Antimony ; Electrolytic deposition of ——. N. K. Chaney. J. Amer. Chem. Soc., 1913, **35**, 1482—1490.

ANTIMONY can be deposited quantitatively from an ammonium polysulphide electrolyte, if the ammonia and ammonium sulphide are gradually expelled by boiling, as electrolysis proceeds. The ammonium polysulphide solution is prepared by saturating concentrated aqueous ammonia with hydrogen sulphide in presence of excess of powdered sulphur, filtering after prolonged shaking, and adding 1 part of the solution to 6 parts of a concentrated ammonia solution which has been saturated with hydrogen sulphide. This polysulphide solution is added gradually to the antimony chloride solution (about 0·2 grm. Sb) till a clear solution is obtained and after diluting to 125 c.c., electrolysis is effected at the boiling point with an initial voltage of 3·5 and a current of $N.D_{100} = 1$ ampère. With the anode rotating at 400 revolutions per minute, the antimony is completely separated in 1 hour as a polished white metallic deposit. Towards the end the E.M.F. is raised to 4 volts. Tin is also deposited under similar conditions.
—A. S.

Barium sulphate ; Filtration of ——. J. L. Osborne. J. of Phys. Chem., 1913, **17**, 629—631.

KRAK (Chemist Analyst, 1912, 26) has shown that if the supernatant liquid be poured off, a precipitate of barium sulphate can be granulated by stirring it with a saturated slightly acid solution of ammonium acetate, so that it may readily be filtered by suction. There is no such action if the supernatant liquid is not removed. Ammonium chloride and hydrochloric acid do not disintegrate the granular precipitate when once it is formed. If the barium sulphate is originally precipitated cold, much longer action of the ammonium acetate is necessary to give the easily filterable granules.—W. H. P.

Organic substances ; Cerium dioxide as contact substance in the analytical combustion of ——. J. Bekk. Ber., 1913, **46**, 2574—2579.

EXPERIMENTS are described showing that cerium dioxide gives good results when used as a contact substance in the analysis of organic substances by combustion. Good results have been obtained for carbon, hydrogen, nitrogen, and halogens, using slight modifications of the methods described by Dennstedt (this J., 1897, 765 ; 1898, 276 ; 1908, 357, 1043), but with asbestos impregnated with cerium dioxide as contact substance. The latter is prepared by soaking purified asbestos in a concentrated solution of cerous nitrate, and then igniting it.—A. S.

Determination of cellulose in wood by Cross and Bevan's method. Sieber and Walter. *See* V.

Detection of nitrous acid in presence of nitric acid. Leclère. *See* VII.

Reduction of mercuric chloride by sodium formate. Findlay and Davies. *See* VII.

Electro-analysis of white bearing metals. Compagno. *See* X.

Determination of filling materials in rubber mixings. Loewen. *See* XIV.

Quantity of lead remaining in solution in impure beet or cane sugar liquors after treatment with basic or normal lead acetate. Pellet. *See* XVII.

Causes of error in the determination of morphine. Débourdeaux. *See* XX.

Determination of iron in Syr. Ferri Phosph. Co. and other pharmaceutical preparations. Evers. *See* XX.

Analysis of black powder and dynamite. Snelling and Storm. *See* XXII.

Journal of the Society of Chemical Industry.

No. 21, Vol. XXXII. NOVEMBER 15, 1913. No. 21, Vol. XXXII.

Liverpool Section.

Meeting held at the University on Wednesday, April 23rd, 1913.

PROF. F. G. DONNAN IN THE CHAIR.

DISCUSSION ON ELECTROLYTIC ALKALI PROCESSES AND THEIR FUTURE IN THIS COUNTRY.

Mr. J. B. C. **Kershaw** said that diaphragm cells, with a moving electrolyte, the flow of which through the cell counteracted the effects of convection currents and of the ionic migration which was constantly occurring, were now the most efficient type of electrolytic cell for the production of alkali and chlorine compounds, and of that class of cell, the Billiter-Siemens cell, which had been described above, was one of the most successful. Table I. showed the figures for the current and energy efficiencies of the best known electrolytic alkali processes, and supported the statement, for the Billiter-Siemens and Finlay cell were seen from that table to possess the highest energy efficiencies. The Finlay cell was handicapped, however, by the low concentration of the caustic liquor produced, and that explained the fact that no commercial development of the cell had yet occurred.

The examination of the cost figures for the Billiter-Siemens cell proved, however, that unless electric power could be generated or supplied at a lower cost than 0·5d. per k.w. hr., the commercial prospects for the development of the diaphragm processes in the United Kingdom were not very favourable. The electric supply costs and records published by the "Electrical Times" provided useful information as to the costs of generating electricity by steam-power at various centres in this country. The figures in Table II. were the lowest costs for the districts named. Most of those returns related to the year 1911, and the price of coal had risen considerably since that date. The costs given were therefore minimum works costs, by the present methods of generating electric power from coal.

From the above figures of costs it could be seen that only two authorities, Stalybridge and Coventry, were generating electricity in 1911 at a cost under 0·4d. per k.w. hr. and that in the majority of large towns the cost was over 0·5d. per unit. It was doubtful, however, whether any small independent plant could generate electricity as cheaply as those selected towns, with their large plant and enormous output. Seeing that at Niagara Falls the k.w. hr. cost only one-sixth penny for plants taking 1000 k.w. and only one-twelfth penny for 5000 k.w., and that in Switzerland and Norway the cost of electric power was considerably lower than at Niagara Falls, it would be understood that many processes might succeed abroad, which would only fail if tried in this country, under the present conditions of power generation and supply. In the course of time it was quite possible that electric power might be generated much more cheaply by the gasification of the coal at the pit's mouth or underground, followed by the use of this gas in gas-engines of large size for driving dynamos. The peat resources of Ireland and Scotland would also, no doubt, be exploited in a similar manner, before the end of the present century, and the utilisation of the waste gases from coke-ovens and blast-furnaces would also in time cheapen the supply of electric power in the districts that supported large iron-smelting and coke-oven plants. It was quite probable, therefore, that as time passed on it might be possible to obtain supplies of electricity for industrial purposes in this country at much lower rates per k.w. hr. than any shown in Table II., and that electrolytic processes which, if introduced here to-day, would only meet with failure, might then become practically and economically successful.

In the meantime the older Le Blanc and Solvay processes of alkali manufacture, which still provided the larger portion of the chemicals required for the soap, textile, paper and glass industries of the world, would continue to exist and to prosper. But those who had the management and control of these old-established processes of alkali and bleach manufacture, would be wise to develop to the fullest extent the manufacture of by- and secondary products, upon their output of which they would have to depend more and more for their profits, in the years before them.

Table I.

Current and energy efficiencies of various electrolytic alkali processes.

Name of process or cell.	Efficiencies per cent.		Concentration of soda liquor.	Authority.
	Current.	Energy.		
Castner-Kellner	91	52·3	?	Kershaw
Hargreaves-Bird	80	54·0	?	do.
Aussig "bell"	87½	40·9	?	do.
Griesheim	75	48	1 to 2 *N*	Allmand
Billiter-Siemens	92	68	3 *N*	do.
Billiter-Leykam	95	59	3 to 4 *N*	do.
Townsend	94	45	4 *N*	do.
Finlay	98	75	2 *N*	do.

Note.—A concentration of 1 *N* is equivalent to 40 grms. of NaOH per litre.

Table II.

Lowest costs of generating electricity by steam-power in the United Kingdom.

Name of company or local authority.	Annual output in B.T. units	Capacity of plant in k.w.	Total working costs per k.w. hr. in pence.
Stalybridge	14,662,000	7,500	0·32
Coventry	10,473,339	9,000	0·33
Leeds	17,841,572	15,440	0·44
Sheffield	14,254,291	11,400	0·48
Newcastle District Electric Power Co.	13,122,792	9,000	0·49
Central London	18,102,440	12,930	0·51
Manchester	83,308,848	47,300	0·54
Birmingham	40,190,547	24,040	0·60
Glasgow	40,823,690	37,478	0·62
Liverpool	37,765,203	37,000	0·64

Professor F. G. **Donnan** referred to the table of power costs which Mr. Kershaw had presented. The vast majority of the cases quoted were municipal supply undertakings. It was well known that in such cases the load-factor was very unfavourable, generally about 20 per cent., instead of the 100 per cent. load-factor of an electrolytic alkali works. For that reason municipal power engineers had installed steam turbo-generators, on account of the lower capital costs. There was also the question of interest on the capital expended in the supply mains. The power costs of such undertakings must therefore be ruled out in dealing with the question of the cost of power for electrolytic alkali works.

If modern gas-producers and gas-engines were employed, using fuel with a reasonable percentage of nitrogen and working with an efficient sulphate and tar recovery, he was of opinion that an electrolytic alkali works in England at the present time should be able to generate its power at a cost of 0·1d. per unit, so that there was no reason whatever, so far as the cost of power was concerned, why successful electrolytic alkali processes could not be worked here. With regard to the figures given by Engelhardt, which Mr. Kershaw had quoted, the lower estimate of about a farthing per unit for the cost of power was, in his (Professor Donnan's) opinion, a quite sufficiently generous one, so that if the other figures given by Engelhardt concerning the capital and working costs of the Billiter-Siemens cell were equally reasonable, it was evident that that electrolytic process could produce alkali and bleach at a handsome profit. The extension of the process on the Continent at the present time was good evidence of the correctness of that conclusion. If, therefore, successful electrolytic alkali processes could be worked at the present time in Germany and Austria, he entirely failed to see why that could not be done in England. Mr. Kershaw had said that it would be necessary for English alkali manufacturers to put their houses in order, and prepare for the future. He (Professor Donnan) was of the opinion that it was a question not of the future but of the present. English alkali manufacturers might soon find that instead of preparing for the future it would be their lot to mourn for the past. Referring to the Finlay cell, of which he had had some personal experience, he said, as was well known,* it was a double diaphragm cell with doubly counter-flowing electrolyte. By an ingenious "filter-press" arrangement the thickness of the electrolyte was reduced to a minimum, whereby both economy of power and space were secured. Working with purified brine and a current density of 4 ampères per square decimetre of diaphragm, tho Finlay cell could produce 8 per cent. caustic liquor at a voltage not exceeding 3 volts and with a cathodic current efficiency of 98—99 per cent. Later (unpublished) results obtained by Mr. Finlay showed that 12 per cent. caustic could be produced with practically the same energy- and current-efficiency. In the Finlay cell there was a constant difference of hydrostatic pressure at every point of the diaphragm, so that uniform percolation of the brine was secured. If the brine was purified, the vertical diaphragms could be used for sufficiently long periods of time without becoming choked or disintegrated. The cells as now used by Mr. Finlay were provided with automatic brine supply and automatic withdrawal of anolyte and catholyte, so that a large installation can be run with low labour charges for supervision. Three 1000 ampère units were being operated at present by Mr. Finlay in Belfast with very satisfactory results. In conclusion he said that the apparent failure of the Hargreaves-Bird cell in England was no evidence that diaphragm cells could not be worked successfully here. The Hargreaves-Bird cell made carbonate, not caustic, and was therefore handicapped from the very outset. Moreover, the Billiter, Finlay, and Townsend cells constituted very great advances in the theory and practical construction of diaphragm cells, and their successful operation on the Continent and in America bore striking testimony to the reality of these advances.

Speaking generally, as regards the question of the employment of electrolytic alkali-chlorine cells in England, he believed that with modern efficient power plant and the efficient cells that already existed, success could be confidently predicted.

Dr. R. E. Slade agreed with Prof. Donnan that it was useless to consider the costs at which electric power was supplied by English municipalities as a basis on which to calculate the cost of electrolytic alkali in this country. Mr. Kershaw's own figures showed that in one case the cost was based on a 10 per cent. load factor, whilst in an electro-chemical works the load factor was usually nearly 100 per cent. He was quite convinced that power could be produced in this country at 0·2d. per unit and perhaps even less if the plant was as large as 2000 horse power and gas engines with ammonia recovery were used. It was not only of great importance that a cell should have a high power efficiency, but also that the power efficiency should, as far as possible, fall off only slowly with increase of current density. In explanation of this point he read the following:—

Determination of the current density at which an alkali-chlorine cell should be run to give the greatest economic efficiency.

As the current density varies the cost per ton of caustic will also vary. If the total cost per ton is divided into its constituent items it is found that some of these costs (per ton) increase and some decrease when the current density is increased. For example, the cost (per ton of caustic) for power will increase as the current density increases for the power efficiency will fall off. The costs for stores, repairs and electrodes will usually increase, also, with increase of current density, whilst the labour and capital costs will generally decrease, and the cost for raw materials remain constant.

The author is unable to give the actual figures for any particular case, but in Fig. 1 are given curves showing the way these costs might be expected to change with the current density. As the output of a given plant varies directly with the current density the values of the output (*e.g.*, in tons per week) are plotted as abscissae against the costs per ton of caustic soda as ordinates.

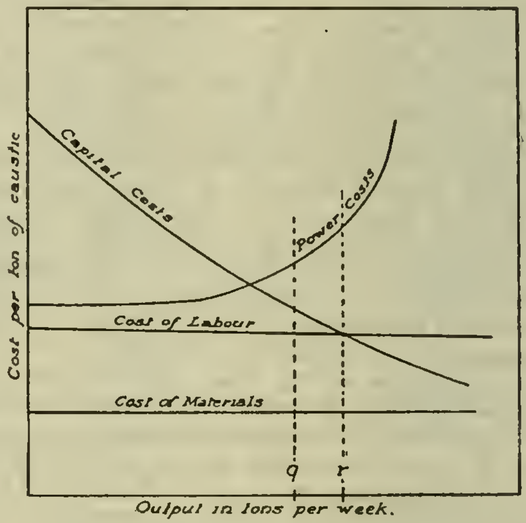


Fig. 1.

The relative values of the costs of the various items have been obtained from a paper by Engelhardt, which is quoted above by Mr. Kershaw, power being taken at 0·3d. per unit. From this figure the cost per ton of caustic at any given output may be determined by measuring the sum of the ordinates at any given point on the abscissa. From the cost thus obtained must be subtracted the value of the chlorine produced which may be plotted on another curve drawn to the same scale. The value of the chlorine produced per ton of caustic usually falls with increase of output as at a higher current density the anodic current efficiency is lower.

In Fig. 2 is given the cost per ton of caustic (obtained as described above) plotted against the output in tons per week. The selling price per ton of caustic is also given. It will be seen that the cost per ton of caustic soda reaches a minimum at (q) and that this minimum corresponds to a point (q) on Fig. 1 where the cost for power (per ton) is by no means at its minimum—that is to say that the lowest price per ton of product is at a greater current density than that at which the current efficiency is near its maximum. Tho profit per ton corresponding to the various outputs is given by the lengths of the lines, bb^1, cc^1, etc. The total profit per week is the product of the profit per ton multiplied by the output in tons per week; at the various outputs this total profit is therefore equal to the products $ab \times bb^1$, $ac \times cc^1$, $ad \times ad^1$, etc., that is the total profits for a given output is proportional to the area of the corresponding rectangles. ab^1, ac^1, ad^1, etc. are examples of these rectangles. The rectangle with the greatest area will not necessarily be that corresponding to the output (q) at which the profit per ton is greatest. If that portion of the curve (showing the cost per ton of caustic) which lies to the right of q makes an angle of less than 45° with the axis of x the rectangle of maximum area will be that corresponding to an output which is greater than q. The curve of total profit per week shows the area of these rectangles plotted against the output per week; it is drawn on a smaller scale than the other two curves. The maximum of this curve is seen to be at the point, *r*. The point, *r*, therefore corresponds to the output per week at which the profits are a maximum. It will be noticed that this output (*r*) is greater than that at which the cost of production is a minimum (q) and this latter output is greater than that at which the power efficiency is the greatest. If the power efficiency of the cell only falls off very slowly as the current density (output) is increased, the cost of power curve (Fig. 1) is flatter, the point at which the cost curve is a minimum (q) corresponds therefore to a greater output and the cost curve is flatter. The maximum of the total profit curve will therefore lie still further to the right. That is to say, the output for maximum profits will be greater and the profits themselves will be greater.

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* Cf., for example, Allmand's "Principles of Applied Electrochemistry," p. 330.

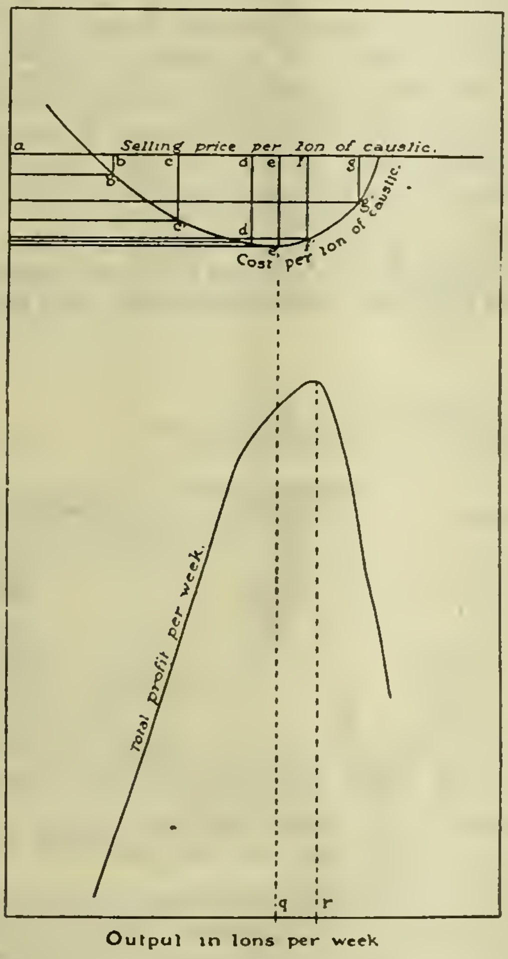

FIG. 2.

Mr. A. Carey said that the question of power was the most vital question in determining the difference between the electrolytic and the older processes for alkali production. His own impression led him to agree with Mr. Kershaw rather than with Professor Donnan as to the cost of power. He would like to know when and where Professor Donnan's one-tenth of a penny unit was a practical working one with coal at the present price, even with a 100 per cent. load factor.

Mr. John Gray said that on the question of power cost he agreed with Mr. Carey and Mr. Kershaw rather than with Professor Donnan. He could only wish that Professor Donnan could put them in the way of obtaining power at one-tenth of a penny. He understood that Mr. Kershaw's figures on the screen referred to cost at the switch-board. He knew of one installation; one of the most recent working at full output, as near 100 per cent. as possible, and the cost was about 0·25d. per unit. That was one of the lowest figure which he believed has been reached in this country.

Mr. H. E. Potts said that he believed there was one direction in which they might expect to obtain cheap power. There had lately been brought out an improvement in the Hodgkinson process of salt production. A very considerable saving in power was effected by the use of the by-products, and if the process was capable of successful practical working, there was a possibility of a cheap power supply.

Mr. Carruthers Thomson, speaking as an engineer, expressed the opinion that much as he would welcome the introduction of power at one-tenth of a penny, at present they had to consider that they were doing very well if they got it at ¼d. Even when theoretically one-tenth of a penny would be possible, practical tests generally revealed a loss and consequent raising of the price. He noticed that all the figures on the table Mr. Kershaw had shown were either almost ¼d. or considerably over that figure.

Mr. W. Gordon Carey said that an electrolytic alkali plant which he had had the privilege of starting and controlling, consisted of 144 cells of the rocking Castner type, measuring 6 feet by 4 feet internally, and containing 200 lb. of mercury. With a current of 560 amperes at 4 volts, using Acheson graphite anodes and iron cathodes each cell made about 0·75 gallon of 20 per cent. caustic soda per hour. In working the cells care had to be taken to prevent undue hydrogen formation in the anode chamber, due to concentration of amalgam, and to interaction of brine and amalgam. A constant watch was kept on that by means of gas analyses otherwise serious explosions might occur. Mercury taken from cells during cleaning was purified from disintegrated graphite and from other foreign matter by mechanical means, and by dilute nitric acid. The total loss of mercury should be under 2 per cent. per annum. With current produced at 0·3 of a penny per unit and taking into account the 40 tons of bleaching powder made per week, the whole process became a paying proposition, allowing interest on the heavy capital cost of mercury, etc., and also taking into account wages, and depreciation of plant at 10 per cent. per annum.

Dr. Allmand discussed the advantages and disadvantages of horizontal and vertical diaphragms, and the corresponding cell constructions necessary. He was of the opinion that the internal heating arrangement employed for the brine in the Billiter-Siemens cell was quite as important a feature of the cell as the diaphragm, the voltage being thereby considerably lowered. Loaded diaphragms were discovered and used about the same time, independently of Dr. Billiter, by both Finlay and Baekeland. He described one or two minor defects of the cell which led Billiter to the subsequent design of the Billiter-Leykam cell. The fact that magnetite anodes were used was new to him. They were stated to have only been produced in cylindrical form, and he thought that electrodes of such a shape could only be adapted with difficulty to cells of the horizontal diaphragm type.

A NEW DIAPHRAGM PROCESS FOR THE MANUFACTURE OF ALKALI AND CHLORINE COMPOUNDS BY ELECTROLYSIS.

BY J. B. C. KERSHAW, F.I.C.

The Billiter-Siemens process of alkali production by electrolysis of brine in a bell-type of cell is protected by British Patent No. 7757 of 1907 (see this J., 1907, 1015, and 1908, 166) and was described by Allmand in a paper before the Faraday Society (November, 1912), and in his text-book on "The Principles of Applied Electrochemistry." During the five years that have elapsed since the 1907 patent was granted to Billiter, the cell has been thoroughly tested on a practical scale, at the Kaliwerke Aschersleben, and the patent rights for Europe have passed into the hands of Messrs. Siemens und Halske of Berlin. There are now five works in operation using the Billiter process for the manufacture of alkali and chlorine compounds. Three of these may be classed as chemical works, since they sell the caustic alkali and chlorine products, obtained from the cell. Of the remaining two, one is a paper works, and the other is a textile works, the chlorine production of the electrolytic plant, in these cases, being used in the works, and not sold.

(Details of these works are given in Table I.)

Kaliwerke Aschersleben A.-G., at Aschersleben, Saxony.

This plant is designed for the production of caustic soda or potash and of chlorine gas, by the decomposition of sodium or potassium chloride. The cells are long, narrow troughs with granite side-walls, held together by corner anchor blocks and long iron rods, and are designed to utilise a current of 2000—2500 amperes. Each cell is provided with an iron bottom, and rests upon iron I-shaped girders which are insulated from the ground. The wire gauze cathodes rest upon this iron bottom inside the cell, and in this way make contact with the current leads. The covers of each cell are made of earthenware, and are provided with the necessary openings for the anodes and for the pipes which carry away the chlorine gas, and also for the salt and the heating solutions.

The main supply pipes for the brine and heating solutions are placed underneath the cells in a wide channel in the floor of the cell room; vertical branches lead from these to the cells. At Aschersleben the chlorine gas is employed in the chemical works, but for what purpose is not stated. The caustic alkali solution is collected from the cells by a pipe running in a floor-channel underneath the cells, and is led to a collecting chamber, whence it is pumped into the concentrating pans, and is sold either as strong caustic liquid, or as solid caustic. The hydrogen, which is liberated in the cathode compartment of the cells, is not used at the Aschersleben works at present, but arrangements exist for its collection and storage, and it is probable that it will either be compressed and sold for balloon purposes, or utilised for the synthetic manufacture of ammonia. In this connection it is interesting to note, that several of the electrolytic alkali works are turning their attention to the utilisation of their hitherto wasted hydrogen for this new manufacture.

TABLE I.

Locality and capacity of works employing the Billiter-Siemens diaphragm cell.

Title of firm or company.	Locality of works.	No. of cells.	Capacity of cells in amperes.	Kilowatts utilized.
Kaliwerke Aschersleben	Aschersleben, Saxony	10	2000	100
Bosnische Elektricitäts Akt.-Ges.	Brückl, Austria	64	2500	650
Ignaz Spiro und Söhne	Krummau, Bohemia	32	500	65
Farbwerke Höchst	Höchst, Germany		?	?
Niagara Alkali Co.	Niagara Falls	50	3000	1000

An overhead travelling crane is provided in the cell room, and by its means the cover of each cell, with its complement of connecting pipes and graphite anodes, can be quickly raised in the air clear of the cell, and any work required in the interior of the cell, can then be carried out, with a minimum of trouble and loss of time.

The electric current is conveyed to the cells by bare copper conductors laid on insulating blocks, and the cells are run in series with an E.M.F. of between 3·5 and 4·2 volts per cell, and a mean current intensity of 2000 amperes. The connecting leads between the cells are so arranged that any cell can be cut out without disturbing the work of the remainder. At the trial of this plant, made in April, 1909, the following results were obtained:—

Current intensity, 2000 amperes.

Current voltage, 3·66 per cell.

Current efficiency, 94·7 per cent.

Concentration of cathode liquor, 130 grams NaOH per litre.

Chlorine gas contained 1·17 per cent. carbon dioxide.

Duration of test, 4 weeks.

The consumption of salt required with the Billiter cell is only a little above that required by theory, since the salt that remains undecomposed is fished out during the concentration of the caustic liquors, and is returned to the electrolytic cells with the fresh brine. Messrs. Siemens und Halske state, in fact, that one kilo. of active chlorine can be obtained by this process with an expenditure of electrical power between 3·4 and 4·0 k.w. hrs. and with a consumption of only 1·8 kilos. of salt. The theoretical figures for 100 per cent. efficiency, are 1·7 k.w. hrs. and 1·6 kilos. salt.

II.—*Plant at the paper works of Spiro und Söhne at Krummau a.-d. Moldau, Bohemia.*

This firm produces sulphite cellulose for paper manufacture, and the electrolytic plant which was erected in 1910, comprises 32 Billiter-Siemens cells, utilising a current of 500 amperes, at 115 volts, and producing chlorine equivalent to 1000 kilos. of bleach per day of 24 hrs. The chief difference between this and the earlier plant erected at Aschersleben, is in the form and construction of the cells. These are reduced considerably in size and are now constructed of boiler-plate provided along the four inner sides of the cell with a thick lining of cement, in order to confine the current to the iron bottom which is in contact (as before) with the negative wire-gauze electrode. Each cell contains 12 graphite anodes which are connected in parallel—the cells themselves are connected in series. The other details of the plant are as already described. The chlorine produced at this plant is absorbed by milk of lime, and is used as calcium hypochlorite for bleaching purposes in the other departments of the works. It is noteworthy that Messrs. Siemens und Halske have now convinced themselves, by actual trials, that this system of using the chlorine produced by the electrolysis of chlorides, is more efficient and economical than its use for the production of hypochlorites in the Kellner or any other type of hypochlorite cells. The disposal of the caustic liquors obtained as a by-product is, however, a difficult problem in small plants where no use can be found for these liquors in the works, and they have to be placed on the open market for sale.

III.—*Plant at the works of the Niagara Alkali Co., the successors of the Roberts Chemical Co., Niagara Falls, U.S.A.*

This plant was erected in 1910, and consists of 50 cells, of the long-trough type, already described under the Aschersleben heading.

The cells are of 3000 amperes capacity, and work with a current efficiency of 95 per cent. The other details of the plant are similar to those at Aschersleben. The Niagara Alkali Co. produce caustic potash in solid or liquid form; also liquid chlorine, liquid bleach, and bleaching powder, according to the requirements of its customers. Pure hydrochloric acid, made by the direct combustion of the chlorine and hydrogen from the electrolytic cells, is another speciality of this firm, which manufactures carbon tetrachloride, tin chloride, zinc chloride, and chloroform amongst its other products.

The present capacity of the plant is 3000 tons 90 per cent. caustic potash per annum, with a power consumption of 1000 k.w. Writing on January 4th of this year, the manager of the company informed the author that extensions of the works are in progress which will increase the number of cells to 150, and the output of caustic potash to 9000 tons per annum.

Concerning the other two works where the Billiter-Siemens cell is in operation, no details of the plant are available for publication beyond those given in Table I.

Yields and costs.—As regards the yields and costs of this new cell and process, the most reliable figures available are those given in a lengthy article upon "Die Betriebskosten der Chloralkalielektrolyse" by Dr. V. Engelhardt in the "Chemiker-Zeitung" in 1911. From this article the following figures are taken. These estimates, it may be explained, are based on the supposition (1) that both the chlorine and caustic alkali produced in the cell are worked up into solid form, and sold as 35 per cent. bleach and 73 per cent. caustic soda, and (2) that the plant is of large size and is fully equipped with all the necessary accessory plant for carrying on the process. The first estimate is based on the provision of electric power at a cost of 0·235 penny per k.w. hr. the second at a cost of 0·587 penny.

Details of power requirements.
1200 k.w. for electrolytic cells; 30 k.w. for the bleaching powder plant; 30 k.w. for the caustic concentrating plant; 20 k.w. for pumps and fans; 70 k.w. for lighting and miscellaneous purposes. Total, 1350 k.w.

Output of finished products.	Tons per ann.
Caustic soda 73 per cent.	3560
Bleaching powder 35 per cent.	*8690
*Capital required.**	£
Electrolytic cells	25,000
Chemical plant	27,000
Buildings, etc.	23,500
Working capital	7,500
Total	£83,000

RUNNING COSTS.

	Marks.	£ Sterling.
Raw materials.		
Salt 5505 tons at 12 M. per ton	66,060	
Lime 6086 tons at 18 M. ,,	109,548	
Coal 6000 tons at 18 M. ,,	108,000	
Total	283,608 =	13,826
Power.		
Estimate 1.—1350 k.w. for 8000 hrs. at ·235d. per k.w. hr.		10,530
Estimate 2.—1350 k.w. for 8000 hrs. at ·587d. per k.w. hr.		26,325
Maintenance and repairs.		
Electrodes	56,000	
Concentrating pans and pots	28,000	
Bleaching powder apparatus	17,500	
Diaphragms	8,000	
Electrolytic cells	5,000	
Miscellaneous repairs	25,500	
Total	140,000 =	6,825
Wages.		
58 process men at 28·8 M. per week	87,000	
3 foremen at 57·6 M. per week	9,000	
Extra help	4,000	
Total	100,000 =	4,875
Cleaning materials, oil, etc.	24,000 =	1,170
Packages, etc.		
Caustic soda	28,000	
Bleaching powder	80,000	
Total	108,000 =	5,265
General expenses.		
Salaries	25,000	
Office and laboratory	12,000	
Insurance	10,000	
Total	47,000 =	2,292
Depreciation of plant and machinery. Estimated at 7 per cent. on capital	114,000 =	5,558
Interest charges. Estimated at 5 per cent. on total capital employed	85,000 =	4,144

(A Summary of these costs is presented in Table II.)

Assuming that Engelhardt's estimate of the yield of bleaching powder for this plant is too high, and that the ratio of bleach to caustic soda is only 2·1 to 1·0, the total receipt from sales would be as follows :—

Caustic soda—3560 tons at £9 15s.	£34,710
Bleaching powder—7476 tons at £5 7s. 6d.	40,183
Total	£74,893

If these estimates be accepted as correct, the profits that can be earned by the Billiter-Siemens diaphragm cell, or by any other type of diaphragm cell, depend chiefly upon the question whether the electrical power for working it can be obtained for less than 5 pfg. (or 0·587d.) per k.w. hr.

The author's thanks are due to Messrs. Siemens und Halske of Berlin, and to the Niagara Alkali Co of U.S.A. for information and photographs relating to the developments of the Billiter process in Europe and America.

The paper was illustrated by lantern slides.

TABLE II.

Summary of costs for a Billiter-Siemens electrolytic plant producing 3560 tons 73 per cent. caustic soda and 8690 tons 35 per cent. bleach per year.

No. 1.—Estimate, with power at 2 pfg. or 0·235d. per k.w. hr.

No. 2.—Estimate, with power at 5 pfg. or 0·587d. per k.w. hr.

	No. 1.	No. 2.
	£	£
Raw materials	13,826	13,826
Power	10,530	26,325
Maintenance and repairs	6,825	6,825
Packages, etc.	5,265	5,265
Wages	4,875	4,875
General expenses	2,292	2,292
Oil waste, etc.	1,170	1,170
Depreciation charges	5,558	5,558
Interest charges	4,144	4,144
Total	£54,485	£70,280

Taking the prices of 73 per cent. caustic soda and bleaching powder at the maker's works in South-West Lancashire on March 15th, 1913, at £9 15s. and £5 7s. 6d. per ton respectively, the value of the output of this plant would be as follows :—

Caustic soda—3560 tons at £9 15s.	£34,710
Bleaching powder—8690 tons at £5 7s. 6d.	46,708
Total	£81,418

DISCUSSION.

Dr. ALLMAND described the Billiter-Leykam cell, an improved form of the bell-jar cell, using cathodes hooded in asbestos and placed underneath the anodes. He said that the cell, working at 85°, furnished 12—16 per cent. NaOH at a current efficiency of 92 per cent. using 3·2 volts and employing unpurified brine, and was, in his opinion, the most efficient non-mercury cell working on a technical scale. Its only drawback was the small amperage per unit of floor space.

Mr. KERSHAW in reply to questions, said that the falling off in intensity was due to the higher concentration.

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* In the author's opinion, this estimated yield is too high, and a ratio of 2·1 tons 35 per cent. bleach to 1·0 ton of 73 per cent. caustic soda would have been more correct. The annual production of bleach by this plant would thus be 7476 tons, or 14 per cent. less than Engelhardt's total. The conversion of costs is based upon the ratio 20 M. (German) equals 19s. 6d. (English). It will be noted that the *Capital account* does not include cost of land, and that the *Running costs* do not allow anything for royalty on the process used.

When barium sulphate was used for the diaphragms, the precipitation was best when the liquor was hot, with a load of 6 to 7 amperes per square decimetre. Disintegration set in, with higher loads at these high temperatures than this. With a 6 normal solution the efficiency is 75 per cent., but the production of chlorine gas falls from 99 per cent. to 72 per cent.

Sydney Section.

Meeting held at Sydney on Wednesday, 16th July, 1913.

MR. LOXLEY MEGGITT IN THE CHAIR.

THE COMPOSITION OF AUSTRALIAN (N.S.W.) MILK.

BY A. A. RAMSAY.

Abstract.

The average composition of the milk from a herd of over 60 cows at the Hawkesbury Agricultural College is given in the following table, the analyses having been commenced in February, 1911, and continued every week until the end of January, 1912 :—

	Morning milk.	Evening milk.	Average.
	per cent.	per cent.	per cent.
Total solids ..	12·70	13·08	12·90
Fat	3·76	4·21	3·99
Solids-not-fat	8·94	8·87	8·91

In the case of the morning milk, the highest percentage of fat, namely, 4·58, was found on July 25, whilst the lowest amount, 3·09, occurred on April 18; for the evening milk, the highest amount of fat, 5·00, was found on April 21, and the lowest, 3·40, on Nov. 29. The average difference in the quantities of fat present in the morning and evening milk was 0·44 per cent. On only one occasion, May 9, did the solids-not-fat fall below 8·50 per cent.; in this instance the morning milk contained 8·37 per cent.

From October onwards, the quantities of casein, albumin, lactose, and ash were determined in the weekly samples, the results obtained lying within the following limits :—Morning milk : lactose, 4·58 to 4·99; casein, 2·77 to 3·54; albumin, 0·22 to 0·53; ash, 0·67 to 0·72 per cent. Evening milk : lactose, 4·58 to 4·99; casein, 2·87 to 3·39; albumin, 0·15 to 0·57; ash, 0·66 to 0·75 per cent.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 05 c. each, as follows : Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Raising water and other liquids by means of compressed air or steam; Method and apparatus for ——. W. H. Barker, London, and Drysdale and Co., Ltd., Glasgow. Eng. Pat. 18,854, Aug. 16, 1912.

The working of liquid elevators is facilitated by arranging a trip weight and lever, actuated by the compressed air or steam, to operate the exhaust-, air inlet- and liquid outlet-valves.—W. H. C.

Pump for corrosive acids. A. Ferraris. Fr. Pat. 457,936, May 15, 1913.

A layer or cushion of mercury or of a suitable oil, is interposed between the plunger of the pump and the acid, to protect the former from corrosion.—W. H. C.

Heating and evaporating liquids by means of steam; Apparatus for ——. D. B. Morison, Hartlepool. Eng. Pat. 23,403, Oct. 14, 1912.

Passages for the introduction of steam and discharge of condensed water, and provided with coupling pieces, are formed in the wall of the evaporator in such manner that the ends of the heating coil can be inserted tangentially into the coupling pieces by turning the coil axially.—W. H. C.

Drying chambers. A. B. Kirk and O. J. Hobson, Portland, Oreg., U.S.A. Eng. Pat. 372, Jan. 6, 1913.

The material is disposed on trays mounted one above the other on a truck within the drying chamber, and heated air passing through the chamber is deflected over the trays by a series of adjustable baffle-plates, similar to the shutters of a venetian blind, arranged on either side. The trays are mounted so that they can be tilted to either side. A flue is provided at the back of the drying chamber for returning the moisture-laden air to the air-heating apparatus.—W. H. C.

Dryer-kiln. F. W. Ballard, Cleveland Heights, Assignor to The Sherwin-Williams Co., Cleveland, Ohio. U.S. Pat. 1,074,485, Sept. 30, 1913.

The main drying chamber communicates with an auxiliary chamber containing heating coils. The ascending current of hot air may pass directly into the upper part of the main drying chamber, or it may first be humidified and cooled, so as to cause it to descend in this chamber. The lower part of the auxiliary chamber may be made to communicate either with the main chamber or with the exterior.—F. Sodn.

Drying apparatus. E. J. M. Martini. Fr. Pat. 457,298, July 8, 1912.

A drying chamber which can be heated is connected by two pipes with a tubular refrigerator, and the two vessels are exhausted. The rarefied air, saturated with moisture in the drying chamber, is deprived of its moisture in the refrigerator, and then returned to the drying chamber.
—W. H. C.

Air-filter having concentric drums. J. F. P. Kestner. Fr. Pat. 457,604, March 29, 1913. Under Int. Conv., March 29, 1912.

The filtering material is stretched upon two or more concentric drum-shaped frames. The surface of the filtering material may be cleaned during the working operation of the filter by scrapers or by nozzles through which suction is applied and which are displaced vertically, either upwards or downwards, after each complete passage round the drum surface.—W. H. C.

Reactions between gases or liquids on the one hand and gases, liquids or solids on the other ; Process for producing ——. E. W. Andersen. Fr. Pat. 457,569, May 7, 1913. Under Int. Conv., May 14, 1912.

THE use of "porous metals" as catalysts is claimed. These "metals," which may comprise alloys, are described as composed wholly or chiefly of iron, uranium, tungsten, etc.—W. H. C.

Filter ; Centrifugal —— for dust and smoke. E. F. Côte. Fr. Pat. 458,037, July 27, 1912.

THE air laden with smoke or dust enters a chamber within which a vertical drum of wire gauze is rapidly rotated, and passes through the drum to the axial outlet. The particles of dust, etc., are arrested by the wire gauze, and being thrown off by centrifugal force, collect in the lower part of the outer casing.—W. H. C.

Filter-presses ; Cloth for —— and machine for making the same. F. E. Carman. Fr. Pat. 457,953, May 16, 1913. Under Int. Conv., May 17, 1912.

THE longitudinal threads forming the warp are formed of suitable flexible material, and the transverse threads forming the weft of a rigid material such as wood. —W. H. C.

Extracting various substances with volatile solvents ; Apparatus for ——. C. Bonneau. Fr. Pat. 457,905, May 14, 1913. Under Int. Conv., May 24, 1912.

THE material is extracted in a closed vertical cylinder, and is discharged through a manhole near the bottom, the discharge being facilitated by a slanting perforated false bottom. Means are provided for the introduction of hot air or superheated steam, and for the condensation of the evaporated solvent.—C. A. M.

Separating solid substances from solutions by evaporation ; Process of ——. G. Jebsen and C. Finckenhagen, Christiania. U.S. Pat. 1,074,264, Sept. 30, 1913.

SEE Fr. Pat. 443,977 of 1912 ; this J., 1912, 1112.—T. F. B.

Classifier for solid material. R. E. Trottier, Puteaux, France. U.S. Pat. 1,074,301, Sept. 30, 1913.

SEE Fr. Pat. 429,117 of 1910 ; this J., 1911, 1240.—T. F. B.

Crushing or pulverising materials ; Process for ——. C. Dietz and E. Gofferje, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,847, Oct. 7, 1913.

SEE Eng. Pat. 11,078 of 1910 ; this J., 1911, 604.—T. F. B.

Drying apparatus ; Continuous —— with vertical axis. Soc. de Constructions Mécaniques d'Alais. Fr. Pat. 456,575, June 21, 1912.

SEE Eng. Pat. 16,262 of 1912 ; this J., 1913, 816.—T. F. B.

IIA.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Coals ; Improved combustion and blending of ——. W. H. Patterson. Brit. Assoc., Sept., 1913. Sect. B. J. Gas Lighting, 1913, **123**, 844—845.

BITUMINOUS coal, in the presence of water, will absorb, on the average, 0·1 per cent. of chlorine (see Eng. Pat. 23,080 of 1910 ; this J., 1911, 1042), and the treated coal, it is stated, yields considerably less ash than the untreated and also gives better results than the latter in practical burning tests under boilers, although the calorific value determined in the bomb calorimeter remains practically unaltered. The treated coal when burned yields a larger proportion of nitric acid than the untreated coal ; It burns more slowly and yields less soot.

As an example of the beneficial effect of blending different coals in some cases, the following results, obtained with two coals (A and B) separately and with a mixture of the two in equal proportions (C), are given :—

	A	B	C
Moisture, per cent.	10·44	4·08	—
Ash, per cent.	5·10	3·57	—
Net calorific value, cals.	6524	7351	—
Water evaporated from and at 212° F. (100° C.), lb.	8·87	10·56	10·54
Time to burn, hours	2·6	4	3·75
Boiler efficiency, per cent.	73	77·1	81·6

—A. S.

Combustion of gaseous mixtures. Taffanel and Le Floch. Comptes rend., 1913, **157**, 595—597.

THE velocities of combustion of a mixture of fire-damp and air, containing 6·5 per cent. of methane, were measured at different temperatures, with the following results, the "velocities" being given in parts of methane burnt per 100 parts of the mixture :—535° C., 0·00075 ; 560°, 0·0016 ; 575°, 0·0025 ; 600°, 0·0037 ; 615°, 0·0075 ; 620°, 0·0145 ; 630°, 0·017 ; 635°, 0·021 ; 640° C., 0·050. From these figures formulæ are deduced for calculating the velocity of reaction from the temperature within the limits of 550° and 680° C., for mixtures containing up to 12 per cent. of methane. A further series of tests was made to determine the limits of inflammability of similar mixtures of fire-damp and air. The following are the figures obtained :—

Initial temperature of reaction	20°	175°	237°	312°	555°	690°
Limit amount of methane, per cent.	5·80	5·25	4·75	4·30	3·40	3·00
Temperature of inflammation	675°	675°	685°	690°	700°	705°
Temperature of combustion (calculated)	1320°	1350°	1300°	1280°	1300°	1330°

—T. F. B.

Natural gas ; Methods for the examination of —— for the production of gasoline. E. S. Merriam and J. A. Birchby. J. Ind. Eng. Chem., 1913, **5**, 824—828.

A SIMPLE test for ascertaining the probable yield of gasoline obtainable from natural gas by compression and cooling, consists in shaking 100 c.c. of the gas with 1 c.c. of kerosene for 3 mins., then shaking another 100 c.c. of gas with the same 1 c.c. of kerosene, and noting the decrease in volume of the gas after each operation. In the first operation the kerosene will be saturated with methane and probably nearly saturated with ethane, but not with the heavier hydrocarbons, and the decrease in volume in the second operation will therefore be approximately proportional to the amount of the latter. The ratio of the volumes absorbed in the two operations will afford some indication of the character of the heavier hydrocarbons present and further information is gained by determining the mean molecular weight (calculated from the weight and volume) of the vapours absorbed by a solvent, *e.g.*, olive oil. The maximum yield of gasoline obtained from a given gas under definite conditions of cooling and pressure can be ascertained by means of a small compressor. The authors use a pair of cylinders of brass tubing (4 by 10 ins.), each fitted with a bronze cap screwed on and soldered. Each cylinder is provided with a piston and with a copper capillary outlet tube leading to a condenser. Hot water jackets surround the cylinders to prevent condensation therein. The pressure is produced by a pump, with hot water as the medium of transmission. The gas is passed slowly from one cylinder through the condenser to the other under a given pressure, then returned, again passed through at a higher pressure, and so on for any desired number of times, the volume of gasoline condensed being noted each time.—A. S.

Lubricating and transformer oils; Evaporation test for mineral ——. C. E. Waters. U.S. Dept. of Commerce and Labour, Bureau of Standards, Techn. Paper No. 13, Jan., 1, 1913. 13 pages.

Gill's method, which consists in saturating a dry filter paper with the oil to be tested and heating the oil on the filter paper, gave concordant results with the less volatile sample of oil, but not with the more volatile one. Experiments with open tubes of different diameter showed that comparative results can only be obtained if the same weight of oil is always heated in vessels of the same size and shape. Brass vessels are recommended, 5 cm. in diameter and 3 cm. deep, 5 grms. of oil being taken.—A. T. L.

Destructive distillation of coal. Beilby. *See* IIb.

Wood for gas manufacture in Australia; Use of ——. Times Eng. Suppl., Oct. 29, 1913. [T.R.]

In a paper read before the Victorian Gas Association, it was stated that wood is largely used, in admixture with coal, for gas making in Australia, the proportion of wood frequently reaching 25 per cent. Box and red gum wood have been found the most suitable, yielding about 12,000 cub. ft. of gas per ton, having a calorific power of about 450 B.Th.U. It was stated further that the use of wood has prevented the deposition of naphthalene in the gas plant and reduced the amount of "scurf" adhering to the retort walls.

Gas retorts; Corrosion of ——. Zinck. Times Eng. Suppl., Oct. 29, 1913. [T.R.]

Attention is drawn to the corrosion of gas retorts due to sodium chloride. During the carbonisation, the caustic soda formed combines with the silica of the retort lining, thus materially reducing its life. Experiments carried out at a coke-oven plant showed that the use of 0·143 per cent. of salt in the water for washing the coal ruins a retort in three years, whilst 0·036 per cent. renders a refractory substance of little value after five years.

Patents.

Peat and like muddy substances; Process and apparatus for heating —— preparatory to mechanically draining the same. G. Wolters, Bochum, Germany. Eng. Pat. 2766, Feb. 3, 1913.

The heating vessel is divided into a series of chambers, through which the peat pulp is caused to pass by blades mounted on a rotating shaft, and having scoops of suitable shape at their ends, or by gravity, the heating medium *e.g.*, injected steam or steam obtained by heating the pulp itself in the exit chamber, passing in the opposite direction. The peat pulp in its passage through the vessel is subjected to progressively increasing temperature and pressure.—W. H. C.

Agglomerated fuel [Briquettes]; Manufacture of ——. M. Rossi. Fr. Pat. 457,783, May 13, 1913. Under Int. Conv., June 8, 1912.

The material is submitted to the action of carbon bisulphide vapour. By this means bituminous coals can be briquetted without the use of a binder, and charcoal with only a small proportion of binder.—A. T. L.

Coke oven; Regenerative ——. Soc. Générale de Fours à Coke (Systèmes Lecocq.). Fr. Pat. 457,674, May 8, 1913. Under Int. Conv., May 13, 1912.

The regenerators beneath the oven chambers are arranged in the direction of the length of each oven chamber and in two sets, each extending for about half the length of a chamber. The regenerators of each set are divided by a number of transverse walls so as to subdivide the base structure of the oven into a number of vertical arched or domed cells, whereby great strength is obtained. The arrangement of the flues is such as to reduce the total height of the structure. For this purpose two sole-flues are provided beneath each oven chamber, extending for the whole length of the chamber. Between each pair of sole-flues and at a somewhat lower level is a flue in communication with one of the subdivided regenerators. One pair of sole-flues is thus connected with two regenerators of one set, and the next pair with two of the other set. —A. T. L.

Carbonaceous materials; Methods of and apparatus for treating —— for the production of coal and like gases and water gas. E. R. Royston, Liverpool. From General Reduction Gas and By Products Co., New York. Eng. Pats. 19,100 and 19,101, Aug. 20, 1912.

(1.) The powdered material is heated in a single rotating jacketed inclined cylinder as described in Eng. Pat. 15,964 of 1911 (this J., 1912, 864), through which it passes in the opposite direction to the flow of heating gases in the jacket. The interior of the cylinder is provided with longitudinal and transverse ribs so that the material is lifted and falls in showers as the cylinder rotates. The feed, and the removal of the treated material, are effected by screw conveyors which discharge through conical nozzles so as to form the material into a plug which prevents the passage of gas. Roller thrust bearings are provided for the cylinder, and a lifting-jack is arranged at the upper end for varying the inclination. (2) Water-gas is made continuously in a rotating cylinder such as described above, steam or water being admitted at the feed end or at about the middle of the length of the cylinder. Unburnt fuel is discharged through a water-seal. The annular heating flue is formed between segmental blocks which line the casing of the cylinder, and an inner wall of refractory brickwork which is spaced from the lining by arranging some of the blocks to project inwardly. The flue is heated by a ring of fixed burners at one end.—A. T. L.

Suction gas plant. R. Kershaw, Mytholmroyd, Yorks. Eng. Pat. 29,934, Dec. 30, 1912.

In a suction gas plant using wood or waste fuel, the hot gases leaving the producer are sprayed with water to remove dust, etc., before entering the scrubber or tar extractor. The water is sprayed into a box arranged just above the gas outlet, which is formed by an upturned bell-mouthed pipe leading to a verticle downpipe connected with the usual scrubber. The spray-box is open to the interior of the producer just above the bell-mouthed pipe, and is also connected with the top of the down-pipe. The suction thus acts through the spray-box as well as through the bell-mouthed pipe and the hot gases pass through both. A hand-operated scraper is provided for keeping the gas outlets free from dirt.—A. T. L.

Mineral, tar, and resinous oils; Method of obtaining refined ——. M. Melamid, Freiburg, Germany. Eng. Pat. 5484 of 1913, date of appl., Sept. 24, 1912.

The oils are treated with pyrophosphoric or metaphosphoric acid or other oxidation products of phosphorus at 150° to 200° C.; subsequently the temperature is raised to 300° to 400° C. (See also Eng. Pat. 9856 of 1912; this J., 1913, 820.)—W. H. C.

Bituminous matter; Manufacture of ——. L. Landsberg. Fr. Pat. 457,054, April 5, 1913.

The acid tar obtained in refining heavy mineral oils with sulphuric acid, are treated with a solvent, such as petrol or petroleum, so as to extract the oil and leave a resinous product soluble in water. After washing, the resinous substance is dissolved in water and reprecipitated by the addition of salt, etc. When dried it is solid and can be powdered. A strong aqueous solution of the soluble resin may be mixed with petroleum residues, tar, creosote, etc., so as to form an emulsion, from which a homogeneous asphaltic solid is separated by addition of calcium chloride or other salts. The solution of resin can be used as a binder in making briquettes and also for impregnating wood, the resin being afterwards rendered insoluble by means of calcium chloride. The powdered resins may be mixed with oxygen-yielding salts, to form explosives, as also may the products obtained by treating the soluble resin with nitric, nitro-sulphuric, or a mixture of *nitri* and glacial acetic acids. Oils obtained from the resins by destructive distillation may be nitrated to form explosive substances, or may be heated with sulphur in the presence of a catalytic agent at 170° to 180° C. to form insoluble sulphur compounds which may be sulphonated and the sulphonic acids used in making sulphur soaps and pastes. Solutions of the resin may be precipitated with salts of copper, nickel, iron, etc., and the precipitates heated so as to obtain the metal or oxide in a finely divided state.—A. T. L.

Liquid fuel; Manufacture of ——. E. H. Vidstrand and H. B. and F. Hultgren. Fr. Pat. 457,174, April 26, 1913. Under Int. Conv., Aug. 7, 1912.

Hydrocarbon gases, or the gases obtained by the dry distillation of peat or coal, are heated to 2000° C. whereby heavier hydrocarbons are produced which condense on cooling, yielding a volatile liquid fuel which can be used in place of petrol. Instead of hydrocarbon gases, a mixture of carbon monoxide, carbon dioxide and hydrogen can be used. The heating is effected in regenerative retorts or by passing the gases through an electric arc. By treating a mixture of 1 part of hydrogen and 13 to 15 parts by weight of acetylene, a liquid is obtained of sp. gr. 0·723 and b. pt. 85·5° C.—A. T. L.

Hydrocarbons soluble in or emulsifiable with water; Process for preparing ——. Chem. Fabrik Westend. Ger. Pat. 263,353, Feb. 8, 1912. Addition to Ger. Pat. 256,764.

The products prepared according to the principal patent (see U.S. Pat. 1,042,915; this J., 1912, 1173) are converted into products of higher viscosity, and suitable for use as lubricants, by treating them with bases, especially alkali or alkaline-earth hydroxides or carbonates, and removing the excess of water.—T. F. B.

Peat, slime, and like substances; Process for treating ——. G. Wolters, Weitmar, Germany. U.S. Pat. 1,074,400, Sept. 30, 1913.

See Eng. Pat. 2766 of 1913; preceding.—T. F. B.

Dust in [coal] mines, tunnels, and other places; Treatment of ——. H. Belger. Fr. Pat. 456,482, April 9, 1913.

See Eng. Pat. 6343 of 1913; this J., 1913, 690.—T. F. B.

Gases; Composition for purifying ——. P. J. Granjon, Marseilles, France. U.S. Pat. 1,074,501, Sept. 30, 1913.

See Fr. Pat. 434,137 of 1911; this J., 1912, 220.—T. F. B.

Porous material for filling receptacles intended for storing explosive gases; Process of preparation of ——. N. G. A. M. J. and L. P. A. G. Champy, Antwerp. Eng. Pat. 21,850, Sept. 25, 1912.

See Fr. Pat. 453,353 of 1913; this J., 1913, 741.—T. F. B.

Burners and furnaces; Liquid fuel ——. The Oil-Flame Furnace Co., Ltd. Fr. Pat. 456,531, April 11, 1913.

See Eng. Pat. 10,565 of 1912; this J., 1913, 903.—T. F. B.

Heavy hydrocarbons; Process and apparatus for converting —— into lighter hydrocarbons. F. Lamplough. Fr. Pat. 457,877, April 24, 1913. Under Int. Conv., Aug. 28 and Dec. 5, 1912.

See Eng. Pat. 19,702 and 28,101 of 1912; this J., 1913, 743.—T. F. B.

Apparatus for automatically testing and sampling liquids [ammoniacal gas liquor waste]. Eng. Pat. 21,313. *See* XXIII.

Apparatus for screening and washing gold, sand, coal, etc. Eng. Pat. 28,675. *See* X.

Manufacture of ammonium chloride from ammoniacal liquors from the carbonisation of coal, peat, etc. Fr. Pat. 457,681. *See* VII.

Producing coke from wood tar, especially leafwood tar Ger. Pat. 263,693. *See* III.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Coal; Destructive distillation of ——. G. T. Beilby. Brit. Assoc., Sept., 1913. Sect. B. J. Gas Lighting, 1913, **123**, 838—840.

The author gives the results of an experimental investigation of the low-temperature carbonisation of coal undertaken in conjunction with H. N. Beilby and G. Weller, the object being to devise an apparatus in which coal could be exposed in thin layers to the action of heat. The mechanical difficulties to be overcome were serious, but an apparatus was evolved capable of carbonising 15 tons of coal per day. It consisted of a column heated externally to 400°—450° C. in a gas-fired oven. Small coal was fed in mechanically at the top and passed down gradually in the form of layers, 2—2½ ins. in thickness, over a series of sloping shelves jolted mechanically. The time required was 1½ hours and the coked residue passed out through a cooling chamber. At present only non-caking coals could be used. A considerable proportion of the residue was no larger than coke breeze, but it had been used with good results in water-gas producers worked with a reduced air-blast. Some of the coke had also been briquetted with 7 per cent. of pitch and yielded a satisfactory domestic fuel, which could be easily kindled and burned almost without smoke. The gas had a thermal value of 850 B.T.U. per cb. ft. and the tar was of a similar character to that observed by other workers in the case of tars from low-temperature carbonisation. It is emphasized that whilst the production of fuel oil and motor spirit are of great importance, the fundamental points in low-temperature carbonisation are the development of a mechanically perfect apparatus and the production of a domestic or industrial fuel from the coked residue.—A. S.

Surface combustion appliances; Design of ——. C. E. Lucke. J. Ind. Eng. Chem., 1913, 5, 801—824.

A detailed illustrated account of the development of commercial appliances for flameless surface combustion. In order to obtain localised combustion it is necessary to supply the mixture of gas and air (in the requisite proportions for complete combustion) at a rate greater than the rate of propagation of flame and then reduce the velocity of the gas mixture until the two rates are approximately equal. This may be accomplished by enlarging the feed tube and placing a baffling device in the enlargement to counteract the tendency of the jet of gas to resist expansion sidewise. Two of the most effective devices of this kind are shown

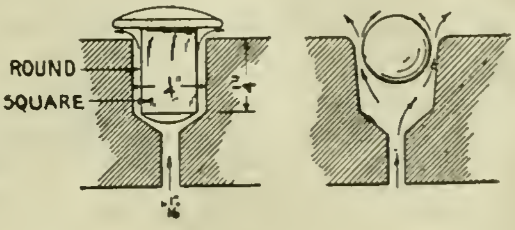


Fig. 1.

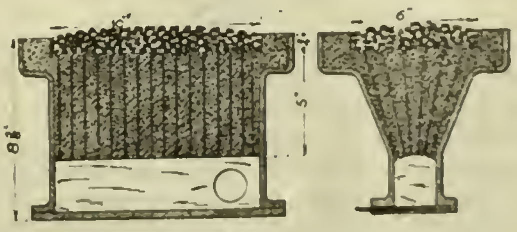


Fig. 2.

in Fig. 1. These have proved useful for rapidly heating to incandescence radiating screens placed a short distance above. For moderately high temperatures, perforated sheets of "Nichrome II" (Ni 56·4—59·9, Cr 10·6—10·8, Fe 30·6—26·2, Mn 2·1—2·3 per cent.) and "Excello" (Ni 83·43, Cr. 14·72, Fe 1·30 per cent.) proved satisfactory as screens, whilst for higher temperatures diaphragms of bonded granular alundum (fused alumina) gave the best results. A bed of loose granular refractory material will, however, act both as a baffle and as a radiating screen and is preferable for general use. To obtain uniform combustion over the whole surface of the bed when the gas mixture is supplied at a low velocity, it is necessary to use groups of narrow bore feed orifices of the requisite length to prevent back-firing. A burner for a muffle furnace designed on these lines is shown in Fig. 2. The gas mixture is supplied through 96 holes moulded in alundum cement in a cast iron casing, and combustion takes place over a bed of loose granular white alundum. Working at a pressure of 3 ins. of water, the gas consumption of this burner was 288 cb. ft. per hour per sq. ft. of bed. Burners of a similar type have been devised for crucible furnaces, for heating steam boilers, and for various domestic purposes. In later types of burners the holes have been formed in tubes or in ribs to permit of independent air cooling, and thus allow of reducing the length of the feed holes and the height and weight of the burner. In a burner for a muffle furnace with the main feed holes disposed in two separate ribs and with a few separate tubes placed at the side and front to equalise the temperature as desired throughout the muffle, it was possible to obtain practically any temperature gradient desired. With a gas consumption of 116 cb. ft. per hour in the main burner, the following temperatures were registered :—

Top distance from front of muffle.	Door closed. No draught.	Door open. Good draught.
ins.	Temp. ° C.	Temp. ° C.
2	960	871
4	1021	950
6	1038	993
8	1043	1011
10	1038	1004
Back 12	1038	993

Temperatures sufficient to soften any available refractory materials can be attained in a crucible furnace heated by a burner of similar type, with an annular bed of refractory material. For supplying the burners a double ported cock is used, the two plugs in which are keyed together. The air, initially under a pressure somewhat greater than that of the gas, is passed through a diaphragm regulator. The diaphragm is exposed above to the gas pressure and carries a balanced crank and connecting rod which actuates a damper valve in the main air-passage. The air and gas, under equal pressure, then pass to the cock, in which the relative proportions are regulated by the cross-sectional areas of the ports. (See also Bone, this J., 1911, 527; 1912, 61, 524.)—A. S.

Patents.

Electric lamps; Incandescence body for ——. Wolfram Lampen Akt.-Ges. Fr. Pat. 457,096, April 24, 1913. Under Int. Conv., June 3, 1912.

Finely divided or amorphous tungsten is mixed with small quantities of other metals such as chromium, vanadium, niobium, tantalum, osmium, ruthenium, zirconium and thorium, or with oxides or salts of these metals, an organic binding substance is added, and the mass is formed into filaments which are carbonised by heating in an atmosphere of steam and hydrogen. Finally the filaments are strongly heated for a few seconds. These filaments are strong and elastic and can be bent cold. The plastic mixture may also be formed into rods or bars by moulding it under great pressure, the rods being then heated in hydrogen or in a vacuum for some time at 1000°—1500° C. and afterwards in hydrogen at a temperature near the melting point.—A. T. L.

Filaments of chromium carbide, alone or alloyed with other metals or metalloids, for electric incandescence lamps; Manufacture of ——. P. M. C. Seguy. Fr. Pat. 457,557, July 13, 1912.

A compound of chromium with another metal and hydrogen, oxygen, sulphur or other metalloid, is mixed with cellulose or other binder, formed into filaments, carbonised at a high temperature, and finally brought to a very high temperature in an atmosphere of hydrocarbon gas at reduced pressure; or the metals may be mixed in the colloidal state and treated as described above.

—A. T. L.

III.—TAR AND TAR PRODUCTS.

Toluene; Electrolytic oxidation of ——. F. Fichter. Z. Elektrochem., 1913, 19, 781—784.

Toluene suspended in 2-N sulphuric acid was submitted to electrolysis in a large cylindrical lead vessel, serving as anode, using a lead spiral as cathode. A current density of 0·01 amp. per sq. cm. was used, and the suspension was vigorously stirred during the process. The experiments were concluded when one half of the toluene had been decomposed. In the toluene layer toluquinone and a small quantity of benzaldehyde were found, whilst the aqueous liquid contained quinol and a little phenol. The assumption that *o*- and *p*-cresol are formed as intermediate products of the reaction, was confirmed to a large extent by a study of the electrolytic oxidation of the cresols, as the result of which the same final products were obtained.

—T. F. B.

Cresols, thymol, and phenol; Rapid volumetric method for determining o-, m-, and p- ——. L. V. Redman, A. J. Weith and F. P. Brock. J. Ind. Eng. Chem., 1913, 5, 831—836.

The method is a modification of that used by Wilkie (this J., 1911, 398) for the determination of phenol. The solution of the phenolic compound is diluted to about 0·1N and 15 c.c. are added to a mixture of 15 c.c. of water and 15 c.c. of $N/1$ sodium bicarbonate in a 500 c.c. stoppered bottle. An excess of 0·03N iodine solution is now added, the mixture is shaken continuously for 1 min., and after addition of 50 c.c. of 2N sulphuric acid, the excess of iodine is titrated with 0·1N thiosulphate using starch as indicator. If the blue colour rapidly reappears after the end point is first reached, 5 c.c. of 20 per cent. potassium iodide solution should be added. Under these conditions *o*-, *m*-, and *p*-cresol, phenol, and thymol can each be determined accurately when present alone, the *o*- and *p*-cresol and thymol being converted into di-iodo-compounds and the *m*-cresol and phenol into tri-iodo-compounds. In a mixture of phenol and the three cresols, the quantities of phenol (a) and *m*-cresol (b) and the sum of the *o*- and *p*-cresol (y) can be calculated from the amount of iodine absorbed (n atoms), if the total weight of the phenol and cresols (m) be known, the following equations being used (e=effective formula weight of phenol and *m*-cresol) :—

$$(1)\ a + b = x; \quad (2)\ x + y = m; \quad (3)\ \frac{3x}{e} + \frac{2y}{108{\cdot}064} = \frac{n}{2};$$

$$(4)\ \frac{a}{94{\cdot}048} + \frac{b}{108{\cdot}064} = \frac{x}{e}; \quad (5)\ \frac{108{\cdot}064 - e}{e - 94{\cdot}048} = \frac{108{\cdot}064\,a.}{94.048\,b}$$

—A. S.

Patents.

[Tar] Distilling apparatus. T. Hughes and M. Ruthenburg, London, and G. K. Davis, Manchester. Eng. Pat. 25,845, Nov. 11, 1912.

An inner vessel, open at the top, is mounted within an outer vessel having a domed top and a vapour escape pipe connected with a condenser. The tar is fed into the annular space between the two vessels and overflows into the inner vessel, where it is heated, preferably by an electrical heater. The residual tar or pitch flows away by a pipe from the inner vessel. A seal is provided on

the outlet pipe to maintain the desired level within the still. Several of these stills are coupled up in series.
—W. H. C.

Coke from wood tar, especially leaf-wood tar ; Process for producing ——. Gewerkschaft Marienglück. Ger. Pat. 263,693, June 17, 1911.

Wood tar is slowly heated until the easily volatile products and heavy oils have been separated, whereupon the temperature is raised, thus causing the residue to pass automatically through a siphon tube to the coking retort. It is stated that the process is not attended by any risk of stoppage of the apparatus or of explosion.—T. F. B.

2-Trichloromethylbenzophenones ; Substituted ——, *substituted benzophenone-2-carboxylic acids, and condensation products derived therefrom.* Act.-Ges. f. Anilinfabr. Fr. Pat. 457,641, April 23, 1913. Under Int. Conv., July 19, 1912.

Substituted 2-methylbenzophenones may be prepared by condensing the chlorides of arylcarboxylic acids with derivatives of toluene such as 4-chlorotoluene or *m*-xylene : with benzoyl chloride these furnish 2-methyl-5-chlorobenzophenone and 2.4-dimethylbenzophenone respectively. These products can be converted into the 2-trichloromethyl compounds by direct chlorination. When heated with dilute caustic soda solution, or when treated with sulphuric acid at the ordinary temperature, these substituted 2-trichloromethylbenzophenones are transformed into the corresponding benzophenonecarboxylic acids, which can be converted into anthraquinone derivatives by known methods. Anthraquinone derivatives are also obtained directly by heating the 2-trichloromethylbenzophenone derivatives, with or without addition of solvents or diluents. In some cases the anthraquinone mesochloride is formed at first, but it can be easily converted into the anthraquinone by treatment with water or alcohol.—T. F. B.

Ethers of monohydric phenols and normal or acid ethers of polyhydric phenols from the corresponding chloro-substitution products of aromatic hydrocarbons ; Manufacture of ——. C. Torley and O. Matter. Fr. Pat. 457,843, April 23, 1913.

Simple or mixed ethers of phenols may be obtained by heating chlorinated aromatic hydrocarbons with alkali aryloxides (phenolates) or alkali alkyl oxides (alcoholates) to high temperatures under pressure. By using polychlorohydrocarbons, it is possible by gradual etherification to produce a series of chlorinated ethers, which can be further etherified with different alkyl or aryl groups. For example, diphenylether is produced by heating sodium phenoxide with monochlorobenzene, in equimolecular proportions, at 300°—350° C., for four hours in a closed vessel ; if metallic copper or other heavy metal be present, the yield is stated to be almost quantitative. α-Naphthyl-methyl ether is obtained in a similar manner from α-chloronaphthalene and sodium methoxide. The preparation of *o*-chlorophenylmethyl ether and of *o*-dimethoxybenzene from *o*-dichlorobenzene and sodium methoxide, is also described.
—T. F. B.

Anthrapyridones ; Process for preparing chlorinated ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,010, June 30, 1912.

Anthrapyridones are treated with chlorine in presence of indifferent organic solvents or diluents.—T. F. B.

Isoselenazones of the anthraquinone series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,139, May 30, 1912.

Isoselenazones of anthraquinone and its derivatives, of the type, $C_{14}H_7ONSe$, where the selenium is a component of a closed ring, are obtained by the action of ammonia on anthraquinone selenocyanides (see Ger. Pat. 256,667 ; this J., 1913, 417). The reaction is analogous to the formation of isothiazolones from anthraquinone thiocyanates and ammonia.—T. F. B.

4-Nitro-1.2-dihydroxybenzene ; Process for preparing ——. J. D. Reidel A.-G. Ger. Pat. 264,012, Nov. 2, 1912.

Diacidyl derivatives of catechol are nitrated in the usual manner, and the acidyl groups are eliminated. The nitro group enters the 4-position only, 4-nitro-1.2-dihydroxybenzene being produced.—T. F. B.

Hydrazo compounds ; Process for preparing —— *by electrolytic reduction of the corresponding azoxy compounds.* O. Dieffenbach and W. Moldenhauer. Ger. Pat. 264,013, April 2, 1912.

An azoxy compound is suspended and melted in a solution of an alkali or alkali salt, and reduced electrolytically ; the electrolysis is stopped before the hydrazo compound separates from the mixture of azoxy and hydrazo compounds.—T. F. B.

Sulphochlorides of phenol-o-carboxylic acids and their derivatives ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,786, Aug. 14, 1912.

Phenol-*o*-carboxylic acids and their derivatives are converted into the sulphochlorides by heating with a large excess of chlorosulphonic acid at temperatures below 100° C. In many cases the reaction takes place at the ordinary temperature.—T. F. B.

Distillation of all kinds of hydrocarbons or easily emulsified liquids ; Process for treating and apparatus for the ——. Soc. Anon. des Combustibles Industriels. Fr. Pat. 458,038, July 27, 1912.

See Eng. Pat. 17,954 of 1912 ; this J., 1913, 904.—T. F. B.

2-Trichloromethylbenzophenone ; Manufacture of substitution products of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 10,790, May 7, 1913. Under Int. Conv., July 19, 1912.

See Fr. Pat. 457,641 of 1913 ; preceding.—T. F. B.

Meta nitro derivatives of hydrocarbons of the benzene series ; Process for the reduction of ——. B. J. Flürscheim, Fleet. U.S. Pat. 1,074,545, Sept. 30, 1913.

See Eng. Pat. 9520 of 1911 ; this J., 1912, 66.—T. F. B.

Carbazole sulphonic acids ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 457,162, April 25, 1913. Under Int. Conv., April 27, 1912.

See Eng. Pat. 9960 of 1913 ; this J., 1913, 972.—T. F. B.

Indole ; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 457,369, July 9, 1912.

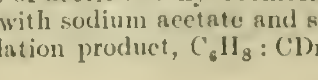
See Eng. Pat. 14,943 of 1912 ; this J., 1913, 528.—T. F. B.

Obtaining refined mineral, tar, and resinous oils. Eng. Pat. 5484. *See* IIa.

Catalytic method of hydrogenation [*and reduction*]. Fr. Pat. 458,033. *See* XX.

IV.—COLOURING MATTERS AND DYES.

Leuco-bases and colouring matters from diphenylethylene. VI. First stage of the oxidation of the cyclohexylidenic leuco-base, $C_6H_{10}:C(Dm)_2$. Tetrahydrogenated Malachite Green. P. Lemoult. Comptes rend., 1913, **157**, 597—599.

When tetramethyldiaminodiphenylcyclohexylidenemethane,  $CH_2\left\langle\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\right\rangle C:CDm_2$, where Dm represents $C_6H_4.N(CH_3)_2$, is oxidised by means of lead peroxide in presence of acetic and hydrochloric acids, and the solution treated with sodium acetate and sulphate, a precipitate of the oxidation product, $C_6H_8:CDm_2$, is obtained (see this

J., 1912, 765): on neutralising the mother liquor with ammonia, a quantity of another product is obtained, consisting of an intermediate compound, $C_6H_9.C(OH)Dm_2$, which may be regarded as a tetrahydrogenated Malachite Green. It dyes tannin-mordanted cotton intense shades, somewhat bluer than those produced by Malachite Green itself. Treatment with hot alcohol results in the elimination of water, with the formation of the product, $C_6H_5 : CDm_2$. The hydroxylated base is obtained in the form of greyish crystals, which melt at 145° C. and then lose water. Addition of acetic acid develops a fine blue colour, which only disappears very slowly on addition of water.—T. F. B.

Ethyl chloride for use in making dyes ; Admission of —— into Holland. Board of Trade J., Sept. 18, 1913. [T.R.]

A DUTCH Royal Decree, dated Aug. 5, provides for the duty-free admission into the Netherlands, under certain conditions, of ethyl chloride required in factories in connection with the manufacture of dyes.

PATENTS.

Azo dyestuffs ; Manufacture of —— and process of developing them on the fibre. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,073, Aug. 6, 1912.

NAVY-BLUE dyestuffs, *i.e.*, bluer than those produced according to Eng. Pat. 9433 of 1911 (this J., 1912, 182), are obtained by combining one mol. of a diazotised aminoazo compound free from amino and hydroxyl groups, with one mol. of 2.2′-dinaphthylamine-5.5′-dihydroxy-7.7′-disulphonic acid, and further combining with one mol. of diazotised 2.5.7- or 2.8.6-aminonaphtholsulphonic acid or 1-chloro-2.5.7- or 1-chloro-2.8.6-aminonaphtholsulphonic acid. *p*-Nitrobenzene-*o*-sulphonic acid-azo-1-naphthylamine-7-sulphonic acid may be used as the aminoazo compound. Cotton is dyed in a bath containing 1000 parts of water, 4 parts of the dyestuff, 2 parts of calcined sodium carbonate, and 30 parts of sodium sulphate: the goods are then treated with diazotised *p*-nitraniline, exposed to air, and rinsed. Deep navy-blue shades, fast to washing, are produced; they can be discharged to a pure white by means of hydrosulphites. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 21,473 of 1910; this J., 1911, 1109.)—T. F. B.

Disazo and polyazo dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 456,432, April 8, 1913. Under Int. Conv., April 19, 1912.

BLUE dyestuffs which dye cotton intense shades from neutral baths but do not dye wool, are obtained by combining the tetrazo derivative of a *p*-diamine or of a *p*-diaminoazo compound with a 1.8-dihydroxynaphthalenesulphonic acid on the one hand, and with 5.5′-dihydroxy-2.2′-dinaphthylamine-7.7′-disulphonic acid or with the urea of 2.5.7-aminonaphtholsulphonic acid on the other hand.—T. F. B.

Monoazo dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 457,840, April 21, 1913. Under Int. Conv., May 1, 1912.

THE diazo compounds of aminoacidylaminosalicylic acids or their homologues or substitution products, are combined with suitable azo components, such as 1-naphthol-4-sulphonic acid, 1.8-aminonaphthol-4.6-disulphonic acid, pyrazolone derivatives, or dihydroxyquinolines. The products can be fixed on the fibre with the aid of chromium mordants; when printed on cotton goods in the usual manner with chromium acetate, they furnish yellow, red, and violet shades very fast to soaping. The aminoacidylaminosalicylic acids may be prepared by reducing the condensation products of aromatic nitroacidyl halides with aminosalicylic acids or their derivatives.—T. F. B.

Monoazo dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,289, May 29, 1912.

THE diazo compound of 1.8-aminonaphthol or one of its mono- or disulphonic acids or their derivatives, is combined with an alkylaralkylanilinesulphonic acid; the dyestuffs may be finally treated with saponifying agents. The products dye fast red shades.—T. F. B.

Anthraquinone series ; Process for preparing condensation products of the ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,290, Aug. 2, 1912.

A MONOKETONE is allowed to react with an *o*-diaminoanthraquinone, in presence or absence of a solvent or condensing agent. The products may be used for preparing dyestuffs; thus, when sulphonated they are converted into wool dyestuffs. They contain the keto group united to both nitrogen atoms, and are therefore probably iminazole derivatives.—T. F. B.

Sulphide dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,293, Oct. 20, 1912. Addition to Ger. Pat. 253,934 (see this J., 1913, 80).

PERI-NAPHTHYLENE-UREA or peri-naphthylenethiourea, or one of their substitution products, is heated with sodium polysulphide in presence of copper or a copper compound. The resulting products dye cotton fast rich brown to black-brown shades (see also Fr. Pat. 449,983 of 1912; this J., 1913, 480).—T. F. B.

Colouring matters of the benzanthrone series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,551, Nov. 19, 1912.

NEW vat dyestuffs are obtained by introducing a radical (alkyl, aryl, aralkyl, aldehydic, acidic, etc.) into the amino group of an aminodibenzanthrone; the process applies to amino derivatives of both normal dibenzanthrones and of isodibenzanthrones (see U.S. Pats. 786,085 and 787,859, and additions to Fr. Pat. 349,531; this J., 1905, 494, 541; 1907, 251; 1909, 1309). The products generally dye cotton different shades from the original dyestuffs, varying from claret to violet. The products from aminodibenzanthrone and amino-isodibenzanthrone with ethyl chloride, benzyl chloride, and benzoyl chloride, are described.—T. F. B.

Colouring matters of the anthraquinone series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,361, Dec. 9, 1912.

p-AMINO-*p*′-CHLORODIPHENYL is condensed with one mol. of 1-chloroanthraquinone-2-carboxylic acid and the product is heated with acetic anhydride and a little sulphuric acid; ring-formation takes place, an acridone ring being apparently formed. The product is condensed with 1-aminoanthraquinone and then heated with concentrated sulphuric acid, whereupon an acridine ring appears to be formed. The resulting dyestuffs would thus contain an anthraquinone-acridone on one side and an anthraquinone-acridine on the other side of the diphenyl nucleus. The dyestuffs may also be prepared by heating 1-chloroanthraquinone-2-carboxylic acid with benzidine, at 140° C. for 12 hours in an autoclave, heating the product with sulphuric acid for 5 hours at 125°—130° C., diluting, and heating for about 24 hours at about 130° C. to split off the carboxyl group. The product is chiefly a mixture of the acridine-acridone and diacridone (see Ger. Pat. 237,236; this J., 1911, 1153). The mixture may be resolved into its constituents by extraction with *m*-cresol, in which the acridine-acridone is fairly soluble. The new acridine-acridones dye cotton reddish-brown shades from the hydrosulphite vat, whilst the mixtures of acridine-acridone and diacridone dye somewhat more violet-brown shades.—T. F. B.

Indigo; Synthetic —— in lumps resembling natural indigo. Badische Anilin und Soda Fabrik. Fr. Pat. 456,613, April 12, 1913. Under Int. Conv., Nov. 7, 1912.

Indigo in lump form, showing a good conchoidal fracture, is said to be obtained by mixing indigo paste with an insoluble substance obtained by precipitation. It is preferable to effect the precipitation in presence of the indigo. Improved results are obtained by adding to the mixture a substance such as glue, dextrin, sugar, etc., to give solidity to the product; a substance which assists reduction or fermentation may also be added. *Example:* 150 kilos. of 20 per cent. indigo paste is mixed with a solution of 85 kilos. of aluminium sulphate, and 90 kilos. of a solution of water glass is added at about 80° C.; the precipitated product is washed, dried, and triturated with a solution of sugar or glue until the air bubbles have been removed, when it is pressed in the hydraulic press and dried. It contains about 40 to 45 per cent. of indigo. —T. F. B.

Bisulphite compounds [of azo dyestuffs] and their use for the production of coloured lakes. Badische Anilin und Soda Fabrik. Fr. Pat. 456,614, April 12, 1913. Under Int. Conv., May 20, 1912.

The dyestuff obtained by combining diazotised 2-naphthylamine-1-sulphonic acid with β-naphthol, which is almost insoluble in water, can be converted into easily soluble bisulphite compounds by treatment with an alkali bisulphite or ammonium bisulphite. Salts of these new compounds may be obtained by the action of salts of alkaline-earth metals, magnesium, or lead; these salts themselves are of no value as lakes, but when treated with an alkali or alkaline-earth hydroxide (*e.g.*, barium hydroxide) the corresponding lake of the dyestuff is obtained.—T. F. B.

Orange, red or brown shades on vegetable fibres; Production of fast —— and dyestuffs therefor. H. Levinstein, J. Baddiley and Levinstein Ltd., Manchester. Eng. Pat. 27,525, Nov. 29, 1912.

Two mols. of resorcinol are combined with the tetrazo compound obtained by re-diazotising the interemediate product derived from 1 mol. of a tetrazotised diamine of the general constitution,

$NH_2.Ar.CO.NH{\cdot}Ar.NH_2$, where Ar is an aryl radical,

and 1 mol. of 2-amino-5-naphthol-7-sulphonic acid, or aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid. Bright shades which are fast to washing are obtained by after-treating on the fibre with formaldehyde.—J. B.

[Azo] colouring-matters; Manufacture of ——. O. Siepermann, East Orange, Assignor to Consolidated Color and Chemical Co., Newark, N.J. U.S. Pat. 1,073,784, Sept. 23, 1913.

One mol. of diazotised β-naphthylaminemonosulphonic acid (2.1) is combined with another molecule of the same acid, and the product is diazotised and combined with β-naphthol. Red dyestuffs insoluble in water, and forming bright red lakes very fast to light, are obtained.—T. F. B.

Indigo, its homologues and substitution products; Preparation of condensation products from ——, and their conversion into halogen and sulphonated derivatives. Soc. pour l'Industrie Chimique à Bâle. First Addition, dated June 15, 1912, to Fr. Pat. 442,948, April 25, 1912 (see this J., 1912, 979).

The reaction of indigo and its homologues with halides of arylated fatty acids is found to be general for all indigoid dyestuffs having the atomic grouping, —NH·C : C·CO—. Similarly, the condensation products can be halogenated, and converted into sulphonic derivatives as previously described. A compound which dyes animal and vegetable fibres orange-red shades from the vat, is obtained by treating with phenylacetyl chloride the condensation product from oxythionaphthene and isatin-α-anilide.—T. F. B.

Indigo series; Process for preparing red condensation products of the ——. Ges. f. Chem. Industrie in Basel. Ger. Pat. 263,470, Sept. 10, 1912. Addition to Ger. Pat. 259,145 (see Eng. Pat. 8421 of 1912; this J., 1912, 635).

2-Thionaphthene-2-indol-indigo is treated with an arylated fatty acid halide, with or without addition of a diluent or condensing agent. The products are yellower in shade than those already described. Further, the product from 2-thionaphthene-2-indol-indigo and phenyl acetyl chloride has the properties of a vat dyestuff, whereas the analogous products of the chief patent do not form vats.—T. F. B.

Sulphide dyestuffs fast to chlorine, and primary products therefor; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 457,535, May 6, 1913. Under Int. Conv., May 8 and 14, 1912.

See Eng. Pat. 10,875 of 1913; this J., 1913, 974. The products are converted into sulphide dyestuffs by the usual methods.—T. F. B.

Dyestuffs soluble in sodium sulphide; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 264,044, Jan. 14, 1912.

The dyestuffs derived from alkyl- or aryl-carbazoles as described in Eng. Pats. 2918, 9689, and 14,143 of 1909. and Fr. Pat. 413,716 (this J., 1909, 517; 1910, 481, 1099) can be converted into products readily soluble in sodium sulphide solutions, by treatment with concentrated sulphuric acid.—T. F. B.

Vat [anthracene] dyestuff; Process for preparing a red-brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 264,042, April 2, 1912. Addition to Ger. Pat. 244,705 (see Eng. Pat. 29,031 of 1911; this J., 1912, 223).

5-Aminoanthraquinone-1.2-thioxanthone is condensed with 1-chloroanthraquinone to form 1-anthraquinonyl-5-aminoanthraquinone-1.2-thioxanthone; when this is heated with a metallic chloride, it is converted into a red-brown vat dyestuff.—T. F. B.

Wool [azo] dyestuff; Process for preparing a red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger Pat. 264,684, April 13, 1912. Addition to Ger. Pat 252,916.

Instead of using the tetrazo compound of 4.4′-diamino-2.2′-dimethyldiphenylmethane as in the principal patent (this J., 1913, 16), the tetrazo compound of 4.4′-diamino-2.2′.5.5′-tetramethyldiphenylmethane is combined with two mols. of 1.5-naphtholsulphonic acid. The products dye very level, clear bluish-red shades.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing brown ——. R. Wedekind und Co. m. b. H. Ger. Pat. 263,621, Sept. 9, 1911.

1-Chloro-2-hydroxyanthraquinone is nitrated, the nitro-compound is reduced, and the chloro-amino compound is melted alone or heated with an indifferent solvent for a long time, with or without addition of sodium acetate and copper powder. The products dye cotton from the alkali hydrosulphite vat in red-brown shades, fast to chlorine, washing, and light.—T. F. B.

Wool [azo] dyestuffs; Manufacture of fast ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 28,752, Dec. 13, 1912. Under Int. Conv., March 23, 1912.

See Addition of Dec. 9, 1912, to Fr. Pat. 441,044 of 1912; this J., 1913, 650.—T. F. B.

Disazo or polyazo dyestuffs; Process for producing mixed ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. Eng. Pat. 8184, April 7, 1913. Under Int. Conv., April 19, 1912.

See Fr. Pat. 456,432 of 1913; preceding.—T. F. B.

Azo colouring-matter. O. Günther, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,429, Sept. 30, 1913.

See Eng. Pat. 19,843 of 1912; this J., 1913, 938.—T. F. B.

Azo dye. P. Hauptmann, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,946, Oct. 7, 1913.

See Fr. Pat. 444,065 of 1912; this J., 1912, 1073.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 456,674, April 15, 1913. Under Int. Conv., April 19, 1912.

See Eng. Pat. 19,989 of 1912; this J., 1913, 745.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 456,675, April 15, 1913. Under Int. Conv., April 19, 1912.

See Eng. Pat. 8767 of 1913; this J., 1913, 905.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,089, May 20, 1913. Under Int. Conv., May 25, 1912.

See Eng. Pat. 12,217 of 1913; this J., 1913, 938.—T. F. B.

Vat [indigoid] dye. W. Bauer, A. Herre, and R. Meyer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,405, Sept. 30, 1913.

See Ger. Pat. 258,258 of 1912; this J., 1913, 529.—T. F. B.

Vat dyestuffs of the indigo series and process of making same. G. Engi, Assignor to Soc. of Chemical Industry in Basle, Switzerland. U.S. Pat. 1,074,850, Oct. 7, 1913.

See Eng. Pat. 9940 of 1912; this J., 1912, 766.—T. F. B.

Disazo dyestuffs and process of making same. E. Zehntner, Assignor to Dye Works, formerly L. Durand, Huguenin und Co., Basle, Switzerland. U.S. Pat. 1,075,134, Oct. 7, 1913.

See Fr. Pat. 451,169 of 1912; this J., 1913, 593.—T. F. B.

Azo dyes and process of making the same. O. Schmidt, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,075,305, Oct. 7, 1913.

See Ger. Pat. 248,010 of 1911; this J., 1912, 765.—T. F. B.

Chromium compounds of hydroxyanthraquinonesulphonic acids [and of azo dyestuffs] and their use in printing and for producing lakes. Badische Anilin und Soda Fabrik. First Addition, dated March 17, 1913, to Fr. Pat. 451,503, Dec. 5, 1912. Under Int. Conv., Oct. 19, 1912.

See Eng. Pat. 26,460 of 1912; this J., 1913, 905.—T. F. B.

Halogenated dyestuffs of the Rosaniline series; Process for producing ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 456,498, June 19, 1912.

See Eng. Pat. 14,742 of 1912; this J., 1913, 694.—T. F. B.

Monoazo dyestuffs: Process for preparing yellow ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 457,891, May 5, 1913.

See Eng. Pat. 10,549 of 1913; this J., 1913, 906.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Mineral oil stains [on cotton]; Researches on ——. A. Scheurer and E. Wallach. Bull. Soc. Ind. Mulhouse, 1913, 83, 510–608.

A comprehensive investigation of the problem of mineral oil stains on cotton, stains obtained under different conditions being compared as to permeability by wetting out tests. The conditions were varied as regards manner of application of the stain, variety and composition of the oil, kind of after-treatment undergone by the cloth, such as singeing, ageing, storing, bleaching by various methods, etc. The effect of the conditions on the colour of the stain was also noted. Of all the constituents of a mineral oil, paraffin is the most harmful. No mineral oil could be found which did not stain, but non-staining preparations can be obtained, either by mixing with the mineral oil a vegetable oil which did emulsify easily in scouring, or by using an emulsifiable mineral oil. The first method is the one recommended and the mixture must contain at least 60 per cent. of the vegetable oil. A mixture of 75 per cent. of colza oil with 25 per cent. of mineral oil gives the best results. Vegetable oils have the drawback of costliness and a tendency to clog. The use of emulsifiable mineral oils would appear to be a better solution of the problem, but at the present time such of these as are on the market are not manufactured with the present object in view, and, as they vary in quality, cannot be recommended.—J. B.

PATENTS.

Surgical splints, jackets, etc.; Material for use in the manufacture of uninflammable ——. J. W. Peck, London. Eng. Pat. 23,777, Oct. 17, 1912.

Calcium chloride or other metallic chloride, or ammonium chloride, preferably dissolved in wood alcohol, is added to the celluloid solution used for impregnating the gauze, etc., for surgical splints.—J. B.

Cork; Process for rendering —— *permanently odourless, without impairing its elasticity.* A. Milch. Ger. Pat. 264,305, June 20, 1911.

Glycerin is heated nearly to its decomposition temperature, then mixed with an equimolecular quantity of formmaldehyde, with exclusion of air, and the mixture after diluting with at least 95 per cent. of water is used for impregnating corks.—A. S.

Celluloid substitutes; Manufacture of non-inflammable ——. L. L. T. Labbé, Levallais, France. Eng. Pat. 21,458, Sept. 20, 1912. Under Int. Conv., Sept. 21, 1911. Addition to Eng. Pat. 12,746, May 26, 1911.

See Addition of Sept. 21, 1911, to Fr. Pat. 430,035 of 1911; this J., 1912, 329.—T. F. B.

Cellulose material; Apparatus for the production of filamentous or pellicular ——. A. Pellerin, Trouville, France. Eng. Pat. 7562, March 31, 1913. Under Int. Conv., April 1, 1912.

See Fr. Pat. 442,022 of 1912; this J., 1912, 916.—T. F. B.

Viscose; Dry —— *in a granular, soluble, and stable condition and process of preparing the same.* H. Lyncke, Berlin. U.S. Pat. 1,074,881, Oct. 7, 1913.

See Fr. Pat. 388,915 of 1908; this J., 1908, 956.—T. F. B.

Xyloline and textilose threads and products made therefrom; Process for rendering —— *more supple and brighter.* Manuf. Française de Textilose (Brev. E. Claviez). Fr. Pat. 458,054, May 19, 1913. Under Int. Conv., Aug. 22, 1912.

See Eng. Pat. 11,000 of 1913; this J., 1913, 975.—T. F. B.

Cloth for filter-presses and machine for making the same. Fr. Pat. 457,953. *See* I.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Tanning and loading of hide and silk and effect of colloidal water in same. Sommerhoff. *See* XV.

Patents.

Bleaching and like fluids; [Electrolytic] apparatus for preparing ——. C. A. M. Buckley, London. Eng. Pat. 18,600, Aug. 13, 1912.

With the object of increasing circulation the anodes are arranged between non-conducting plates with spaces in between for the passage of the liquid. The gases which are evolved cause the circulation. The cathode is in a separate tank, the top of which is in communication with the lower part of the anode tank for the purpose of maintaining the level without causing undue mixing. The bottom of the cathode tank slopes towards the anode tank and the caustic soda which falls from the cathode is allowed to flow by gravity to the anode tank through a valve, the quantity passing being regulated, or shut off entirely during intermittent working. Cooling coils are provided.—J. B.

Bleaching process. R. Grüter and Chem. Werke, vorm. Dr. H. Byk, Berlin. Eng. Pat. 6896, March 20, 1913.

The material—fibres, straw, grasses, etc.—is treated separately with strong hydrogen peroxide and gaseous ammonia.—J. B.

Washing, cleaning, and otherwise treating goods with liquids and/or gases; Machines of the rotary type for ——. J. Smith, H. L. Mitchell, and W. H. Askham, Ravensthorpe, and H. Hey, Dewsbury. Eng. Pat. 24,699, Oct. 28, 1912.

In machines of the type in which the goods are contained in a perforated drum revolving inside an outer casing which contains the scouring or other liquid, steam, inert gas, or other fluid, instead of being admitted through the bearing of the drum, is admitted through a series of orifices placed immediately around the axle, which orifices during the revolution slide over corresponding orifices in the fixed casing, through which the fluid is admitted. —J. B.

Silk; Process for treating raw —— *to render dyeing possible without degumming.* F. Cardazzi. Fr. Pat. 457,326, April 3, 1913. Under Int. Conv., Dec. 18, 1912.

The sericin of the silk is rendered insoluble by treating the raw fibre with formaldehyde vapour. Loss of weight is thus avoided in the subsequent dyeing operations.—J. B.

Dyeings on the fibre; Producing fast ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 25,897, Nov. 11, 1912.

Diazotisable dyestuffs are developed on the fibre with amino- or alkylamino-derivatives of carbazole or its (N)-substituted derivatives. The polyamino derivatives of carbazole are the most suitable. Tetra-aminocarbazole gives with Primuline a brown extremely fast to washing, while Diaminogene Extra gives a black. Diamine Azo Scarlet 4B gives with tetra-amino(N)-ethylcarbazole a brick-red shade.—J. B.

Hank dyeing machine. J. Decock. First Addition, dated March 15, 1913, to Fr. Pat. 442,713, April 10, 1912 (this J., 1912, 1027).

Certain improvements in mechanical detail in a machine of the type in which the yarn sticks are carried through the bath on an endless chain which engages with a series of other chains by means of which the yarn is carried along through the air to effect oxidation and finally returned to the first chain and again plunged into the dye-bath. —J. B.

Dyeing; Process of —— *in the vat.* Badische Anilin und Soda Fabrik. Fr. Pat. 457,154, April 25, 1913. Under Int. Conv., Sept. 11, 1912.

Dyeing is effected at or near the boiling point, whereby even dyeing is secured in the case of many vat dyestuffs which otherwise do not penetrate well.—J. B.

Dyeing wool or hair felt. Manufacture Lyonnaise de Matières Colorantes. Fr. Pat. 457,706, July 18, 1912.

Penetration is secured in the dyeing of very dense felts by the use of certain basic dyestuffs in conjunction with mineral acids in a boiling bath. Suitable dyestuffs are: New Methylene Blue N, Crystal Violet 10B, Safranine S150, Brilliant Green crystals extra, Jute Black GN pure, Fuchsin and Diamond Phosphine GG.—J. B.

[Dyeing] Yarn and other materials in one bath or in successive baths; Apparatus for treating—. L. Hermsdorf and B. Teufer. Fr. Pat. 458,047, May 19, 1913.

The yarn is wound on spools which are carried on an endless chain through the bath or baths. A cog-wheel mounted on the axle of the spool engages in a rack mounted on the wall of the bath in such a way that the spool is made to revolve in a direction opposite to that in which the chain is travelling, and at an angular velocity greater than the velocity at which it is travelling forward. —J. B.

Printing colours. L. Schütze and R. Fischer, Leipzig. Eng. Pat. 12,567, May 29, 1913. Under Int. Conv., Dec. 24, 1912.

Albumin which has been dissolved or emulsified by addition of an alkali or alkaline salt, together with a sulphonated oil or a salt thereof, is used as a vehicle for the colour. An ethereal oil may be added to assist emulsification.—J. B.

Discharges on indigo and other reducible vat dyestuffs; Production of coloured ——. Gebr. Enderlin, Druckfabr. u. Mechanische Weberei A.-G. Ger. Pat. 263,647, July 30, 1912.

The usual indigo-discharge colour, prepared with a reducing agent such as Rongalite CL (an ammonium base containing an aryl radical and sulphoxylate) and anthraquinone, zinc oxide, etc., is mixed with an iron or tin salt or stannous oxide and the vat dyestuff; this is printed on the dyeing to be discharged, and the goods are steamed, passed through a caustic soda bath, and finally soured.—T. F. B.

White and coloured discharges on indigo-dyed goods by means of ferrous salts and alkali lye; Production of ——. M. Ribbert A.-G. Ger. Pat. 264,243, Oct. 11, 1912.

Indigo-dyed goods are printed with a mixture of ferrous sulphate, anthraquinone, a tin salt, sodium dimethylphenylbenzylammoniumhydroxydisulphonate or analogous salt of an organic quaternary alkarylammonium compound, and a small quantity of an organic acid, such as tartaric, oxalic, or acetic acid, or a sulphite; after drying, the goods are passed through a boiling caustic soda bath. To produce coloured discharges, the printing paste is mixed with a vat dyestuff which is not decomposed but is fixed on the fibre under the conditions obtaining in the above process.—T. F. B.

Printing vegetable fibres with vat dyestuffs; Process for —— W. Bister. Ger. Pat. 264,244, Oct. 20, 1912.

The fibre is prepared with an alkaline solution, *e.g.*, of caustic soda, to which a hydrosulphite or other reducing agent may be added; a vat dyestuff thickened in the usual way and mixed with hydrosulphite is then printed on, and the colour is developed by steaming in any form of steaming apparatus. The depth of shade obtainable depends chiefly on the time of steaming.—T. F. B.

Textile fibres; Production of fast shades on ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,881, Oct. 30, 1912.

See Ger. Pats. 258,979 and 259,293 of 1912; this J., 1913, 654.—T. F. B.

Dyeing thread and like material: Apparatus for ——. B. Teufer, Chemnitz, Germany. U.S. Pat. 1,074,390, Sept. 30, 1913.

See Fr. Pat. 458,047; preceding.—J. B.

Dyeings [with azo dyestuffs] capable of being discharged; Process for producing on cotton ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 7303, March 27, 1913. Under Int. Conv., April 11, 1912.

See Fr. Pat. 455,493 of 1913; this J., 1913, 940.—T. F. B.

Manufacture of azo dyestuffs and developing them on the fibre. Eng. Pat. 18,073. *See* IV.

Colour photography on fabrics. Fr. Pat. 457,446. *See* XXI.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur trioxide; Action of —— *on salts.* W. Traube. Ber., 1913, **46**, 2513—2524.

Weighed quantities of salts were exposed, in a well-dried space, to the vapour of sulphur trioxide, afterwards removed by absorption by means of concentrated sulphuric acid, under diminished pressure. The resulting increase of weight was noted, and the substance formed, analysed. Sodium or ammonium chloride yielded a chloropyrosulphonate $Cl.SO_2.O.SO_2.ONa$ (or $.ONH_4$); sodium nitrite a nitrosotrisulphonate, $NO_2(SO_3)_3Na$.—J. T. D.

Fluosulphonic acid and its salts. W. Traube. Ber., 1913, **46**, 2525—2530.

Sodium fluoride absorbs sulphur trioxide (see preceding abstract) slowly, 1 mol. absorbing always less than 1 mol. of the trioxide; from the residue alcohol dissolves a substance of the composition $NaF.SO_3$, leaving unaltered sodium fluoride. An analogous ammonium salt is similarly prepared. These are salts of Thorpe and Kirmann's fluosulphonic acid (Z. anorg., Chem., 1893, 3, 63); and they are very stable, dissolving in water without decomposition. They are more easily prepared by dissolving sodium fluoride in fuming sulphuric acid and distilling, when fluosulphonic acid passes over, and if it be received in alcoholic ammonia, yields on evaporation the ammonium salt. Even aqueous solutions of potassium pyrosulphate and ammonium fluoride react to produce the fluosulphonate in small quantity; and it can also be produced by neutralisation of the aqueous solution of fluosulphonic acid by ammonia.—J. T. D.

Nitrogen; Fixation of ——. *Progress in Scandinavia.* Times Eng. Suppl., Oct. 15, 1913.

The successful commercial development of the process for oxidising ammonia to nitric acid by means of the catalytic action of platinum (see Eng. Pats. 698 and 8300 of 1902, and Addition to Fr. Pat. 317,544 of 1902; this J., 1902, 548; 1903, 93, 420) is referred to. The carbide works at Odda, Norway, when operations were started, comprised 10 furnaces, each with a capacity of 7—8 tons of carbide per 24 hours. Ten more furnaces, of 16—18 tons capacity each, have recently been added. The temperature is maintained at 5720° F. (3160° C.), the electrodes of the older furnaces taking 1400 kilowatts and those of the newer ones, 3500 kilowatts. It is stated that the radiation of heat from the new furnaces is less than from a steam boiler. The hot gases from the furnaces are used in the lime-kilns instead of producer-gas. The annual output, 32,000 tons up till recently, is now 90,000 tons of carbide. Most of this carbide passes direct to the calcium cyanamide works of an associated company, which at the present time has an annual output of 80,000 tons, the number of furnaces having been increased nearly sevenfold since the opening of the works four years ago. The nitrogen used, is prepared by the Linde process, 100 tons of air being liquefied daily. The furnaces have a capacity of 1 ton each: the nitrogen is supplied through valves in the side, and a current at 60—75 volts through an electrode in the centre. After about 24 hours at 1650° F. (900° C.), the carbide is converted into cyanamide, the resulting product containing 20 per cent. of nitrogen. In addition to these developments, a company formed to acquire the rights of the Ostwald process (except in Westphalia and Rhineland), is erecting new works for the manufacture of carbide and cyanamide (and nitric acid) at Aura, Norway, with an estimated output of 200,000 tons of calcium cyanamide, and has acquired waterfalls at other places in Norway and also in Iceland, capable of furnishing power for an annual output of nearly 2 million tons of calcium cyanamide. Works are to be erected at Dagenham on the Thames, at Trafford Park, Manchester, in Scotland, and in Ireland for producing from calcium cyanamide, 12,000, 12,000, 9000, and 3000 tons of nitric acid respectively. In the event of the supply of calcium cyanamide being curtailed or stopped, it will be possible to use the ammoniacal liquors from coke-ovens, blast-furnaces, residual recovery plant, and gasworks as sources of ammonia.—A. S.

Water of crystallisation in sulphates; Determination of ——. S. B. Kuzirian. Amer. J. Sci., 1913, **36**, 401—405. (Compare this J., 1913, 908, 909.)

Sulphates are completely deprived of water of crystallisation when fused with sodium paratungstate at a dull red heat, the proportion of water being accurately indicated by the loss of weight. Even with sulphates which are decomposed by ordinary ignition, there is no liberation of sulphur trioxide.—F. Sodn.

Tellurous acid and copper ammonium tellurite [from residues from copper refining]; Preparation of ——. G. O. Oberhelman and P. E. Browning. Amer. J. Sci., 1913, **36**, 399—400.

Residues containing a large proportion of tellurous oxide, from the electrolytic refining of copper, were extracted with ammonia, the solution treated with acetic acid, and the precipitated tellurous acid redissolved in sodium hydroxide and again precipitated with acetic acid. When precipitated cold and dried without heating, the tellurous acid is readily soluble in alkali hydroxides, but when precipitated in hot solution and dried by heating, it tends to become insoluble. A purple crystalline double tellurite of copper and ammonium separated from the original ammoniacal solution on standing, and an apparently identical salt was obtained by the cautious addition of acetic acid to an ammoniacal solution of tellurous oxide and copper chloride.—F. Sodn.

Arsenic; The forms of ——. *I. Grey and brown arsenic.* V. Kohlschütter, E. Frank, and C. Ehlers. Annalen, 1913, **400**, 268—301.

Both grey and brown arsenic are regarded as different ultramicroscopic states of division of ordinary metallic arsenic. Grey arsenic produced by sublimation or deposition from carbon bisulphide solutions of yellow arsenic—hence in the absence of foreign materials other than the yellow arsenic itself—is the coarser, and brown arsenic, produced by reducing agents from solutions of arsenic compounds, the finer state of division. The yellow, and the metallic arsenic are therefore the only definite allotropic modifications of the element. These views are based mainly upon the great difference in density between yellow and grey arsenic, 1·97 and 4·7 respectively, and microscopic and optical observations of the formation of the latter.—G. F. M.

Phosphorus; Vaporisation of —— *in oxygen and other gases.* M. Centnerszwer. Z. physik. Chem., 1913, **85**, 99—112.

The vapour pressure of phosphorus was determined by a dynamic method, using currents of different gases. In pure dry oxygen phosphorus vaporises according to Dalton's law without oxidation. Certain gases and vapours (*e.g.* ethylene, phenyl iodide) prevent the oxidation of phosphorus by air, but they do not affect the vapour pressure, nor do they have a permanent effect on the phosphorus. On removing the negative catalyst the oxidation recommences. The partial pressure of phosphorus in hydrogen, in oxygen, in illuminating gas, and in air (with a trace of phenyl iodide to prevent oxidation) is about 0·25 mm. at 20° C. In carbon dioxide, however, the distinctly higher value of 0·31 mm. is obtained.—W. H. P.

Salt manufacture at Carrickfergus. Times, Oct. 27, 1913. [T.R.]

During the last few weeks the fusion process of salt refining (see this J., 1910, 756, 1104) has been in operation at the Carrickfergus plant of the International Salt Co. The present plant has a capacity of 25,000 tons per annum, but it is intended immediately to increase this to 56,000 tons.

Barytes production of Missouri. U.S. Geological Survey Report for 1912. [T.R.]

Out of a total U.S. production of 37,478 tons, Missouri produced 24,530 tons of barytes, valued at £23,400, in 1912. The production during the past year has been the largest for several years and the price has been high, some sales averaging $7.00 a ton. Washington County produces four-fifths of the output of the State. Although Missouri has long been a producer, few areas have been exhausted, and sufficient new ore bodies are being developed each year to assure the maintenance of the present rate of production indefinitely.

Iodine in Java. Rev. Scient., Rep., 1913, 25, 352. Pharm. J., Sept. 20, 1913. [T.R.]

Iodine is derived in some quantity from the saline constituents of certain mineral springs in Java, where it occurs chiefly as magnesium iodide, and is precipitated from them by means of copper sulphate. One Javan spring is said to yield as much as 12 cgrms. of iodine from each litre of water. The output of iodine from the Dutch East Indies amounts to about 30 tons per annum. It might be much more if more capital were employed in the undertaking.

Solubility of calcium sulphite [*in water and in sugar solutions*]. Robart. *See* XVII.

Patents.

Sulphuric acid; Apparatus for de-arsenicating ——. R. Bithell and J. A. Beck, Belfast. Eng. Pat. 1500, Jan. 18, 1913.

The acid is introduced into the topmost of a series of superposed lead chambers, through a pipe extending nearly to the bottom of the chamber, and overflows from a desired level by way of a pipe extending to near the bottom of the next, lower chamber, and so on. Hydrogen sulphide is introduced into the lowermost chamber through a horizontal, perforated pipe, and passes out from the top of the chamber into the bottom of the next, higher compartment through a perforated inlet pipe. The pipes leading the gas from one chamber to the next, are looped outside the chambers so that the loop of each pipe passes round the outlet branch of the next, higher pipe, whereby a layer of acid is constantly maintained in each compartment.—O. R.

Nitric acid; Process for high concentration of watery ——. H. Pauling, Cologne, Germany, Assignor to Southern Electro-Chemical Co., New York. U.S. Pat. 1,074,287, Sept. 30, 1913.

A mixture of aqueous nitric acid and a dehydrating agent, *e.g.*, sulphuric acid, is passed through a distilling column against a counter-current of superheated steam, the vapours of concentrated nitric acid are collected, and condensed in stages, and the acid first condensed is returned to the column for further concentration.—A. S.

Nitric acid; Manufacture of ——. C. Casman. Fr. Pat. 457,800, May 13, 1913. Under Int. Conv., Mar. 6, 1913.

Nitric acid, preferably mixed with a little sulphuric acid, is heated in a vessel fed with compressed air, and the nitric oxide or nitrous acid formed, it is stated, by the combination of "nitrous vapours" (N_2O_5)" with the air, is converted into nitric acid in a series of unheated vessels, the first of which is supplied with compressed air and steam.—F. Sodn.

Hydrochloric acid gas; Apparatus for the complete absorption of ——. Deutsche Ton- und Steinzeugwerke A.-G. and T. Meyer. Ger. Pat. 263,651, April 14, 1912.

The gas issuing from the usual condensing apparatus passes through one or more cylindrical towers in which it is thoroughly moistened by water spray from a jet fixed in the roof of the tower. The gas inlet and outlet tubes both enter the tower tangentially, the first in the dome-shaped cover, and the other a little above the bottom of the tower. (See also this J., 1913, 285.)—A. S.

Pyrites and other metallic sulphides; Furnaces for decomposing ——. W. A. Hall, New York. Eng. Pat. 20,759, Sept. 11, 1912.

A furnace, of the type in which the material travels over a series of shelves provided with stirrers, is associated with a system of standpipes, fitted with valves for controlling the supply of steam, air, and reducing gases to the inlets adjacent to the various shelves. The sulphides whilst passing through the furnace are subjected to the action of steam and a reducing flame alternately, whereby hydrogen sulphide and sulphur are produced.—O. R.

Sulphur; Production of ——. W. A. Hall, New York. Eng. Pat. 20,760, Sept. 11, 1912.

Hydrogen sulphide and sulphur dioxide are made to interact at 300°—800° C. in the presence of sulphur vapour (50—90 per cent. of the total mixture) and a little steam. —O. R.

Ammonia and its salts: Manufacture of ——. T. Winstanley and F. H. Williams, Manchester. Eng. Pat. 21,304, Sept. 19, 1912.

Refuse nitrogenous matter, such as waste from wool, hair, leather, or the like, is distilled in a retort in contact with hydrogen, generated by passing steam over red-hot iron turnings, and an electric current of say 12 amps. and 150 volts is passed through the retort at the same time so as to facilitate combination between nitrogen and hydrogen; the issuing gases are returned into the retort until they are sufficiently rich in ammonia and the residue of the distillation is recovered in the form of animal charcoal.—O. R.

Ammonium chloride; Manufacture of —— *from ammoniacal liquors from the carbonisation of coal, peat, etc.* Fr. Pat. 457,681, May 9, 1913. Under Int. Conv., May 30, 1912.

The ammoniacal liquor is freed from tar and from iron by known methods, then neutralised with hydrochloric acid, and a quantity of sodium chloride or calcium chloride slightly in excess of that necessary for converting the other ammonium salts present into ammonium chloride is added. Ammonium chloride is recovered from the solution by crystallisation or by evaporation and sublimation.—A. S.

Hydrogen under pressure and at a raised temperature: Carrying out operations with ——. [*Production of ammonia.*] J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 28,200, Dec. 6, 1912.

Iron vessels employed in operating with hydrogen under pressure and at a high temperature are protected by interposing an atmosphere of nitrogen between the hydrogen, or mixture containing hydrogen and the wall of the vessel. For example, in the production of ammonia, nitrogen is made to pass between the wall of the vessel and a pervious lining and is then allowed to mix with hydrogen in the space within the lining.—F. Sodn.

Hydrogen; Operations in which —— is employed under pressure and at high temperatures in iron tubes or vessels. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pats. 29,260 and 13,258, Dec. 19, 1912 and June 7, 1913.

Hydrogen under pressure may be used in conjunction with vessels constructed ot steel alloys at temperatures considerably above 450° C., when these alloys contain certain proportions of chromium, vanadium, tungsten, molybdenum, or the like. Suitable alloys contain *e.g.* (1) W 18 and Cr 3 per cent., and (2) Cr 2·9 and C 0·2 per cent. Alloys containing too high a percentage of nickel should be avoided.—O. R.

Aluminium sulphate from its solution; Production of ——. I. P. Llewellyn, Goole, and Peter Spence and Sons, Ltd., Manchester. Eng. Pat. 26,616, Nov. 20, 1912.

Aluminium sulphate is produced in the form of thin scales or flakes by rubbing its solution in a thin film upon a surface of crystallised aluminium sulphate or between two such surfaces, under conditions which ensure rapid evaporation and crystallisation. For instance, a hot concentrated solution (sp. gr. 1·55 at the boiling point) is distributed upon a revolving drum on which a layer of the crystallised salt is gradually formed, and the film of solution is rubbed upon this layer or between it and a like layer on a spreading device, the crystalline sulphate being removed by means of a scraper, but always so as to leave a layer of the material on the drum. The product is readily soluble and in a suitable condition for subsequent drying.—F. Sodn.

Hydrogen peroxide. Manufacture of ——. A. Hempel. First Addition, dated July 10, 1912, to Fr. Pat. 445,096, Aug. 25, 1911 (this J., 1913, 24).

To obtain good yields in the process described in the chief patent, tubulures are so arranged in the upper part of the apparatus, that the vapours of hydrogen peroxide are removed without coming into contact with the liquor entering or leaving the apparatus. Any mixture containing hydrogen peroxide, either alone or in the presence of acids, salts, or alkalis may be dealt with.—F. Sodn.

Hydrogen peroxide; Process and apparatus for the continuous manufacture of ——. Henkel und Co. Fr. Pat. 457,696, May 9, 1913.

Dilute sulphuric acid or other suitable electrolyte, saturated with oxygen under high pressure, is submitted to electrolysis in a tubular apparatus which comprises an earthenware cylinder (surrounded by an outer steel casing) containing the anode (of carbon, for instance), and within this, a clay diaphragm enclosing a porous porcelain tube which supports the cathode (*e.g.*, a coil of wire). The electrolyte is circulated through the apparatus under the desired pressure by a set of " montejus " which at the same time saturate it with oxygen. Openings are provided in the lower part of the diaphragm for the circulation of the electrolyte from the anode to the cathode compartment. The space between the cathode and the diaphragm is so restricted that the electrolyte passes very rapidly over the former, and oxygen is forced also into the porcelain tube so as to travel through the pores into contact with the cathode. The apparatus and "montejus" are internally gilded or otherwise lined to withstand corrosion. —F. Sodn.

Hydrogen peroxide solutions; Process for stabilising ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Ger. Pat: 263,650, Feb. 15, 1912.

A small quantity of soap is added to the solution. The reaction, at first neutral, slowly becomes acid on standing, and more rapidly on warming. The solutions are more stable than those rendered acid to the same degree by addition of mineral acid.—A. S.

Calcium carbocyanamide; Process for separating —— from solutions of calcium cyanamide. C. Krauss, H. Kappen, and Akt.-Ges. für Stickstoffdünger. Fr. Pat. 457,582, May 7, 1913.

If carbon dioxide or gas containing carbon dioxide be passed into a solution of calcium cyanamide to which calcium hydroxide has been added, up to 80 per cent. of the calcium cyanamide, it is stated, can be precipitated as calcium cyanamide-carbonate, $CaC_2N_2O_2$, whereas without the addition of calcium hydroxide not more than 32 per cent. can be thus precipitated. The cyanamide-carbonate can be easily decomposed, with regeneration of calcium cyanamide, and the process may be applied to the preparation of solutions of pure calcium cyanamide from the crude commercial product (nitrolim).—A. S.

Dialkali cyanamides and alkali cyanides; Process for making ——. Chem. Fabr. von Heyden A.-G. Fr. Pat. 457,735, May 10, 1913. Under Int. Conv., May 28, 1912.

See Eng. Pat. 5051 of 1913; this J., 1913, 924. Alkali cyanides are made by treating cyanamide or its polymerides with alkali metals or their alloys and carbonaceous materials.—T. F. B.

Aluminium nitride; Manufacture of ——. Soc. Général des Nitrures. Fr. Pats. 457,650, May 8, 1913 (under Int. Conv., May 10, 1912) and 457,723, May 10, 1913 (under Int. Conv., May 13 and Dec. 16, 1912).

(1). In the manufacture of nitrides of aluminium, silicon, etc., produced by the action of nitrogen on a mixture of the oxide and carbon at a high temperature, it is claimed that by using a charge composed of agglomerates of the oxide with an excess of carbon over the quantity necessary for the reaction, the uniform passage of the electric current is ensured, and local overheating with resulting formation of carbide is avoided. (2). In addition to using an excess of carbon in the charge, the furnace is so designed that the charge becomes progressively larger in cross-section as it passes through the furnace, so that there is always a sufficient quantity of carbon per unit of cross-section to ensure an uniform passage of the current. An inclined rotary furnace may be used, the current being introduced through two conducting rings, of which the lower one projects into the interior of the furnace; the descending charge piles up against the projection to form a layer of greater thickness. Additional rings of conducting material, projecting into the furnace, may be provided between the two electrodes. Or, a fixed vertical furnace may be used, in which the upper electrode acts as a distributing plate, so that the charge is directed against the inclined walls of the furnace and forms a descending layer of progressively increasing cross-section. Instead of using an excess of carbon in the charge, other substances which are good conductors may be added, especially iron or its alloys or ores; these have the additional advantage of exerting a favourable influence on the reaction and they may afterwards be separated magnetically from the nitride. When an excess of carbon is used in the charge, air may be employed directly as the source of nitrogen, the oxygen being removed by combination with the excess of carbon in the charge. —A. S.

Nitrides; Manufacture of ——. G. Coutagne. Fr. Pat. 457,992, July 25, 1912.

In the manufacture of nitrides by the action of nitrogen at a high temperature on a mixture of oxides and carbon, the heating is effected by means of a high-tension arc produced in a current of nitrogen or gaseous mixture containing nitrogen, travelling in the opposite direction to the mixture of oxides and carbon. For example the charge is made to descend a fixed vertical column, which is provided with a circular opening communicating with a lateral chamber in which the arc is produced. The nitrogen is introduced in such a manner that the arc rotates and extends from the first electrode to the agglomerated carbon forming the rim of the lateral opening, this acting as the second electrode. The highly heated nitrogen passes through the opening into the column containing the charge, which is also heated by conduction and radiation from the second electrode. In another form, a cylindrical furnace slightly inclined to the horizontal and made to rotate slowly, is used. The arc is produced in the lower part of the furnace, the second electrode being one of the rings of agglomerated carbon forming the lining of the furnace. In both cases the first electrode, from which the arc starts, may be water-cooled. The process may be applied to the manufacture of all substances produced by the action of a gas on a solid at high temperatures, provided the gas does not attack carbon.—A. S.

Zinc oxide practically free from lead; Production of —— from ores and slags containing lead and zinc. P. Schmidt und Desgraz, Ges. m. b. H. Ger. Pat. 261,800, Oct. 27, 1912. Addition to Ger. Pat. 261,307.

The oxide or roasted sulphide ores are fused with suitable fluxes and treated with metallic iron in order to separate the lead. For instance the used mixture may be passed through a filter of metallic iron. The product is then further treated by the process described in the chief patent.—A. S.

Lead oxides: Separation of —— from a mixture of lead oxide and zinc oxide. H. Heimann. Ger. Pat. 263,938, Nov. 12, 1912.

The mixed oxides are treated with a hot solution of baryta, which dissolves the lead oxides. From the solution the lead is precipitated by barium sulphide, barium hydroxide being regenerated.—A. S.

Alkaline-earth oxides; Electrochemical production of —— from a mixture of alkali salts and alkaline-earth sulphates and carbonates. W. Scheermesser. Ger. Pat. 263,613, July 13, 1912.

Alkaline-earth sulphates and carbonates are mixed with alkali chlorides, and the mixture is fused and electrolysed, whereby the alkaline-earth salt is decomposed, whilst the alkali chloride remains intact. Further quantities of alkaline-earth salts may be added as electrolysis proceeds. From a fused mixture of barium carbonate and sodium chloride, for example, using a graphite anode and iron cathode, it is stated that a yield of barium oxide (at the cathode) corresponding to 90—95 per cent. of the current employed is obtained.—A. S.

Metals and metallic oxides; Preparation of —— in a finely divided condition. H. Kast. Ger. Pat. 263,648, Feb. 23, 1912. Addition to Ger. Pat. 256,962 (this J., 1913, 426).

In order to avoid separation of carbon in carrying out the process described in the chief patent, the salts of the aromatic nitro-acids are heated in an atmosphere of carbon dioxide or steam, or in presence of oxygen-yielding substances, such as weakly oxidising gases, nitrates, chlorates, chromates, etc., especially ammonium nitrate.—A. S.

Zinc salts; Electrolysis of fused ——. Fabrik Elektrischer Zünder Ges. m. b. H. Ger. Pat. 263,942, Sept. 25, 1912.

In the electrolysis of fused zinc chloride or bromide, irregularities occur owing to the presence of water or zinc hydroxide in the electrolyte. These are avoided, according to the present patent, by the addition of aluminium compounds, *e.g.*, aluminium chloride. The aluminium hydroxide formed does not interfere with the electrolysis, and becomes again converted into aluminium chloride, probably in accordance with the equation:—

$$2Al(OH)_3+6Cl_2=2AlCl_3+6HCl+3O_2.$$

The oxygen in part escapes in the free state and in part combines with the carbon of the anodes to form carbon dioxide.—A. S.

Nitrogen simultaneously with oxides of nitrogen; Process of obtaining ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3662, Feb. 12, 1913. Under Int. Conv., Feb. 19, 1912.

See Fr. Pat. 453,845 of 1913; this J., 1913, 791.—T. F. B.

Metallic salts; Deposition of —— from solutions containing them. H. Rees, Llansamlet, and H. L. Sulman, Assignors to The Metals Extraction Corporation, Ltd., London. U.S. Pat. 1,074,203, Sept. 30, 1913.

See Fr. Pat. 433,477 of 1911; this J., 1912, 230.—T. F. B.

Metalloidal material [boron suboxide]. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,074,672, Oct. 7, 1913.

See Fr. Pat. 421,831 of 1910; this J., 1911, 488.—T. F. B.

Electrolysis of fused alkali chlorides; Apparatus for ——. E. Steinbuch, Monthey, Assignor to Soc. of Chem. Industry in Basle, Switzerland. U.S. Pat. 1,074,988, Oct. 7, 1913.

See Fr. Pat. 417,246 of 1910; this J., 1911, 27.—T. F. B.

Hydrogen under pressure; Working with ——. C. Bosch and F. Lappe, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,075,085, Oct. 7, 1913.

See Eng. Pat. 28,200 of 1912; preceding.—T. F. B.

Salt; Process for making cubes or blocks of ——. T. Lichtenberger and G. Kassel. Fr. Pat. 457,830, April 14, 1913.

See Eng. Pat. 8903 of 1913; this J., 1913, 867.—T. F. B.

Sulphur and sulphates from solutions of polythionates, Process for making ——. W. Feld. Fr. Pat. 457,853, March 6, 1913.

See Eng. Pat. 10,147 of 1912; this J., 1913, 602.—T. F. B.

Pump for corrosive acids. Fr. Pat. 457,936. *See* I.

[Electrolytic] apparatus for making bleaching and like fluids. Eng. Pat. 18,600. See VI.

VIII.—GLASS; CERAMICS.

Black glass; Production of ——. E. Plenske. Sprechsaal, 1913, 46, 612—614.

The black is obtained in a borax glass by using manganese and copper as stains instead of the more usual manganese and cobalt. The proportions recommended are 3 per cent. each of pyrolusite and copper oxide. Cuprous oxide may be used.—H. H. S.

Patents.

Glass furnaces; Gas regenerators for production and utilisation of poor gas applicable to ——. C. Deselle. Fr. Pat. 457,058, April 8, 1913.

The utilisation of low-grade coals for gas-fired furnaces is facilitated by an arrangement of "reduction and dissociation chambers," packed with coke, placed around the central combustion chamber. The gaseous mixture of carbon monoxide and dioxide, steam, hydrogen and hydrocarbons derived from the coal passes through these chambers before entering the combustion chamber, into which the secondary air is introduced. Carbon dioxide, organic substances and steam are reduced by the glowing coke. The furnace is provided with a sand bed on to which the glass falls in case of breakage of a crucible. —H. H. S.

Silicate of magnesium; Employment of hydrated natural —— for the manufacture of ceramic ware, tracing chalk and heat insulators, fired or unfired. I. J. B. Darget. Fr. Pat. 456,459, June 25, 1912.

Hydrated silicates of aluminium and magnesium act together as mutual binding agents, and mixtures of the two in varying proportions may be used for the manufacture of different ceramic products. Also two silicates of magnesium of different alumina content bind each other; that which contains the most alumina and has the lesser density is the more energetic cement.—H. H. S.

Kiln; Recuperative non-continuous ——, with concentric chambers, for the ceramic industry. A. Charlier. Fr. Pat. 457,398, May 2, 1913.

The passage of the flames and heated gases through a succession of concentric chambers enables the capacity of the kiln to be enlarged at will without increasing its height. —H. H. S.

Cement-like masses, especially suitable for filling teeth. E. Stern. Ger. Pat. 264,299, May 23, 1912.

Products suitable for use as dental fillings are obtained by mixing molybdic acid or tungstic acid or their salts with the usual double silicates. In place of the above acids, their complex compounds, such as phospho- or silico-molybdic or -tungstic acid or their salts may be used.—T. F. B.

Enamel, glass, and glazings; Manufacture of white colouring matter for ——. R. Rickmann, Cologne-Marienburg, Germany. Eng. Pat. 27,954, Dec. 4, 1912. Under Int. Conv., Dec. 4, 1911.

See Fr. Pat. 451,328 of 1912; this J., 1913, 604.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Cement-asbestos tiles; Manufacture of —— and the like. R. E. Golightly, Wotton-under-Edge, Glos. Eng. Pat. 29,857, Dec. 28, 1912.

A mixture of about 35 per cent. of Portland cement and 15 per cent. of asbestos fibre, is mixed with water and formed into tiles, and these, after being exposed to a damp atmosphere for 24 hours, are "matured" in an autoclave by the action of steam at a pressure of 80 lb. for 48 hours. The cement used should not give an expansion exceeding 5 mm. by the Le Chatelier test.—T. St.

Portland cement [and iron in a blast-furnace]; Production of ——. J. W. Richards, South Bethlehem, and W. S. Landis, Bethlehem, Pa. U.S. Pat. 1,073,820, Sept. 23, 1913.

A process for making iron and cement in a single operation in a blast-furnace having a basic lining, by adding sufficient limestone to produce a liquid slag of the composition of Portland cement clinker.—W. R. S.

Cement; Manufacture of ——. L. P. Basset. Fr. Pat. 457,511, July 11, 1912.

In the manufacture of cement from clay and calcium sulphate, the carbon oxy-sulphide, derived from the decomposition of the calcium sulphate, is burnt by admitting additional air at one or more points in the kiln. The composition of the gaseous products may be varied independently of the regulation of the main firing, and the additional air may be introduced either at the end of the rotary kiln, beyond the burning zone or into a secondary combustion chamber, attached to the kiln, in such a way that the temperature of the kiln is not reduced below that necessary for clinkering the cement.—W. C. H.

Cements; Process for rendering —— impermeable and water-resisting, and the preparation of water-resisting products. G. Darzens and C. Pierrard. Fr. Pat. 457,886, July 23, 1912.

Cement is made impermeable by mixing with it complex organic substances, *e.g.* salts of sulphonated fatty acids, which are soluble but are decomposed by catalysis or by the action of the main components of the cement into insoluble soaps of lime, alumina, zinc or other metallic oxide. Insoluble mineral soaps also may be used and rendered soluble by incorporating with them organic salts, *e.g.*, salts of β-naphtholsulphonic acid or of "phosphoglyceric acid," which have the property of forming with these soaps double salts which are relatively soluble.—W. C. H.

Bricks or light stone; Manufacture of —— by means of blast-furnace slag. C. H. Schol. First Addition, dated April 12, 1913, to Fr. Pat. 437,595, Nov. 25, 1911 (this J., 1912, 538).

Lime, cement, and similar substances may be used as binding agents in place of ground slag. The slag may be rendered spongy and porous by incorporating with it, whilst still in a molten condition, natural pumice stone, quartz or other substances containing silicic acid, clay, etc. In disintegrating blast-furnace slag by the simultaneous action of water and compressed air, the fused slag is spread on a bed of moist sand or similar material. The blocks of slag used in the manufacture, immediately after being coated with the binding agent, or the moulded articles, are exposed to the action of superheated steam or gases containing carbon dioxide. The pulverised slag may be graded into different sizes, and separated from particles rich in iron, by subjecting the mass to the action of a jet of compressed air.—W. C. H.

Bricks, artificial stone and similar products; Manufacture of ——. L. F. Kaye (formerly known as L. F. Kwiatkowski). Fr. Pat. 457,664, May 8, 1913.

In the manufacture of bricks, artificial stone, etc., from lime and sand or silicious material, part of the latter is mixed either with quicklime in the presence of an amount of moisture insufficient for the hydration of the lime, or with slaked lime. Before grinding, the mixture is stored, in the case of quicklime, in presence of the heat developed by the hydration or otherwise supplied, whilst in the case of slaked lime the stored mixture is preferably but not necessarily heated. When hydration is nearly complete, the mixture is ground, a further quantity of water added, if necessary for hydration, and lastly the remainder of the silicious material, together with sufficient water to render the mass plastic. After storage the mass is moulded and the articles hardened by steam or otherwise. A certain proportion of natural or Portland cement may be added as a binding agent. (See also this J., 1904, 1217.) —W. C. H.

Plaster of Paris; Process and apparatus for the manufacture of ——. F. Primat. Fr. Pat. 456,550, April 11, 1913. Under Int. Conv., Jan 27, 1913.

The raw materials are fed into one end of an inclined revolving drum, in which they are dried by means of the waste gases from the burners used for heating the actual burning chamber. The latter, which receives the dried raw material from the drying chamber, also consists of an inclined revolving drum heated by gas and provided at its higher part with steel balls, which effect the grinding of the materials, and at its lower end with perforations of various sizes which effect the sifting of the plaster. The whole process is continuous, and any unburnt or "dead" material is delivered from the lower end of the lower drum. —W. C. H.

Lime kiln. L. Collinet. Fr. Pat. 457,505, May 6, 1913.

The base of the kiln is provided with a grating in the form of an inverted truncated cone, of which the bars taper so as to secure intervening gaps of uniform width. The under side of this grating communicates with channels leading to the outer air, and this arrangement, together with an erect elongated cone, pierced with holes, at the centre of the base of the kiln, serves to ensure a uniform and proper internal distribution of air. The burnt material falls through apertures, with removable bars, on to shoots which discharge it directly into waggons, or on to a vibrating screen.—F. Sodn.

Mortar for joining and repairing the refractory brickwork of coke-ovens, etc. Bergbauges. Teicha m. b. H. Ger. Pat. 263,703, Sept. 24, 1912.

A mixture of quartz (100 parts), iron ore (15), dextrin (10), and sodium carbonate (10 parts). In the first firing the mortar forms a vitreous mass which flows over the surface of the masonry.—A. S.

Fire-brick; Process of manufacturing light ——. M. Hanabusa, Tokyo, Japan. U.S. Pat. 1,074,618, Oct. 7, 1913.

See Fr. Pat. 439,970 of 1912; this J., 1912, 723.—T. F. B.

Artificial stone; Process of making —— *and product obtained thereby.* S. Sborowitz, Berlin, Assignor to Deutsche Konit-Ges. m. b. H., Stralau, Germany. U.S. Pat. 1,074,983, Oct. 7, 1913.

See Eng. Pat. 17,482 of 1912; this J., 1913, 869.—T. F. B.

Cement; Manufacture of —— *in rotary furnaces.* C. von Ritter-Záhony. Fr. Pat. 456,394, March 3, 1913. Under Int. Conv., March 30, 1912.

See Eng. Pat. 13,803 of 1912; this J., 1913, 604.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnace and coke-oven gases in metallurgy; Utilisation of ——. E. Houbaer. Iron and Steel Inst., Sept. 13, 1913, 43 pages. [Advance proof.]

The importance of the temperature of combustion as a factor in comparing the values of fuel gases for various purposes, is emphasised. At the Cockerill Works, Seraing, Belgium, seven blast-furnaces with a total capacity of 1000 tons of pig-iron, yield daily 1,800,000 cb. m. of gas, the greater part of which is used directly for the generation of power; the surplus is now used under boilers; some of this will, in the future, heat a metal mixer. Five batteries of coke ovens, with a total output of 800 tons of coke per day, yield 3740 cb. m. of gas per hour all practically utilised; 2040 cb. m. for power generation and 1660 cb. m. for heating two open-hearth furnaces (9 and 12—13 tons capacity respectively), two stoves, and two reheating furnaces. A gas-holder of 50,000 cb. m. capacity is being constructed to store at least a portion of the coke-oven gas produced on Sundays and holidays; equalise the pressure and composition of the gas; provide a reserve. Metal mixers heated by blast-furnace or coke-oven gas, require no regenerative chambers, hot air from the Cowper stoves sufficing. The chief advantages claimed for the use of coke-oven gas in open-hearth furnaces (see this J., 1912, 75; 1913, 235) are: (1) increased production, (2) simplification in construction, (3) less repairs, especially to the roof and chambers, (4) possibility of using a cheaper charge, and (5) ease of working. In the working of a 12-ton furnace at Seraing, the average consumption was about 280 cb. m. of coke-oven gas per ton of steel. Coke-oven gas should not be used in engines but reserved for operations where a high temperature is required and where its calorific power can be utilised to the fullest extent. In some cases it may be profitable to use blast-furnace or producer gas for heating the coke-ovens and so recover a larger quantity of the richer coke-oven gas for special purposes. Pitch from coke-oven tar when pulverised in special burners by means of steam and compressed air, may be used for heating furnaces of all kinds. It is estimated that for a works producing 1000 tons of pig-iron, and 1000 tons of coke in regenerative ovens, the blast-furnace gas would supply energy equal to 28,500 horse-power; the coke-oven gas would serve for making 625 tons of steel in open-hearth furnaces or for heating 1150 tons of ingots in reheating furnaces; and the pitch for making 150 tons of steel in open-hearth furnaces.—A. S.

Iron; Nitrogen in ——. W. Herwig. Stahl u. Eisen, 1913, 33, 1721—1726.

The gas contained in blisters formed on steel plates during rolling and annealing was found to consist chiefly of nitrogen; gases evolved during the solidification of iron immediately after tapping from the blast-furnace, include large quantities of hydrogen and carbon monoxide, white iron containing more hydrogen, and hot-blast gray iron more carbon monoxide. The nitrogen in steel turnings, by heating in a current of hydrogen, was reduced from 0·022 to 0·006 per cent., and although it was not increased by heating in a current of nitrogen yet from a mixture of nitrogen and hydrogen in equal proportions, in one case, a steel with as much as 0·052 per cent. N was obtained. The author considers that a similar reaction takes place in the converter. A steel containing 0·04 per cent. N, when tested, broke without elongation but was improved by prolonged annealing.
—T. St.

Steel; Over-oxidation of ——. W. R. Shimer and F. O. Kichline. Trans. Amer. Inst. Min. Eng., 1913, 46, 2361—2377.

The extent of over-oxidation of steels produced by excessive blowing in a Bessemer converter, and by other means, has been studied both chemically and micrographically. The experiments were on a practical scale in a converter blowing steel for the Duplex process. The highest oxygen contents obtained, out of about 24 tests, were 0·074—0·064—0·049 per cent., other results ranging down to about 0·017. Oxidising with ore gave lower results than with air. It was found that de-oxidation was in all cases readily effected by the addition of hot metal. As might be expected, the higher the carbon content of the blown metal the lower the amount of retained oxygen. It is considered to be improbable that, under usual Bessemer and open-hearth practice, with the employment of recarburisers, more than 0·030 per cent. oxygen and, under any circumstances, without recarburising, more than 0·075 per cent., can be retained. In the analysis of the test pieces for oxygen (heating in hydrogen) it is noted, incidentally, that small amounts of manganese and chromium oxides are, simultaneously, reduced along with the iron oxide.

Steel; Properties of hardened and tempered hypoeutectic ——. H. Hanemann and R. Kühnel. Stahl u. Eiesn, 1913, 33, 1686—1689.

Seven pieces of steel, each 5 mm. diam. and 200 mm. long, and containing C 0·05, 0·085, 0·20, 0·34, 0·44, 0·50, and 0·65 per cent. respectively, were heated in a salt-bath to temperatures from 750° C. to 950° C. and, after quenching either in oil or water, were subjected to mechanical tests. They were then heated to temperatures of from 100° C. to 600° C., and again mechanically tested. The results, tabulated and graphically illustrated, indicate that temperature has very little influence for a carbon content of 0·05 per cent. but with higher percentages of carbon, a connection can be traced between the tenacity and the equilibrium diagram of iron-carbon alloys; that water-quenching, as compared with oil, gives a higher value at a lower carbon content, whilst the extension and reduction in area remain constant; that the hardness increased up to 0·44 per cent. of carbon, and then remained constant; that maximum tenacity was given by a steel containing 0·65 per cent. of carbon.—A. H. C.

Phosphorus in vanadium steel and ferro-vanadium; Determination of ——. C. F. Sidener and P. M. Skartvedt. J. Ind. Eng. Chem., 1913, 5, 838—839.

The hydrochloric acid solution of the sample is treated with aluminium chloride (about 0·02 grm. Al), nearly neutralised with ammonia, the iron reduced by ammonium bisulphite solution, and the aluminium precipitated as hydroxide and phosphate by means of phenylhydrazine (Hess and Campbell, this J., 1899, 1053). After boiling for 2 mins., the precipitate, which contains also vanadium, is filtered off, washed, dissolved in dilute nitric acid, the vanadium oxidised with hydrogen peroxide, the solution boiled for 5 mins. with a slight excess of sodium carbonate, and the aluminium phosphate re-precipitated by adding dilute nitric acid gradually until the solution no longer produces an immediate brown tint on turmeric paper. The precipitate is filtered off, washed with a 1 per cent. solution of ammonium nitrate, and dissolved in dilute nitric acid. The solution is tested with hydrogen peroxide, and the precipitation with sodium carbonate and nitric acid repeated as many times as may be necessary to obtain a solution free from vanadium. The phosphorus is then precipitated with ammonium molybdate and determined by the permanganate oxidation method.—A. S.

[*Steel.*] *Impact tests at different temperatures.* L. Guillet and L. Révillon. Rev. Mét., 1909, **6**, 94—101.

The test-pieces were 10 mm. sq. and 60 mm. long and were notched to a depth of 2 mm., the notch being 2 mm. wide and round at the bottom. The tests were made with a Guillery machine by the drop method, the anvil having an opening of 40 mm. The thermo-couple for measuring the temperature was inserted in a hole drilled at an angle from one face of the test-piece, to within about 3 mm. of the notch. The test-pieces were heated in an electric platinum-resistance furnace, then placed immediately in the testing machine and the tests begun when the reading of the galvanometer began to fall. Five carbon steels containing: C 0·218 to 1·224 per cent., two nickel-steels (2·99 and 7·1 per cent. Ni) and one nickel-chromium steel (Ni 4·38, Cr 0·85 per cent.) were examined. The results are given in tables and curves. The resistance to impact first increases with rise of temperature and then decreases to a minimum. The temperature of maximum resistance varies from 150° to 200° C. according to the character of the steel, being higher in the case of the nickel and nickel-chrome steels, but maximum brittleness occurs in all cases at 475° C. (incipient red heat). The nickel-chrome steel showed the least variation in resistance to impact with change of temperature. (See also this J., 1910, 1386.)—A. S.

Copper and some of its alloys; Variation of the resilience of —— with the temperature. L. Guillet and V. Bernard. Comptes rend., 1913, **156**, 1899—1901.

Tests were made on copper, six different brasses, cupro-nickel, German silver, and two aluminium-bronzes, the method employed being that described previously (see preceding abstract). Curve-diagrams are given illustrating the results. Many of the alloys showed a maximum resilience at about 100° C. and all, with the exception of the cupro-nickel (Cu 77·9, Ni 20·2, Zn 1·7 per cent.), showed a maximum brittleness beginning at 300°—400° C. In the case of a brass free from lead (Cu 90·6, Zn 9·3 per cent,). the brittleness diminished considerably between 700° and 900° C., but the maximum brittleness persisted nearly to 900°C. in the case of an otherwise similar brass containing lead (Cu 90·3, Zn 8·2, Pb 1·3 per cent.). Brasses containing Cu 80·9 and 70·3 per cent. remained brittle at 700°—850° C., but those containing Cu 61·6 and 61·3 per cent. respectively showed improvement at about 700° C. Cupro-nickel became brittle at about 600° C. but improved somewhat at about 1000° C. German silver (Cu 54·1, Zn 25·4, Ni 19·7 per cent.) was brittle from 300° C. nearly to the melting point and was much less resilient than cupro-nickel at all temperatures. With one of the aluminium bronzes (Cu 90·0, Al 9·8 per cent.) it was impossible to obtain precise results between 600° and 800° C. With the other (Cu 88·5, Al 7·5, Fe 3·7 per cent.) there was a pronounced diminution of brittleness at 700° C. —A. S.

Copper alloys; Influence of temperature on the resiliency of industrial ——. L. Guillet and V. Bernard. Comptes rend., 1913, **157**, 548—550. (See also preceding abstract.)

Additional observations were taken on samples of brass, bronze and an aluminium bronze containing 1·4 per cent. zinc. *Brass*: it was again found that lead diminishes the resiliency either hot or cold. *Aluminium bronze*: the resiliency decreases as the temperature rises. *Bronze* bends until a temperature of 200°—300°C. is reached. Lead and zinc increase its brittleness; otherwise the resiliency below 200° C. is a function of the copper content.—W. R. S.

Gold; The effect of charcoal in gold-bearing cyanide solutions with reference to the precipitation of ——. M. Green. Inst. Min. and Met., Oct. 1913. [Advance proof.]

The author finds that the precipitation of gold by charcoal is not due to osmotic pressure, nor does carbon (*e.g.* graphite) act as a precipitant. Charcoal which had been deprived of loosely occluded gases in a gas burette was found to be nearly as efficient a precipitating agent as before the removal of the gases. With a powerful vacuum pump the charcoal lost only occluded air at ordinary temperature, but at 500° C. gas was suddenly evolved. The residual charcoal had now almost lost its gold-precipitating power, which was however largely restored on reheating it in air to dull redness. The revivified charcoal on renewed exhaustion in a vacuum again become a feeble precipitant. The gas obtained by exhausting at 500° C. contained 26 per cent. CO, which, in the author's opinion, is the active agent in the precipitation.—W. R. S.

Silver plating; Spotting-out and ——. C. F. Burgess and L. T. Richardson. Amer. Inst. of Metals, Oct. 1913. [Advance proof.]

The gradual formation of spots on plated articles ("spotting-out") is stated as being probably due to galvanic action. The surfaces of brass castings often contain minute pits or cavities which are apt to enclose small quantities of electrolyte (cyanides), which bring the brass and silver into electrical contact. Since the electrolyte is not necessarily consumed in the process, but may serve simply as a conducting medium, it is possible for a very small amount to cause extensive corrosion.—W. R. S.

Mercury; Occurrence, distribution, and uses of ——. Bull. Imp. Inst., 1913, **11**, 479—495.

A brief description of the distribution of mercury ores, the extraction of the metal, and its properties and uses. The output of mercury in the chief producing countries, and statistics of imports and exports are given in the following tables:

Production of mercury.

	1910.	1911.	1912.*
	Metric tons.	Metric tons.	Metric tons.
Austria-Hungary	603	685	675
Italy	893	815	823
Spain	1000	1055	1035
China†	49	—	—
Mexico	200	95	112
United States	701	723	857

* Estimated production. † Exports only.

	1910.		1911.	
	Imports.	Exports.	Imports.	Exports.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.
United Kingdom ..	1520	843	1587	1071
France	146	—	196	—
Germany	836	31	919	36
India	160	2	106	2
Union of South Africa	129	—	108	—
Australia	57	—	41·5	—
Canada	129	—	59	—
United States	0·3	65	—	—

—A. S.

Copper alloys; Approximate melting-points of some commercial ——. H. W. Gillett and A. B. Norton. Amer. Inst. of Metals, Oct., 1913. [Advance proof.]

The alloys (except the manganese bronze, in which case the previously made alloy was melted) were all made by melting together the constituents in the carborundum crucible in which the determinations were made. Heating and cooling curves were plotted and the temperature at which solidification began or fusion was completed, was taken as the melting-point. The composition given is that aimed at, and actual analysis in all cases where it was made, showed that this was very nearly attained. The results are as follows :—

Alloy.	Percentage composition.				M. pt. ° C.
	Cu	Zn	Sn	Pb	
Gun metal..........	88	2	10	—	995
Leaded gun metal ..	85½	2	9½	3	980
Red brass	85	5	5	5	970
Low grade red brass	82	10	3	5	980
Leaded bronze	80	—	10	10	945
Bronze with zinc ..	85	5	10	—	980
Half yellow, half red	75	20	2	3	920
Cast yellow brass ..	67	31	—	2	895
Naval brass	61½	37	1½	—	855
Manganese bronze ..	56 Fe 1·5	41 Al 0·45	0·9 Mn 0·15	—	870

—J. T. D.

Lead ; Cathodic determination of —— and the analysis of lead alloys. R. Gartenmeister. Chem.-Zeit., 1913, **37**, 1281—1282.

To separate lead quantitatively at the cathode by the electrolysis of the nitrate, a depolariser is necessary to prevent the formation of peroxide at the anode and the evolution of hydrogen at the cathode. The use of gallic acid and alcohol is suggested. For each grm. of lead a total volume of electrolyte of about 125 c.c., containing 2—2·5 c.c. of free nitric acid (sp. gr. 1·4), 5 grms. of gallic acid, and 5 to 6 c.c. of alcohol. Under these conditions copper (completely), silver, tin, arsenic, antimony and bismuth, are also deposited. For alloys containing lead, tin, and antimony the lead is first precipitated as sulphide in alkaline solution. After washing with sodium sulphide and ammonium chloride containing a little sulphide, the precipitate is dissolved in nitric acid, the filter is incinerated and the ash also dissolved, and after evaporation to dryness the electrolyte is prepared as above. In analysing ordinary commercial alloys it is then only necessary to correct for any copper contained in the deposited lead.—W. H. P.

Tin chlorides ; Reduction of —— by hydrogen ; and a new method of effecting reductions. F. Meyer and H. Kerstein. Ber., 1913, **46**, 2882—2887.

A long quartz tube closed at one end is heated over more or less of its height by being introduced closed end downwards into an electric resistance furnace. Two concentric tubes pass into it, the inner one reaching to near its bottom, the outer one to about the middle of the heated zone, when that has its maximum depth. Through the inner tube and the annulus, gases can be separately and independently introduced, and a side-tube in the cap allows of the exit of surplus gas. When stannous chloride is placed in the quartz tube, the temperature raised to 1000° C., and hydrogen introduced by the long interior tube, (reaching nearly to the bottom of the long, wide, quartz tube), complete reduction ultimately takes place, without any loss of stannous chloride, any of this, which is vaporised condensing in the upper part of the tube and returning to the reaction zone. Five grms. of tin per hour were thus obtained. When stannic chloride vapour (alone or mixed with hydrogen) was introduced through the annulus, and hydrogen through the inner tube, at 600° C., there was complete reduction to stannous chloride higher up, and as this sank into the hydrogen atmosphere, it was reduced to metal ; in this case 2½ to 3 grms. of metal per hour were produced.—J. T. D.

Soldering fluxes for soft solder. W. Arthur. Amer. Inst. of Metals, Oct., 1913. [Advance proof.]

Zinc chloride is useless for soldering small zinc wires in fuse plugs, as a small amount remaining after soldering, an electric current will be started, the zinc corroded next to the solder, and again deposited a short distance away. Ammonium chloride also causes a certain amount of corrosion. Lactic acid and ammonium lactate tarnish brass and copper ; otherwise they are good fluxes, as are also a solution of citric acid and ammonium phosphate solution for tin, copper, brass, and zinc, but not iron.

—W. R. S.

Colloidal solutions of metals ; Electrical method of preparing aqueous ——. H. Morris-Airey and S. H. Long. Proc. Univ. Durham Phil. Soc., 1912—1913, **5**, 68—70.

Colloidal solutions of gold, silver, platinum, palladium, copper, lead, iron, zinc, tin, nickel, aluminium, magnesium, bismuth, antimony, and cadmium, respectively, have been prepared in a few seconds by the electrical disintegration method, using a high frequency alternating arc, the leads to which were taken from two points on the inductance of the oscillatory circuit of a Poulsen arc as used in wireless telegraphy. By varying the conditions it was possible to obtain currents of from 0·14 to 15 ampères and an E.M.F. of 480—4080 volts, and colloidal solutions showing a wide range of colours were thus obtained from several metals, especially gold, silver, and copper (see also following abstract).—A. S.

Colloidal gold ; Colour changes in ——. S. H. Long. Proc. Univ. Durham Phil. Soc., 1912—1913, **5**, 113—118.

Electrical migration and other tests were made on red, blue and purple colloidal gold solutions prepared by electrical disintegration by means of a high frequency alternating arc (see preceding abstract). The results show that the red colloid moves to the cathode and is probably associated with hydroxyl ions : the particles are very small. The blue colloid moves to the anode and is probably associated with hydrogen ions. The red colloid is less stable than the blue, into which it is converted by the action of an electrolyte or of an electric field. The purple colloid is a mixture of the red and blue forms in variable proportions.—A. S.

Mineral production of New South Wales in 1912. Board of Trade J., Oct. 9, 1913. [T.R.]

The Report for 1912 of the New South Wales Department of Mines gives the total value of the mineral output of that State during 1912 as £11,641,435, an increase of £1,883,428 over the value in 1911. The following table shows the quantity and value of the output of the principal minerals in 1911 and 1912 :—

—		Quantity.		Value.	
		1911.	1912.	1911.	1912.
				£	£
Gold	tons	8,691,604	9,885,815	3,167,165	3,660,015
Copper (ingots, matte and ore)	,,	12,100	11,034	590,102	579,791
Gold	oz. fine	181,121	165,295	769,353	702,129
Iron	tons	36,354	32,677	145,416	130,708
Lead (pig, etc.)............................	,,	17,276	17,251	209,784	264,530
Silver-lead (ore, concentrates, etc.)	,,	338,468	345,307	2,265,669	3,229,614
Silver (ingots and matte)	oz.	1,767,496	2,389,195	177,095	251,652
Shale (oil)	tons	75,104	86,018	36,980	34,770
Tin (ingots and ore)	,,	1,929	2,074	307,089	338,074
Wolfram	,,	283	172	29,091	16,584
Zinc (spelter and concentrates)..................	,,	516,378	520,518	1,414,980	1,766,242

The tin-mining industry has been favoured by the high price of the metal, and there has consequently been an increase in the value of the production. The greater portion of the tin has, as usual, been furnished by the dredges. During the year stanniferous lodes have been discovered over a tract of country stretching northwards from Ardlethan, a town on the Temora-Barellan railway; a considerable amount of massive tin ore, yielding from 30 to 50 per cent. metal, has been found on the surface.

Mineral production of British India in 1912. Rec. Geol. Survey, India, 1912. Board of Trade J., Oct. 2, 1913. [T.R.]

The quantities and values of the principal minerals raised in British India in 1912, as compared with 1911, were as follows :—

—		1911.		1912.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Coal	tons	12,715,534	2,502,616	14,706,339	3,310,365
Gold	ozs.	583,567	2,238,143	590,555	2,271,806
Petroleum	gails.	225,792,094	884,398	249,083,518	975,278
Salt (*a*)	tons	1,325,882	469,235	1,454,602	509,824
Manganese ore (*b*)	,,	670,290	648,801	637,444	884,404
Saltpetre	cwts.	14,679	220,268	14,798	217,035
Mica	,,	33,896	70,552	43,835	97,286
Lead and lead ore	tons	35,361	181,989	25,739	153,069
Jadestone (*c*)		—	41,660	—	10,800
Ruby, sapphire and spinel	carats	288,213	67,594	323,245	69,547
Tungsten-ore	tons	1,308	99,989	1,672	115,200
Graphite		—	9,425	—	nil.
Tin and tin-ore (*e*)	cwts.	3,707	24,904	7,507	50,944
Iron-ore (*d*)	tons	366,212	34,496	580,029	47,044
Silver		—	11,575	—	11,829
Chromite	tons	3,804	5,072	2,890	3,849
Magnesite	,,	3,490	1,047	15,379	4,614
Diamonds	carats	53	478	27	411
Amber	cwts.	14	133	27	179
Monazite	tons	832	24,044	1,135	41,419
Copper ore	,,	2,238	3,404	9,619	13,709

(*a*) Prices without duty. (*b*) Values f.o.b. Indian ports. (*c*) Exports. (*d*) Estimated values. (*e*) Includes wolfram.

No graphite was produced in British India during 1912, difficulties in working having stopped the mine in Travancore, the only considerable producer.

Mineral production of Victoria for 1912. Board of Trade J., Oct. 23, 1913. [T.R.]

The Report for 1912 of the Secretary of Mines for Victoria gives the total value of the minerals raised in that State during 1912 as £2,331,294, as compared with £2,463,865 in the previous year. The following table shows the output and value of the principal minerals in 1911 and 1912 :—

—		Quantity.		Value.	
		1911.	1912.	1911.	1912.
				£	£
Gold	oz. fine	504,000	480,131	2,140,855	2,039,464
Silver*	,,	18,494	17,424	2,070	2,200
Coal	tons	653,864	589,143	289,829	258,455
Brown coal	,,	6,134	4,012	2,313	866
Tin ore	,,	33	48	3,417	5,733
Antimony ore	,,	1,098	2,430	8,928	16,162
Wolfram	,,	18	10	1,309	574
Gypsum	,,	591	2,078	448	3,359
Magnesite	,,	166	211	498	633
Kaolin	,,	371	288	440	342
Diatomaceous earth	,,	400	850	1,600	3,400

*.Extracted from gold at Melbourne Mint.

Preparation of tellurous acid and copper ammonium tellurite [*from residues from copper refining*]. Oberhelman and Browning. *See* VII.

Patents.

Liquid or like fuel [*in open-hearth steel furnaces*]; *Combustion of* ——. A. Smith, London. Eng. Pat. 21,243, Sept. 18, 1912.

The liquid or semi-liquid fuel is vaporized in a vessel arranged in the waste gas flue, and superheated, but not "cracked," in the regenerators. For heating the regenerators at starting, the vaporizing vessel is heated by direct firing and the vapour is burned in the first regenerator. In one arrangement two sets of regenerators are provided and the currents are reversed periodically, and in another, the currents are continuous, an air-heating flue being formed in the roof of the furnace, with flues for waste-products and for superheating the oil vapours beneath the hearth.—A. T. L.

[*Steel.*] *Martin furnace.* L. Bodart and A. Gaudry. Fr. Pat. 457,694, May 9, 1913. Under Int. Conv., March 13, 1913.

The gas and air inlets of the furnace are placed in the same horizontal plane and are inclined downwards towards the hearth.—W. R. S.

Iron scrap and turnings ; Process and apparatus for melting ——. W. Wagner, Paris. Eng. Pat. 5452, March 4, 1913.

The excess heat of a furnace producing pig iron is utilised for melting the scrap, previously made into briquettes by a compressor fixed to the walls of the furnace.
—W. R. S.

Iron and steel ; Process for case-hardening ——. Gebr. Schubert, Berlin. Eng. Pat. 13,805, June 14, 1913. Under Int. Conv., Oct. 15, 1912.

The articles are coated with a hardening composition and surrounded by a layer of refractory material impregnated with a hardening agent, after which a fire-resisting mass is applied, and the articles heated in any suitable manner.
—W. R. S.

Iron and steel ; Cementation of ——. C. Gendre. First Addition, dated March 14, 1913, to Fr. Pat. 453,542, April 5, 1912 (this J., 1913, 794).

The carburising material originally described is modified, for the sake of economy, by considerably reducing the amount of soya bean, and by substituting barium carbonate for potassium carbonate.—T. St.

Iron and steel; Making ——. J. R. Billings, Assignor to Billings Process Co., Birmingham, Ala. U.S. Pat. 1,073,587, Sept. 23, 1913.

Carbonaceous fuel and oxygen or air are introduced under pressure into the molten metal in such quantities as to effect substantially complete combustion of the carbon, thereby raising the temperature of the mass and obtaining metal of the desired grade, which is poured into the moulds whilst still "heavily charged with carbon dioxide."—W. R. S.

Iron; Extraction of —— free from titanium from titaniferous ferruginous sands. P. H. Ledeboer. Fr. Pat. 456,401, March 21, 1913.

The sands, after preliminary magnetic concentration, if necessary, are intimately mixed with carbon, or carbonaceous material, and reduced at a temperature insufficient to melt the reduced iron. The resulting iron is either powdery, or finely granulated, whilst the titanic oxide remains unchanged. The iron is then separated by electro-magnetic treatment.—T. St.

Metallic powders; Manufacture of solid bodies from ——. H. Leiser, Charlottenburg, Germany. Eng. Pat. 22,041, Sept. 27, 1912. Under Int. Conv., Oct. 2, 1911.

The process is applicable to metals melting above 1300° C., and consists in subjecting a dry mixture of the crystalline and amorphous varieties of the metal, in powder form, to great pressure, and simultaneously heating the mass to a temperature which may be far below the melting point. The amorphous portion, which must be considerably smaller in amount than the crystalline portion, is thus rendered crystalline. By varying the proportions of the two forms, and by regulating the pressure and heating, the product can be controlled as to density, porosity, resistance to chemical action, and the like.—T. St.

Metals [tungsten]; Method of rendering insufficiently ductile —— ductile. C. Trenzen, Cologne-Braunsfeld, Germany. U.S. Pat. 1,074,993, Oct. 7, 1913.

The amorphous metal is heated to a high temperature, and "at the moment when it would pass to the crystalline state," is subjected to considerable pressure. Amorphous tungsten, for instance, is heated in hydrogen to about 950° C. for 10 minutes and then subjected to pressure. —A. S.

Gold, sand, coal, and other minerals; Apparatus for screening and washing ——. R. W. Pleasance, Manor Park, Essex. Eng. Pat. 28,675, Dec. 12, 1912.

The apparatus consists of several adjustable screens, the inclination of which can be varied according to the angle of repose of the material. (See also Eng. Pat. 6181 of 1907.)—W. R. S.

Furnaces for heating or annealing plates, hoop iron, wire, or the like, in boxes or muffles. L. Pletsch, Taranrog, and M. Olbrich, Ekaterinoslaw, Russia. Eng. Pat. 5815, March 8, 1913.

More uniform and economical heating of boxes and muffles in annealing furnaces is effected by leading the gaseous products of two fires into the chamber, at the bottom and top respectively, so that the gases mingle, and combustion takes place round about the boxes. —T. St.

Annealing furnace. Allgemeine Elektricitäts-Ges. Ger. Pat. 264,019, Nov. 10, 1912.

Cast-iron sockets provided with rollers which run on rails supported on springs, are fixed to an endless chain below and entirely outside the furnace. Bars bent alternately to the right and to the left are fixed in the sockets so that they can be easily removed. These bars project upwards into the furnace through a slot in the floor and serve to support the objects to be annealed. The slot is closed, as far as possible by spring plates attached to the sockets.—A. S.

Furnace for roasting ore. E. Dohet, St. Servais, Belgium. Eng. Pat. 7892, April 3, 1913.

In a furnace for the roasting of blende, etc., consisting of superposed hearths, the gearing is so arranged that the rakes which agitate and move forward the ore are stopped for a period when they reach the end of the outward stroke, where they are in contact with the outside air. They are thus cooled before each forward stroke into the furnace, and wear is lessened.—T. St.

Furnace; Continuous rotary —— for the roasting of blende, pyrites and other sulphide ores, for chloridising copper residues, and for drying diverse materials. A. Lekeu. Fr. Pat. 457,566, May 7, 1913.

A rotating furnace lined with refractory material is provided internally with helical projections, which serve to agitate and feed along the ore. Heated air is passed through in the direction opposite to that of the ore, and the products of combustion from a removable furnace placed at the ore-discharge end, pass through channels in the refractory lining. The ore is fed into, and discharged from the rotating furnace, through channels passing through the lining. Movable joints consisting of several iron rings, serve to prevent loss of heated air and furnace gases.—T. St.

Tilting furnace for smelting pyrites and sulphur ores. E. Knudsen, Mühlbach, Austria-Hungary. U.S. Pat. 1,075,214, Oct. 7, 1913.

The furnace is of the Bessemer type, the hearth being inclined downwards towards a well at one side and the blast directed into the well. There are two openings, "angularly displaced," in the upper part of the furnace, one over the well and the other over the hearth, the former being provided with a cover.—A. S.

Furnace; Electric alternating ——. J. Bally. First and Second Additions, dated July 12 and 13, 1912, to Fr. Pat. 432,151, July 11, 1911 (this J., 1912, 32).

(1) The furnace is employed for the manufacture of steel, the wells being connected together at the lower parts by a hollow annular base in the centre of which is a fan for producing a current of air through the base. The annular wall of the furnace is surrounded by spaces which form an insulating sheath of air. These spaces may form hoppers for heating the charge, and from which the material passes to the base. The annular working chamber is covered by an arch formed of sectors, and provided with working doors. The vertical cross-pieces of the furnace are connected together by resistances which form an auxiliary heating circuit. (2) The inductor has a conical form, fitting into a space of corresponding shape, so as to facilitate the tilting of the furnace.—B. N.

Blast-furnaces; Oxygen or oxygenated air mixed with steam or carbon dioxide as a blast for ——. L. F. C. Girardet. Fr. Pat. 457,645, April 25, 1913.

The blast is composed of a mixture of oxygen (or air enriched in oxygen) with steam and carbon dioxide in such proportions that the temperature at the zone of the tuyères remains normal.—W. R. S.

Threads, or hairs, of lead, or other metal, or alloy; Apparatus for the manufacture of fine ——. E. H. Strange and H. E. Coley, London. Eng. Pat. 7140, March 25, 1913.

Improvements in the apparatus described in Eng. Pat. 6630 of 1907. From the bottom of the vessel containing the molten metal issues a vertical pipe opening at its lower end into a horizontal pipe provided with fine perforations. The metal issues from the perforations, under considerable pressure due to the head of molten metal, in fine streams which are received on a moving cooled metallic surface.—A. S.

Ores; Apparatus for the treatment of ——. G. Mitchell, Los Angeles, Cal. U.S. Pat. 1,074,282, Sept. 30, 1913.

A combined smelting and converting furnace. The converter section is removable and its open top registers with an opening in the bottom of one end of the smelting furnace. A trough extending lengthwise of the smelting furnace and communicating with the hearth thereof, discharges into the converter section and is provided also with a discharge spout between the hearth and the converter, so that matte may be tapped from the trough into a ladle and afterwards discharged into the converter.—A. S.

Ores and the like; Method of treating ——. N. C. Christensen, jun., Salt Lake City, Utah. U.S. Pat. 1,075,011, Oct. 7, 1911.

The crushed ore after being moistened with a portion of a relatively concentrated solution of "at least one of the common chlorides," is roasted, the volatilised products and acid fumes are condensed in another portion of the solution, and this solution is then used for leaching the roasted ore.—A. S.

Copper alloy. W. F. Nolan, St. Paul, Minn. U.S. Pat. 1,074,285, Sept. 30, 1913.

An alloy of Cu 98·15, Mn 1·48, V 0·25 and Al 0·12 per cent.—A. S.

Cupriferous materials; Cyclic process of extracting metals from ——. A. David, Brooklyn, N.Y., Assignor to Midland Ores and Patents Co., New York. U.S. Pat. 1,075,093, Oct. 7, 1913.

Cupriferous material containing silver is leached with a solution containing a ferric salt, a solvent of silver chloride, *e.g.*, sodium chloride, and free acid; the solution is treated with electrolytic iron to precipitate the copper, and is then electrolysed so as to deposit iron in a highly reactive form and regenerate the solvent ready for leaching a further quantity of cupriferous material.—A. S.

Metallic oxides; Electrometallurgical process of reducing ——. D. A. Lyon, Palo Alto, and E. R. Cox, jun., Heroult, Cal. U.S. Pat. 1,075,295, Oct. 7, 1913.

The oxide ore, mixed with suitable fluxes and with carbon, is caused to pass down a stack in which reduction is effected, and in a chamber below the stack the resulting metal and slag are melted by the application of an electric current. Above the surface of the charge in the stack, air is introduced in quantity sufficient to burn a portion of the carbon monoxide produced, and the hot products of combustion are used to preheat the charge of ore and fluxes.—A. S.

Argentiferous lead and blende; Extraction of —— when contained together in ores. E. Langguth. Fr. Pat. 456,500, April 10, 1913.

The ore is fused with zinc chloride, and the molten mass poured into water. After separation of the solid matter, the lead is recovered from the hot aqueous solution, either by fractional crystallisation of the lead chloride, or by precipitation with zinc. When the lead content is high, it may be partially precipitated from the fused mass by means of zinc before pouring into water.—T. St.

Zinc; Removing the reducing gases from vertical muffles in the extraction of ——. A. Roitzheim. Fr. Pat. 456,636, April 14, 1913.

An open space, extending almost the length of the muffle, is formed in the centre of the charge, by division walls of refractory material. These walls are composed of overlapping sections, like the slats of a venetian blind, to allow the free passage of the carbon monoxide and zinc vapours into the central space, and thence to the condensers. The oblique arrangement of the portions of the division walls allows of the easy removal of slag obstructions.—T. St.

Complex ores; Process for eliminating zinc from ——. H. E. L. Fiévet. Fr. Pat. 457,707, July 18, 1912.

Complex ores rich in zinc sulphide or oxide are heated in a converter with metallic iron by which the zinc is liberated and then volatilised. Ferrous oxide and carbon may also be used.—W. R. S.

Volatile metals [zinc]; Electrothermal manufacture of ——. F. Tharaldsen. Fr. Pat. 457,859, March 31, 1913.

A bath of fused slag is employed, and to prevent the formation of dust the charge, mixed with pulverised slag or slagging materials, is introduced below the surface of the slag. The mixture of ore and liquid slag forms the heating resistance.—B. N.

Fine ores, pyrites residues, and other materials utilisable in furnaces by agglomeration; Method of briquetting ——. Brück, Kretschel und Co. Fr. Pat. 457,245, April 29, 1913. Under Int. Conv., May 9, 1912.

Fine ores, etc., are intimately mixed with the dust separated in the dry cleaning of blast-furnace gas, the mixture is pressed into briquettes, and subjected, in autoclaves, to the action of superheated steam at 6 to 8 atmospheres pressure.—T. St.

Ores; Agglomeration of ——. A. G. Andersson. Fr. Pat. 458,066, May 20, 1913.

Moistened fines are formed into lumps by treatment in movable or rotatory cylinders or on any form of shaking device. A cementing agent may be added, and the material dried in any manner.—W. R. S.

Agglomeration of flue-dust. F. Dahl. Ger. Pat. 264,802, June 27, 1912.

Finely divided compounds of iron or manganese, of a lower degree of oxidation, are used as binding agents, and the mixture after being formed into briquettes is subjected to an oxidising flame or to a current of air enriched in oxygen at a high temperature in order to oxidise the added iron or manganese compounds, whereby, it is stated, briquettes of great strength are obtained.—A. S.

Ores; Concentration of ——. H. H. Greenway and A. H. P. Lowry. Fr. Pat. 458,051, May 19, 1913. Under Int. Conv., May 24, 1912.

A flotation process using a warm solution of sodium bichromate, together with a frothing agent such as eucalyptus oil. The selective action of this medium on finely divided sulphides is claimed for their separation. —W. R. S.

Furnaces for metallurgical purposes; Regenerative open-hearth [Siemens-Martin] ——. K. Albert, Amöneburg, Germany. Eng. Pat. 28,960, Dec. 16, 1912.

See Fr. Pat. 451,797 of 1912; this J., 1913, 662.—T. F. B

Case-hardening process for articles of iron, steel, and steel alloys. F. Giolitti, Turin, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 1,074,114, Sept. 30, 1913.

See Fr. Pat. 434,443 of 1911; this J., 1912, 341.—T. F. B.

Cementation; Product for effecting ——. H. Redman Fr. Pat. 457,145, April 25, 1913.

See Eng. Pat. 8596 of 1913; this J., 1913, 980.—T. F. B.

Armour plates and other steel articles; Manufacture of ——. Vickers, Ltd. Fr. Pat. 457,548, July 12, 1912.

See Eng. Pat. 885 of 1912; this J., 1913, 607.—T. F. B.

Treating materials [ores, etc.]; Process of ——. F. W. Yost, Chicago. U.S. Pat. 1,074,150, Sept. 30, 1913.

See Addition of June 28, 1910, to Fr. Pat. 417,037 of 1910; this J., 1911, 10.—T. F. B.

Alloy of zinc. T. A. Bayliss, Warwick, Assignor to B. G. Clark, London. U.S. Pat. 1,074,234, Sept. 30, 1913.

See Eng. Pat. 12,457 of 1911; this J., 1912, 647.—T. F. B.

Furnaces for roasting, smelting, or otherwise treating ores. The Oil-Flame Furnace Co., Ltd. Fr. Pat. 456,530, April 11, 1913.

See Eng. Pats. 10,564 and 27,531 of 1912; this J., 1913, 914.—T. F. B.

Electrolyte for use in electrometallurgical processes. N. H. M. Dekker. Fr. Pat. 457,816, July 22, 1912.

See Eng. Pat. 17,836 of 1912 ; this J., 1913, 662.—T. F. B.

Light metals, pure anhydrous caustic alkalis, and alloys of light metals with heavier metals ; Processes and apparatus for making —— and for treating these alloys to obtain other products. E. A. Ashcroft. Fr. Pat. 457,817, Feb. 14, 1913.

See Eng. Pats. 1001, 1003, and 1004 of 1912 ; this J., 1913, 199, 200.—T. F. B.

Furnaces for melting and alloying metals in vacuo. W. S. Simpson. Fr. Pat. 457,862, April 4, 1913. Under Int. Conv., May 21, 1912.

See Eng. Pat. 12,067 of 1912 ; this J., 1913, 755.—T. F. B.

Operations in which hydrogen is employed under high pressure and at high temperatures in iron tubes or vessels. Eng. Pats. 29,260 and 13,258. *See* VII.

Preparation of metals and metallic oxides in a finely divided condition. Ger. Pat. 263,648. *See* VII.

Production of Portland cement [*and iron in a blast furnace*]. U.S. Pat. 1,073,820. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Electrolytic oxidation of toluene. Fichter. *See* III.

Patents.

Electrolytic decomposition. E. Higgins, Liverpool. Eng. Pat. 22,280, Oct. 1, 1912.

The current is conveyed through converging jets of the electrolyte. At the moment the jets impinge, the products of electrolysis are projected away from the sphere of electrolytic action.—B. N.

Electrolytic condenser. C. J. Zimmerman, Niagara Falls, N.Y., Assignor to General Electric Co. U.S. Pat. 1,074,231, Sept. 30, 1913.

An alternating current rectifier comprising an aluminium electrode with a co-operating one, in an electrolyte consisting of an aqueous solution of an oxyacid of boron, a borate and glycerin.—B. N.

Electrolytes ; Apparatus for fusing ——. H. R. Carveth, Niagara Falls, N.Y., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,074,408, Sept. 30, 1913.

The melting pot has out-turned edges, and is enclosed in a water-jacket having correspondingly in-turned edges for cooling the walls of the pot. Terminals, attached to a source of electrical energy, are supported on, but electrically insulated from, the pot, and are connected with holders supporting a number of groups of horizontally and vertically adjustable electrodes of opposite polarity which dip into the charge. The holders are provided with clamps, so that the electrodes may be adjusted and replaced without interruption of the electric current. —B. N.

Crucibles for electric furnaces. The Morgan Crucible Co., Ltd., and C. W. Speirs, London. Eng. Pat. 24,626, Oct. 28, 1912.

The crucible is provided at its upper end with an extension, of larger sectional area than the rest of the body, for maintaining this part relatively cool, and one of the terminals of the current is attached to this portion. The crucible may also be provided with a lip or spout.—B. N.

Resistances ; Composition for electrical ——. A. I. Grabham, Wellington, N.Z. Eng. Pat. 27,500, Nov. 29, 1912.

A mixture of manganese oxide, 2 drms., zinc oxide, 2 drms., sodium silicate in the viscous state, 100 minims, and brass filings, 2¾ to 3½ drms.—B. N.

Resistances ; Electric heating —— applicable to electric furnaces. Soc. Générale des Nitrures. Fr. Pat. 458,031, July 26, 1912.

The wall of the cylindrical furnace is constructed of wedge-shaped sectors which constitute the heating resistance. The ends of the cylinder are formed of the sectors, *a* and *b*, arranged alternately, and between the two ends, the sectors, *c*, are placed as shown in Fig. 4, the intermediate portion of the resistance, smaller in cross-section, being covered with refractory material. The sectors, *c*, may be perforated with channels parallel to the longitudinal axes of the sectors, or may be furnished with longitudinal grooves, so that on assembling the pieces circular channels are formed which are filled with non-conducting material. In the ends, formed of the sectors, *a* and *b*, non-conducting elements may be introduced, thus forming alternating zones which are bad and good conductors of the electric current, and permitting of the employment of polyphase currents. Some of the sectors, *c*, may also be of non-conducting material, and, by arranging these in the form of a helix, the total length of the resistance may be reduced. —B. N.

Fig 1

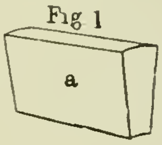


Fig 3

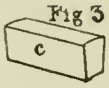


Fig.2

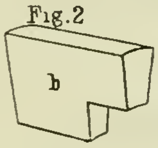
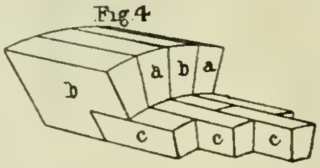


Fig 4



Ozone ; Process of producing —— and separating gases. H. Dumars, Glen Ridge, N.J. U.S. Pat. 1,074,106, Sept. 30, 1913.

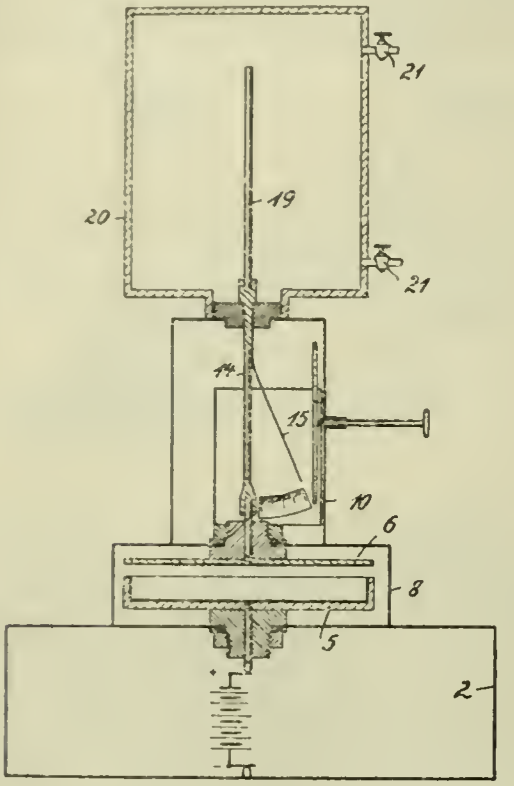
Air cooled to a temperature at which ozone will liquefy, whilst oxygen and nitrogen remain gaseous, is caused to flow through an ozoniser, and the liquid ozone and residual gases are collected separately.—F. Sodn.

Ozoniser. F. H. Richards, Hartford, Conn., Assignor to J. P. Morris, New York. U.S. Pat. 1,074,462, Sept. 30, 1913.

A pair of concentric tubes, approximately equal in length, and enclosing between them an annular air space, is arranged so that the outer tube extends above the inner. A pair of self-adjusting rings is fitted to the tubes, the upper ring for the outer tube having a tube-bearing shelf on the inner side, and the lower ring for the inner tube having a tube-bearing shelf on the outer side. The rings are supported by a frame comprising a continuous annular bearing surface for the lower ring, and a number of pillars for supporting the upper ring. Between the two rings and the pillars, air-outlet spaces are arranged, and an air-passage is provided over the upper end of the inner tube.—B. N.

Ions ; Apparatus for the measurement of ——. Siemens und Halske A.-G. Fr. Pat. 458,078, May 20, 1913. Under Int. Conv., May 21, 1912.

The common envelope, 10, 8, 2, encloses a battery, an air condenser, and an electroscope forming an electrostatic measuring instrument. The negative terminal of the battery is connected with the earth, and the positive terminal with one electrode, 5, of the air condenser, the other electrode, 6, being connected with the rod, 14, carrying the leaf, 15, of the electroscope. The rod, 14, is attached to a dispersion rod, 19, which may be of variable length, and surrounded by a removable gas-tight vessel, 20, provided with openings, 21, for the introduction of the ionised gas or emanation. The plates, 5 and 6, may be coated with a substance of constant radio-activity. In an alternative form the electroscope is replaced by a bipolar electrometer for measuring the intensity of ionisation,



e.g., of Röntgen rays, one of the quadrants being connected with a radiation vessel, into which the rays penetrate, above the electrometer. The apparatus also comprises an interrupter for the electrometer, by means of which the tension between the plates of the air condenser may be measured, and the tension between the dispersion rod and the earth.—B. N.

Electrolytes for galvanic batteries. W. H. Lowe, Brondesbury. Eng. Pat. 27,634, Nov. 30, 1912.

See U.S. Pat. 1,043,328 of 1912; this J., 1912, 1136. —T. F. B.

Electrolysis; Process of ——. H. M. Du Bois, Detroit. U.S. Pat. 1,075,026, Oct. 7, 1913.

See Eng. Pat. 1420 of 1913; this J., 1913, 873.—T. F. B.

Electrolysis; Process of —— and apparatus therefor. K. S. Guiterman. Fr. Pat. 456,501, April 10, 1913.

See U.S. Pat. 1,062,966 of 1913; this J., 1913, 703.—T. F. B.

Cells sensitive to light with aluminium electrodes and acetone as electrolyte. C. Stille. Fr. Pat. 457,616, April 14, 1913. Under Int. Conv., April 24, 1912.

See Eng. Pat. 9060 of 1913; this J., 1913, 873.—T. F. B.

Furnace; Electric ——. Comp. Française pour l'Exploit. des Procédés Thomson-Houston. Fr. Pat. 456,488, April 10, 1913.

See U.S. Pat. 1,063,483 of 1913; this J., 1913, 758.—T. F. B.

Preparing hydrazo compounds by electrolytic reduction of azoxy compounds. Ger. Pat. 264,013. *See* III.

[Electrolytic] apparatus for making bleaching and like fluids. Eng. Pat. 18,600. *See* VI.

Continuous manufacture of hydrogen peroxide. Fr. Pat. 457,696. *See* VII.

Electrochemical production of alkaline-earth oxides from a mixture of alkali salts and alkaline-earth sulphates and carbonates. Ger. Pat. 263,613. *See* VII.

Electrolysis of fused zinc salts. Ger. Pat. 263,942. *See* VII.

XII.—FATS; OILS; WAXES.

"Chlorine value" as a new oil constant. A. Zlataroff. Z. Unters. Nahr. Genussm., 1913, 26, 348—349.

A preliminary notice of a method for determining the chlorine absorption value of oils, using phenyl-iodo-chloride ($C_6H_5ICl_2$) as the chlorinating agent. In experiments with samples of triolein (not quite pure), "chlorine values" varying between 273 and 300 were obtained. —N. C. A.

Copra and margarine and the rise in the price of cocoanut oil. Times, Oct. 20, 1913. [T.R.]

The comparative scarcity of copra in view of the increasing demand for margarine, has caused a great rise in its price. In every quarter where copra is bought and sold, and even in Japan, despite the popularity of the soya bean, plant for the manufacture of cocoanut oil is being rapidly erected. To extract the oil the copra is milled, the resultant meal steamed and formed into cakes and the oil squeezed out by hydraulic pressure. This is done, not upon the spot, but by a limited number of refiners in Europe and America.

Cocoanut oil has long been used in the manufacture of freely lathering soaps, called "washers" in the trade, as well as for what are termed "cold process" and "marine" soaps. It also plays a part in the manufacture of candles and nightlights. On the other hand, it was never used for edible purposes in civilised countries owing to its insinuating cocoanut taste and its capacity for quickly turning rancid. All this has now been eliminated by chemical means, and cocoanut oil finds its way to the table in many forms. Cocoanut lard is now manufactured on a very large scale, and the oil has taken the place of animal fats in the manufacture of margarine. In its most highly refined form, blended with milk, it appears on the Continent as actual butter. Before the discovery of the above mentioned methods of purification, £12 was considered a good price for copra, whereas now it costs £48 a ton, without likelihood of any fall. The kernels are the staple food of most of the people where the nuts grow and their needs must be satisfied before there is any margin for export. Thus there can never be over-production.

Patents.

Oils and fats; Process and apparatus for treating [hydrogenating] —— in order to raise their melting point. K. Birkeland and O. Devik. Fr. Pat. 456,632, Apr. 14, 1913. Under Int. Conv., Apr. 15, July 5, and Sept. 26, 1912.

A mixture of the oil and catalytic agent is forced downwards through a nozzle or nozzles into an atmosphere of hydrogen filling the space above the bulk of the oil, which is contained in an autoclave or other vessel. The hydrogen is drawn into the oil jets by injector action and subsequently rises in small bubbles through the body of oil. The process is preferably carried out under a pressure of 10 to 15 atmos. and at a temperature of about 150° C. Sudden reduction of the pressure promotes the hydrogenation of the oil.—C. A. M.

Fats and oils; Process and apparatus for decomposing —— and bleaching the resulting products. B. E. Reuter. Fr. Pat. 457,496, May 6, 1913.

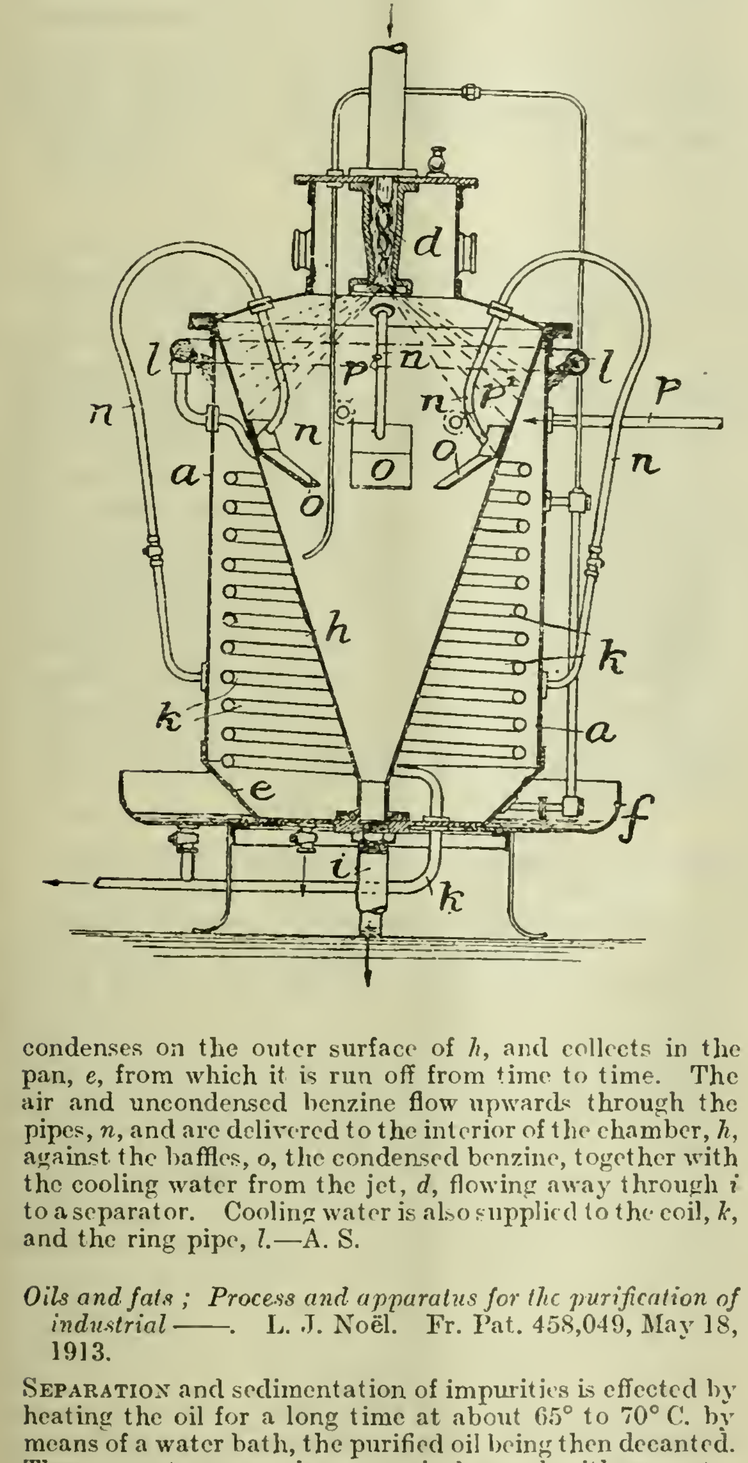
See U.S. Pat. 1,068,079 of 1913; this J., 1913, 875. Fatty acids, fats, oils, etc., are mixed with enough water to form an emulsion and heated with 0·05 to 0·2 per cent. of a hydrosulphite compound, and the mixture is boiled for 15 to 30 minutes. Sufficient sulphuric acid is added to destroy the emulsion and to decompose the hydrosulphite, and the bleached fatty acid or fat is freed from water.—T. F. B.

Oils from seeds; Apparatus for extracting —— by means of volatile solvents. A. Debuisne. Fr. Pat. 457,838, Apr. 21, 1913.

The seeds are extracted with carbon tetrachloride or other solvent heavier than water in a vessel provided with a false bottom, the latter being kept in position by means of a perforated tube which serves also for the introduction of gases or vapours. Pipes for the introduction of steam and brushes for cleaning the apparatus may also be provided.—C. A. M.

Condenser for benzine vapours in extraction apparatus for palm-kernel oil, etc. K. Diehm and A. Knolle. Ger. Pat. 262,194, Dec. 1, 1912.

The mixture of benzine vapour and air enters the space between the casing, *a*, and the conical chamber, *h*, through the pipes, *p*, p^1, p^2, and the greater part of the benzine condenses on the outer surface of *h*, and collects in the pan, *e*, from which it is run off from time to time. The air and uncondensed benzine flow upwards through the pipes, *n*, and are delivered to the interior of the chamber, *h*, against the baffles, *o*, the condensed benzine, together with the cooling water from the jet, *d*, flowing away through *i* to a separator. Cooling water is also supplied to the coil, *k*, and the ring pipe, *l*.—A. S.



Oils and fats; Process and apparatus for the purification of industrial ——. L. J. Noël. Fr. Pat. 458,049, May 18, 1913.

Separation and sedimentation of impurities is effected by heating the oil for a long time at about 65° to 70° C. by means of a water bath, the purified oil being then decanted. The apparatus comprises a conical vessel with an outer jacket for the circulation of hot water, and with a central pipe through which water can be added to the oil. —C. A. M.

Albuminous or albuminoid substances from the residues from the extraction of oil from oleaginous seeds; Process of extracting ——. L. Hoffmann and G. H. J. van Spanje. Fr. Pat. 457,148, July 4, 1912.

The residues are washed with an alkaline or saline (sodium chloride) solution, and the albumin precipitated by the addition of acid and dried at a relatively low temperature. —C. A. M.

Solutions of organic compounds giving emulsions with water; Liquid or solid ——. R. Vidal. Fourth Addition, dated July 16, 1912, to Fr. Pat. 445,053, July 8, 1911 (see this J., 1912, 1190; 1913, 150, 498, 759).

(1) Essential oils are extracted by triturating plants with alkaline solutions of castor oil, with or without the addition of hydroxy organic compounds. (2) Solutions of carbon chlorides or sulphides, or hydrocarbons, or chlorides or bromides of hydrocarbons are obtained by dissolving the substances in an alkaline solution of castor oil, with or without the addition of a hydroxy organic compound; whilst water or alcohol may be added to obtain a clear solution. The use of such solutions or emulsions is claimed for industrial and agricultural purposes.—C. A. M.

Apparatus for extracting various substances with volatile solvents. Fr. Pat. 457,905. *See* I.

[*Lubricant for*] *cartridges.* Eng. Pat. 27,409. *See* XXII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine for medical purposes. See XX

Patents.

Paint; Anti-corrosive and anti-fouling —— *for ships.* J. F. Peter and G. D. R. Buchanan, Glasgow. Eng. Pat. 427, Jan. 7, 1913.

White lead or other class of paint is mixed with a relatively small proportion (*e.g.*, 2 lb. to 1 cwt. of paint) of flowers of sulphur. (Reference is directed to Eng. Pats. 15,381 of 1887, 25,549 of 1896, 24,370 of 1901, and 7750 of 1905; this J., 1888, 853; 1897, 923; 1902, 1285.)—A. S.

[*Lacquers.*] *Nitrocellulose; Manufacture of solutions of or containing* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 21,368 and 23,544, Sept. 19 and Oct. 15, 1912.

See Ger. Pat. 263,404 of 1912; this J. 1913, 918. Similar solutions, suitable for lacquering purposes, are obtained by dissolving nitrocellulose in a fully hydrogenised monocyclic ketone containing five or six carbon atoms in the ring; benzene, petroleum spirit, or other hydrocarbon, and linseed oil may also be added to the solution.—T. F. B.

Coating and impregnating materials and moulded articles. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 22,449, Oct. 2, 1912.

A concentrated solution of citric acid and a polyhydric alcohol, such as glycerol, is heated to about 105° C., and then, with or without addition of mineral fillers, used for coating metallic surfaces, for coating or impregnating paper, wood, cotton, asbestos, etc., or for the preparation of moulded articles. In all cases the process is completed by heating to 135°—230° C. The coatings prepared in this way are said to be waterproof, very adherent and flexible, and good electrical insulators.—A. S.

Pigments [*from triphenylmethane dyestuffs*]; *Process for making yellowish-green* ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated April 1, 1913, to Fr. Pat. 422,843, Nov. 21, 1910. Under Int. Conv., April 16, 1912.

See Eng. Pat. 7757 of 1913; this J., 1913, 759.—T. F. B.

Colophony and colophony-soap; Process of making ——. J. Aktschourin, Aktschourinski Tupik, Russia. U.S. Pat. 1,074,339, Sept. 30, 1913.

See Fr. Pat. 432,998 of 1911; this J., 1912, 140.—T. F. B.

Obtaining refined mineral, tar, and resinous oils. Eng. Pat. 5484. See IIa.

Bisulphite compounds [*of azo dyestuffs*] *and their use for the production of coloured lakes.* Fr. Pat. 456,614. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Para rubber; Quality of —— from various sources. Bull. Imp. Inst., 1913, **11**, 375—380.

Ceylon. Samples obtained from trees tapped at intervals of from three to seven days contained a little more caoutchouc (96·0—96·3 per cent., referred to the dry washed rubber) than those from trees tapped every day or every other day (95·7 and 95·4 per cent. of caoutchouc respectively).

India. In six specimens of crêpe rubber from the Mergui District, Burma, the percentages of resin and protein were somewhat higher than is usual in the best plantation Para, and three of the samples yielded an excessive quantity of ash. The two best specimens were of very good quality and contained 94·3 and 93·6 per cent. of caoutchouc respectively (on the dry, washed rubber).

S. Nigeria. Two samples of biscuit rubber from Sapele, Central Province, were satisfactory both in composition and physical properties.

B. Guiana. A sample of biscuit rubber from trees, 4½—5 years old, grown at Issorora, N.W. District, was equal in composition to plantation Para from the East, but was somewhat deficient in strength. When the trees become older the rubber should be of excellent quality.

Papua. The rubber exported from Papua up to the present has been obtained from *Ficus Rigo* and an unidentified vine (see this J., 1912, 1087), but there are over 4000 acres planted with *Hevea brasiliensis*, and some of these trees have recently been tapped. A sample of the first consignment of Para rubber (from Sogeri) proved quite equal to the highest grades of plantation Para both in composition and physical properties.—A. S.

Ceara rubber from Northern Nigeria. Bull. Imp. Inst., 1913, **11**, 380—381.

THE rubber examined (balls and strips) was obtained from trees growing at Bida, which were tapped on alternate days according to the Lewa system, the latex being coagulated on the tree with fresh lime juice. The strip rubber was very satisfactory in physical properties and compared favourably in composition with Ceara rubber prepared in East Africa by the Lewa process.—A. S.

Caoutchouc; Determination of —— as bromide. W. Vaubel and E. Weinerth. Gummi-Zeit., 1913, **28**, 92—93.

COMPARATIVE determinations of caoutchouc were made by the Budde-Axelrod bromination method (this J., 1907, 1058; 1909, 994, 1149; 1910, 1465) and the volumetric method using bromate solution and based on a bromine absorption of 6 atoms per $C_{10}H_{16}$ (see this J., 1912, 887). The results agreed well for Para rubber but not for a rubber mixing or for other raw rubbers; the latter appeared to yield compounds containing a very high percentage of bromine, almost in the ratio $Br_2:CH_2$. —H. E. P.

Rubber cultivation in the Federated Malay States. Board of Trade J., Oct. 9, 1913. [T.R.]

THE following are statistics of the rubber cultivation during the past three years:—

—	1910.	1911.	1912.
Number of estates	435	700	703
Total acreage	579,598	766,793	794,545
Acreage planted to 31st Dec.	245,774	352,074	399,197
Rubber exported ... lb.	12,212,526	19,695,330	34,732,415
Value of rubber exported ... dols.	38,466,140	39,914,672	63,124,342
Price of rubber per lb.	5s. 2d. to 12s. 10d.	4s. 6d. to 8s. 0¼d.	4s. 1d. to 5s. 8½d.

It is estimated that the total area of land now planted with rubber in Malaya (*i.e.*, the Federated Malay States, the Unfederated States, and the Straits Settlements) is 621,621 acres, of which only 165,566 were producing rubber at the end of 1912. The average yield per acre is over 250 lb. The yield from the whole area now under cultivation should in six or seven years' time amount to 88,000 tons at a conservative estimate.

Vulcanisation; Role of polyprene sulphide in ——. H. Skellon. India Rubber J., 1913, **46**, 723—724.

THE results of further experiments on the lines described previously (see this J., 1913, 876), especially on ebonite, indicate that in vulcanised rubber goods a portion of the free sulphur is dissolved in the polyprene sulphide present, and that sulphur is more soluble in polyprene sulphide than in rubber. This explains why "blooming" is rarer in ebonite than in soft rubber goods. It is very probable that polysulphides of polyprene exist in vulcanised rubber. —H. E. P.

PATENTS.

Caoutchouc; Manufacture of synthetic ——. A. Heinemann, London. Eng. Pat. 18,506, Aug. 12, 1912.

THE true caoutchouc substances formed by polymerising isoprene, particularly impure isoprene, may be separated from the polymerides of lower molecular weight (which prevent the drying of the product) by taking advantage of their different solubilities in ethyl acetate. True caoutchouc substances are insoluble in excess of ethyl acetate, whilst the lower polymerides are soluble. The polymerised isoprene may be freed from unconverted isoprene and liquid hydrocarbons by treatment with steam, and the residue mixed with a quantity of ethyl acetate sufficient to dissolve only the lower polymerides, this quantity being greater than that required to dissolve the whole of the residue. Another method consists in slowly adding ethyl acetate to a solution of the crude caoutchouc substances in dipentene (obtained by heating polymerised isoprene), until the whole of the true caoutchouc substance is precipitated.—T. F. B.

Caoutchouc; Synthetic —— and process of manufacture. C. E. Anquetil. Fr. Pat. 456,586, June 21, 1912.

THE resinous exudations from certain plants of the natural orders:—*Apocynaceae*, *Artocarpeae*, *Euphorbiaceae*, *Sapotaceae*, *Lobeliaceae*, *Asclepideae*, etc., consist for the most part of (a) a liquid hydrocarbon and (b) complex resins. The hydrocarbon can be transformed by polymerisation into a substance similar to caoutchouc, and dry distillation of the resinous constituents also yields a hydrocarbon which is susceptible of a similar transformation. A solution of 100 kilos. of the gum in 150 kilos. of benzene is heated with 5 kilos. of glacial acetic acid in an autoclave for 4 hours at 140°—150° C. The syrupy product is strained—after dilution with benzene if necessary—poured into alcohol, and the precipitated rubber-like substance washed with alcohol. The mother liquors are distilled to recover the resins, which are then subjected to dry distillation. The distillate, containing large quantities of a hydrocarbon closely allied to diterpilene ($C_{20}H_{32}$) and dipentene ($C_{10}H_{16}$), is vaporised, passed through tubes heated to 600°—650° C., the product condensed and fractionated, and the fraction distilling between 18° and 60° C. added in the proportion of 20—25 per cent. to a further quantity of the original gum, which is then subjected to the same treatment as before.—E. W. L.

Caoutchouc ; Industrial manufacture of ——. G. Reynaud. Third Addition, dated July 13, 1912, to Fr. Pat. 419,860, Nov. 6, 1909 (this J., 1911, 226, 968 ; 1913, 799).

The lime used in the modification described in the second Addition (*loc. cit.*, 1913, 779), is replaced by magnesia which can be more easily eliminated in the subsequent stages of the process. The mass, containing magnesia, 10—20 per cent. and sulphur, 5—20 per cent., is heated at 100°—150° C. until the desired degree of hardness is attained. —E. W. L.

Rubber-like material ; Manufacture of a ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 9985, Aug. 28, 1913.

Glycerol and phthalic anhydride, in about equimolecular proportions, are heated together at 200°—210° C until thickening occurs, then 1 mol. of oleic acid is added and heating continued at temperatures below 230° C. When the reacton is complete, the red viscous liquid, with or without addition of castor oil or pitch, is mixed with 10—30 per cent. of sulphur and again heated to form an elastic rubber-like material. Other unsaturated acids, such as cinnamic acid, may be used in place of oleic acid, and other polyhydric alcohols in place of glycerol. (See also Eng. Pat. 23,776 of 1912 ; this J. 1913, 951.)—A. S.

Gutta-percha ; Artificial —— *possessing electrical insulating properties superior to those of natural gutta-percha.* A. Caubel and P. Gounon. Fr. Pat. 457,920, July 24, 1912.

100 parts by weight of linseed oil and 8 parts of pine resin are heated to 120° C. for 4 to 5 hours, and the hot mass is then mixed gradually with 250 parts by weight of a solution of 105 parts of sodium bichromate and 49 of sulphuric acid in 1200 parts of water. The mixture is well stirred for an hour, then the aqueous layer is separated, and the residual plastic mass washed with water, dried and mixed with 15 to 25 per cent. of paraffin wax. The product is not susceptible of vulcanisation, but a mixture of it with 30 per cent. of ebonite dust can be worked like ebonite, and has better insulating properties. Other oxidising agents may be used instead of bichromate.—E. W. L.

Caoutchouc ; Process for the production of a substance similar to ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,821, Dec. 14, 1912.

See Addition of Dec. 18, 1912, to Fr. Pat. 441,655 of 1912 ; this J., 1913, 667.—T. F. B.

Caoutchouc substance. F. Hofmann, C. Coutelle, K. Meisenburg, and K. Delbrück, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,432, Sept. 30, 1913.

See Fr. Pat. 422,955 of 1910 ; this J., 1911, 637.—T. F. B.

Liquid or solid solutions of organic compounds giving emulsions with water. Addition to Fr. Pat. 445,053. *See* XII.

Treating raw hide and the product resulting therefrom. U.S. Pat. 1,074,360. *See* XV.

Converting crude butadiene into a form suitable for polymerisation. Ger. Pat. 264,245. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Tanning materials ; New colonial and other ——. Bull. Imp. Inst., 1913, 11, 401—428.

Black wattle bark from E. Africa Protectorate. Black wattle is now being extensively cultivated in E. Africa, and exportation of the bark (10 tons) was commenced in 1911—1912. Examination of a number of samples showed that the bark was mostly of good quality and could compete successfully with Natal bark. It is important to keep the thin and thick bark separate for export, the latter being richer in tannin and of better colour than the thin bark. In 18 samples examined (including thin bark, thick bark, and average samples) the tannin content varied between 29·4 and 43·6 per cent., but was above 35 per cent. in all but 3 samples.

Acacia arabica pods from the Sudan and N. Nigeria. The whole pods from the Sudan contain about 30 per cent. of tannin, but by lightly grinding and sifting, a powder containing 55—61 per cent. of tannin can be prepared. It is stated that the powder would not be suitable for importation, but the whole pods would be readily saleable. A sample of pods from N. Nigeria contained somewhat less tannin (26·7 per cent.) than the pods from the Sudan.

Mangrove extract from Fiji. The samples examined could not be used, without decolourisation, for tanning hides, but would be suitable for dyeing sails, fishing nets, etc., for which purpose they compared favourably with commercial mangrove cutch.

Divi-divi pods (*Caesalpinia coriaria*) *from the Gold Coast.* The sample was badly prepared and relatively poor in tannin (33·1 per cent.). The pods are richest in tannin when just mature and after collection they should be split longitudinally, the seeds removed and the husks dried as rapidly as possible in the sun, in order to avoid fermentation, which produces a red colouring matter.

Other samples examined were : pods of *Acacia arabica*, var. *Kraussiana* from S. Africa, talh bark (*Acacia Seyal*), red variety, from the Sudan, *A. longifolia* and *A. cyanophylla* bark from Cyprus, *Anogeissus leiocarpa* bark from S. Nigeria and the Sudan, mangrove barks from S. Nigeria, *Brachystegia* barks from Mozambique, *Osyris abyssinica* leaves and twigs from the Transvaal, "Subakh" bark (*Combretum Hartmannianum*) from the Sudan, *Aleurites* bark from Hong Kong, *Phyllocladus rhomboidalis* bark from Tasmania, "Kumbuk" bark (*Terminalia glabra*) from Ceylon, and *Phyllanthus emblica* leaves from Hong Kong. These were all either not sufficiently rich in tannin, or otherwise unsuitable for export, but could be used locally as tanning materials or, in many cases, for the manufacture of tanning extracts. The demand for tanning extracts is steadily increasing and a large proportion of the demand in the United Kingdom could be supplied from the Colonies and India.—A. S.

Hide and silk ; Tanning and loading of —— *and effect of colloidal water in same.* E. O. Sommerhoff. Collegium, 1913, 533—538.

The differences in behaviour between an old and a freshly prepared "pink salt" are attributed to the formation of a complex compound of chlorostannic acid and α-stannic oxychloride, $\{[\alpha(OH)_2Cl_2Sn]_2{-}H_2SnCl_6+yH_2O\}x$, existing in the solution in the colloidal condition. Silk readily absorbs this compound and on subsequently bringing the fibre into cold water, hydrolysis takes place ; chlorostannic acid diffuses out and is replaced by water which is held in the colloidal condition in combination with the basic α-stannic oxychloride. The actual loading material is thus not the tin compound but the colloidal water.

This theory is extended to mineral tannages. A bath containing a complex colloidal chromium compound is obtained by mixing a basic chromium sulphate solution (obtained by addition of sodium carbonate to chromium sulphate solution), with an acid chromium sulphate (obtained by cautious reduction of potassium bichromate with dextrose). This complex compound is absorbed by hide and subsequently hydrolysed with transference of oxygen to the albuminous matter. The acid component diffuses out and is further hydrolysed whilst the basic compound becomes fixed as a colloidal gel on the oxidised albumin. Such a complex molecular combination of colloidal albumin and colloidal basic chromium sulphate exhibits the properties of both its constituents, the ductility of the former and the property of retaining colloidal water even at fairly high temperatures, possessed by the latter. The same reasoning can be applied to vegetable tannages. In the case of gambier, *e.g.*, the complex compound absorbed by the hide and subsequently hydrolysed is a complex acid formed by the combination of catechin and catechutannic acid.—T. C.

Tannery effluents; The valuation and fixation of ——. J. W. Phelan and J. H. Cohen. J. Amer. Leather Chem. Assoc., 1913, **8**, 426—438.

THE authors attempt to show that the recovery of materials from tannery effluents may be commercially successful. The nitrogen content ranges from one hundredth to several hundredths of 1 per cent., and recent statements that 50 per cent. of the weight of hide substance is lost in the tanning process seem inaccurate. The authors calculate the loss to be between 4 and 5 per cent. Precipitation methods are considered the best means to recover the nitrogen in the effluent. By mixing tanyard and limeyard effluents, making alkaline with lime, and adding aluminium sulphate, 60 per cent. of the total nitrogen was recovered in the sludge. Of this nitrogen the greater part is available for fertilising purposes. Methods are described for recovering the sludge. Where space is ample a settling tank system may be employed. The ground plan of a plant capable of treating one million gallons of effluent per day is described. A rapid filter system is desirable where little space is available, and the Moore slimes filter, capable of treating one million gallons per day, is described.—J. R. B.

PATENTS.

Tarry colloid with tanning properties; Process for obtaining a light-coloured ——. I. Bugarszky, L. Török, and Dr. Kereszty, Dr. Wolf ès Tsa Vegyèszeti Gyàr R. T. Fr. Pat. 457,444, May 3, 1913.

SEE Eng. Pat. 28,168 of 1912; this J., 1913, 307. The product is claimed to have tanning properties.—T. F. B.

Rawhide; Treating —— and the product resulting therefrom. A. H. Henderson, Assignor to The Henderson Rubber Co., Baltimore, Md. U.S. Pat. 1,074,360, Sept. 30, 1913.

RAWHIDE is rendered flexible and elastic by the action of moist heat, then divided into particles, treated with a hot 5 per cent. solution of salt, partially dried, heated and agitated with oil, and then mixed and kneaded together. The mass is now subjected to heat and pressure in the presence of vulcanising agents, and then formed into sheets. Claim is made for the product, alone or combined with rubber.—A. S.

Skins; Treatment (tanning) of ——. R. Vidal. Fr. Pat. 457,742, July 19, 1912.

SKINS are treated with solutions of alkali compounds of aromatic sulphonic derivatives or of phenols, cresols or naphthols or by solutions of alkali monosulphides added to one or other of the free phenols, cresols or naphthols. The leather produced is white and supple and when skins are treated with the hair on, the latter is cleaned, freed from grease and made in a fit condition to be dyed. When alkali monosulphides are used the skins may be dyed at the same time by adding sulphide colours or Alizarin Black to the bath. Example: a skin is immersed for ¼—½ an hour or longer in 4—5 times its weight of a solution of crystalline sodium sulphide 200 parts, phenol 120 parts, and water 1500 parts.—D. J. L.

Glue; Manufacture of —— from dry skin. A. A. Chardin. Fr. Pat. 456,625, April 14, 1913.

THE finely cut skin, especially dried rabbit-skin, after washing with water, is soaked for 10—12 hours in water containing a little hydrogen peroxide and finally rinsed again in water before boiling.—D. J. L.

Glue or glutinous material; Manufacture of a —— for use in agglomerating organic or inorganic materials. L. Grote and J. L. Rostan. Fr. Pat. 457,743, July 19, 1912.

A SOLUTION of formaldehyde of 10—40 per cent. strength is allowed to act on starch, a solution of hypochlorites or chlorides is added and finally a solution of fish glue. The glutinous matter thus obtained may be mixed with tar, rosin, pitch, magnesite, slate or cellulose and may then be moulded for various purposes.—D. J. L.

XVI.—SOILS; FERTILISERS.

Soils; Ether extract and chloroform extract of ——. G. S. Fraps and J. B. Rather. Texas Exper. Station, Bull. 155, Jan., 1913. 6 pages.

IN the examination of 28 soils an average ether extract of 0·0203 per cent. and a subsequent chloroform extract of 0·0174 per cent. were obtained. The combined ether extracts contained 50 per cent. of unsaponifiable and 40 per cent. of saponifiable matter, with a loss of 10 per cent. The chloroform extracts had 36 per cent. of unsaponifiable, 43 per cent. of saponifiable, and 3 per cent. of insoluble matter, with 18 per cent. loss. The ether extract probably contains fatty acids and wax alcohols.—W. H. P.

PATENTS.

Fertilizer; Process for making ——. S. B. Newberry and H. N. Barrett, Baybridge, Ohio. U.S. Pat. 1,074,808, Oct. 7, 1913.

INSOLUBLE phosphate is ground with gypsum and carbonaceous matter and the mixture is calcined until the gypsum is decomposed and the carbonaceous matter oxidised.—G. W. McD.

Phosphorites; Art of converting ——. H. V. Dunham, Bainbridge, N.Y., Assignor to Nacirema Chemical Co., Vermont. U.S. Pat. 1,074,779, Oct. 7, 1913.

SEE Eng. Pat. 19,045 of 1911; this J., 1912, 37.—T. F. B.

Fertiliser. A. R. Frank, Spandau, Germany, Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,074,785, Oct. 7, 1913.

SEE Ger. Pat. 219,932 of 1908; this J., 1910, 581.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Carbohydrates; Determination of —— especially in plant extracts. New method for the determination of maltose in presence of other sugars. W. A. Davis and A. J. Daish. J. Agric. Sci., 1913, 5, 437—468.

IN the gravimetric determination of reducing sugars large errors may be encountered unless the asbestos on which the cuprous oxide is collected has been purified by boiling for at least half an hour in 20 per cent. sodium hydroxide solution. Asbestos which no longer loses weight when boiled with nitric and hydrochloric acids, may lose as much as 7 per cent. in the alkaline treatment. The weighing of the reduced copper as cuprous oxide is only permissible in the analysis of pure sugar solutions; in other cases the authors recommend weighing as cupric oxide. For this purpose, the porcelain Gooch crucible containing the precipitate, after washing, and drying at 100° C., is placed inside a No. 1 porcelain crucible and heated to constant weight in a fairly powerful flame from a ½ in. Teclu or Fletcher argand burner. Usually half-an-hour's heating is sufficient, but the flame should not come into direct contact with the Gooch crucible or cupric oxide may be reduced. Of volumetric methods of sugar analysis that of Ling, Jones and Rendle (this J., 1905, 753; 1908, 581) is considered preferable in all respects to Bertrand's (this J., 1907, 60), the latter being found only roughly approximate. Sucrose present in plant extracts must not be inverted in the ordinary way by hydrochloric acid if maltose or pentoses are present, as the latter may be partially hydrolysed. In extracts which have been defecated by basic lead acetate, freed from excess of lead by addition of sodium carbonate and then faintly acidified with sulphuric acid, sucrose may be safely and completely hydrolysed by invertase (several c.c. of autolysed yeast to 50 c.c. of extract, acting for 24 hours at 38°—40° C. in presence of toluene) or by boiling with 10 per cent. of citric acid for 10 mins. Such a large proportion of citric acid is rendered necessary by the presence of sodium acetate. A scheme for the determination of dry matter, sucrose, maltose, pentoses, dextrose and lævulose in plant materials is given.

Determination of maltose in presence of other sugars. It is impossible to hydrolyse maltose completely by acids at 70° or 100° C. without simultaneously destroying large quantities of lævulose or dextrose. The following accurate method for the determination of maltose in plant extracts and similar liquids, is based on the elimination of other sugars by means of yeasts free from maltase, such as *S. exiguus*, *S. marxianus* or *S. anomalus*. The extract is defecated by basic lead acetate, and the excess of lead removed from the filtered liquid and washings by hydrogen sulphide. The filtrate and washings from the lead sulphide are freed from hydrogen sulphide by passing a current of air through for 1—2 hours and then adding a little ferric hydroxide. Of the filtered liquid, five aliquot portions (each about 50 c.c.) are treated with a few c.c. of *N*/1-sodium hydroxide if necessary, and, after admixture with 5 c.c. of sterilised yeast water, are sterilised and inoculated, three with pure cultures of the yeasts named above, and the remaining two with baker's yeast. After fermenting for 21—28 days at about 25° C. the liquids are treated with alumina cream, filtered, and their reducing power determined. The difference between the average reducing power of the first three (fermented by maltase-free yeasts) and that of the last two (fermented by baker's yeast) represents the reduction due to maltose. Test liquids containing maltose and sucrose possessed, after fermentation by the three yeasts named above, reducing powers corresponding to 97·4—100·8 per cent. of the maltose originally present. (See J. L. Baker and W. D. Dick, this J., 1905, 352.)—J. H. L.

Calcium sulphite; Solubility of —— [*in sugar solutions*]. J. Robart. Bull. Assoc. Chim. Sucr., 1913, **31**, 108—111.

The solubility of calcium sulphite in water is about 78 mgrms. per litre expressed as lime (CaO); in sugar solution (12 per cent.) 37 mgrms. The quantity of lime dissolved increases slightly when calcium carbonate is present, but alkali hydroxides and carbonates diminish the solubility to practically nil. Contrary to the usual opinion it is not necessary to raise the temperature of sulphited juices to the boiling point, before filtration, the difference in solubility at the boiling point and at the temperature usual in practice being very small. On the other hand the solutions should not be allowed to cool before being filtered, otherwise an increased quantity of sulphite would be found dissolved in the filtered juice.—L. J. de W.

[*Sugar.*] *Refinery work; Undetermined losses in* ——. J. E. Duschky. Z. Ver. deutsch. Zuckerind., 1913, 851—876.

On boiling alkaline refinery syrups for periods of time usual in practice there was no perceptible increase of reducing substances. With acid syrups also there was no increase provided the acidity did not exceed 7 c.c. of *N*/100 acid per 100° Brix of syrup. Beyond this the reducing substances were found to increase with the acidity. The colour of the solution of the alkaline syrups increased with the length of time of boiling and with increase of temperature, particularly with the temperature at which the mass was "dropped." Darkening of acid syrups was much less than with alkaline ones. The loss on boiling refinery syrups from sound sugars amounted to 0·03—0·05 per cent. for each period of boiling.—L. J. de W.

Sucrose content [*of cane molasses*]; *New double polarisation method for the determination of the true* ——. L. G. Langguth Steuerwald. Archief Suikerind. Nederl-Indie, 1913, **21**, 831—833; Intern. Sugar J., 1913, **15**, 489.

Direct polarisation.—35·816 grms. ($26·048 \times \frac{1}{2} \times \frac{5}{2} \times \frac{11}{10}$) of the sample are treated with 40 c.c. of basic lead acetate solution, diluted to 250 c.c., and filtered. 100 c.c. of the filtrate are treated with 1 c.c. of acetic acid (30 per cent.) and 2 c.c. of alumina cream, and water added to 110 c.c. After again filtering, the solution is polarised in a 200 mm. tube, the temperature noted, and the reading multiplied by two. *Inversion reading.*—50 c.c. of the filtrate from the direct reading are treated with 30 c.c. of hydrochloric acid (sp. gr. 1·10), and after three hours at 20°—25° C., or two hours at temperatures above 25° C., the solution is diluted to 100 c.c. and polarised, using a 200 mm. water-jacketed tube, and carefully determining the temperature within one-tenth of a degree. On converting the reading to the actual polarisation the following formula is applied for the calculation of the percentage of sucrose:—

$$\frac{D+P}{C-\frac{1}{2}t}$$

D and P being respectively the direct polarisation and polarisation after inversion, and C the constant read from the following table.

Reading in the 200 mm. tube after inversion = P	Temperature at which the reading is made = *t*.						
	32° C.	30° C.	28° C.	26° C.	24° C.	22° C.	20° C.
— 18	—	—	—	—	—	145·51	145·54
— 17	—	—	—	145·39	145·42	145·46	145·49
— 16	—	145·27	145·30	145·34	145·37	145·41	145·44
— 15	145·18	145·22	145·25	145·28	145·32	145·35	145·39
— 14	145·12	145·16	145·19	145·23	145·26	145·30	145·34
— 13	145·06	145·15	145·13	145·17	145·21	145·25	145·29
— 12	145·00	145·04	145·08	145·12	145·16	145·20	145·24
— 11	144·94	144·98	145·02	145·07	145·11	145·15	145·19
— 10	144·88	144·93	144·97	145·01	145·06	145·10	145·14
— 9	144·82	144·87	144·91	144·96	145·00	145·05	145·10
— 8	144·77	144·81	144·86	144·90	144·95	145·00	145·05
— 7	144·71	144·75	144·79	144·84	144·90	144·95	145·00
— 6	144·65	144·70	144·74	144·79	144·84	144·89	144·95
— 5	144·59	144·64	144·69	144·74	144·79	144·84	144·90
— 4	144·53	144·58	144·63	144·68	144·74	144·79	141·85
— 3	144·47	144·52	144·58	144·63	144·69	144·74	144·80
— 2	144·41	144·46	144·52	144·58	144·63	144·69	144·75
— 1	144·35	144·41	144·46	144·52	144·58	144·64	144·70

—J. P. O.

PATENTS.

[*Sugar.*] *Process of carbosulphitation of diffusion juices for the production of nearly colourless syrup and massecuite.* J. Robart. Fr. Pat. 456,535, June 20, 1912.

A process of carbonatation and sulphitation at a low temperature (see this J., 1913, 802).—L. E.

Sugar factory apparatus, etc.; Process for utilising steam from ——. E. Portemont. Fr. Pat. 457,161, April 25, 1913.

Low-pressure steam, *e.g.*, from a multiple effect, is utilised for heating or concentrating liquids. The liquid circulates through narrow annular spaces formed by pairs of concentric tubes which traverse a chamber contained in an outer vessel. The tube system is heated externally by steam admitted to the chamber. The inner of each pair of tubes extends below the chamber to a tube-plate, which divides the outer vessel into two compartments, and steam, admitted to the lower compartment, ascends through these tubes. Hence, the liquid is exposed, in thin layers, to two heating surfaces and is thus rapidly circulated, streaming from the top of the annular spaces over the surface of the chamber and collecting on the tube-plate, whence it returns through the annular spaces. Steam at different pressures may be admitted to the chamber and the compartment beneath the tube-plate respectively. Thus, if the apparatus is connected with a triple effect system, steam from any two of the effects may be utilised.—L. E.

Decolorising carbon; Process for the regenerating of ——. A. Wijnberg, Amsterdam. U.S. Pat. 1,074,337, Sept. 30, 1913.

See Eng. Pat. 19,357 of 1912; this J., 1913, 85.—T. F. B.

Preparation of compounds of sugars with monohydroxybenzoic acid, etc. Ger. Pat. 264,651. See XX.

XVIII.—FERMENTATION INDUSTRIES.

Starch: Action of maltase on ——. Z. Wierzchowski. Biochem. Zeits., 1913, **56**, 209—219.

Ground maize contains both diastase and maltase, the former readily soluble and the latter only slightly soluble in water. After removal of the diastase by repeated extraction with water, the material acts much more vigorously on maltose but much less vigorously on starch than before. The sole product of its action on starch is dextrose; no dextrins are formed, and even when 80—90 per cent. of the starch has been saccharified the remainder continues to produce a blue colour with iodine, provided that the ground maize employed has been completely freed from diastase. The velocity of saccharification appears to depend on the degree of liquefaction of the starch, and the most favourable condition is when the liquid shows slight alkalinity towards methyl orange. The maltase of maize thus appears to cleave, with equal ease, the three kinds of carbonyl linkages, α, β and γ, assumed by Syniewski to be present in the molecule of starch (see this J., 1902, 1341). This enzyme is therefore the amylase *par excellence*, since it decomposes starch completely into dextrose.—J. H. L.

Yeasts and moulds; Assimilation of urea by ——. P. Lindner and G. Wüst. Woch. Brau., 1913, **30**, 477—479.

The organisms investigated were *Sacch. thermantitonum*, *Pastorianus*, *intermedius*, *ellipsoideus*, *hyalosporus*, *farinosus* and *Ludwigii*, *Schizosacch. Pombe*, *Endomyces Magnusii* and a yeast (197) which produced esters. The culture liquids contained 0·38—3·3 per cent. of urea, together with maltose, magnesium sulphate and monopotassium phosphate. In general, growth was more plentiful than in similar solutions containing only maltose (contaminated by a small proportion of proteins) besides salts. Very feeble growth took place in solutions containing urea alone (or with ammonium salts), and when alcohol was added as source of carbon large crops were obtained only in two cases, *viz.*, *Sacch. farinosus* and the ester-forming yeast. The results of the present investigation indicate that urea serves tolerably well as source of nitrogen for yeasts.
—J. H. L.

Yeasts and moulds; Growth of some —— *in solutions of alcohol and sugars of equal concentration.* P. Lindner. Woch. Brau., 1913, **30**, 457—460.

Twenty-two organisms were tested in solutions containing 2·5 per cent. of alcohol, lævulose, dextrose, sucrose, maltose, lactose or galactose respectively, together with small quantities of magnesium sulphate, monopotassium phosphate and ammonium sulphate. Portions of 10 c.c. of each solution were inoculated with a trace of the organisms, and kept in the dark for 19 days at the ordinary temperature. In those cases, constituting the majority, in which alcohol had been well assimilated, the crops appeared, in general, about as large as those produced from sugars. Determinations of the approximate weight of the crops revealed that in some cases, *e.g.*, Henneberg's "*Kahmhefe*" A (761) and *Willia belgica*, they were much greater than those formed in sugar solutions. Very large crops were produced in all cases by *Sachsia suaveolens* (Lindner), that from sucrose being much greater than that from either dextrose or lævulose. A pressed yeast (Sinner, 85), capable of fermenting sucrose, dextrose, lævulose and maltose readily, did not develop in any of the test solutions, possibly because the nitrogenous matter offered was unsuitable. Perhaps for the same reason, *Endomyces Lindneri* only produced a crop in the maltose solution, this sugar containing a small quantity of nitrogenous matter as impurity. The fact that certain mycoderma yeasts ("*Kahmhefen*") assimilate alcohol very readily, may account for the large yeast crops and low yields of alcohol obtained in yeast factories which employ the aeration process (see this J., 1911, 641) and the yeast of which is contaminated with mycoderma forms. All the tests described were carried out in the presence of air: whether in absence of air alcohol is assimilated by the aerobic mycoderma yeasts, is doubtful. Assimilation tests with alcohol constitute a new means of characterising yeasts and moulds, which possesses the great advantage that alcohol can be obtained quite free from impurities which are present in many sugars.—J. H. L.

Alcoholic fermentation; Influence of acids on ——. H. Mons. and Mme. Rosenblatt. Bull Soc. Chim., 1913, **13**, 924—929 (see this J., 1909, 952; 1910, 711).

The authors' experiments do not confirm the statement of Johannson (Biochem. Zeits., 1912, **47**, 97) that solutions of free fatty acids of very low concentration stimulate fermentation; but slight stimulation was observed in the case of some acid salts, *viz.*, monopotassium oxalate (M/200), di- and mono-potassium citrate (M/10 and M/5), monosodium tartrate (M/4) and monopotassium phosphate (M/3). The figures in brackets represent the molecular concentrations at which the salts exert their optimum effects.—J. H. L.

Beer; Retention of head by ——. O. Fürnrohr. Z. ges. Brauw., 1913, **36**, 473—475, 481—488.

The formation and retention of a compact head by beer depends chiefly on the presence of albumoses. If the latter are salted out by zinc sulphate, the beer no longer forms a good head, and if the precipitated albumoses are shaken with distilled water they confer on the latter the property lost by the beer. Filtration of beer is known to impair its head-retaining capacity in some cases; the author found that a considerable portion of the albumoses is removed from the beer and retained by the filter pulp. In these and subsequent experiments three precipitants were employed for nitrogenous matters, *viz.*, copper sulphate, which salts out the primary albumoses, zinc sulphate, which salts out the whole of the albumoses, and phosphotungstic acid which precipitates also peptones and lower proteolytic products. It was found that the means employed for hopping malt worts may have an important influence on the head-retaining capacity of the beer. The extent to which proteolysis takes place during mashing is also an important factor. The peptic activity of malt extracts made between 12·5° and 62·5° C. increases as the temperature of extraction is raised, whereas the diastatic activity of the extracts diminishes. Thus an extract made at 62·5° C. yielded less than half as much albumose (when salted out by copper sulphate) as an extract made at 12·5° C., whereas the diastatic power of the former extract was only 17·4 per cent. of that of the latter. Mashing-in, and pre-mashing at low temperatures therefore favour the production of mashes of high diastatic activity and avoid excessive proteolysis. The author recommends that when a new malt is first worked, the best conditions of mashing should be ascertained by means of experiments such as those described in this paper.—J. H. L.

Detection and determination of minute quantities of formaldehyde in the presence of hexamethylene-amine and methyl alcohol in the presence of ethyl alcohol. Dunning. *See* XX.

Patents.

Malt; Process and apparatus for preparing green ——. F. Winter. Fr. Pat. 457,675, May 8, 1913. Under Int. Conv., May 19, 1912.

The raw grain, in a thin uniform layer, is steeped in shallow boxes, with floors sloping slightly to one end, where the steep water is discharged through an outlet pipe. A carriage which runs in guides mounted on the longitudinal walls of the box carries rotating blades which turn the malt during germination. The end walls of the box are curved to correspond with the path of the rotating blades. Openings in the bottom of the box, fitted with water-tight covers, serve for the discharge of the green malt into troughs through which it is conveyed to the kiln.—L. E.

Beer; Process for charging —— *with carbon dioxide.* O. M. Lamsens. Fr. Pat. 457,789, May 13, 1913.

The gases which accumulate in a closed fermentation vat escape, at a certain pressure, through a valved outlet pipe, and are conveyed to storage casks containing the beer to be treated. The inlet pipe extends to the lower part of each storage vessel, and is fitted at its lower end with a porous cylinder through which the gases escape, in the form of minute bubbles, into the beer.—L. E.

Wines; Process for decolourising red, and restoring soured ——. G. Radunic. Fr. Pat. 457,102, April 24, 1913.

Calcium oxide or hydroxide is added in small quantities to red wine until the colour has become slightly greenish, or to soured wine until the liquid is slightly alkaline. The wine is then freed from the precipitate, fined, and treated with a wine of high acidity or with a fixed acid such as tartaric acid.—L. E.

Malt substitutes; Process and apparatus for making ——. J. Takamine. Fr. Pat. 456,391, Feb. 17, 1913.

See U.S. Pat. 1,054,626 of 1913; this J., 1913, 444.—T.F.B.

Lactic acid; Process of making ——. O. Friedberger, Giessen, Germany, Assignor to E. A. Byrnes, C. P. Townsend, and J. H. Brickenstein. U.S. Pat. 1,074,708, Oct. 7, 1913.

See Eng. Pat. 2507 of 1911; this J., 1912, 248.—T. F. B.

Fermentation; Process of promoting ——. E. Pohl, Rhöndorf, Germany. U.S. Pat. 1,074,814, Oct. 7, 1913.

See Fr. Pat. 436,477 of 1911; this J., 1912, 454.—T. F. B.

Wort; Process for recovering the bitter principles and resinous substances in the residues of the preparation of ——. M. Hessberg. Fr. Pat. 457,938, May 15, 1913. Under Int. Conv., June 7 and Nov. 27, 1912.

See Eng. Pats. 13,721 and 29,143 of 1912; this J., 1912, 1091; 1913, 620.—T. F. B.

Treating yeast and combining it with other materials for use as cattle food, etc. Eng. Pat. 21,708. *See* XIXa.

Preparing phosphoric esters of carbohydrates. Fr. Pat. 458,096. *See* XX.

XIXa.—FOODS.

Patents.

Yeast; Method of treating —— and of combining it with other materials for use as cattle-food, and for other purposes. A. S. Rowe, London. Eng. Pat. 21,708, Sept. 24, 1912.

Pressed brewers' yeast is kept at a temperature not exceeding 80° F. (26·6° C.) until the cells cease to multiply, then heated to 160°—212° F. (71·1°—100° C.) and stirred until coagulation takes place, cooled, mixed with other fodders, and the mixture dried and ground, or formed into cakes. The coagulated yeast may also be treated with formaldehyde and used as a substitute for casein in dressing fabrics, and for other purposes.—W. P. S.

Milk; Process for producing desiccated ——. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America. U.S. Pat. 1,074,419, Sept. 30, 1913.

Milk is partially evaporated at a temperature below the coagulating point of albumin, and then dried and subjected to a blast of hot air on a rotating cylinder heated internally to above the coagulating point of albumin. —W. P. S.

Dairy residues; Manufacture of a salutary drink from ——. A. Jolles, Vienna. Eng. Pat. 8471, April 10, 1913.

See U.S. Pat. 1,073,135 of 1913; this J., 1913, 987.—T. F. B.

Milk; Process of sterilising ——. C. de Bock, Zele, Belgium. U.S. Pat. 1,074,315, Sept. 30, 1913.

See Eng. Pat. 5456 of 1911; this J., 1912, 405.—T. F. B.

Aliments; Method of preserving ——. V. Frestadius, E. Norlin, and E. Oman, Stockholm. U.S. Pat. 1,074,856, Oct. 7, 1913.

See Eng. Pat. 20,262 of 1912; this J, 1912, 1144.—T. F. B.

Coffee substitute from cereals; Process for making a ——. A. M. S. Dannebjerg. Fr. Pat. 457,238, April 29, 1913. Under Int. Conv., May 1, 1912.

See Eng. Pat. 9970 of 1913; this J., 1913, 957.—T. F. B.

Extracting albuminous or albuminoid substances from the residues from the extraction of oil from oleaginous seeds. Fr. Pat. 457,148. *See* XII.

XIXb.—WATER PURIFICATION; SANITATION.

Antiseptics and disinfectants. D. Sommerville. J. Roy. Soc. Arts, 1913, **61**, 913—919, 927—937, 945—952.

A general discussion of the problems of infection and disinfection. It is concluded that in the process of disinfection one or more of three types of activity may be engaged: (1) ionisation and diffusion, (2) adsorption, (3) chemical action. The last type of activity is preceded by the first and second when the disinfectant is an electrolyte and by the second when the disinfectant is a colloid. The importance of adsorption in disinfection is emphasised, especially in regard to the advantages possessed in many cases by emulsions. Colloidal metals are powerful disinfectants. In the case of phenolic substances the germicidal power frequently increases with the boiling point. For example a fraction from blast-furnace phenols boiling at 248° C. had a Rideal-Walker coefficient 3 points above that of a fraction boiling at 220° C., and five points above that of a third fraction boiling at 207° C. In practical disinfection it is necessary to vary the nature and concentration of the disinfectants according to the species of microbe to be destroyed and other conditions, and no method of standardisation can give information concerning the strength of disinfectant, time of application, etc., necessary for a given case in actual practice. The use of the Rideal-Walker test, which compares the strength of a disinfectant with that of a pure phenol solution required to kill *B. typhosus* in a definite time under standardised conditions, has, however, led to a marked improvement in the germicidal value of higher grade phenolic disinfectant emulsions. Full details of the method of carrying out the test are given and it is stated that variations in results obtained by two workers have always proved to be due not to some defect of the method but to neglect of one or more of the prescribed conditions.—A. S.

Valuation and fixation of tannery effluents. Phelan and Cohen. *See* XV.

Patents.

Water; Process for the purification of —— and the desiccation of sludge. L. Linden. Fr. Pat. 457,499, May 6, 1913.

The water is passed through a tank the lower part of which is divided into three sumps or wells: a central partition extending into the middle well divides the tank into two compartments and the water flows from the first compartment under the partition into the second whence it is conducted to a filter chamber. The water may be passed either upwards or downwards through the filter chamber. Fatty substances collecting on the surface of the water in the tank are recovered by means of a series of gutters or channels. The sludge is dried, first on shelving ridges and then on a series of heated travelling bands.—W. P. S.

Sewage, etc. ; Treatment of ——. B. Kaibel. Fr. Pat. 456,425, April 8, 1913. Under Int. Conv., April 11, 1912.

An apparatus for the separation of fatty and heavy solid substances from sewage consists of a cylindrical tank provided with a sludge well. The sewage enters through a perforated ring pipe near the top of the tank and leaves through a similar pipe at the bottom, the clear liquid being led to a siphon which may be constructed so as to have a short intermittent action. Means are provided for removing the collected sludge and fatty substances.
—W. P. S.

Sewage ; Apparatus for the treatment of ——. G. Lambert. Fr. Pat. 457,073, July 3, 1912.

The apparatus comprises a sediment tank, a second tank divided into three compartments, the first two of which serve as settling tanks and the third as a septic tank, a filter of coarse material, and a final settling tank. The sewage is conducted through the various tanks in the order given.—W. P. S.

Carcasses, slaughter-house refuse, etc. ; Process for preventing loss of organic nitrogenous substances during the treatment of ——. P. M. A. Vallotte. Fr. Pat. 457,051, April 4, 1913.

To prevent loss of soluble nitrogenous substances when carcasses, etc., are boiled with water, they are treated previously with from 1 to 1·25 per cent. of their weight of alcohol, formaldehyde, or alum.—W. P. S.

Radioactive liquids ; Process and products for obtaining economically large quantities of ——. H. Farjas. Fr. Pat. 456,990, July 1, 1912. (Compare this J., 1910, 951.)

Radioactive minerals, rendered free from uranium and all substances injurious to health, are incorporated with cement or other material which may be moulded, and the mixture is employed in the construction of reservoirs, baths, pipes, etc., which are thus made to furnish large supplies of radioactive water.—F. Sodn.

Bacteria inhabiting living tissue ; Methods of and means for destroying —— *without injuring the latter.* P. J. A. Maignon, Philadelphia, U.S.A. Eng. Pat. 6495, Mar. 15, 1913.

An antiseptic consisting of calcium hydroxide, 15, sodium carbonate, 14, boric acid, 3, and aluminium sulphate, 2 parts, is claimed.—W. P. S.

Disinfectants. F. Hoffmann-La Roche und Co. Ger. Pat. 263,332, Nov. 15, 1910.

The use of the halogen derivatives of acetylene as disinfectants is claimed.—T. F. B.

Water ; Plant for purifying —— *and removing the iron contained therein.* R. Lantzsch, Berlin. Eng. Pat. 22,342, Oct. 1, 1912. Under Int. Conv., Oct. 2, 1911.

See Ger. Pat. 254,357 of 1911 ; this J., 1913, 105.—T. F. B.

Water for private and industrial purposes ; Apparatus for purifying ——. G. C. E. Liot, Asnières, France. Eng. Pat. 16,935, July 23, 1913. Under Int. Conv., July 24, 1912.

See Fr. Pat. 446,383 of 1912 ; this J., 1913, 158.—T. F. B.

Sulphate lyes for use in softening water ; Process for rendering stable ——. W. Günther. Fr. Pat. 457,159, April 25, 1913.

See Eng. Pat. 9867 of 1913 ; this J., 1913, 988.—T. F. B.

Water ; Oxidation process for treating raw ——. Drechsler. Fr. Pat. 457,303, Jan. 21, 1913.

See Eng. Pat. 1416 of 1913 ; this J., 1913, 922.—T. F. B.

Refuse-destructor. H. N. Leask, Egremont. U.S. Pat. 1,074,508, Sept. 30, 1913.

See Eng. Pat. 22,137 of 1909 ; this J., 1910, 1267.—T. F. B.

Liquid or solid solutions of organic compounds giving emulsions with water. Addition to Fr. Pat. 445,053. *See* XII.

Preparing soluble heavy-metal compounds of albuminous substances containing sulphur. Ger. Pat. 264,926. *See* XX.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Turpentine for medical purposes. Bull. 253, Inland Rev. Dept., Ottawa.

The standards sanctioned for turpentine for medical purposes by the Canadian Privy Council in 1912 are : 1. It shall be free from mineral oil. 2. Unless sold as wood turpentine, it shall absorb not less than 340 times its weight of iodine (Hübl solution and method). If sold as wood turpentine it shall absorb not less than 240 times its weight of iodine by the same method. 3. The undissolved (unpolymerised) residue on treatment of 10 c.c. with 40 c.c. of a sulphuric acid containing 20 per cent. of fuming acid shall not exceed 10 per cent. by volume of the sample. 4. The refractive index of this residue shall be not less than 1·495 at 20° C. 5. The refractive index of the sample at 20° C. shall lie between 1·468 and 1·473. 6. The sp. gr. of the sample at 20° C. shall not be less than 0·86. 7. The initial boiling point shall not be lower than 150° C. under ordinary atmospheric pressure. 8. At least 75 per cent. by volume shall distil below 160° C. 9. The residue on evaporation over a steam bath shall not exceed 2 per cent.

Forty-two samples out of 158 collected were found to contain petroleum, and ten other samples did not comply with the above requirements.

Alkaloids and alkaloidal salts ; Solvents for ——. G. L. Schaefer. Amer. J. Pharm., 1913, **85**, 439—442.

Methyl alcohol is frequently to be preferred to ethyl alcohol as a solvent for alkaloids and their salts. Morphine in dry preparations, salts, etc., can be determined as follows. The material corresponding to 0·3 grm. of morphine is finely triturated with clean sand and an excess of sodium bicarbonate, chalk, or magnesia. During the trituration, the mixture is moistened with a small quantity of water. The mass is allowed to dry at a temperature not exceeding 40° C. with occasional trituration, and extracted with 30—40 c.c. of a freshly made mixture of 1 vol. of methyl alcohol to 4 vols. of chloroform or benzene. The whole is allowed to stand for an hour with occasional shaking. The solvent is filtered off and the residue washed with the same. The solution is distilled, the alkaloidal residue taken up with excess of *N*/20 sulphuric acid, and the free acid titrated in the usual way. The solubilities of certain alkaloids and their salts in ethyl alcohol, methyl alcohol, chloroform, benzene, and certain mixtures of these are given.—F. Shdn.

Essential oils from various countries. Bull. Imp. Inst. 1913, **11**, 428—439.

An account of the results of the examination of samples of "juniper" (*J. phœnicia*), "sage" (*S. cypria*), laurel leaf, "mint" (*M. sylvestris*), and myrtle oils from Cyprus, peppermint oil and "Ngai yau" (*Artenisia vulgaris*) oil from Hong Kong, lime leaf oil from Montserrat, "petit grain" and pimento leaf oils from Jamaica, and clove leaf oil from Zanzibar. In most cases the oils would not be of much commercial value. The Chinese peppermint oil from Hong Kong contained 59—62 per cent. of total menthol (14—16·5 per cent. as esters), being distinctly superior in this respect to Japanese dementholised oil. The pimento leaf oil from Jamaica and the clove leaf, oil from Zanzibar should prove of value as sources of eugenol, of which they contain respectively 68·6 and 85·7 per cent.—A. S.

Salicylic acid; The iron compounds of ——. R. F. Weinland and A. Herz. Annalen, 1913, **400**, 219—268.

Salicylic acid forms with iron coloured complex acids of the type $[Fe(\overset{O}{C_6H_4}COO)_2]H$, and $[Fe(\overset{O}{C_6H_4}COO)_3]H_3$, and a base $[Fe_3(C_6H_4(OH)COO)_6](OH)_3$, all of which can be isolated in the form of their salts. The introduction of a second iron complex as cation in the above disalicylatoferric acid gives rise to salts possessing the violet colour of the salicylic acid-iron reaction, and it is probable that this colour is actually due to salts of this acid with either the salicylatoferric base or with simpler iron cations such as exist in aqueous solutions of ferric salts. On gradually adding increasing quantities of ferric chloride to sodium salicylate there are produced first the yellow colour of the trisalicylatoferric acid, then the deep red of the disalicylatoferric acid, and finally the violet probably due to the formation of a ferric salt of the latter which is but feebly dissociated.—G. F. M.

Glycerol α-monochlorhydrin; New production of ——. J. Nivière. Bull. Soc. Chim., 1913, **13**, 893—894.

Hydrochloric acid gas is passed into glycerol, maintained at 120°—130° C. in a flask provided with a reflux condenser, until it is no longer readily absorbed. The liquid is then fractionally distilled under reduced pressure. The fraction distilling between 120° and 150° C. at 18 mm. pressure is refractionated and the portion distilling between 121·5° and 122·5° C. at 15 mm. pressure is collected. About 660 grms. of monochlorhydrin are obtained from 1 kilo. of glycerol.—J. H. L.

Anaesthetics; Chemistry of ——. *V. Ethyl chloride.* C. Baskerville and W. A. Hamor. J. Ind. Eng. Chem., 1913, **5**, 828—831.

A brief review of the preparation, properties, storage and impurities of ethyl chloride, more especially in regard to its use as an anæsthetic. In addition to the usual method of preparation by the action of hydrochloric acid gas on alcohol in presence of zinc chloride or phosphorus pentoxide, ethyl chloride may also be made by mixing 2 parts of concentrated sulphuric acid with 1 part of 96 per cent. alcohol, and after standing, diluting with ½ part of water, adding potassium chloride, and distilling. Alcohol of the highest degree of purity should be used. Methyl chloride is likely to be produced if alcohol denatured with wood spirit or a mixture containing wood spirit be employed. A simple test of purity consists in absorbing the ethyl chloride from a 30 c.c. containing vessel in 35 c.c. of water. The solution should not be acid to litmus paper, 10 c.c. should give no reaction with silver nitrate, and 10 c.c. when boiled with 3 drops of potassium bichromate solution and 5 drops of dilute sulphuric acid should give no odour of acetaldehyde nor should a bluish or greenish colour be produced.—A. S.

Formaldehyde in the presence of hexamethylene-amine and methyl alcohol in the presence of ethyl alcohol; Detection and quantitative determination of minute quantities of ——. H. A. B. Dunning. Amer. J. Pharm., 1913, **85**, 453—459.

Small quantities of formaldehyde can be estimated as follows. 5 c.c. of the sample are mixed with 0·1 c.c. of 15 per cent. sodium hydroxide solution, then with 0·1 c.c. of phenylhydrazine base and 0·7 grm. of solid sodium hydroxide, and the whole shaken for 10 minutes, and compared colourimetrically with standard solutions of formaldehyde treated in the same manner. If the specimens are to be kept for some time before testing, then 0·1 c.c. of 15 per cent. sodium hydroxide solution must be added, which prevents the decomposition of hexamethyleneamine into formaldehyde by any acid which may be present. Dextrose, acetone, and acetaldehyde do not interfere in solutions of formaldehyde weaker than 1 in 30,000. For the determination of small quantities of methyl alcohol, Simmond's method (this J., 1912, 150), depending on oxidation with permanganate and colourimetric estimation of the resulting formaldehyde with Schiff's reagent (fuchsin bisulphite) gives satisfactory results.—F. Shdn.

Methyl alcohol and formaldehyde; Determination of small quantities of —— *in solutions containing both.* M. Nicloux. Bull. Soc. Chim., 1913, **13**, 935—939.

The method is based on determinations of (1) the volume of standard potassium bichromate solution required for the oxidation of the methyl alcohol and formaldehyde (see this J., 1897, 941), and (2) the volume of carbon dioxide liberated by this oxidation.—J. H. L.

Patents.

Aldehydes and ketones; Manufacture of —— *from the corresponding alcohols.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 21,367, Sept. 19, 1912.

The conversion of primary or secondary alcohols of the aliphatic, aromatic, or monocyclic hydro-aromatic series, into the corresponding aldehydes and ketones, is effected by passing the alcohol in a state of attenuation over a heated catalytic agent. The attenuation is brought about either by reducing the pressure or by diluting the alcohol vapour with an indifferent gas, or by both methods. *Example.* Vaporised benzyl alcohol is mixed with a weak current of nitrogen and passed at a pressure of 1 mm. over a contact mass containing about 15 per cent. of finely divided copper, kept at a temperature of about 280° C. The vapours are condensed and the benzaldehyde is fractionated if necessary. The preparation of cyclohexanone from cyclohexanol is also described. (Compare this J., 1903, 577, 657, 1012; also Eng. Pats. 9550 and 9008 of 1905 and 17,573 of 1906; this J., 1905, 902; 1906, 89; 1907, 777.)—T. F. B.

Halogen derivatives of organic compounds; Manufacture of ——. W. H. Perkin, C. Weizmann, and H. Davies, Manchester. Eng. Pat. 22,653, Oct. 4, 1912. Addition to Eng. Pat. 277, Jan. 3, 1912.

The process for producing dichloro-hydrocarbons, described in the principal patent (this J., 1913, 212), is applicable to the substitution of halogen for hydrogen in other organic compounds, to produce higher or lower halogen derivatives. Thus, the compound to be halogenated is converted into vapour and treated with the vapour of the halogen in such a manner that the halogen is immediately consumed, and the product is removed from the zone of reaction as it is formed. The apparatus described in Eng. Pats. 13,051 and 22,737 of 1912 (this J., 1913, 740) may be used with advantage. The reaction can be accelerated by heat or light, or by phosphorus compounds, iodine, etc. The preparation of 1.2.3.4-tetrachlorobutane from butyl chloride, of monochloroheptane from normal heptane, of dibromo-isopentane from iso-amyl bromide, and of monochloro-acetic acid from acetic acid, is described.—T. F. B.

Dichloroethylene; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 264,006, July 25, 1912. Addition to Ger. Pat. 254,069 (see this J., 1913, 212).

A mixture of chlorine and acetylene, containing not more than about 10 per cent. of chlorine, is heated at a temperature of 40° C. or higher, without the use of capillary tubes or constricted spaces as required in the process of the principal patent. It is stated that there is no danger of explosions with mixtures containing 10 per cent. of chlorine, and very little when 25 per cent. is present. —T. F. B.

Acetic acid esters of amyl alcohol and its homologues; Manufacture of ——. F. Kaufler, Brückl, Austria. Eng. Pat. 3133, Feb. 6, 1913. Addition to Eng. Pat. 2779 of 1913, dated Feb. 23, 1912.

The efficiency of the porous, bulky sodium acetate, prepared as described in the chief patent (this J., 1913, 767) is increased by catalytic agents, particularly copper salts.

The catalyst may be added either before or during the preparation of the acetate, for example, by adding copper carbonate to the sodium carbonate to be treated with acetic acid, or by adding copper acetate to the sodium acetate. In an example, 3 parts of copper acetate are added to 72 parts of the prepared sodium acetate.—T. F. B.

Arseno-compounds; Manufacture of asymmetrical ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 14,409, June 21, 1913. Addition to Eng. Pat. 11,709, May 15, 1911 (see this J., 1912, 256).

Products closely allied to those described in the principal patent are obtained by using, in the process there described, an inorganic arsenic compound or an ester of an inorganic arsenic compound instead of one of the arsinic acids or arsenoxides. Thus the process consists in reducing a mixture of arsenic trichloride, or arsenious acid, or arsenic acid, or an ester of one of these acids, with an aromatic arsinic acid or arsenoxide. The products contain more than one atom of arsenic to each aromatic residue, in quantity varying with the amount of inorganic arsenic compound used. The new compounds are termed "polyarseno compounds," and possess a therapeutic action on animals infected with trypanosomes.—T. F. B.

Arsenic-antimony compounds; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 17,533, July 30, 1913.

Organic antimony-arsenic compounds, which probably contain the atomic grouping, —As : Sb—, are obtained by treating an aromatic primary arsine with antimony compounds of the general type, $(Halogen)_2SbX$ or $OSbX$, where X is an organic or inorganic residue or radical, *e.g.*, antimony trichloride or tribromide, phenylstibine dichloride or oxide, tartar emetic, or antimonyl chloride. The product of the action of antimony trichloride on 3-amino-4-hydroxyphenylarsine in methyl alcohol solution, is a brownish-red substance readily soluble in water, alkali hydroxide solutions, dilute hydrochloric acid, alcohols, etc.; it is precipitated from its alcoholic solutions by ether. Its aqueous solutions yield a sparingly soluble sulphate on addition of sulphuric acid, as do the known arseno-compounds. Five other examples of these new products are given in the specification.—T. F. B.

3·3′-*Diamino*-4·4′-*dihydroxyarsenobenzene; Preparation of neutral derivatives of* —— *soluble in water.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 264,014, May 12, 1912. Addition to Ger. Pat. 245,756.

3-Nitro- or 3-amino-4-hydroxybenzene-1-arsenoxide is treated with the amount of formaldehyde-sulphoxylate necessary for its reduction and for the formation of the sulphoxylate compound (see Eng. Pat. 3612 of 1912, Fr. Pats. 441,392 and 441,882, and Ger. Pat. 263,460; this J., 1912, 844, 900; 1913, 960).—T. F. B.

Phenylarsinic acid; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 264,924, Nov. 9, 1910.

When an N-alkali-benzene diazotate is treated with an alkali arsenite in aqueous solution in absence of free alkali, phenylarsinic acid is the principal product of the reaction. Only very small quantities of phenylarsinic acid are formed, together with benzene, azobenzene, hydrazobenzene, and aniline, by the action of alkaline solutions of diazobenzene chloride on arsenious acid.—T. F. B.

Alkyloxyalkylidene esters of cresotinic acid; Process of producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,387, July 16, 1913. Under Int. Conv., Aug. 3, 1912.

Alkyloxyalkylidene esters of cresotinic acid of the formula, $(CH_3)(HO).C_6H_3.CO.OCHR'.OR$, where R and R′ represent the same or different alkyl radicals (or R′ may be hydrogen), are obtained by treating salts of cresotinic acid with a-halogen-dialkyl ethers, such as monochlorodimethyl ether. The products are stated to have a more rapid and more energetic antirheumatic action than the known alkyl esters of cresotinic acid. The preparation of the methoxymethyl ester of *m*-cresotinic acid, and of the ethoxyethylidene ester of *p*-cresotinic acid, is described in detail. (See also Eng. Pat. 8955 of 1902 and U.S. Pat. 740,628 of 1903; this J., 1903, 378, 1306.)—T. F. B.

N-Halogenalkyl-CC-dialkylbarbituric acids and preparation of the same. O. Wolfes, Darmstadt, Germany. U.S. Pat. 1,074,030, Sept. 23, 1913.

Derivatives of halogenalkylurea are condensed with dialkylmalonyl halides to form N-halogenalkyl-CC-dialkylbarbituric acids. Thus, mono-N-dibromopropyl-CC-diethylbarbituric acid is obtained by the interaction o dibromopropylurea and diethylmalonyl chloride.—T.F.B.

1-*Methyl*-2.4-*diamino*-5-*formylamino*-6-*oxypyrimidine; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,009, May 29, 1912.

Methylation of 2·4-diamino-5-formylamino-6-oxypyrimidine results in the formation of the 1-methyl compound, and not the 3-methyl compound as might be anticipated. When the product is treated with condensing agents to form the second ring, 1-methylguanine is obtained.
—T. F. B.

1.7-*Dimethylguanine; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,011, Aug. 18, 1912. Addition to Ger. Pat. 262,470 (see this J., 1913, 924).

Guanine itself, as well as 1-methylguanine, can be converted into 1.7-dimethylguanine by treatment with methylating agents, with the exception of methyl iodide.
—T. F. B.

Diethyl sulphate; Process for the manufacture of ——. L. Lilienfeld, Vienna. U.S. Pat. 1,074,633, Oct. 7, 1913.

Diethyl sulphate is obtained by distilling sodium ethyl sulphate in a vacuum, with or without addition of a suitable diluent.—T. F. B.

Diacetone alcohol; Apparatus for making ——. C. W. Crockett, Passaic, N.J., Assignor to Alco Deo Co. U.S. Pat. 1,075,284, Oct. 7, 1913.

Relates to an apparatus for converting acetone continuously into diacetone-alcohol. The plant consists of a reservoir for acetone, connected with a "converter tank" containing an insoluble, granular catalytic agent, which will partially polymerise the acetone. The liquid is then passed successively through a series of evaporating units each kept at the same temperature; in these evaporators some of the unpolymerised acetone is driven off, and the liquid becomes progressively richer in diacetone-alcohol, which is finally condensed after leaving the last evaporating unit. A condenser for the unconverted acetone is provided, and is connected with the acetone reservoir in such a manner that the unconverted acetone may be returned for further treatment.—T. F. B.

Dinitroglycol and glycol; Synthetic production of ——. E. Jolicard. Fr. Pat. 456,456, June 18, 1912.

When a current of acetylene is passed through a series of absorption flasks containing sulphuric acid of 66° B. (sp. gr. 1·842) at a temperature of 10°—15° C., sulphoglycol, $SO_2(OCH_2)_2$, is produced. Acetylene combines in a similar manner with nitric acid of 40° B. (sp. gr. 1·383) in presence of an equal quantity of sulphuric acid, forming dinitroglycol. Dinitroglycol is also produced when acetylene reacts with nitric acid alone, either in the gaseous state or in solution. When sulphuric acid containing about 20 per cent. of nitric acid is used for the absorption, sulphonitroglycol is obtained. The glycol compounds can be converted into free glycol by the usual methods. Dinitroglycol may be used in preparing explosives, in which it may wholly or partially replace nitroglycerin.—T. F. B.

Anhydrides of unsaturated fatty acids of high molecular weight and of their halogen addition products; Process for making —— and converting these into amides and ureas. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 456,571, June 21, 1912.

Anhydrides of the higher unsaturated fatty acids (*e.g.*, behenolic or erucic acid) as well as anhydrides of their halogen addition compounds, are readily obtained by treating the acids with phosphorus oxychloride. The anhydrides of the halogen addition products can also be prepared by treating the anhydrides of the fatty acids themselves with halogens or with hydrohalogen acids. By treating the anhydrides with ammonia or urea, the corresponding amides or ureides are produced. Behenolic anhydride (m. pt. 53°—54° C.), erucic anhydride (m. pt. 49°—50° C.), *iso*-dibromobehenic anhydride (m. pt. 55°—56° C.), di-iodobrassidic anhydride (m. pt. 35°—37° C.), behenolamide (m. pt. 90°—91° C.), brassidinamide (m. pt. 91°—96° C.), chlorobehenamide (m. pt. 86°—88° C.), iodobehenamide (m. pt. 91°—92° C.), and di-iodobrassidinamide (m. pt. 94°—95° C.) are described in the specification.
—T. F. B.

Cyanamide; Process for making a mixture of urea and dicyanodiamide rich in dicyanodiamide from ——. H. Immendorf and H. Kappen. Fr. Pat. 457,525, May 6, 1913.

When cyanamide is heated with ferric oxide or other catalytic agent, ammonia is liberated, and a mixture of urea and dicyanodiamide is obtained. By effecting the reaction in alkaline solutions, products rich in dicyanodiamide result. Manganese dioxide or oxide or their hydrates, ferric oxide or its hydrates, stannic acid, chromic oxide or its hydrates, hydrated silicic acid, and similar substances may be used as catalysts. The activity of the catalyst is greatly diminished during the process, owing to its absorbing the bases which are liberated; it can be regenerated by treatment with acid or with water. When commercial calcium cyanamide is used as the raw material, the calcium chloride present, hinders the separation of the mixture of urea and dicyanodiamide; this difficulty may be avoided by converting the calcium chloride into a salt insoluble in alcohol, such as the sulphate or carbonate.
—T. F. B.

Hydrogenation [and reduction]; Catalytic method of ——. A. Brochet. Fr. Pat. 458,033, July 27, 1912.

Hydrogen or a gaseous mixture containing hydrogen is passed into the substance to be treated, either in the liquid form or in solution or suspension, in presence of a base-metal catalyst, which may be held on an inert support. The velocity of the reaction is increased by working under pressure, although extremely high pressures are not necessary. By this process it is possible to reduce benzaldehyde to benzyl alcohol, acetophenone to methylphenylcarbinol, *p*-nitrophenol to *p*-aminophenol, and *p*-nitraniline to *p*-phenylenediamine. The following example of the hydrogenation of phenol is given:—One per cent. of reduced nickel is mixed with phenol, which is heated to 100°—120° C. and treated with hydrogen under a pressure of 10—15 kilos. per sq. cm. If the mixture is thoroughly agitated, the whole of the phenol is converted into cyclohexanol, which can be recovered by distillation. No cyclohexane or cyclohexanone is formed.—T. F. B.

Phosphoric esters of carbohydrates; Process for preparing ——. S. Carlson. Fr. Pat. 458,096, May 20, 1913. Under Int. Conv., May 20, 1912.

The synthetic action of the phosphatese in yeasts, as applied to the preparation of phosphoric esters of carbohydrates, can be utilised if the living yeasts are treated with antiseptics such as toluene, thymol, chloroform, phenol, formaldehyde, etc., in quantity sufficient to suppress their fermentative activity, but insufficient to destroy their synthetic action: the latter is lowered to some extent, usually to from 50 to 20 per cent. of the normal. To prepare the calcium salt of the phosphoric ester of a carbohydrate, 100 grms. of the sugar dissolved in 250 c.c. of water are mixed with 150 grms. of pressed yeast (containing about 30 per cent. of dry substance and 10 c.c. of toluene; after about four hours the yeast is filtered off, the albuminous compounds are separated by heating to 60° C., and the filtrate mixed with the calculated quantity of a calcium salt and with an equal volume of alcohol. On standing the calcium salt of the ester separates. Free phosphates in solutions of carbohydrate-phosphoric esters may be removed by addition of a magnesium salt, ammonia, and ammonium chloride.
—T. F. B.

Sugars with monohydroxybenzoic acids and their carbo-alkyloxy-, acetyl-, and alkyl-derivatives; Preparation of compounds of ——. K. J. Freudenberg. Ger. Pat. 264,654, April 3, 1912.

A sugar is treated with the chloride of a monocarboalkyloxy-, acetoxy-, or alkyloxy-benzoic acid, in presence of a tertiary base and an indifferent solvent, such as chloroform. It is stated that 70 to 80 per cent. of the acid chloride is converted into the completely acidylated sugar ester (penta-acidyl derivative). If the sugar derivative of the free monohydroxybenzoic acid is required the carbo-alkyloxy compound is saponified.—T. F. B.

Panama bark; Process for preventing formation of dust in the treatment of ——. R. Mandelbaum, and A. Kauffmann and Co. Ger. Pat. 264,163, Sept. 28, 1912.

Panama bark is impregnated with a hygroscopic substance, such as calcium chloride or zinc chloride, or with a concentrated solution of borax, or with a solution of glue, dextrin, sugar, or the like, with or without a hygroscopic or antiseptic substance such as salicylic acid.—T. F. B.

Butadiene derived from natural raw materials; Process for converting crude —— into a form suitable for polymerisation. Ges. f. Teerverwertung m. b. H. Ger. Pat. 264,245, Dec. 29, 1911.

The raw materials containing butadiene, *e.g.*, the first runnings in crude benzol distillation, are freed from carbon bisulphide, heated to convert the cyclopentadiene into a polymer of high boiling-point, and treated with sodium to remove the acetylenic hydrocarbons. The carbon bisulphide and cyclopentadiene can be separated by the same heating process, or the cyclopentadiene and the acetylenic hydrocarbons may be removed by means of sodium in a single operation. The product is fractionated to obtain butadiene of the desired purity.
—T. F. B.

Amino-acid amides and their derivatives; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 264,263, June 2, 1911.

Amides of amino-acids and their derivatives are obtained by treating the addition products of the amides of the corresponding halogen substituted acids and hexamethylenetetramine with alcoholic hydrochloric acid.—T. F. B.

Mercury derivatives of aryloxy-fatty acids; Preparation of easily soluble compounds of nucleus-substituted ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,267, March 26, 1912.

The alkali or ammonium salts of oxymercuri-aryloxy-fatty acids (see Ger. Pat. 261,229; this J., 1913, 841) are treated with amino acids or with other nitrogenous compounds which, though neutral towards litmus, possess both basic and acidic characters, or with imino-compounds of acidic character. Similar stable and soluble products are obtained by treating the free oxymercuri-aryloxy-fatty acids with alkali salts of the above mentioned nitrogen compounds, or mixtures of the mercury-acids and the nitrogen compounds may be treated with an alkali hydroxide or carbonate, ammonia, or an organic base.—T. F. B.

Mercury derivatives of aminobenzoic acids; Process for preparing nucleus-substituted ——. Verein. Chemische Werke A.-G. Ger. Pat. 264,388, March 30, 1912.

Compounds of the formula, $AcNH.C_6H_3(COOH)(HgCl)$ [AcNH : COOH : HgCl=3 : 1 : 6], are obtained by heating a mercuric salt of *m*-acylaminobenzoic acid, by heating mercuric oxide with a *m*-acylaminobenzoic acid, or by heating a salt of the acid with a mercuric salt.—T. F. B.

Xanthine derivatives; Process for preparing easily soluble ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,389, Sept. 27, 1912.

A XANTHINE base is treated with an alkali salt of a quinolinecarboxylic acid, or an alkali compound of a xanthine base is treated with the free acid, or a mixture of the xanthine base and quinolinecarboxylic acid is treated with alkali. The products are neutral and more easily soluble than known compounds such as theobromine sodium-sodium salicylate or theophyllin sodium-sodium acetate.—T. F. B.

Ferrous salt of glutamic acid; Process for preparing a ——. F. Hoffmann-La Roche und Co. Ger. Pat. 264,390, Feb. 22, 1913.

WHEN aqueous solutions of glutamic acid are heated with metallic iron, air being excluded, ferrous salts of glutamic acid are obtained. Aqueous glutamic acid solutions have no action on ferric oxide or ferric sulphide.—T. F. B.

Ferrous salt of 2-pyrrolidone-5-carboxylic acid; Preparation of a ——. F. Hoffmann-La Roche und Co. Ger. Pat. 264,391, March 7, 1913. Addition to Ger. Pat. 264,390.

2-PYRROLIDONE-5-CARBOXYLIC acid is converted into a ferrous salt by heating with metallic iron in a manner similar to that described for preparing ferrous glutamate (see preceding abstract).—T. F. B.

Methyl thiocyanate; Process for preparing ——. K. Schmitz. Ger. Pat. 264,922, Feb. 26, 1913.

THE potassium-methyl sulphate obtained as by-product in the reaction between dimethyl sulphate and potassium thiocyanate, is heated with a further mol. of potassium thiocyanate and one mol. of an alkaline-earth salt which is soluble in water. Methyl thiocyanate is also prepared by heating dimethyl sulphate with an aqueous solution of an alkaline-earth thiocyanate.—T. F. B.

Heavy-metal compounds of albuminous substances containing sulphur; Process for preparing soluble ——. R. Uhl. Ger. Pat. 264,926, Feb. 13, 1912.

THE products obtained by the action of carbon bisulphide or carbon oxysulphide on albuminoid compounds or analogous substances in alkaline solution, are decomposed in alkaline solution by means of heavy metals or their compounds, other than lead or lead compounds. The products are more stable than the albumin-sulphur compounds, and are soluble in water and in dilute alkalis. They are stated to be non-toxic, and to possess powerful antiseptic and bactericidal properties.—T. F. B.

Isoprene; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,035, Sept. 27, 1912.

SEE Fr. Pat. 452,246 of 1912; this J., 1913, 672.—T. F. B.

Diolefines [and methylbutenol esters]; Process for producing ——. Badische Anilin und Soda Fabrik. First Addition, dated March 11, 1913, to Fr. Pat. 434,586, Sept. 26, 1911. Under Int. Conv., Aug. 7 and 8, 1912, and Feb. 10, 1913.

SEE Eng. Pats. 21,616 of 1912 and 13,327 of 1913; this J., 1913, 921.—T. F. B.

Butadiene and its homologues; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss. Fr. Pat. 458,098, May 20, 1913. Under Int. Conv., May 30, 1912.

SEE Eng. Pat. 12,771 of 1912; this J., 1913, 711.—T. F. B.

Diethylbromoacetyl carbamide; Process for producing ——. Dr. Bruno Beckmann Chem. Fabrik, G. m. b. H., Berlin. Eng. Pat. 15,933, July 10, 1912. Under Int. Conv., Aug 24, 1912.

SEE Ger. Pat. 262,048 of 1912; this J., 1913, 925.—T. F. B.

Piaselenol; Derivative of ——. E. Fischer, Berlin, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,425, Sept. 30, 1913.

SEE Ger. Pat. 261,412 of 1912; this J., 1913, 842.—T. F. B.

Organic mercury compounds. M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,781, Oct. 7, 1913.

SEE Ger. Pat. 261,229 of 1912; this J., 1913, 841.—T. F. B.

Dialkylaminoformic acid; Esters of ——. G. Merling, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat, 1,074,966, Oct. 7, 1913.

SEE Eng. Pat. 11,587 of 1912; this J., 1913, 212.—T. F. B.

Beta-methyl-gamma-oxybutyldimethylamine; Process of producing ——. G. Merling, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,074,967, Oct. 7, 1913.

SEE Ger. Pat. 254,713 of 1911; this J., 1913, 380.—T. F. B.

2-Phenylquinoline-4-carboxylic acid; Process for the manufacture of ——. A. Thiele and G. Wichmann, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,075,171, Oct. 7, 1913.

SEE Eng. Pat. 15,684 of 1912; this J., 1912, 953.—T. F. B.

Liquid or solid solutions of organic compounds giving emulsions with water. Addition to Fr. Pat. 445,053. *See* XII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic developers; Physico-chemical studies of ——. *III. Quinol as an inductor.* N. Schilow and E. Timtschenko. Z. Elektrochem., 1913, 19, 816—819.

SODIUM arsenite has an effect on the atmospheric oxidation of quinol solutions very similar to that of sodium sulphite (see this J., 1912, 1094; 1913, 214, 431); during the earlier stages of the oxidation, the process is less rapid than without arsenite, but in the later stages the total amount of oxygen absorbed is greater than when arsenite is absent. Since sodium arsenite is not likely to form complex compounds with quinol, it is probable that it acts merely as a protective agent for the quinol. The oxygen is distributed between the quinol and the arsenite in the ratio of 1 : 1·2, as compared with 1 : 1 which is the ratio for an ideal "acceptor" of oxygen. Analogous experiments with the aid of hydroxylamine and hydrazine as "acceptors" gave somewhat similar results, but it is considered probable that series of addition products are formed in these cases. The retarding and "regularising" effect of hydroxylamine is so marked that its use in the preparation of "stand" developers is suggested.
—T. F. B.

PATENTS.

Photographic fixing baths; Process for testing the strength of —— *and means for use therein.* A. Bilty, Aschaffenburg, Germany. Eng. Pat. 9691, April 24, 1913.

A TEST paper is made by coating with a silver salt emulsion a paper which is either strongly coloured or provided with

a printed or otherwise marked surface. If the emulsion is of the same grade as that of the paper to be used, the test paper serves both as an indication of the strength of the fixing bath and of the time necessary for fixation.
—T. F. B.

Photography of colours ; Processes for ——. E. C. G. Caille. First Addition, dated July 6, 1912, to Fr. Pat. 445,787, July 5, 1912.

To assist the adherence of the gelatin or emulsion to the polychrome screen in the process described in the principal patent (this J., 1912, 1202), it is suggested to interpose a layer of collodion, insoluble glue, potassium silicate solution (0·5 to 1 per cent.), or similar substance.—T. F. B.

Colour photography on fabrics ; Process of ——. T. Valette and R. Feret. Fr. Pat. 457,446, May 3, 1913.

Photographs are printed by projection or contact on sensitised fabric fastened on a rigid support in such a manner as to ensure that it retains its shape. Two or more monochrome prints are applied in exact register, the fabric being sensitised before each printing with a solution containing a double sulphite of sodium and an aromatic diazo compound, and also a phenol ; neither the amine nor the phenol should contain a free sulphonic or carboxylic group. It is known that these solutions only produce the corresponding dyestuff under the influence of light. The sensitising baths are made up to produce the appropriate colour ; for instance, the yellow may be derived from aniline and phenol, the red from *p*-nitraniline and β-naphthol, and the blue from toluidine and α-naphthol or amino-α-naphthol.—T. F. B.

Film supports ; Process for preparing non-inflammable waterproof ——. Balland et Cie. Fr. Pat. 457,925, May 13, 1913.

Films made of gelatin, viscose, or other substances sensitive to water, are coated with a solution of cellulose or cellulose acetate or other ester, in acetone, alcohol, or other suitable solvent.—T. F. B.

Colour photography ; Process for producing bleaching-out films for ——. J. Szczepanik and F. Habrich. Ger. Pat. 264,207, Sept. 10, 1912.

Suitable powdered substances are stained with fast (*i.e.*, not "bleeding"), red, yellow, and blue colours sensitive to bleaching-out, and are then applied to paper, glass, etc., with or without the use of a binding agent, which may also be coloured. Substances emulsified in the binding agent may be used in place of the powders. The powders or emulsion may be stained to equal depths and made equally sensitive by varying the conditions of sensitisation, or they may be stained to such a depth that a single strength of sensitising solution renders all colours equally sensitive. To prevent the differently coloured particles of the emulsion from mixing, they may be treated with tanning or like agents.—T. F. B.

Colour photography ; Polychrome screens for ——. R. Ruth and A. Schuller, Oude-God, Belgium. Eng. Pat. 22,451, Oct. 2, 1912.

See Fr. Pat. 449,080 of 1912 ; this J., 1913, 508.—T. F. B.

Photographs ; Process of treating [colouring] ——. A. M. Sandig, Chicago. Eng. Pat. 9056, April 17, 1913.

See U.S. Pat. 1,067,198 of 1913 ; this J., 1913, 807.—T.F.B.

Photographs in natural colours ; Process for obtaining ——. Neue Photographische Ges. A.-G. Fr. Pat. 457,079, July 3, 1912.

See Ger. Pat. 257,160 of 1911 ; this J., 1913, 674.—T. F. B.

Photographic fixing baths ; Process for testing the utility of ——. Act.-Ges. f. Buntpapier- u. Leimfabr. Fr. Pat. 457,083, April 24, 1913.

See Eng. Pat. 9691 of 1913 ; preceding.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; Annual Report of the Chief Inspector (Major A. B. Denne) of —— *for the Union of South Africa for the year ending Dec.* 31, 1912. [U.G. 41—1913.]

There are, in South Africa, three large explosives factories, and, during the year three small "tshisa" stick factories were started in the neighbourhood of Johannesburg. The quantities of explosives manufactured were 6405 tons at the B.S.A. Explosives Co., Modderfontein, 10,554 tons at the Cape Explosive Works, Somerset West, and 5931 tons at the works of Kynoch Ltd., Umbogintwini. There were no accidents of note at Somerset West and Umbogintwini, but two, each involving the loss of six lives at Modderfontein. In the Transvaal there were 214 magazines under licence. In many cases, owing to the exceptionally hot weather, the temperature rose beyond 95° F. (35° C.), laid down as the maximum permissible in the regulations. In the wood and iron magazine, required by former regulations, and constructed on the "sub-surface" type, the temperature rose as high as 98° F. (36·7° C.), whilst the maximum attained in a stone magazine was not more than 82° F. (27·8° C.). The number of licensed magazines in Cape Colony was 190. The amounts of explosives manufactured, imported, and exported during the year were :—

	Manufactured.	Imported.	Exported.
Blasting gelatin .... tons	13,139	43	220
Gelignite .... ,,	5,341	62	258
Dynamite .... ,,	4,371	79	18
Blasting powder........ ,,	—	30	—
"Permitted" explosives ,,	40	53	—
Totals .... ,,	22,891	267	496
Detonators .... No.	—	49,415,000	72,000

Nitrocotton is imported by two of the factories, the Cape Explosives Works being the only one to manufacture its own. 19,886 cases of safety fuse (500 coils each) were imported from the following places : Great Britain (13,050), Germany (5045), and Belgium (1791). Fifty-seven samples of safety fuse were tested during the year. Complaints of "running" fuse have been of less frequent occurrence than formerly. 185 samples of explosives were dealt with in the Johannesburg laboratory. The chief items were : blasting gelatins (46), gelignites (39), and dynamites, dope (45). In the Durban laboratory 291 samples were examined, of which 261 were importations. At Cape Town 115 samples were dealt with, the chief items being : blasting gelatins (33), gelignites (31), and guhr dynamites (24).—G. W. McD.

Patents.

Explosives for use in coal mining and the like. G. Carew, and British Westfalite, Ltd., Denaby, Yorks. Eng. Pat. 8530, April 11, 1913.

A safety explosive consisting of ammonium nitrate (58—61 parts), potassium nitrate (13—15), ammonium chloride (20—22), trinitrotoluene (4—6), and moisture (0—1 part).
—G. W. McD.

Explosive nitro bodies ; Method of densifying fusible ——. G. Issler, Wahn, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,074,263, Sept. 30, 1913.

Fusible explosive nitro bodies are rendered denser by fusing one end of the charge, and applying pressure to the rest through the medium of the liquefied portion, whilst gradually cooling the part more remote from the liquid portion.—G. W. McD.

Powder and propellant for use in firearms. C. Newton, Buffalo, N.Y. U.S. Pat. 1,074,809, Oct. 7, 1913.

The propellant has a perforated core consisting of layers of colloids so arranged that those forming the exterior surface of the core and the interior of the perforations burn the slowest, and each successive layer from the surface towards the centre of the core is composed of a more rapid burning colloid than the one which envelopes it. The whole is protected at the end from the flame by a slow burning substance which retards the rate of burning. —G. W. McD.

Dynamites and other high explosives; Machine for packing —— into shells. H. Auchu, Emporium, Pa. U.S. Pat. 1,074,923, Oct. 7, 1913.

A machine frame is provided with a shell holder and a packer sliding in a collar. The pressure which the packer applies to the explosive may be regulated by a series of weights. A lever and cam by which the packer is operated are so arranged that when the shell has been loaded they are out of engagement, and the movement of the packer stops.—G. W. McD.

Cartridges [; Lubricant for ——]. Chemische Producten- und Zündkapselfabrik V. Alder, Vienna. Eng. Pat. 27,409, Nov. 28, 1912. Under Int. Conv., Dec. 7, 1911.

A lubricant for cartridge cases consisting of a mixture of either asphaltum or carnauba wax (70 parts), ceresin (20), and beeswax (10 parts). Stearine or liquid oils may be used in place of beeswax.—G. W. McD.

Detonating or priming compounds for rim fire cartridges and percussion caps. W. Meyer, Berlin-Wilmersdorf, Germany. Eng. Pat. 25,550, Nov. 7, 1912. Addition to Eng. Pat. 21,337, Sept. 27, 1911.

See Addition of Sept. 7, 1912, to Fr. Pat. 435,049 of 1911; this J., 1913, 454.—T. F. B.

Explosive compounds. C. F. Dippel, Brenham, Texas, U.S.A. Eng. Pat. 12,376, May 27, 1913. Under Int. Conv., May 27, 1912.

See U.S. Pat. 1,054,515 of 1913; this J., 1913, 381.—T.F.B.

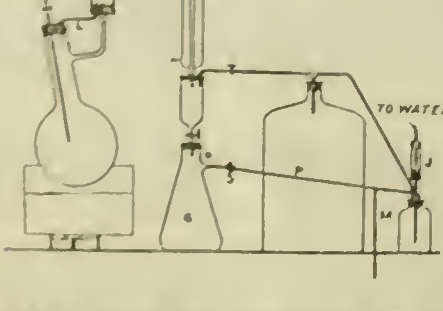
Manufacture of bituminous matter [for explosives, etc.] Fr. Pat. 457,054. *See* IIa.

Synthetic production of dinitroglycol and ethylglycol. Fr. Pat. 456,456. *See* XX.

XXIII.—ANALYTICAL PROCESSES.

Evaporation of large volumes of liquid in vacuo; Simple laboratory apparatus for the continuous ——. W. A. Davis. J. Agric. Sci., 1913, 5, 434—436.

The apparatus (see fig.) overcomes the difficulty caused by the frothing of liquids such as alcoholic plant-extracts during vacuum distillation. It requires practically no watching when once the distillation has been started. When froth rises into the trap, B, made from a piece of wide glass tubing, it is broken against copper gauze in the latter and flows back into the flask through the tube, L. The distillate in G can be removed at any time without affecting the vacuum if the cocks at R and S are first closed. The large reservoir, P, prevents sudden changes of pressure, and thus helps to ensure regular ebullition. J is a Hutchinson valve (see this J., 1912 906) and M a manometer tube.—J. H. L.



Hydrolytic reactions between soluble salts during the analysis of evaporation residues. P. Kaschinsky. Ann. Chim. Analyt., 1913, 18, 385—389.

On analysing the evaporation residues of the waters of certain saline lakes dried at 180° C., and the same residues, calcined at a low red heat, treated with ammonium carbonate, and again dried at 180° C., by extracting them with water, and determining acids and bases in the aqueous solution and in the insoluble portion, it was found, on comparison with the results of analysis of the original waters, that on evaporation, and still more on calcination, there was considerable loss of chlorine, bromine, and iodine, and that the soluble sulphates diminished considerably, through formation of insoluble basic salts. These results are due chiefly to the hydrolysis, during evaporation and calcination, of magnesium salts.—J. T. D.

Methods for the examination of natural gas for the production of gasoline. Merriam and Birchby. *See* IIa.

Evaporation test for mineral lubricating and transformer oils. Waters. *See* IIa.

Rapid volumetric method for determining o- m- and p -cresol, thymol, and phenol. Redman and others. *See* III.

Determination of water of crystallisation in sulphates. Kuzirian. *See* VII.

Determination of phosphorus in vanadium steel and ferro-vanadium. Sidener and Skartvedt. *See* X.

Cathodic determination of lead and the analysis of lead alloys. Gartenmeister. *See* X.

"Chlorine value" as a new oil constant. Zlataroff. *See* XII.

Determination of caoutchouc as bromide. Vaubel and Weinerth. *See* XIV.

Determination of carbohydrates, especially in plant extracts. Determination of maltose in presence of other sugars. Davis and Daish. *See* XVII.

New double polarisation method for the determination of the true sucrose content [of cane molasses]. Steuerwald. *See* XVII.

Solvents for alkaloids and alkaloidal salts. Schaefer. *See* XX.

Iron compounds of salicylic acid. Weinland and Herz. *See* XX.

Detection and determination of minute quantities of formaldehyde in the presence of hexamethylene-amine and methyl alcohol in the presence of ethyl alcohol. Dunning. *See* XX.

Determination of methyl alcohol and formaldehyde in solutions containing both. Nicloux. *See* XX.

Patents.

Liquids [ammoniacal gas liquor waste]; Apparatus for automatically testing and sampling ——. R. H. B. and P. C. Lamprey, and South Metropolitan Gas Co., London. Eng. Pat. 21,313, Sept. 19, 1912.

The apparatus described is intended for testing and sampling ammoniacal gas liquor waste. The liquor flows through a boiler and seals the gas pipe which supplies the burner for heating the latter; when the flow of liquid is diverted from the boiler, leaving a measured quantity therein, the seal of the gas supply is broken and the gas passes to the burner and to a holder. The movement of the holder closes the overflow of the boiler before distillation, and also operates a device for discharging a measured quantity of reagent into the boiler. Means are provided for directing the flow of liquid to the boiler, these comprising a clockwork escapement, drum, etc. The distillate is collected in receivers mounted in a rotating table which also carries receivers for the untreated liquid.—W. P. S.

Combustion apparatus for organic elementary analysis. H. Brach. Ger. Pat. 263,680, March 6, 1913.

The combustion tube is enclosed gas-tight in a wider tube, also filled with copper oxide or the like, and the gases issuing from the absorption apparatus are returned, passed through this outer tube, in order to ensure complete combustion, and then again through the absorption apparatus. It is possible in this way to effect rapid combustion with quantities of substance not less than those taken for the usual method.—A. S.

Apparatus for the measurement of ions. Fr. Pat. 458,078. *See* XI.

Books Received.

Die Aetherischen Oele. Von E. Gildemeister und Fr. Hoffmann. Zweite Auflage von E. Gildemeister. Zweiter Band. Schimmel und Co.'s Verlag, Miltitz bei Leipzig. (Für den Buchhandel: S. Staackmann, Leipzig) 1913. Price M. 17. Bound, M. 20. [For Vol. I. (2nd Edition) see this J., 1910, 1181.]

Volume (9⅜ by 6⅔ ins.), containing 673 pages of subject matter with 52 illustrations, four maps, and four curve-diagrams and tables. This volume is devoted mainly to the arrangement and classification of the essential oils under the chief plant classes from which they are derived. These are are follows :—I. Chlorophyceæ. II. Eumycetes. III. Embryophyta asiphonogama. IV. Embryophyta siphonogama, which again includes the families of the *abies*, the *callitris*, the *andropogon*, the *liliaceae*, the *iridaceae*, the *zingiberaceae*, the *orchidaceae*, the *piperaceae*, the *santalaceae*, the *magnoliaceae*, the *lauraceae*, the *cruciferae*, the *rosaceae*, the *leguminoseae*, the *geraniaceae*, and the *rutaceae*, etc.

Plantation White Sugar Manufacture. By W. H. Th. Harloff and H. Schmidt. Translated from the second revised Dutch edition by J. P. Ogilvie. Norman Rodger, 2, St. Dunstan's Hill, London. 1913. Price 7s. 6d. net.

This volume (8 by 5¾ ins.) contains 135 pages of subject matter, and an alphabetical index. The text is divided into two major sections : I. The Chemistry of White Sugar Manufacture, and II. The Manufacture of White Sugar. Part I. is divided into the following sub-sections :—(i.) Influence of alkalis and alkaline earths on the constituents of cane juice. (ii.) Influence of acids on the constituents of the sugar cane. (iii.) Influence of heating on the constituents of cane juice. (iv.) Colouring substances of the cane and those produced during the process of manufacture. (v.) The different fermentations that may occur in the sugar factory. Part II. is divided into six sub-sections, as follow :—(i.) Carbonic acid saturation (carbonatation). (ii.) The acid thin-juice process. (iii.) Raw juice sulphitation or sulphurous acid saturation. (iv.) Treatment of thick-juice. (v.) Centrifugal syrup treatment. (vi.) Curing.

Transactions of the American Institute of Metals. Volume VI. Sixth Annual Meeting. Held at Buffalo, New York. Sept. 24—27, 1912. American Institute of Metals. Buffalo, New York. 1913. Price 3 dollars.

Volume (9 by 6 ins.) containing 250 pages of subject matter, with 39 illustrations, followed by Bulletins 10 to 19, with abstracts of metallurgical literature and patents, Notes and Reports during 1912, and list of members. The contents include "Structure of galvanized iron" (this J., 1912, 644) ; "The electric furnace for brass melting" (this J., 1913, 27) ; "Electric melting of copper and brass" (this J., 1913, 27) ; "Test bars for non-ferrous alloys" (this J., 1913, 28) ; "Vaporization of metals" (this J., 1913, 28).

Circular of the Bureau of Standards. (Department of Commerce). No. 32. Standard Regulations for manufactured Gas and Gas Service. (2nd Edition) issued October, 1913. (See also this J., 1912, 561, 630). Government Printing Office. Washington, 1913.

This volume (10 by 7 ins.) contains 165 pages of subject matter and an alphabetical index of subjects. The subdivision and arrangement of subject matter are as follows : —Part I. Discussion of technical specifications. a. Candlepower and heating value. b. Heating value regulations. c. Candlepower requirements. d. Purity. e. Gas-pressure limits. f. Meters and meter testing. Part II. Enforcement of Technical Regulations. a. City *v.* State control of gas service. b. State inspection service. Part III. Proposed Ordinance and Rules. a. Proposed city ordinance. b. Proposed State regulations. Part IV. Summary of laws in Force. a. Regulations by States or State Commissions. b. Municipal laws in force. Part V. Manufacture and Distribution of Gas. a. Constituents of gas. b. Methods of manufacture. c. Distribution methods. Appendixes. Statistics, etc., of the gas industry.

Transactions of the American Institute of Chemical Engineers. Vol. V. 1912. D. Van Nostrand Co., New York. E. and F. N. Spon, Ltd., London. 1913. Price 30s. net.

This volume (9¼ by 6⅜ ins.) contains 21 papers, occupying 254 pages, read before the Institute during 1912, the Code of ethics and constitution of the Institute (4 and 10 pages respectively), a list of members (11 pages), and an alphabetical index (4 pages). Abstracts of several of the papers have already appeared in the Journal of this Society.

The Polytechnic Engineer. Published annually by the students of the Polytechnic Institute of Brooklyn, 85, Livingston Street, Brooklyn, N.Y., U.S. America. Vol. XIII. 1913. Price $1.25 per copy.

Volume (9¼ by 6⅛ ins.), containing 135 pages of subject matter, a table of contents of the present volume, a frontispiece of Dr. S. Sheldon, a past President, and dedication to him of Volume XIII. The contents consist chiefly of a series of papers by the students of the Institute. Some three or four of these relate to chemical technology.

The Silicates in Chemistry and Commerce, including the Exposition of a Hexite and Pentite Theory, and of a Stereo-chemical Theory of General Application. By Dr. W. Asch and Dr. D. Asch, Berlin. Translated with critical notes and some additions by Alfred B. Searle. Constable and Company, Ltd., 10, Orange Street, Leicester Square, London, W.C. 1913. Price 21s. net.

Volume (10 by 6½ ins.), containing 444 pages of subject matter, and alphabetical indexes of subjects and names. The text is subdivided and classified as follows :—Introduction. The chemistry of carbon and silicon. I. Historical review of existing theories concerning the constitution of the aluminosilicates and other silicates. II. Critical examination of existing theories concerning alumino-silicates. III. Hypothesis concerning the bonding of the atoms in alumino-silicates and allied compounds. Under III. are found chapters on "The constitution of clays." "Ultramarine." "New theory of hydraulic binding materials and particularly of Portland cements." "New theory of the porcelain cements as used for dental fillings." "New theory of glass, glazes and porcelain," etc. IV. Conversion of the Hexite-Pentite theory into a stereo-chemical theory and the combination of the latter with the modern theory of the structure of crystals. V. Summary and conclusions. VI. Bibliography of references mentioned in the text. VII. Appendix. VIII. Formulæ and analyses.

THE SUGARS AND THEIR SIMPLE DERIVATIVES. By JOHN E. MACKENZIE, D.Sc., Ph.D. Gurney and Jackson, London. 1913. Price 7s. 6d. net. Oliver and Boyd, Tweeddale Court, Edinburgh.

THIS volume (9 by 6 ins.), contains 232 pages of subject matter with alphabetical indexes of names and subjects. A list of journals is also supplied, to which reference has been made. The subject matter is classified as follows:—I. Introduction. General properties of sugars and synthetic methods of preparation. II. Sucrose. III. Maltose. IV. Lactose. V. Glucose. VI. Glucosamine. VII. Configuration. VIII. Dioses, trioses and tetroses. IX. Pentoses. X. Methylpentoses. XI. Aldohexoses. XII. Ketohexoses. XIII. Disaccharides, trisaccharides, tetrasaccharides. XIV. Glucosides. XV. Fermentation. XVI. Metabolism.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

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London Section.

Meeting held at Burlington House, on Monday, November 3rd, 1913.

PROF. W. R. E. HODGKINSON IN THE CHAIR.

ANALYSIS OF CRUDE GLYCERIN BY THE INTERNATIONAL STANDARD METHODS, 1911.

Determination of Organic Residue.

BY R. G. GRIMWOOD.

In 1911, a report on the analysis of crude glycerin was published (this J., 1911, 556) giving the various standard processes agreed to by International Committees. The process described in this report for the determination of organic residue is a lengthy one, scarcely capable of being carried out in a working day, and the oven prescribed, though the best available at the time, has many faults. Thermo-electric measurements have shown that widely divergent temperatures may exist in different parts of such an oven, and the maintenance of a constant temperature presents considerable difficulty. Discrepancies in the results obtained by different chemists seem to indicate that insufficient attention has been given to the fact that a thermometer does not always register the temperature at which the operation is taking place.

During the past two years experiments have been made as to the possibility of shortening the time taken for the initial evaporation of the glycerin in this process, and with a view to producing an oven having a uniform temperature throughout its evaporating or heating surface.

The evaporation of the glycerin.—The time required for getting rid of the greater part of the glycerin, the first part of the process of organic residue determination, is chiefly due to the high specific gravity of glycerin vapour, and if some means is used to carry away the vapour as it is formed the time is materially reduced. Undoubtedly the most effective method of getting rid of the glycerin vapour is to blow steam either on to or directly over the surface of the heated crude glycerin. In a laboratory, however, steam at 140° to 160° C. is not usually available, and to produce it from steam at 100° C. by means of a superheater necessitates constant attention.

Two practicable methods of carrying away the glycerin vapour have been found, which are almost as effective and are automatic in action.

In the first method a small electric fan is so arranged that a column of air is sucked into the oven and propelled over the surface of the glycerin, carrying away the vapour as it is formed; and in the second air is supplied at low pressure by means of an ordinary laboratory water blower and conveyed to the oven, by suitable tubing, where it is distributed from small jets pierced in the sides of a copper tube running round the walls of the oven. It is advisable to connect the air outlet of the water-blower dash-pot to a three-necked Wolffe's bottle, having a tubular at the bottom, one neck being used for the air inlet, a second for the air outlet, whilst in the third is fixed a bent glass tube to act as a pressure gauge. The tubular at the bottom of the bottle is connected to a water seal and serves for the drainage of any water carried forward with the air.

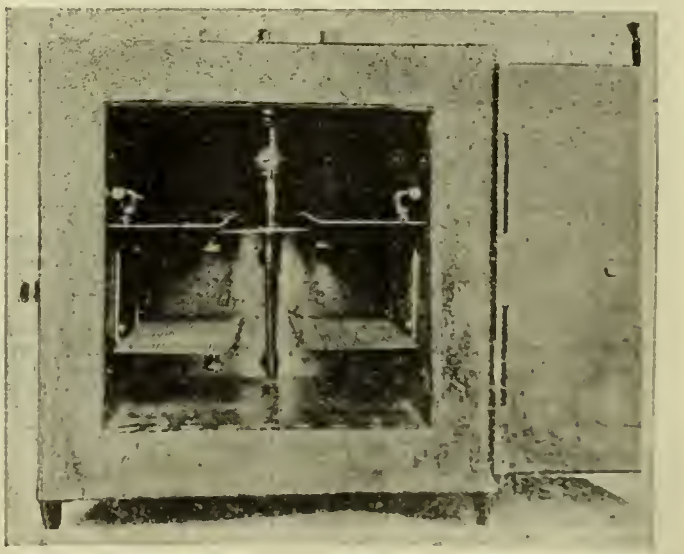
The latter method has the advantage of being quite automatic and independent of everything but the usual water supply.

It has been found that, rapidly removing the glycerin vapour by these methods, a somewhat higher temperature can be used than that specified in the International Standard Methods, as the nominal temperature of the oven, so that instead of taking from three to four hours to evaporate the glycerin the same result can be obtained in from one to two hours.

The oven.—It has been mentioned that the oven specified in the International Standard Methods has proved unsatisfactory,* nor has it been found possible to obtain a gas heated oven, suitable for the purpose, which would compare with one electrically heated for equability of temperature.

The oven which has been found most satisfactory for the purpose consists of an outer shell of Uralite built into an angle iron frame between which and the inner shell of sheet iron, or oven proper, coils of a special resistance wire are fixed along the bottom and two of the sides. The interior of the oven, which is approximately 10 inches cube, is fitted with four shelves about 3½ inches apart, and the lower shelves about the same distance from the bottom. These shelves, which run the full depth from front to back, are rather less than 4 inches wide; they are made of stout perforated sheet iron and are carried on brackets fitted with back-nutted levelling screws. Through the centre of the oven, from top to bottom and from front to back, there thus remains a clear open space of rather more than 2 inches in width.

As an outlet for the glycerin vapour two openings are provided on the top of the oven approximately over the centre of the shelves, and a third opening about the centre of the top permits the introduction of a thermometer the bulb of which dips into a small vessel, carried on a loose bridge between two of the brackets, containing a thin layer of vaseline. These openings consist of brass collars, ¾ inch diameter, screwed into the inner lining and passing through the Uralite casing. Two similar openings are provided in the back, one for the passage of the tube to the air blower or for the spindle of a fan and the second so that a wire may be carried to an electric torch fixed inside the oven. The door, the inside of which is of metal, is also fitted with a covered port-hole for inspection.



The two top shelves will conveniently take six residue dishes for evaporating the glycerin, and twelve dishes can be baked at one time for the rest of the process.

To raise the temperature of the oven to 160° C. with sufficient rapidity a greater amperage than that necessary to maintain the temperature is used, and the final adjustment of the temperature is made by throwing in a resistance or by partially opening a port, in the Uralite cover, on top of the oven. The wiring of the oven, and consequently the current used, must of course depend on the voltage of the supply, but the following details will give some idea of the requirements and capacity of the oven.

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* In an oven being used for organic residue determinations, complying in every respect with the I.S.M. specification, a maximum variation of 16° C. was found on one shelf and between two shelves a maximum variation of 45° C.

On a 100 volt alternating circuit the oven takes 9·2 ampéres. In 50 minutes with this current the temperature reaches 156°—157° C. when the resistance is introduced, reducing to 8·3—8·4 ampères, and the temperature runs up to 160° C. and remains constant. Total time 1 hour. The door was kept fully open for 30 seconds, the time necessary to remove six dishes. In ten minutes from the closing of the door the temperature had again reached 160° C.

Determinations were made with Eureka-copper couples and the current generated measured with a milli-voltmeter, 2·3 divisions on its scale being equivalent to 1° C. within the range of the variations.

TABLE I.

Variations in temperature in electrical oven for residue determinations.

Position of movable couple.	Temperatures=° C. Thermometer with fixed couple.	Movable couple.	Difference.
Top shelf, right hand ; front .	160	160	0
,, ,, middle	160	162·2	+2·2
,, ,, back .	160	162·0	+2·0
,, left hand ; front ...	160	159·6	—0·4
,, ,, middle .	160	160·2	+0·2
,, ,, back ...	160	159·0	—1·0
Bottom shelf, right hand ; front ..	160	159·0	—1·0
,, ,, middle	160	160·5	+0·5
,, ,, back ..	160	160·4	+0·4
,, left hand : front .	160	157·8	—2·2
,, ,, middle	160	160·0	0
,, ,, back .	160	160·4	+0·4
Maximum variation from thermometer reading ...			±2·2 C°.

air in the service adjusted to about that of 2 inches of water, or the fan is started. The dishes are then placed on the two top shelves and the door quickly closed. At the end of 30 minutes, and of each subsequent 30 minutes, the current is turned on to the electric torch and the condition of the residues examined through the porthole in the door. If the glycerin in any of the dishes has skinned over the dish is removed, a few drops of water added, the crust broken up and the dish returned to the oven. If owing to inequalities of the surface of the dish a pool has formed, the glycerin is redistributed. By this treatment most crude glycerins at the end of one hour and most saponification glycerins at the end of two hours will have evaporated sufficiently to permit of their treatment for the first baking, when the process is carried on exactly as set out in the International Standard Methods.

Various typical glycerins, having the composition as set out in Table II., have been examined by the method prescribed in the I.S.M. and by the modification suggested, and the results are set out in Table III. These results are in good accordance and the differences no greater than those obtained in two determinations made by the same method.

TABLE II.

Analyses of glycerins used for comparative residue determinations.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
	Good saponification glycerin.	Bad saponification glycerin.	Good crude glycerin.	Middle crude glycerin.	Bad crude glycerin.
	per cent.	per cent.	per cent.	per cent.	per cent.
Glycerol(I.S.M.).	90·65	88·00	83·24	82·01	78·65
Ash	0·23	1·51	9·00	9·81	10·35
Residue	0·30	2·38	1·46	2·33	4·69
Water	8·83	7·99	6·37	5·90	5·44
	100·01	99·88	100·07	100·05	99·13

TABLE III.

	No. 1.		No. 2.		No. 3.		No. 4.		No. 5.	
	Good saponification glycerin.		Bad saponification glycerin.		Good crude glycerin.		Middle crude glycerin.		Bad crude glycerin.	
Residue obtained by :	Residue. per cent.	Time of evaporation. Hours.	Residue. per cent.	Time of evaporation. Hours.	Residue. per cent.	Time of evaporat tion. Hours.	Residue. per cent.	Time of evaporation. Hours.	Residue. per cent.	Time of evaporation. Hours.
Old method (as described I.S.M., 1911. p. 7)....	0·31	4	2·35	4	1·45	2½	2·36	3	4·70	3
Evaporation at 150°—160° C. with fan	0·30	1½	2·38	2¼	1·44	1	2·32	1½	4·73	1½
Evaporation at 140° C. with blower	0·29	3½	2·38	4	1·49	2½	2·31	2½	4·68	3
Evaporation at 150° C. with blower	0·29	2	2·39	2½	1·44	2	2·31	2	4·65	2
Evaporation at 160° C. with blower	0·30	2	2·39	2	1·48	1	2·34	1	4·67	1

Determination of total residue at 160° *C.*—The quantities for the determinations having been prepared in accordance with the method described on page 7 of the International Standard Methods, 1911, the dishes are placed on top of the oven and the excess water dried off. The temperature of the oven having been adjusted to 150°—160° C., the water is turned on to the blower and the pressure of

Determinations have also been made of the acetyl value of residues obtained by the International Standard Method, and by the modified method suggested, with the results set out in Table IV.

It should be noted that whatever method is used for getting rid of the greater part of the glycerin no variation is made in the method of subsequent bakings ; that specified on p. 8 of the I.S.M. being strictly adhered to. It is not the author's experience, however, that residues continue to lose weight as stated in the first paragraph on the page referred to. Many glycerin residues after the third baking, and most after the fourth, increase in weight.

TABLE IV.

Acetyl value of residues, obtained by different methods. Results calculated as glycerol.

	No. 2. Bad saponification glycerin.	No. 5. Bad crude glycerin.
	per cent.	per cent.
Residue obtained by International Standard method	0·54	1·41
Residue obtained at 160° C., using blower	0·57	1·37

Dishes for organic residue determinations.—Messrs. Schott of Jena have made for this purpose Jena-glass dishes which have many advantages over the petue-dish usually used. They are approximately 80 mm. diameter and 12 mm. deep, and weigh from 15 to 20 grms. The weight alters but very little in use, they seldom crack in the oven and being thin they cool rapidly.

Acetylation of residues—Preparation of residues.—The evaporation of the water extract of a residue, in the acetylating flash, takes several hours on the water bath. This evaporation may be carried out expeditiously by connecting the acetylating flash to a water cooled spiral condenser fixed in a filter pump flask and evacuating with a water suction pump. On heating the flask in a water bath at 70° to 80° C., the water rapidly distils off, leaving the residue ready for acetylation. With this apparatus, using a three-way cock on the connecting tube so that the whole apparatus has not to be re-evacuated each time a flask is removed and another substituted, four or five residue extracts can be prepared ready for acetylation in an hour.

The author is much indebted to Mr. Otto Hehner, in whose laboratory the work has been carried out, for his many suggestions. He is also indebted to Mr. J. H. Coste for information on thermo-electric measurements, and to Messrs. Brown and Sons, the makers of the oven, for their assistance.

DISCUSSION.

The CHAIRMAN thought that the apparatus described might be used for a great many other things besides glycerin.

Mr. W. COLEBROOK REYNOLDS said that he had used a "water oven" fitted with a ball condenser and containing dry boiling turpentine for maintaining a steady temperature of about 160° C., without local superheating. He thought it should prove satisfactory in glycerin analysis and avoid special apparatus. For higher temperatures mixtures of turpentine and aniline could be used but the joints required to be made up with silver solder instead of soft solder.

THE COMPOSITE NATURE OF RAW INDIA-RUBBER.

BY DR. W. A. CASPARI.

(Communication from the Chemical Laboratory of University College, London.)

In recent years renewed attention has been paid to the fact, originally recorded by Gladstone and Hibbert,[1] that raw rubber does not dissolve completely in the usual rubber solvents. Weber,[2] Spence,[3] Beadle and Stevens,[4] and others have effected partial fractionations of raw rubber by means of benzene or chloroform into an insoluble nitrogenous portion and a soluble portion almost or wholly free from nitrogen, and have published observations on the distinctive properties of the two fractions.

It does not appear from the literature that any of these investigators pushed on to a well-defined quantitative separation of the fractions; and indeed it has been observed[1] that the insoluble portion slowly and progressively parts with soluble matter when treated with fresh solvent, apparently *ad infinitum.* Benzene and chloroform, therefore, would not seem to be the ideal solvents for a clean separation. Further and not less important disadvantages of solvents of the benzene and chloroform types are that they have about the same high refractive indices as the insoluble constituent of rubber, and that this constituent swells up in them to an inordinate extent. Consequently the boundaries between dissolved and undissolved are apt to be very imperfect, both mechanically and visually.

The present investigations began with an examination of the various known rubber solvents, leading to the conclusion that petroleum ether of B.P. 40°—65° is the most suitable for effecting a clean fractionation. Rubber swells relatively little in paraffin hydrocarbons, and the residue is opaque and of firmer consistency than in other classes of solvent. The two bodies into which rubber is split by means of petroleum ether may of course be themselves complex; but, such as they are, they may be described thus:—

(A) *Soluble* rubber, an elastic colloid of comparatively poor mechanical strength, with a marked tendency towards tackiness, especially when heated. It yields transparent solutions with rubber solvents, swelling to a moderate extent before going into solution.

(B) Insoluble or, as we may term it, *pectous* rubber, an elastic colloid of considerable mechanical strength. In contact with solvents it preserves its structure and swells to a gel which, when fully distended, is least voluminous in paraffin hydrocarbons, very much more in benzene and its homologues, and most of all in carbon tetrachloride, chloroform, and carbon disulphide.

Both substances consist essentially of the same hydrocarbon $(C_{10}H_{16})_n$, and have about the same specific gravity. Both possess self-adhesive properties, the soluble in a decidedly higher degree than the pectous. The one cannot be separated from the other by fractional precipitation, *e.g.*, with alcohol or acetone. Considerable differences, as will be seen below, exist between the soluble portions isolated from different raw rubbers; and on the other hand the corresponding pectous portions differ no less widely among themselves.

Whilst certain raw rubbers can be thus split into two portions in a definite and reproducible manner, it need not necessarily be assumed that these are wholly distinct forms of rubber. The gel-forming part may conceivably be simply a residue of sol-forming rubber which has failed to burst its way out of a micellular framework possibly consisting of the rubber constituent commonly referred to as protein. We may do well, however, to proceed with some caution in invoking protein, since we have as yet no convincing proof that the nitrogenous matter present encloses rubber particles, or is able to form a framework, or even that it is of the nature of protein at all. Whatever be the truth, it is only to be expected that the bulk of the nitrogenous matter, which is provably little if at all soluble on its own account in rubber solvents, will remain entangled in the gel-forming portion. The point of immediate technical interest is that fractionation by solvents brings out remarkable differences between rubber sorts, and especially between the two great rival classes, viz., Para and plantation rubbers.

When cuttings of rubber are immersed in petroleum ether, swelling takes place during several hours, and most of the soluble passes into transparent solution. In favourable circumstances the pectous remains as well-defined, opaque, discrete masses showing the contours of the original cuttings on an enlarged scale. In many rubbers, however, the pectous is so weak or so small in amount that it runs together to a glutinous mass or tends to disperse itself, and a clean separation is then no longer practicable. Thus of the not very numerous varieties available, all the

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[1] J. Chem. Soc., 1888, **53**, 679.
[2] This J., 1900, **19**, 680.
[3] Journ. Inst. Comm. Res. Tropics, 1907, No. 13.
[4] This J., 1912, **31**, 1099.

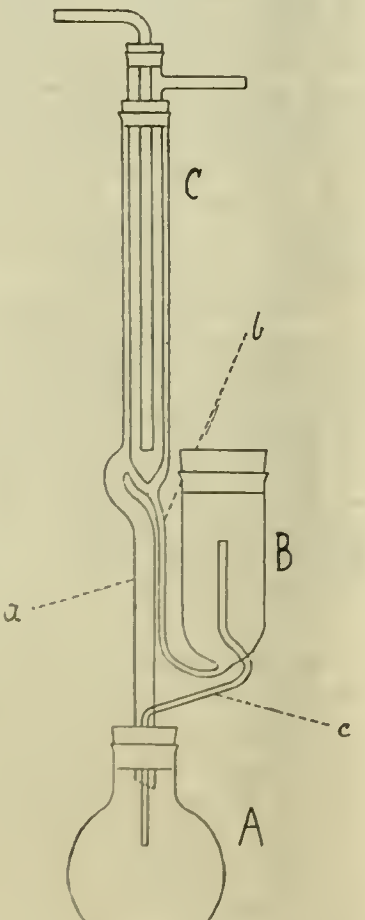
[1] Spence, *loc. cit.*

African sorts behaved unsatisfactorily, as also Caucho Ball, Borneo, and certain plantation sheets. On the other hand, Amazonian rubbers and Ceylon and Malayan plantation rubbers generally permit of a clean fractionation. Quantitative determinations by the aid of petroleum ether are therefore not universally applicable and are likely to be useful mainly in the examination of distinct batches or samples of one rubber sort.

So long as the pectous remains in contact with liquid, care must be taken to avoid anything like violent agitation. When the swollen flakes of pectous are well shaken up with the liquid, they go into a uniform turbid emulsion, the more readily, the weaker they are; plantation pectous, especially, is very easily broken up and has to be handled with care. Once emulsified, pectous rubber is no longer recoverable as such by any process of precipitation or centrifugal treatment. If, however, an emulsion be evaporated to dryness, cut up afresh, and again submitted to the action of solvent, the pectous, having now returned to a coherent condition, separates well enough.

In order to carry out quantitative determinations by means of petroleum ether, either of the two following methods may be adopted :—

(1) *Continuous extraction method,* directed mainly towards the pectous constituent. One or two grms. of clean plantation or washed and dried wild rubber are cut into cubes of not more than 2 mm. and are allowed to soak in about 50 c.c. of petroleum ether for 10 hours. The whole is then cautiously transferred to the receiver B of a special extractor shown in the figure. The flask A is charged with petroleum spirit which is kept boiling. The vapour of the solvent ascends through *a* and is condensed in C. Through *b* the condensed solvent trickles into B from the bottom upwards. An overflow *c*, which can be heightened at will by slipping a tightly fitting glass tube over it, separates the transparent rubber solution from the flakes of pectous which lie at a lower level and returns it to A.



Complete extraction requires about 10 hours. The contents of A are then distilled and dried in a current of inert gas, giving soluble rubber. The contents of B are turned into a wide-mouthed flask and similarly treated, giving pectous rubber.

(2) *Measured-volume method,* directed mainly towards the soluble constituent. One grm. of comminuted rubber is placed in a well-corked conical flask with exactly 50 c.c. of petroleum ether and left to stand overnight. The contents of the flask are then allowed to macerate for a day, being meanwhile frequently agitated by very gently swirling the flask, care being taken not to break up the pectous flakes. Of the clear supernatant, 20 c.c. are pipetted off into a tared wide-mouthed flask, evaporated, dried without overheating, and weighed. On multiplying the weight by 250, the percentage of soluble matter in the sample is obtained.

Method (1) has the advantage of isolating the pectous, which, having suffered little from heat, may be regarded as practically in its original physical condition. The soluble, however, will by this method have been heated for a long time in boiling petroleum ether, and will doubtless have undergone alterations as to its physical condition. By method (2) the soluble is altered as little as possible, and this method should therefore be followed when the viscosity or other physical property of solutions is to be examined. By either method all the resin present, unless previously removed, goes into the soluble fraction, whilst protein, ash, and minor impurities generally, remain entangled in the pectous.

Soluble rubber, thus prepared, has the general properties of unvulcanised rubber, except that it is quite transparent and, if deresinified, colourless. As compared with pectous it is stickier, more plastic, and weaker mechanically. It is worthy of note that soluble rubber, when converted into an emulsion of water in rubber by the ordinary washing process, is extremely difficult to dry, because a transparent surface-layer of dry rubber is formed which is almost impermeable to water vapour. Pectous rubber, in the same circumstances, behaves like a spongy substance and dries quite rapidly. From this it seems to follow that the industrial washing and drying of rubber is rendered possible mainly by the presence of pectous, and that washed crapes should dry more readily, the more of it they contain.

Pectous rubber, when prepared by the extraction method or by a process of thorough washing by decantation, is practically insoluble in petroleum ether. Samples left in contact with petroleum ether for three weeks were found to yield at most 5 per cent. to the solvent. With solvents of the benzene or carbon tetrachloride types, however, the case is altered. These have the property not only of distending the pectous to a very dilute gel but also of gradually taking it into solution. Thus the following successive amounts were found to be dissolved out of 1 grm. of pectous rubbers at one-week intervals :—

	1 week.	2 weeks.	3 weeks.
	grm.	grm.	grm.
Hard Fine Para, benzene	0·019	0·017	0·014
,, CCl_4	0.027	0·021	0·017
Plantation, benzene ..	0.225	0·201	0·186
,, CCl_4	0·260	0·208	0·166

It is seen that Para pectous offers considerable resistance to the dissolving action of these solvents, but that plantation pectous is, in comparison, rapidly broken down by them; in other words, the former is more strongly pectised than the latter.

When the clear solutions obtained by extracting pectous with benzene are evaporated, the residues have a general resemblance to soluble rubber; but they are insoluble in petroleum hydrocarbons, with which they merely yield slightly swollen gels. Towards benzene itself they behave as reversible colloids, giving very viscid solutions after swelling up greatly. There appear to be, then, two kinds of soluble rubber, of which the first is soluble in all solvents and the second insoluble in paraffin hydrocarbons but otherwise freely soluble, and produced by the slow breakdown of pectous in presence of solvents.

Before proceeding to the quantitative results obtained when raw rubbers are examined by petroleum ether treatment, it may be pointed out that *viscosity* measurements with rubber solutions are likely to be most intelligible when carried out on the most homogeneous solutions obtainable. The solutions examined by recent investigators[1] have usually been made with benzene or toluene. Now when rubber is thoroughly swollen in these solvents, most of the pectous passes into a glairy slime which is readily dispersible in, and, being transparent, is indistinguishable from, the solution proper. Such solutions may be proved to contain more than one form of rubber by being diluted with petroleum ether, when they immediately become turbid. In order, therefore, not to complicate matters needlessly, it seems desirable to limit ourselves for the present to the study of the viscosity of soluble rubber alone in solutions. The simplest method of carrying this principle into practice is obviously to measure the viscosity of the transparent solutions produced by the direct action of petroleum ether on rubber. Some preliminary data obtained on these lines are given below.

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[1] Schidrowitz and Goldsbrough, this J., 1909, **28**, 3.
Foi, Koll.-Zeitschr., 1913, **12**, 131.

The subjoined table of experimental results embodies a scheme for the examination of raw rubbers which, when the connection between such data and technical quality is better understood, may prove of some use towards the laboratory valuation of rubber. Column A gives the percentage of resin, determined as usual, columns B and C soluble rubber (minus resin) and pectous rubber respectively. The figures in column D were obtained thus :—

Petroleum ether solutions were prepared by simple maceration according to method (2) and—their concentration having been ascertained—were so diluted with the solvent that there remained 1 grm. of resin-free rubber per 100 c.c. Viscosities were taken at 20° by means of an Ostwald viscometer and the times of outflow were divided by that of pure solvent in the same viscometer.

As a measure, in some sort, of the physical differences between different pectous rubbers, the amount of solvent taken up in swelling was determined (column E). The solvent employed was ligroin of B.P. 100°—120°, which owing to its inferior volatility is more manageable than petroleum ether. About ½ grm. of pectous was weighed out, allowed to swell for 24 hours in a large excess of solvent, rapidly dried by means of filter-paper, enclosed in a weighing-bottle, and weighed. The figures represent multiples by volume.

		A. Resin.	B. Soluble.	C. Pectous.	D. Viscosity.	E. Imbibition.
1	H.F.Para, sample I...	2·9	51·6	45·5	27·0	18·7
2	,, sample II.	3·2	57·0	39·8	25·2	20·9
3	,, Acre	2·5	9·4	88·1	13·3	9·8
4	Manaos Scrappy	1·8	66·4	31·8	4·5	24·7
5	Para Negrohead	1·6	74·5	23·9	4·8	21·2
6	Picos Maniçoba	4·1	62·1	33·9	16·1	9·1
7	Ceara Scrappy	3·5	67·7	28·8	7·7	7·4
8	Ceylon Biscuit— sample I.	1·7	57·8	40·5	14·2	37·6
9	,, sample II.	2·8	68·7	28·5	20·0	33·7
10	Malayan Crape— sample I.	2·8	86·0	11·2	11·3	30·6
11	,, sample II.	2·6	72·7	24·7	16·2	30·3

The above figures, which are taken from the results of the examination of several samples in each class, afford some idea of the typical differences between each class. In general, fine Paras contain seldom less than 35 per cent. of pectous, rising in the case of Acre to over 80 per cent. Lower-grade Amazonian sorts (4 and 5) contain rather less pectous (which, however, is of much the same nature as that from fine sorts), and they are specially characterised by low viscosity of the soluble. The *Manihot* sorts (6 and 7) stand apart in containing a peculiarly weak, inelastic pectous; moreover, the separation by means of petroleum ether is somewhat imperfect. Plantation rubbers contain little pectous (10—25 per cent.), whilst as regards viscosity of the soluble they are not greatly inferior to Para fine.

The contrast between fine Para and plantation is peculiarly instructive as regards the pectous portions. In general, it may be assumed as a first approximation that the "nerve" of raw rubber, no matter whether that property be of ultimate technical value or not, depends in the main on the pectous constituent. Now the pectous of hard fine Para is not only a more important constituent in point of percentage amount than that of plantation, but it is also qualitatively different. Para pectous is altogether a robuster substance than plantation pectous. It is extremely strong in the dry state and yields firm springy flakes when swollen in rubber solvents. Plantation pectous, though moderately strong when dry, yields weak glutinous aggregates with solvents and, as we have seen above, has a relatively strong tendency to pass into a soluble form.

The behaviour of Para pectous, in fact, is much like that of a weakly vulcanised rubber; and the analogy becomes more striking when we consider that, physically, vulcanisation is nothing more than a pectisation of the rubber. Para pectous, as it happens, contains more sulphur than might be expected, as shown by the following analyses of typical hard fine, scrappy, and plantation products :—

	Sulphur.	Nitrogen.	Ash.
	per cent.	per cent.	per cent.
H. F. Para	0·52	0·66	1·36
Para Negrohead	0·31	0·64	1·66
Malayan Crape	0·19	1·12	0·86

Of this sulphur a small proportion must no doubt be set down to mineral sulphates, and a yet smaller proportion perhaps to proteid matter. This pre-vulcanisation, as it were, of Para rubber does not therefore seem to be of the same character as ordinary sulphur-vulcanisation, which calls for at least 2 per cent. of combined sulphur. Whether it is of a chemical nature at all, and whether it is due to the method of coagulation or to some inherent property of the latex, are problems of the future. Meanwhile it would appear that if the production of plantation rubber aims at a close imitation of hard fine Para as its ideal, it has still some ground to cover.

Manchester Section.

Meeting held at Grand Hotel, on Friday, November 7th, 1913.

MR. JULIUS HÜBNER IN THE CHAIR.

A CONTRIBUTION TO THE HISTORY OF DYEING.

BY JULIUS HÜBNER, M.SC.TECH., F.I.C.

In order to appreciate fully the importance and the educational value of historical research in regard to industries and trades, one must read the life work of Beckmann,[4] his History of Inventions. Every student of technology, in my opinion, ought to be acquainted with the history of his particular branch of study. This is, however, almost entirely neglected in our educational institutions and, as a rule, we find only the scantiest historical references in our modern books on technology. In some cases such references consist merely of a repetition of statements which have been made by writers in the latter half of the 18th century and which have passed on from one publication to another to the present day.

I became more firmly convinced of the value of historical research when Professor Meldola made "The Antiquity of Tinctorial Art," a part and certainly not the least important part of his Presidential Address to the Society of Dyers and Colourists in 1910 and in which he concluded with the following statement: "I have in my mind the desirability of technical societies such as ours including in their work the antiquarian side of their subject. This, as a rule, is neglected. Nevertheless it is desirable to secure records of the past with respect to ancient industries, and the experts in any particular subject are assuredly the right people to undertake such work."

Professor Meldola (J. Soc. Dyers and Col., 1910, 26, 107—110) has very fully dealt with many of the interesting statements contained in Pliny,[2] and the history of purple has been most exhaustively treated in "Ein Beitrag zur Purpurkunde," by A. Dedekind (4 vols., Berlin, 1898), whilst references to weaving and dyeing contained in the Old Testament have been cited, among others, in a paper on "The Dyes of the Ancients," by Chas. Glen (J. Soc. Dyers and Col., 1911, 293–6). From these sources I shall, therefore, only quote a few additional passages which may be of interest.

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* The complete titles of publications from which extracts have been quoted will be found at the end of the paper. They are referred to in the text by corresponding numbers.

We have definite proof that the Egyptians practised the art of dyeing during the XII. dynasty, about 2500 B.C. (J. Hübner. "The Analysis of some Ancient Egyptian Fabrics," J. Soc. Dyers and Col., XXV., 8, 1909). The colour of all the dyed mummy bandages was yellowish and in most cases had been produced with the yellow colouring matter of the Safflower. Two of the bandages had been dyed with iron buff. Other colours besides yellow were dyed at this early period, because, according to Glen (*loc. cit.*), a garment dyed with indigo, dating from 3000 B.C., was found in Thebes. In Exodus (XXVIII. and XXXIX., about 1490 B.C.) we find reference to "woollen and linen thread of the finest colours," and to gold cut into wires which were worked "in the blue, and in the purple, and in the scarlet."

According to Herodotus[1] VI. 21 (484—408 B.C.) "the Milesians imported into Tarantum their fine breed of sheep, and at the same time introduced the art of dyeing and preparing wool."

Caecilius[1] (who died 168 B.C.) and Plautus[1] (who died 184 B.C.) inform us that Molochinarius was one who dyed cloth of the colour of the mallow, and Virgil (70—19 B.C.) again refers to the Milesian dyed wools as follows :—

"The nymphs, around her placed, their spindles ply,
And draw Milesian wool of glassy dye."

In Book VII., chap. LVI., Pliny,[2] Holland's Transl. (1601) states that dyeing of wool was the invention of "the Lydians in Sardis," and as regards "Divers kinds of wool and clothes" in Book VII., chap. XLVIII., referring to Egyptian wool, that "the cloth made thereof, after it is worne bare, is then died, and serveth new againe, and will weare still and a last man's life."

The following most curious statement is made in Book VIII.,[2] chap. XLVIII., "I have my selfe seene the sheepes fleeces upon their backes while they be alive, died with purple, with scarlet in grain, and the violet liquor of the fish Murex : by the means of certaine barks of a foot and a halfe long dipped in these colours, and so imprinted and set upon their fleeces as if riotous wantonnes and superfluitie should force Natures worke, and make wool to grow of that colour."

In Book XXI.,[2] chap. VIII., concerning the "mysterie of dying cloth," he speaks of three "tinctures . . . the one in graine which striveth with that bright orient colour in Roses . . . the Scarlet or Purple of Tyros or the double died Dibapha . . . the second Amethyst colour, and resembles the March violet . . . the third made of the purple and porcellane shell fishes . . . for of this tincture there are cloaths which encline much to the colour of Tornsoll." As the name Tornsoll or Turnsol appears repeatedly in old literature, I shall refer to it in the history of colouring matters.

According to Pliny,[2] Book XIX., chap. I., the Greeks, before the time of Alexander the Great (336 B.C.) knew only a few colours. Only during his time and during the time of his successors did they improve in the dyeing of black, yellow, green and other colours when they also acquired the art of making these colours fast on linen.

A very remarkable statement as regards the fastness of the colours is made in Plutarch's Life of Alexander (Bischoff[3]). He found among the treasures in the palaces of the king of Persia a large quantity of purple dyed material which although 180 years old had retained its beautiful brilliancy. He ascribes this to the fact that the purple had been prepared with honey.

There can be no doubt but that alum and a number of other compounds, especially iron salts, were used as mordants in dyeing by the ancients. Although Beckmann[4] maintains that alum proper was unknown in Pliny's time, the following extract from this writer will show that they were acquainted with it. In his XXXV. Book,[2] chap. XV., he states "for the clear alume which they name the white, is proper for to colour wooll with any bright tincture ; contrariwise, the blacke serveth for sad, darke, and browne colours." If the white alum mentioned here had been an iron salt, bright colours could not have been produced.

According to Macquer[5] "the Greeks distinguished three operations in dyeing, *i.e.* (1) opening and dilating of the pores, (2) the dipping into the dyeing liquor, and (3) fixing of the colour by means of certain drugs (of a styptic or astringent quality)." The Romans called this fixing operation "colorem alligare," for which they used a species of fucus, to which Pliny ascribes the property of fixing the colours on wool so effectually as never to be removed.

Lime was also used by dyers in Pliny's time under the name of Lapis Phrigius, probably in dyeing Woad, Indigo or Iron Buff (Pliny,[2] Book XXXVI. chap. XIX. ; Dioscorides, Book V. chap. XLI.).

In a reference to dyeing in the 4th century we find Servius[1] commenting on a remark made by Virgil as regards the high price of Milesian fleeces : "Milesian fleeces, most valuable wools ; for Miletus is a city of Asia, where the best wools are dyed," whilst Prudentius[1] (A.D. 404) in a hymn to the honour of St. Romanus, informs us of the use of herbs in dyeing in the following words :—

"Their hardy frame they deck
All o'er with tesselated spots : and art
Is added, that the threads, twice dyed with herbs,
May sportively intwine their various hues
And mimic forms, within the yielding warp."

Apollinarius Sidonius[1] (Carmen XV.), in describing the products of different countries, informs us that during the 5th century silk was brought from the country of the Seres to be dyed in Phœnicia :

"The Tyrian murex, twice i' th' cauldron boil'd,
Had dyed its silken threads."

According to Bischoff,[3] we find that dyers were highly esteemed in Persia in very early times and that although Mahommedans, they had Christ as their patron. A very quaint old Persian tradition (Henry Sieke, not. ad. Evang. Infantiae Saluator, p. 55) states that Christ was a dyer, that he was apprenticed to a dyer who instructed him to dye fabrics of different colours ; Christ placed all the materials into one vat and the dyer, when he took them out, to his great astonishment, found that they were each dyed to the shade required. Abgeli de la Brosse, in "Lexicon Persicum," under "tinctoria ars" states that even to-day (1641) a dyehouse is called in Persia "Christ's workshop."

Bischoff[3] states that no dyeing was practised in the Occident about the 5th century. Lewis Anthony Muratory, in his Antiquitt. Italic. Vol. II. Diss. 24, p. 367, informs us that in translating an old manuscript from an Italian Monastery, he found that dye houses existed in Italy in the 8th century, but we find it frequently stated that during the 11th century dyeing was introduced into Italy by the Crusaders and with it new colouring matters at that time unknown in Europe.

Black dyeing must, however, have been practised in Germany during the 10th century because Bischoff[3] informs us that under Henry I., the Fowler, a Guild of Black Dyers was formed.

Emperor Friedrich I. (Barbarossa)[3] during the 12th century destroyed Milan, from whence many dyers went to Germany.

That dyeing must have flourished during the 12th century in and near Jerusalem and that it was exclusively in the hands of the Jews, is amply shown in the following statements made by Benjamin of Tudela in Early Travels in Palestine (A.D. 1163, Transl. by Thomas Wright) :— In Jerusalem "the dyeing-house is rented by the year, and the exclusive privilege of dyeing is purchased from the king by the Jews of Jerusalem, two hundred of whom dwell in one corner of the city, under the tower of David," further, "twelve Jews, dyers by profession, live at Bethlehem," and about Nob, the city of the priests, he states "the two Jews who live here are dyers." In Jaffa we are informed "one Jew, only, a dyer by profession, lives here," whilst about Brindisi "containing about ten Jews, who are dyers," "Corfu, containing but one Jew, a dyer, of the name of R. Joseph," and finally, in the neighbourhood of Thebes there are "about two thousand Jewish inhabitants. These are the most eminent manufacturers of silk and purple cloth in all Greece."

Somewhat later the art of dyeing in Italy was exclusively in the hands of the Jews, who, no doubt, had been brought from the East.

Most elaborate regulations for dyers were in existence in Germany in very early times. Bischoff[3] informs us that an apprentice had to serve five years before he was able to become a "master dyer," and that he had to work winter and summer from four o'clock in the morning till seven o'clock at night. The five years apprenticeship was finally followed by a practical test called "the master-piece" (Meisterstück) for the "master-ship." This consisted in dyeing "24 ells of white, two ells wide linen cloth from the clear indigo vat; further 2 lbs. of woollen yarn blue from woad and the same quantity green from indigo."

As early as the 13th century the German dyers formed a guild (Extr. from Christoph Theophilius von Murr,[3] Aelteste Nürnbergische Handwerks-Geschichte and Original Urkunden von 1258—1540).

A French "reglement" of 1385[3] divides the dyers into those of "the great dye" (Teinturiers en bon teint) and those of "the lesser dye" (en petit teint).

In 1418 we find a law in Germany (Lübeck, Puetters Reichsgeschichte, 145, IV.[3]) prohibiting a merchant buying undyed cloth in one town and having it dyed in another. The cloth had to be dyed where it was bought. The dyers at this time were divided into Cloth-, Woad-, or Rhenish Dyers and into Black-, or Bad Dyers (Schlecht Färber), and somewhat later into Woollen-, or Fine Dyers, Black Dyers and Silk Dyers. It was in the 15th century that we first find the manufacture of silk introduced into Germany and the silk dyers possessed the privilege of not belonging to a guild; their art was considered a "free art," they did not bear the name or "masters" but that of "Gentlemen" (Herren).

In the 16th century a distinction was made between Black Dyers and dyers of other colours thus:—in 1505, Hanns Schwarzferber (Black Dyer) and in 1537, Wilhelm Aichler ein Ferber (a Dyer).

Bischoff's[3] description of the travelling of the dyers' assistants (Wanderjahre) is most interesting reading. He shows how the dyers moved from place to place and how each master gladly gave shelter to the travelling dyer in order to obtain the latest knowledge as regards the progress which had been made in dyeing in other parts of the country. Thus whilst dyeing may have been considered "a secret art," as far as the outside world was concerned, evidently there existed the true spirit of co-operation among the dyers themselves; this is more than can be said of them in later times.

According to Beckmann[4] a recess of the Diet in 1577 prohibited the use of indigo instead of woad, describing it as a pernicious, deceitful, eating and corrosive dye "corroding devil" (Fressender Teufel), for which vitriol and other eating substances were used. This prohibition was renewed in 1594 and 1603. A further prohibition was issued in Saxony in the year 1650 by Duke Ernest the Pious.

In England we find the first mention of indigo in 1581 under the reign of Elizabeth; this however refers to black dyeing *i.e.*, "that no woollen articles were to be dyed black with either gall-nut, madder or other materials till they had received the first ground, or been rendered blue by woad, or woad and indigo together."

There can be little doubt but that the early Britons knew how to weave (Barlow[7]) for pieces of coarse cloth have been found in ancient British Barrows. Boadicea (A.D. 62) is said to have worn under her cloak a motley tunic checkered over with many colours, which was probably of native workmanship.

William of Malmesbury (1095—1143)[7] in referring to the making of tapestry by Anglo-Norman ladies says:—"The shuttle is not filled with purple only but with various colours."

In 1199[7] cloth was worked at Nottingham and "all persons within ten miles of the town were forbidden to work dyed cloth except in the borough." White and red cloth made in Ireland was at that time much used in England.

In "Calendar of Patent Rolls,"[8] 1243, 27 Henry III., under Winchester, Feb. 22nd, we find mention of wool in the following instructions:—"Safe conduct for the good men taking the king's carded wool (stamen) to London and elsewhere through this land to make his profit thereof," and further under May 19th, 1272, Westminster, "Licence for Poncius de Mora, king's merchant of London, to export wool, he having sworn on the Gospels that he will not export or sell the same to Flemings or anywhere within the power of the Countess of Flanders," whilst in 1277, 5—6 Edward I.,[8] we find mention of a fuller as "Adam le Fullere" and a deed referring to "Roger the dyer" bears the date 1307.[8]

That dyeing, however, has been practised in this country before that time is certain because we find in the records of the borough of King's Lynn a roll probably made in the reign of Edward III., which is a copy of a much earlier document, the Composicio de Lennae, 1243, showing the "Costumies de la Tolboth de Lenn" in which are set forth the dues payable on Woad or "wad" as it was then called: "of evy tenne w^t wad iiii. d. (Plowright.)[9]

In 1268 an agreement[9] was made between the citizens of Norwich and the Woad merchants of Amiens and Corby regarding dues on woad and in the Lynn Customs Rolls of 1302 and 1303 we find reference to the importation of 11 casks of "wayd" from Amiens.

In 1317 (Close Roll,[9] 11 Edward II. m. 22) it is stated that "Walter de Cotiller of Exeter lately brought five barrels of woad (gaide) price 140 good pounds of Tours and Elbeuf."

After this we find more frequent mention of dyers, but, I am sorry to say, not in any connection with their "art"; with few exceptions they are accused of stealing, murdering and other criminal offences. Thus Walter le Dyer of Oxenford, Geoffrey le Deyghere, John le Sherere are mentioned in 1338, whilst reference to a dyer in the north we find under Oct. 30th, 1339,[8] namely, "William le Dyere, son of Walter le Dyere, of Preston." Among others who broke into a park at Hungerford, Co. Berks., hunted therein and carried away deer, were no less than three dyers (March 10th, 1342).[8]

In 1343,[8] 17 Edward III., May 26th, is recorded a "Pardon to Roger son of Walter le Deyghare of Ludelowe of his outlawry in the County of Middlesex, and on July 1st, of the same year, a "Promise to William the Dyer (Tinctore) of Gisbourgh to pay to him 11 marks due for two sacks of his wool." In 1338,[8] Feb. 14th, two chaplains were to be found "to celebrate divine service daily in the said church for the good estate of Philip le Dyere, Margaret his wife, William le Dyere and Isabella his wife in life."

Reference to a dyer, probably of leather, in Ireland, is found in an agreement re hides in 1354,[8] which was made by John Dyere of Drogheda.

So far I have not been able to find any other records from which it might have been possible to obtain more exact information as regards the practice of dyeing and the gradual development of it during the 13th, and the early part of the 14th century, but from the following extracts we find that it must have been in a fairly advanced state about the middle of the 14th century.

According to Riley[10] in 1352–3, in 27 Edward III., "the King had a Subsidy granted to him of 6d. per each Scarlet Cloth, 3d. for a Half Cloth died in Grain, and 4d. for a Cloth not grained." That the dyers tried to evade the duty is clearly shown in 32 Edward III., Aug. 6th, 1358,[8] because we find regulations re cloths which had been brought white to places and were then dyed, fulled and sold before they were sealed. He appointed searchers "to make inquisition in the counties of Bedford, Buckingham, Cambridge, Huntingdon, what and how many weavers, fullers, dyers and hirers of weavers there are in each city . . . and in whose hands or keeping those dyeworks have been, and to charge and compel all such weavers, fullers, dyers and hirers of dye-works, by their oaths and grievous amercements, they must not let any cloths pass out of the dye house until it has been sealed with the seal ordained for the collection of the custom." This regulation was sent out to all counties. It is interesting to note that nearly all the names attached to this document are of foreign origin.

The following regulations for checking the "malpractices" of dyers we find in 36 Edward III., A.D. 1362, Letter Book G. fol. CI, namely "no dyer who dyes wools with woad, shall dye hats, caps, linen thread, or silk" and "that no dyer shall refuse to let anyone take away his dyed wools, without demanding anything for the dyeing of them, before the wools so dyed shall be dry." In a notice in Edward III., A.D. 1369, Letter Book G. fol. CCXIX., we find "delivered into Simon Posse, dighere, a cup . . . and the said Simon found sureties, namely, Walter Flynt, and Victor de Male, dighere."

A reference to leather dyeing and the use of Brazil wood is contained in "Articles for Leather Sellers and Pouchmakers and for Dyers serving those trades" (46 Edward III., A.D. 1372, Letter Book G. fol. CCLXVIII.) namely:—"sheep leather scraped on the back in counterfeit of roe-leather, dyed in divers colours, in deceit of the people . . . no dyer of leather shall cause to be dyed in brasil that has been delivered by any leatherseller or pouchmaker unto him for dyeing his leathers, the leather of any other person." The articles are signed among others by Richard Westone, dier, and Katherine, his wife.

Madder, Weld and Woad are mentioned in 1374 by Chaucer in Former Age (Murray[6]) "No madder, welde, or wood, no litestere Ne knew," and in Nun's Pr., "End-Link" 13[6] we also find reference to Brazil wood and to Cochineal in the following words:—"His colour for to dyghen with brasile ne with greyn of Portyngale.

During the 14th century Edward III. brought a number of dyers from Flanders and Holland.

Already in 1415 Coventry was known for its blue dyed materials.[9] In that year the inhabitants petitioned Parliament against the artifices of the dyers of that town, on the ground that "there is a confederacy and agreement in the mystery of the Dyers in the same town that none of the said Dyers will dye a dozen of cloth of common colour for less than 6s. or 8s., "whereas they used to dye in ordinary past years a dozen of such cloth for 5s. or 6s.; and further, if any of the goods were not sufficiently dyed or came out false "they would not abate a 'denier' of their price nor amend their mystery"; also that the said Dyers are great common cloth-makers in the same town, and use in their cloth all the flower of the Woad: "and the remainder which settles down must serve the common people; to the great deceit, damage, and oppression as well of the common people living in the said town as of others around."

According to Anderson[11] England exported in 1428 "two pieces of Scarlet, one piece of Sanguine dyed in grain, two pieces of Marbel clour . . . two pieces of Russet of Mustrevillers, two pieces of black Cloth of Lyre, one piece of white cloth, three hundred pieces of Essex Straits (all woollen cloths) and a few more yards of Morrey, died in grain, some red, green, grey, Brunette, and twelve yards of red Sattin (Satyn figurato)."

The term "to dye in grain" has been used in very early times. Originally it meant dyeing with the scarlet grain or Kermes and later on with Cochineal, but still later, dyeing in the fibre itself or more generally to dye in any fast colour. Thus Plutarch (Murray[6]) informs us that "this sail . . . was not white but red, died in grain, and of the colour of Scarlet." Chaucer in "Squire's Tales" (503) mentions "so depe in grayn he dyed his colours," whilst in John Weaver Wells Wills (1531, Murray[6]) we find "Maud K. my gowne off vyolett yn grayne." In Fuller, Pisgah IV., VI., 99 (1650, Murray[6]) it is stated that the term "in grain" is distinctly used as referring to fast colours only, because he informs us that "these colours not being dyed in grain, lose much of their lustre, and gloss in washing." Further proof of this is found in the London Gazette, No. 4540/6, of 1709, "the best broad Italian colour'd Mantua's at 6s. 9d. per yard, and grain colours in proportion," and in "English Gazetter," of 1778 (Murray[6]), "Strond, Famous for dying scarlet broad cloth, and for all other grain colours."

Between 1429 and 1453 (Edward VI., and Henry VI.,[8]) the following dyers are mentioned in different State Papers: Henry Dyer of Wytteney, Co. Oxford, "dyer"; Henry Moundevyle of Wytneye, Co. Oxford, "diere"; Thomas Dyere of Corscombe, Co. Somerset, "dyere"; William Dyer of Fordyngbrygge, Co. Southampton, "dyer"; Adam Dyer of Chepnyngcampeden, "dier," and John Dier, alias Henry of Warminster, Co. Wilts., "dier" alias "baker."

I have given these names in addition to those already mentioned chiefly in order to show the different ways of arranging the names and of spelling the word dyer.

As regards the word dyeing we find in "A Dictionary of Archaic and Provincial Words" (J. O. Halliwell, 1904) that the word "lit" meant "to colour or dye," and the author finds that in Scotland in early times litster meant dyer. This is illustrated by North in the following:—"He'll die all manner of colours but blue, and that is gone to the litting" (Upton's MS., addition to Junius) and further in (MS. Lincoln A.I. 17, f. 33): "We use na clathes that are littede of dyverse colours: our wiffes ne are not gayly arayed for to please us."

Madder and Woad are also mentioned in 1436 (Murray,[6] Pol. Poems (Rolls) II., 180) in "Yit marchaundry of Braban and Selande the madre and woode that dyers take on hande to dyne with."

The making of caps was the principal trade of Coventry prior to the year 1436 and the manufacture of woollen broad-cloth was introduced when the town became famous for its "Coventry true blue."[9] The term "true blue" was adopted by the Puritans in opposition to the scarlet badge of Charles I. In an old proverb it says:—"He is true blue, he'll never stain."

We find that a Company of Dyers is mentioned as a Guild in 1188, but the first Charter of Incorporation was granted to the Worshipful Company of Dyers by Henry IV., on February 16th, 1471. The Charter was renewed by Edward IV., December 2nd, 1472, in the same words, and was subsequently confirmed by Henry VIII., Edward VI., and by Philip and Mary. An inspeximus Charter was granted by 2nd Elizabeth, November 22nd, 1559 (fine paid £6. 13s. 4d.), and by 4th James I., June 30th, 1606. Under the Charter no person could exercise the Art of Dyeing in London or within ten miles thereof unless he were a Freeman of the Company. Under the Bye-laws of the Company, approved 31st October, 1704, the Company had jurisdiction over the trade in the City and within ten miles thereof, with power to enter and make search in every House, Shop and Warehouse within the radius, and to take for such search once every quarter 1s. towards the expenses. The Company also had power to impose certain penalties in the event of the use of substitutes for the proper materials in dyeing. By the Act of Parliament of 23rd, George III., Chap. 15, of 1783, special powers were given to the Company with reference to the preventing of fraud and abuses in the trade.

The Company together with the King and the Vintners' Company are the only persons who have the privilege of keeping Swans on the River Thames. Sir Robert Tyrwhitt, the younger, of Leighton Broomswould, in the County of Huntingdon, gave in 1545 to the Dyers' Company his mansion-house in Upper Thames Street, known as "The Three Stars" and other estate there, now Dyers' Hall Wharf. A painting of the Wharf showing dyers washing their dyed cloths in the River Thames, by Samuel Scott, is in the Guild Hall and a copy of it, presented to the Dyers' Company by John Henry Smee, is in the Dyers' Hall in Dowgate Street. The Hall of the Company originally stood on the present site of the Dyers' Hall Wharf, Upper Thames Street, and on its destruction by fire in 1666 and 1681 was built in College Street, Dowgate Hill. The present Hall stands on the same site, and was rebuilt in 1838.

The Company owns Almshouses, which were originally situate in White Cock Alley, Thames Street, and in Dyers' Buildings, Holborn, they were subsequently removed to City Road, and finally to Dyers' Buildings, King Henry's Walk, Balls Pond, where they still remain. About these Maitland[12] informs us that one was "for the benefit of Six poor widows, who are allowed Thirty Shillings per annum each," whilst the other "contains Eight Rooms for so many aged poor Women who are only allow'd Two-pence per week, which shows the Foundation to be of an ancient Establishment."

The Arms of the Dyers' Company (Fig. 1) contain a chevron engrailed *argent*, between three bags of madder of the last, corded *or. Crest*: on a wreath three sprigs of the grain-tree erect *vert*, fruted *gules*, etc., with the Motto:—"Da gloriam Deo."

This is all the information which the author was able to obtain because nearly all the muniments and records of the Company were destroyed by the Fire of London, or by a subsequent fire in 1681, and there is unfortunately no printed History of the Company in existence.

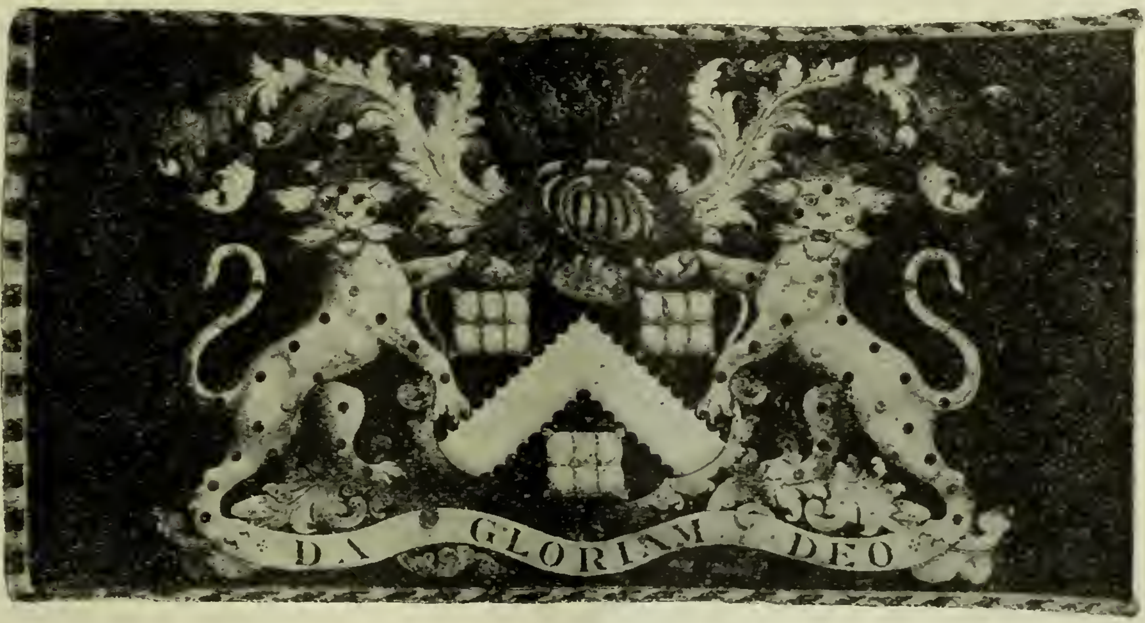


Fig. 1.

According to Anderson,[11] Henry VII., in 1507 granted "a Licence to Augustin Chigi, a Merchant of Sienna in Tuscany, to import from Flanders . . . 1300 Quintals of Alum" but "not to sell the said Alum at a higher price than £1. 6s. 8d. per Quintal or Hundredweight." In 1608, in the reign of Queen Elizabeth, an alum works was established by Thomas Chaloner, at Gisborough in Yorkshire. James I. assumed the Monopoly and Charles I. in 1625 prohibited the importation of foreign alum into England.

In "Letters and Papers" 14 Henry VIII.[13] we find that the weavers of the City of York had a privilege granted that "no one else to make cloths dyed or striped within the city"; provided that the dyers without the city shall not contribute to those within. Cochineal is distinctly mentioned in a letter (of January 17th, 1538)[13] of Husee to Lady Lisle in which we read that "the kersey that James left to be dyed scarlet cannot be done, as there is no grain to be had, and Baptist, the dyer, will not do it for 6s. the yard." From this we are able to form an idea as to the costliness of dyeing at the time.

The use of Brazil wood, presumably in place of Cochineal, was condemned in 1532–3[13] in Act 24 Henry VIII., ii., "Diers . . . haue vsed deceyuable waies in dyeing with brasell and such other lyke subtilties."

That English Dyers specialised in early times is shown in "Les clarcissement de la Langue Francoyse compose par maistre Jehan Palsgraue Angloys natyf de Londres et gradue de Paris. Anno uerbi incarnati MDXXX." I have taken the following extracts from the Original (Black Letter) in the British Museum:—"This dyer dyeth none other colours but only scarlets." He also refers to the use of Madder in "I Madder clothe to be dyed" and "Your vyolet hath nat his full dye but he is maddered."

Among the materials in use in Palsgrave's time should be mentioned:—"Alume to dye colour with all. . . . Brasell tre to dye with . . . Gall to make ynke with . . . Grayne bery . . . grayne to dye with . . . Maddre an herbe . . . Mirabolan a frute . . . Wode to dye with." Whilst "Clothe wollen . . . Clotho lynen . . . Clothe tyssue . . . Damaske . . . Dressar of wole . . . Flese of wolle . . . Flaxe wyfe . . . Fustyan . . . Raw clothe na fulled . . . Saye clothe (serge) . . ." are mentioned, only two references to cotton are found namely "Cotton for weke" (I assume for lamp wicks), and "Noppe of wolle or clothe" which he translates as "Coton do tapis."

In books containing instructions for dyeing which were published prior to the middle of the 17th century no mention is made of the dyeing of cotton. This may be explained by statements found in Barlow.[7] He informs us that cotton was imported from Antwerp into England in 1560 and Wm. Camden (1551—1623) speaking of Manchester says:—"This town excels the towns immediately around it for handsomeness . . . but did much more excel them in the last age as well by the glory of its woollen cloths, which they call Manchester cottons."

In a pamphlet entitled "The Treasure of Traffike" by Lewis Roberts, published in 1641, which I consulted in the Manchester Free Library, the first mention is made of cotton being made into cloth in Lancashire, and in the "History of the Cotton Manufacture," by Baines, this statement is confirmed. What before this time went under the name of Manchester cotton was really composed of wool.

The "Calendar of State Papers, Domestic Series"[14] supplies us with authentic information regarding dyeing and dyers in this country during the 16th and 17th century. The following extracts have been taken from the copies in the British Museum.

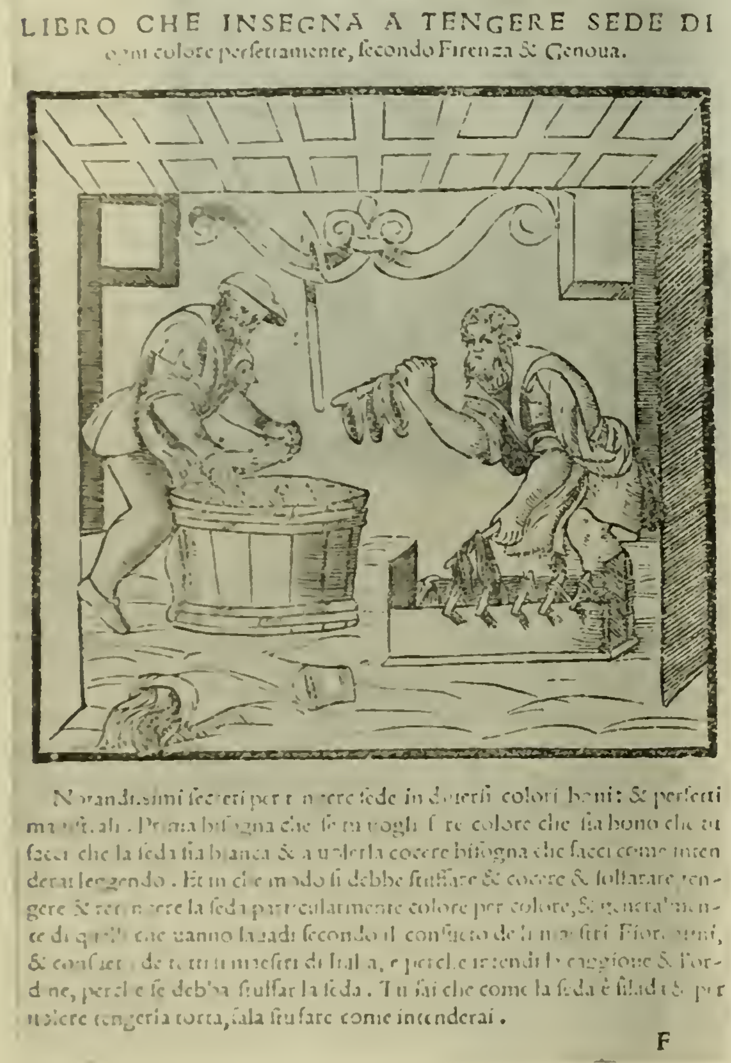
"Peter Back to the Queen (Elizabeth)[14] on June 7th, 1567, solicits to be allowed to carry on certain experiments in the manufacture of salt, and preparation of madder as a dye," whilst in April 1571, Caspar Vosbergh sent a communication to Burghley concerning the uses of Woad in dyeing.

On June 23rd, 1572 the Wardens and Company of Dyers of London[14] sent to Burleigh "observations on Mr. Hasting's plan for the dyeing of all cloths and manufactures in England, with curious particulars of the art and mystery of dyeing."

On September 29th, 1573[14] the "Articles of a bill for the true dyeing of wools and cloths" and on March 7th, 1576,[11] the advantages to be gained by the bill for the avoiding false and counterfeit colours, and for bringing in a true and perfect manner of dyeing into the realm, with answers to the same, were published.

Logwood was extensively used during the 16th century. The blues produced by dyeing with this material were, however, very fugitive and the blacks no doubt inferior to the "woaded and maddered" blacks then in vogue. This gave rise to the "Act of the 23rd year of Queen Elizabeth (Cap. IX)[14] prohibiting the Use of Logwood or Blockwood in the dyeing of cloths . . . as a Practice False and Deceitful, directing all Logwood found, to be burnt."

It is interesting to note[9] that the trade which flourished in Coventry for so many years and to which I referred above, decayed in consequence of the importation of a foreign article. Shakespeare in "Certayne ordinary Complaints of divers of our Countrymen in these our Daye," in 1581, refers to various trades and he advocates the establishment of new ones and also "other sciences mo." "I have heard that the chief trade of Coventry was heretofore in making of blew threde, and then the town was rich even upon that trade in manner only, and now our thredde comes all from beyond sea. Wherefore that Trade of Coventry is decaied, and thereby the town likewise."


LIBRO CHE INSEGNA A TENGERE SEDE DI
ogni colore perfettamente, secondo Firenza & Genoua.

F

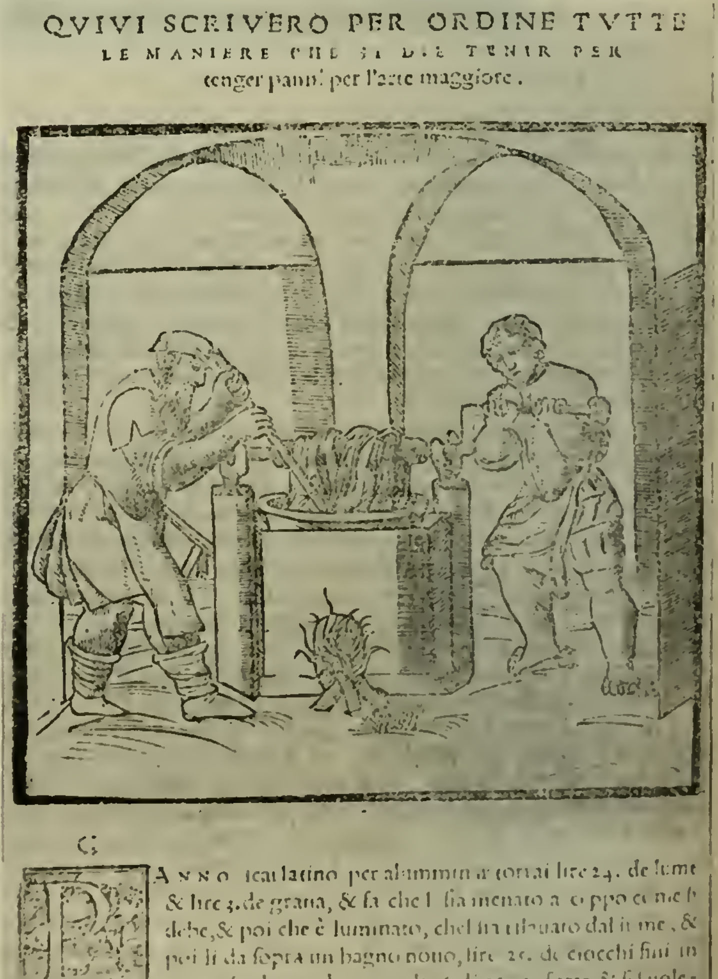
FIG. 2.

From Anderson[11] we learn that in 1603, Raleigh tells King James I. "that there were about 80,000 undressed and undyed Cloths annually exported from England;" he urges the dyeing of these cloths at home. We find the further statement that "Hitherto the English were but little skilled in the Arts of dyeing and dressing their own Woollen Cloths . . . they usually sent them white into Holland, where they were dyed and dressed." Alderman Cockayne suggested a scheme to support the dyers and further to give to the King a monopoly of the "home-dyed cloths." The King, on his advice, issued a proclamation, prohibiting any white cloths to be sent beyond Sea; seizing at the same time the Charter of the Company of Merchant Adventurers, which empowered them to export white cloths. "The Hollanders and German Cities . . . resenting this, prohibited the Importation of all English-dyed cloths." The working of the Act proved however unsuccessful because Cockayne's cloths "were worse done than those done in Holland," and, when in addition, the weavers objected very strongly, Cockayne's Patent was annulled in 1615, the Lord Chancellor Bacon saying:—"As we may think to hold up our Cloathing by Vent of Whites, till we can dye and dress; so the Dutch will think to hold up their Manufactures of dyeing and dressing upon our Whites till they can cloathe."

According to Bischoff,[3] the first regulations for dyers were issued in Venice in 1429 under the name of "Mariegola dell'arte tintori." It is however doubtful whether these regulations were printed; no copy can be found in the British Museum. Further, the word Mariegola is meaningless, it should probably be La Regola or La Riegola, *i.e.*, the Regulation. It is also stated that an edition of these regulations appeared, in 1510.

Gioanuentura Rosetti, the Director of the Arsenal in Venice, found these regulations very incomplete. In order to obtain further knowledge as regards the art of dyeing he travelled in Italy and in other countries and he ultimately published his experiences in 1540 under the title:—"Plicthos de Larte de tentori che insegna tenger panitelle banbasi et sede si per larthe magiore come per la comune." At the end of the book we find:—Composte per Gioanuentura Rosetti prouisionato to ne le Arsena. dallo Illustrissimus Senato Venetiano. MDXL.

Plictho was an assumed name and the title translated means:—"Plictho's art of Dyeing, which teaches how to dye cloth, linen, cotton and silk, in durable as well as false or common colours." The book contains two pictures, one of a cloth dyer, the other of a yarn dyer (Figs. 2 and 3) which are of interest because they are the earliest prints relating to dyeing which the author has been able to find. They have been photographed by permission from the originals in the British Museum.


QVIVI SCRIVERO PER ORDINE TVTTE
LE MANIERE CHE SI DIE TENIR PER
tenger panni per l'arte maggiore.

G

Cardinalesco.

FIG. 3

Below Fig. 2 the dyeing of scarlet on woollen cloth with Cochineal, alum and Brazil wood is described according to the "Great Art," whilst general instructions for the scouring and dyeing of silk yarn, as practised by "the great Masters of Florence and other towns of Italy" are given below Fig. 3. Rosetti does not mention indigo in his book and we must, therefore, assume that it was not used in dyeing in his time in Italy. Another edition of Rosetti's work was published in 1611.

The first book printed in black letter in the English language which deals with the subject of dyeing and which is not mentioned by Bischoff, is "A profitable boke declaring dyuers approued remedies, to take out spottes and staines, in Silkes, Veluets, Limmen and Woollen clothes. With diuers colours how to die Veluets and Silkes, Linnen and Woollen, Fustian and Threade. Also to dresse Leather and to colour Felles, etc. . . . with a perfite table hervnto, to fynde all things readye, not the like reuealde in English heretofore. Taken out of Dutche and englished by L.M. Imprinted at London by Thomas Purfoote and William Pounsanbie. 1583." The name of the author is given in the British Museum Catalogue as L(eonard) M(ascall).

The methods of dyeing given in this book are highly interesting and I feel that it will not be out of place to give one or two, which I have copied from the original.

"To dye wool. Ye shall put too foure pounde of woollen yearne tenne ounces of Allum, and seeth it with branne water so much as ye shall thinke good, then take your yearne out, and put that water out of that Kettle, and put therein agayne three partes of fresh branne water, and one part of fayre cleare water, then warme it a little on the fyre then put therein two pound of greening weedes and let it so warme a while, then put therein your wool, and styr it wel with a sticke the space of three howers, but let it not seeth, in any wise, so done, then take out your wooll agayne, and put it agayne into your Kettle, and put thereto half a glassful of vnsleakte lime, with as much common ashes, and thereto put your wool agayne and styrre it with a staffe six or seuen Paternoster whiles, than take foorth your wooll and ye shall haue a fayre colour."

In some of the recipes the words "wood" and "woad" are used indiscriminately. Verdegrease is given for dyeing yellow and among other materials employed we find :—"Oken woode," samfleure "or samfloure" (Safflower), used in dyeing "linnen or thread red." He clearly describes the removal of the yellow colouring matter of the Safflower by placing it into a bag and by washing it repeatedly. He further refers to "Brasill," "gall nots," and "also for red silke to dye with crap dye so calde in dutche," which no doubt is madder.

"To make a good black dye" he uses galls, copperas, "Rye meale and halfe so much of swarfe of the grindstone, and so much of elder barke, and in the like of olde yron, and the scales of yron, as it come off by the hammer beating."

In some cases it is difficult to find out what ingredients are actually used because he does not translate the old Dutch words; thus for dyeing a "carnation" he uses "purpur that is dye and lay it to soke a night in pisse." The "purpur" may have been Cochineal.

A most accurate description is given of the preparation and the working of the Woad vat in "A fayre Linnen cloth to dye blue." "A vessell of halfe an Ame so cald in dutch" (an old German or Dutch measure equal to about 40 gals.) is used for dyeing with "3 pound of wheat bran, 3 pound of ashes, and a pound of greening weede, stir al this in the pan, and let it seeth iii or iiii paternosters long, then take of floray under half a pound, and soke it in faire water, and let it there rest a quarter of an houre couered," the floray is then put in the "Ame," the hot liquor poured over it and allowed to stand covered "and looke if the die begin to come, or begin to wax green." The dipping of the cloth, followed by wringing is next described and then "let it rest so, two or three houres, till ye shall see the dye begin to come, and the flower to lie aboue, and to euery going ye go thereto, see if the colour be green ynough, or waxe greene, and when ye shall scom of the flower with a dish, and then put your cloth agayn therein." From the foregoing we may infer that Indigo proper was not used but that the colouring matter employed consisted of the flower of the Woad vats or, may be, of that of the Indigo vats employed in other countries. Of this Pliny informs us that it was used as a painter's colour. We find it in early English books under the following names :—Florey, floree, floray, florrey, flurry, fleur and flower.

Among other ingredients Mascall mentions :—"Yelow wood, woad, graynes Bloemen so calde in dutche (probably the same as floray) lacke, saffron, horsetayle, coperose, salammoniacum," the latter was used along with Brazil wood, "lack" and "old pisse, of such as vse to drinke much wyne, and let it stand till it stinke," for dyeing "a fayre red colour" on leather, and the "flowers of the blue bottles among corne."

"Endir" and "Endiz" are also mentioned for dyeing blue; to these I shall refer when dealing with the history of Indigo and Woad. In order to produce a green colour the "leaues of an herbe calde night shade" were employed along with alum, whilst for dyeing leather a red colour, "Mosherump with a little unquenched lyme and brasill" was used. The "lowe elder berryes . . . buds of white and blackthorn, which ye must gather in the moneth of August . . . barkes of Pomegranads and the pilles of dryde Oranges" were employed especially in dyeing skins.

A most curious recipe is given for dyeing with Madder "called Kubea tinctorum" (a misprint, Rubea) on "skinnes." They are first prepared with "lyes of whyte Wyne, . . . baye Salt and ashes of the shelles of Seacrabbes"; they are then dyed with Madder and alum.

"Black after the common sort of the countrey women" (which shows that home-dyeing was practised by women) is described in the following words :—"firste they al to strike their hose, or other cloth with swart of the grindstone" then they lay "alder pilles" and cloth in alternate layers and boil. Instead of alder may be used one of the following materials :—"plumtree pilles, black thorne, yong oken pilles, oke apples greene, tender shewts of bracbryers, greene walnut huskes."

One more point of interest should be mentioned, namely the preparation of so-called "Waters" for dyeing. These were evidently made for home-dyeing and sold to the country people. Thus we find a "black water" and a "red water to dye with." In these waters the colouring matters were precipitated and in order to fix them more readily on the fibres gum arabic was added.

In 1607, Oct. 21st (James I.[14]), we find "Reasons for the cherishing of the mistery, *i.e.*, the trade of dyeing in England, showing clearly the imperfection of the present trade, and the promises of the artists who profess to use logwood in a better manner than formerly." This is indorsed "David Ramsay's petition for priviledge to dye."

A licence was given to Sir Arthur Aston in 1604 (Aug. 23[14]) for 41 years, to use and sell certain woods used in dyeing whilst in 1607, Sept. 21st, duties were imposed on Blockwood, Logwood and other woods used for the dyeing of cloths.

That foreign dyers were still largely employed in this country is shown by a "Grant to . . . Simon Russell and Peter Carpinter, dyers of Flanders, of denization," given on Jan. 20th, 1608.[14]

The prohibition of the importation of Logwood made it necessary in 1608 (June 13th[14]) to issue a warrant to pay to the Earl of Dunbar £4,000, in compensation of the imposition laid upon Logwood, Brazil wood, etc., which was formerly granted him in lieu of a patent for the sole manufacture of Logwood revoked by Parliament.

That silk must have been dyed in large quantities in this country in the 17th century is shown in a record[14] dated Jan. 22nd, 1608, Serjeants' Inn. "According to his Majesty's pleasure we have considered the best remedy of the great abuse in dyeing black silks . . . no person shall dye, within England or Wales, any raw silk in skeins into the colour called coal black or London heavy weight black, but into that called light weight black; nor shall augment, by dyeing or otherwise the weight of any kind of raw silk above the quantity of 6 oz. per lb. avoirdupois of organzine silk and 8 oz. thrown silk."

In 1608,[14] Oct. 21st, we find that a fixing material for Logwood had been invented because it is stated that "the sole venting and making of the fixing stuff, and the dyeing and finishing of true wearing colours in logwood, *non obstante* any law. . . ." The Lord Mayor of London called all the dyers together and examined them when "they disclaimed the use of logwood, yet the contrary was proved." They stated that "logwood betterd the dyeing."

In this document regulations are given for dyeing and we find further that somebody asks for "Liberty for the sole making and finding of the fixing stuff to such dyers as dye with logwood . . . upon grounds of woad or madder or both;" the payments to him are then stated. He prays that if this is not granted the dyers will soon make the stuff themselves "for men of art, after sometime using the said stuff, will find the way of making it." It is further stated that "they enter into their books fustic instead of logwood, and more is so entered than there is in the Customs' book in a year," and "if dyers desisted the use of logwood . . . as their falsehoods will be discovered, it would advantage his Majesty much more in his customs, by the importation of madder, woad, cochineal, etc."

In 1610[14] we find reference to "bombazine cotton" which however most likely consisted of worsted and silk, in the following statement, "for reformation of frauds daily committed in the manufacture of bombazine cotton and in the dyeing of silk."

That the privileges granted to the Merchant Adventurers evidently interfered with the weaving and dyeing trades is borne out by a statement found under March 29th, 1610, as follows[14] :—"The Merchant Adventurers will either pay £50,000 to the King, or perform the contract treated with Lord Fenton, but this has dangerous exceptions. The cloth-workers and dyers threaten to cut the throats of the old Company, especially of Sir Lionel Cranfield. The Lords are negotiating with the old Company to set them to work," and further a "Petition of the handicraft cloth-workers and dyers in or about London to the King, that he would direct the Merchant Adventurers to employ them, for relief of their great distress."

That the use of Logwood was still considered dangerous in 1615[14] is shown in "Grant to Rich. Giles of London, of the office of seizing and burning all logwood and deceitful dyeing woods brought into the port of London."

In May, 1619,[14] an act was passed for the reformation of dyeing because "there are a number of black dyers, and there being some abuse in dyeing. An agreement was made between the four silkmen and the four dyers that all silk of that nature should be dyed in their four houses and the rest of the dyers come to work with them." This resulted, however, in dishonest dealings and was, therefore, broken off.

James I.,[14] on June 26th, 1619, gave a licence to Sir Thos. Coventry, to confer with silkmen and silk dyers for reformation of abuses in dyeing their silks." In the same year on July 12th a patent (No. 14) was granted to George Wood for printing. The following is the entry of the grant in the record books of the Great Seal Patent Office :—"A special priviledge graunted to George Wood for twenty-one yeares of 'the sole printing and stayning, within England and Wales, of linnen cloth in colors,' paying yearly into His Mat^{s} excheq^{r} Xii."

James I.[14] (Feb. 29th, 1620) also issued a "Proclamation prohibiting the general import of logwood, but permitting Sir Thos. Crompton to import 50 tons yearly to be used in dyeing mean commodities only . . . all the logwood imported to be seized, half of it burned and the other half delivered by the informer for £6 per ton to Sir Thos."

The dyers seem, however, to have taken but little notice of this prohibition, because in 1622[14] (Feb. 20th) "the Wardens and Assistants of the Dyers' Company of London searching for goods deceitfully dyed found in the house of Daniel Tilbergen and Peter Cozie, both aliens, the false and deceivable dye called logwood and cloth dyed therewith. They tried to seize it but were forcibly prevented by the wife and servants of the parties."

The prohibition of the use of logwood and the fact that large quantities of goods were still sent to foreign dyers resulted in great distress among dyers in this country, and in 1622[14] they petitioned "against foreign dyers not to buy cloth from them."

Madder was probably not cultivated in this country before 1624. because we find that on Jan. 22nd a patent (No. 28) was granted to William Shipman to "vse, exercise, practice, and putt in vse, the sowing, setting, and planting of the herabe, roote, or plant called madder."

The difficulties experienced by the Dyers' Company in searching the dyehouses is illustrated in another petition[14] submitted on July 30th, 1628, in which we find it stated that "in the 20th year of King James the Council granted a warrant to the Petitioners for the better execution of their charter in searching deceitful work appertaining to the same mystery. Having been withstood in their search by persons which keep their doors locked, and set their servants and mastiff dogs upon the petitioners."

The application of tin in dyeing scarlet with Cochineal was discovered about 1630. Although it has been stated by some that this discovery was made by a German named Kuster or Kuffler, there is no doubt but that it was accidentally discovered by a Dutchman named Cornelius Drebbel of Alkmaar, who was a merchant, not a chemist, as has been frequently stated. Kuffler was a dyer in Leyden to whom Drebbel communicated the details and who put the discovery into practice in his dyehouse. After him the colour was first called Kuffler's colour and later Scarlet of Holland. A Fleming named Kepler brought the secret to England about 1643, when the first dyehouse for dyeing the new scarlet was established at Bow near London. For many years the colour was known under the name of Bow-dye. That the process did not long remain a secret is seen from the remarks made by Boyle (p. 1052).

In Anderson[11] we find it stated that "Painted Callicoes are first mentioned as imported by the East India Company in 1631."

David Ramsey in a patent dated Jan. 29th, 1634 (No. 68), describes "a new waye of dyeing woollen and lynnen clothes, stuffe, silkes, and other manufactures, in any kind of coloure, without the helpe or vse of cutchinell, that shall be as perfect, permanent and lasting as any grayned coloure soe dyed with the said cutchinell, and that the dyeing shal be pformed . . . by the only vse of matteriall naturally groweing and arising within our owne domynions."

The following record is of special interest because it refers to dyers and dyeing in Lancashire in 1635.[14] It is a petition to Charles I., from William Forth, Mayor of Wigan, in which he certifies that "the dyers of Wigan, Prescott, Ormskirk, and Bolton are injured by the shearmen thereabouts, who ingross into their hands the woollen cloths, and unless the dyers will dye them the same at that rate that the shearmen may gain a penny a yard profit, can obtain no work." This is followed by another Petition by the dyers in which it is stated that, "the shearmen or fullers in the above Parishes have taken into their hands the dyeing of the countries woollen cloth. They put it out to dyeing for them, and will not permit any dyer to receive it except the shearmen receive a penny per yard profit."

A most curious statement is contained in a communication dated 1637[14] (Charles I.) in which Edward Daniel says "that this wool of these several colours may be dyed with sea-coal as well as with wood or better for we here in London dye wool, cloths, silks and other stuffs with sea-coal." I have been unable to find any reference to sea-coal as regards its use in dyeing in the early literature except that Gerarde[16] informs us that it is identical with Sea-bindweed or Soldanella, which possesses astringent properties.

That as late as 1642[14] a great number of foreigners were employed in dyeing in this country is borne out by the following act: "Rates for the dyers of cloth and stuff being Strangers born, to pay the king for being tolerated to continue their trades."

According to Anderson,[11] in 1654 the finest English Broad-cloths were still sent to Holland to be dyed and dressed but that in 1667 "one Brewer from the Netherlands, came over to England with his Servants and had due Encouragement from the Crown for instructing our People in dyeing and dressing for our finest white Woollen Cloths."

The year 1667 is one of special interest as regards the history of dyeing. In this year the Gobelins Manufactory was established in Paris for the making of Tapestry and other furniture materials for the use of the Crown. The factory was built by two brothers, Giles and John Gobelin, but so little faith had the people at the time in the undertaking that it was named "Gobelin's folly" (la Folie-Gobelin). Later on when the successful working of the establishment had become an accomplished fact, the name was changed to "Hotel Royal des Gobelin."

Although we have seen that the English Government of that time paid certain attention to the art of dyeing, the measures intended for advancement of the industry were practically, without exception, in the form of prohibitions of the importation and the use of certain materials employed in dyeing. At the same time the Government of France was engaged in a much more serious consideration, namely the providing of instructions for dyers in order to improve the state of the art. Thus we find that John Baptist Colbert in 1669 instructed d'Albo to compile regulations for dyers which were issued in 1672 in Paris as "Instruction générale pour la teinture des laine de toutes couleurs et pour la culture des drogues ous ingrediens qu'on y employe."

His division of all the dyers into "dyers of the greater dye" (teinturiers en bon teint) and "dyers of the lesser dye" (teinturiers en petit teint) was however in existence in a "French Reglement" of 1383.

Bancroft[15] informs us that in 1662 the Royal Society, then recently formed, at their meeting on the 30th of April desired Mr. Haak to translate "Plictho" into English. This was however never done.

Sir William Petty, at the request of the Royal Society, submitted "An apparatus to the History of the Common Practices of Dyeing," which was printed in 1667, in "The History of the Royal Society of London," by Thos. Sprat. The following extracts from this valuable work provide a clear picture of the methods and the materials used in dyeing in Petty's time. After a description of the use of brimstone in the bleaching of silk and wool, he states that "The last I shall name is the colouring of Wool, Linnen, Cotton, Silk, Hair, and the Threads and Webs of them with Woods, Roots, Harbs, Seeds, Leaves, Salts, Limes, Lixiviums, Waters, Heats, Fermentations, Macerations and other great variety of Handlings."

Of the materials used he mentions: "Iron and Steel in all true Blacks, called Spanish Blacks . . . in Flanders Black they use copperas, steel filings and slippe, which is the stuff found in the troughs of grind-stones . . . Pewter for Bow-dye, Scarlet . . . Litharge, to add weight unto dyed silk . . . Arsenick is used in Crimson . . . Verdegrease is used by Linnen Dyers in their Yellow and Greenish Colours . . . Allum, the very true use thereof seems to me obscure enough, notwithstanding all the Narrations I could get from Dyers about it."

The different views held at the time, as regards the action of alum in dyeing are then very fully discussed and he finally comes to the following conclusion: "Wherefore I conclude (as the most probable opinion) that the use of allum is to be a Vinculum between the Cloth and the Colour."

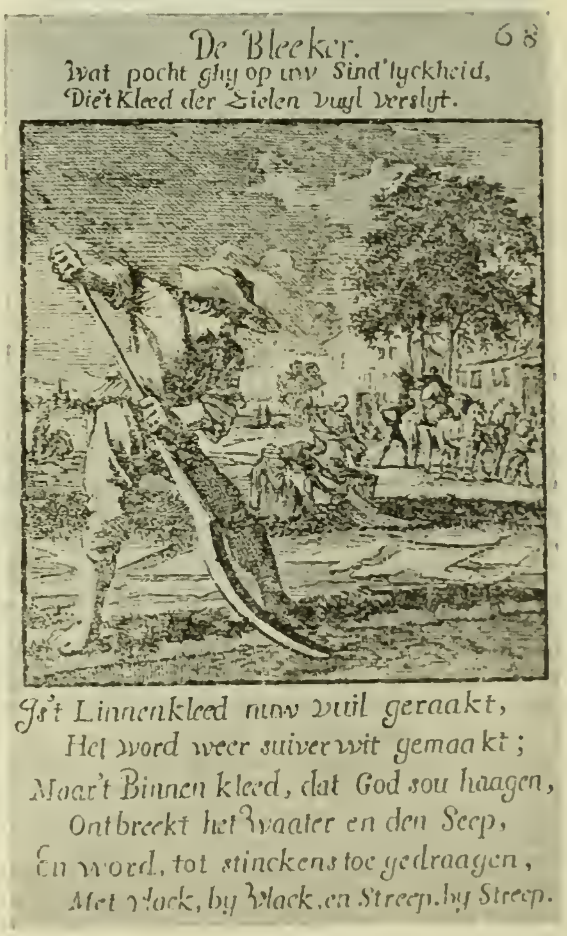
Among other ingredients used by dyers at the time are mentioned: "Salt-Peter . . . Lime is much used in the working of the blew-fats . . . Of the Animal family Cochineel (if the same be any part of an Animal) . . . Urine of labouring men, kept till it be stale and stinking . . . honey . . . Yelk of Eggs, and Ox-gall."

That the action of soft and hard water respectively in dyeing with the different colouring matters was clearly understood, is well illustrated in the following remark:—"There are two sorts of water used by Dyers, viz., River water and well water (harsh water). The Dyers use this water in Reds . . . This water is naught for Blews and makes Yellows and Greens look rusty." "Water is called by Dyers White Liquor . . . Liquor absolutely is their Bran-liquor . . . now Bran-liquors are used for mealy dying stuffs such as Mather is." He ascribes the fixing of the colouring matter of the Madder to the starch in the bran. He then repeats a number of the materials already mentioned but names among others:—"Alder, Bark, Pomegranate, Pills, Wallnut rinds and roots, Oaken Sapling Bark, and Saw-dust of the same; Crab-tree Bark, Galls and Sumach . . . but of the Colorantia Colorata are of three sorts . . . of which Logwood, old Fustic, and Mather are the Polychresta . . . Woad, Indico, Weld, Wood-wax, Turmeric . . . Redwood, Brazel, Cochineel, Safflowres, Kermes-berries and Sanders, the latter of which is seldom used and Kermes not often, . . . Arnotto and young Fustick."

As regards Weld he informs us that "this weed is much cultivated in Kent, for the use of London-Dyers," whilst about "Wood-wax or *Genista Tinctoria* commonly called Gasing weed by the Dyers" we find that it is "seldom made use of only as to coarse Cloths."

A remark which deserves mention on account of its curiosity is the following:—"In Cloth Dying wood-soot is of good use." He states that soot of wood "containeth in itself both a Colour and Salt . . . the natural colour which it Dyeth of itself is the Colour of the Honey; but it is the foundation of many other Colours upon Wool and Cloth; for other things 'tis not used."

From the following statement we may assume that a kind of discharging was practised in Petty's time:—"Some of the Dyers Materials are used to bind and strengthen a Colour, some to brighten it, some to give lustre to the stuff, some to discharge and take off the colour either in the whole or in part and some out of fraud, to make the Material Dyed (if costly) to be heavier." Unfortunately he does not mention the particular materials which are used for discharging.



De Bleeker. 68

Wat pocht ghy op uw Sind'lyckheid,
Die't Kleed der Zielen vuyl verslyt.

Is't Linnenkleed nuw vuil geraakt,
Het word weer suiver wit gemaakt;
Maar't Binnen kleed, dat God sou haagen,
Ontbreekt het Waater en den Seep,
En word, tot stinckens toe gedraagen,
Met Vlack, by Vlack, en Streep, by Streep.

Fig. 4.—A Bleacher.

As regards the boiling-off and the weighting of silk we are informed that one pound of raw sik "loseth four ounces by washing out the Gums and natural Sordes, and that the same scowred Silk may be raised to above thirty ounces from the remaining twelve, if it be dyed black with some Materials."

In concluding his remarks he expresses the firm belief that secrets cannot be kept for any length of time because "were not Watches . . . or lately the Bow-dye, devis'd by particular men, but soon made common." It is, therefore, clear that the dyeing of Cochineal Scarlet was commonly known and practised in this country before 1667.

Figs. 4 and 5 have been taken from :—Het Menselyk Bedryf, Vertoond in 100 Verbeeldingen van Ambachten, Konsten. Hanteeringen en Bedryven ; met Versen. Amsterdam Gedaan door Johannes en Caspaares Luiken, 1694.

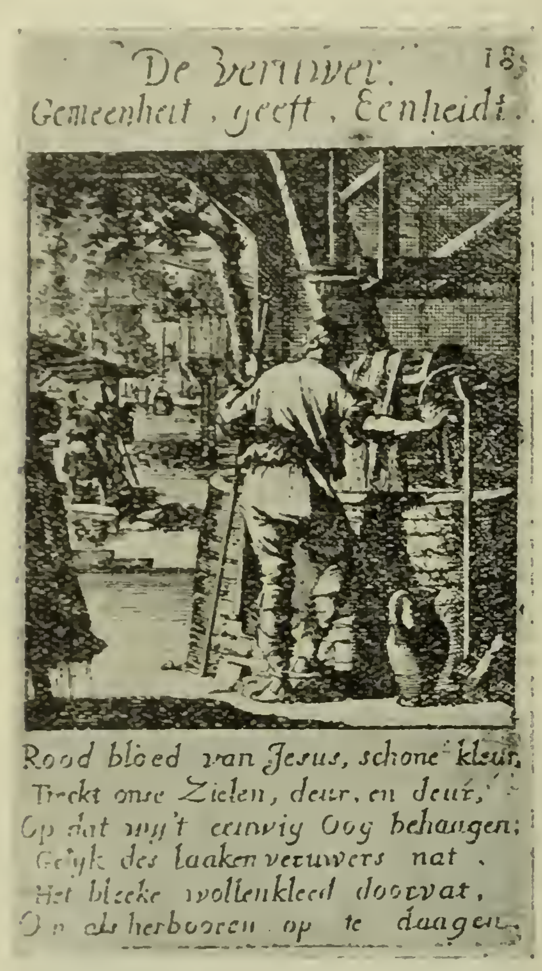

De Verruwer. 183
Gemeenheit, geeft, Eenheidt.
Rood bloed van Jesus, schone kleur,
Trekt onse Zielen, deur, en deur,
Op dat wy 't eeuwig Oog behaagen;
Gelyk des laakenverwers nat
Het bleeke wollenkleed doorvat,
Om als herbooren op te daagen.

FIG. 5.—A Dyer.

The preamble[14] to the Act of the 13th and 14th of Charles II., declares that " The ingenious industry of modern times hath taught the dyers of England the art of fixing the colours made of Logwood, alias Blackwood, so that by experience they are found as lasting as the colours made with any sort of dyeing wood whatsoever." This was given as the reason for repealing the statute of Elizabeth and was no doubt brought about by strong influences on the part of the dyers although the methods suggested for fixing the colours produced with Logwood had certainly failed.

According to Anderson[11] printing of calico " was first set Foot in London " in 1676. In the same year a patent (No. 190) was granted to William Sherwin for " A new and speedy way for printing of broad callicoe & Scotch cloth, with a double necked rowling presse, which being the only true way of East India printing and stayneing such kind of goods, was never till now performed in our kingdome of England or dominion of Wales."

In 1677 a Latin edition of Robert Boyle's works was published in Geneva whilst an English edition under the title " The Works of the Honourable Robert Boyle " appeared in London in 1772.

In this we find that Boyle was acquainted with a blind Dutchman, John Vermaasen, who " discerns colours with his fingers," black being the roughest, and also that a blind Earl of Mansfield could distinguish black from white by the touch.

In a letter from H. Oldenburg to Boyle, dated Aug. 25th, 1664, it is stated that Boyle had considered the question of more suitably fixing Logwood. " Mr. Howard affirms to have the way of fixing log-wood . . . and it was committed to him, yourself and Dr. Merret to consider of a way of fixing all sorts of colours."

I found some interesting information as regards dyeing in a book written by G. Markham, published in London in 1683, entitled " The English House-Wife." After discussing the preparation of wool, hemp and flax, speaking about the house-wife he states that " this done, she shall send them unto the Diers, to be died after her own fancy ; yet forasmuch as I would not have our English House-Wife ignorant in anything meet for her knowledge, I will shew her here, . . . how she shall dye her Wool her self into any colour meet for her use." The methods given are crude, but the results may have been as satisfactory as those produced by the modern " house-wife " when resorting to home-dyeing. One of the instructions deserves mention because it is another example of a method of dyeing in which soot is employed. " First boyl your wooll in Allum and Water, then take it forth, and when cold, take Chamber-lye, and Chimney soot, and mixing them together well boyl your Wooll again therein."

The year 1685 deserves special mention because a number of skilled dyers came to this country from France, on account of the " Revocation of the Edict of Nantes." By this measure France lost more than 500,000 of her most industrious and useful subjects, of whom over 70,000 settled in this country.

Whilst at the close of the 17th century calico printing was in its infancy in Europe, the most beautiful work was already produced in India by a combined method of stencilling and dyeing. A most remarkable and clear description of the processes employed is found in the letters of a missionary, Father Cœurdoux (Vol. XXVI., Recueil des Lettres Edifantes), communicated to the Royal Academy of Sciences of Paris by the Abbé Mazas (Mém. des Sçavans Étrangers, tom. IV. Bancroft[15], p. 350), a short résumé of which I shall give here. The dyer and calico printer will readily recognise the similarity between the processes employed in these early times and our modern methods.

The partly bleached cloth from the weaver was first worn next to the skin by the dyer and his family during eight to ten days. This was followed by several macerations in water with the addition of goats' or sheep's dung, beating, washing and drying by exposure to the sun, soaking in extract of the external parts of the fruit of the yellow myrabolan tree with buffalos' milk, then squeezing and drying. Pressure and friction was applied to the cloth by means of wooden rollers, in order to obtain a surface smooth enough for drawing the mordants with a stencil. The black pattern was produced by drawing with iron liquor, made by dissolving iron in a mixture of sour palm wine and water in which rice had been boiled. In order to produce a blue pattern, the cloth was soaked in goats' or sheeps' dung, washed and dried. The blue pattern was traced with charcoal, every other part covered with melted wax and the piece dyed in the Indigo vat. The wax was then removed by means of hot water and dung, the cloth rinsed, dried and beaten and then boiled with " Washermen's earth " (probably fuller's earth). This was followed by dunging, washing, drying, beating and oiling in buffalos' milk and myrabolans. For red, aluminium mordant, for violet, a mixture of this with iron mordant was stencilled on the cloth, which was then dried in the sun, soaked in water and ultimately dyed with certain roots, probably madder. The goods were finally washed with goats' dung, soaped and bleached in the sun in order to clear the whites. Yellow and green was then stencilled on the white and blue parts respectively, by using alum, galls, pomegranate rinds and turmeric.

I feel compelled to conclude my remarks with the close of the 17th century because the progress made during the 18th century is too extensive to permit its inclusion in this paper. For the same reason the special history of individual colouring matters has also been excluded, but I hope to bring these omissions before you at some future date. As the title of my paper indicates, I make no claim to completeness, especially as regards the history of dyeing in the East, but I have carefully studied the original publications available in the British Museum and other Libraries, and have endeavoured to quote correctly from early literature.

I conclude with the words which Beckmann, the founder of technological science and the creator of the word technology, used in the Preface to his History of Inventions :— " I am sensible that many here will find circumstances which they may think unworthy of the labour which I have bestowed upon them; but those who know how different our judgements are respecting utility, will not make theirs a rule of mine."

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Municipal School of Technology,
Victoria University, Manchester.

Newcastle Section.

Meeting held at Armstrong College, on Wednesday, October 15th, 1913.

MR. E. F. HOOPER IN THE CHAIR.

THE FRACTIONAL DISTILLATION OF MIXED PINE WOODS.

BY J. H. PATERSON, D.SC., AND R. E. FORBESTER, M.SC.

Abstract.

Large quantities of wood, mostly pine wood, have to be got rid of every year in our shipyards. The following experiments were undertaken with a view to determining whether it would be possible to carbonise the wood and recover the by-products in such a manner as to make the process a commercial success.

The experimental plant consisted of a cylindrical iron retort six feet long by 14 inches in diameter, mounted in a brick setting and heated by hot air supplied in such a manner that the temperature inside the retort could be kept stationary at any point between 100° C. and 400° C. for a considerable length of time. The retort, holding about ½ cwt. of mixed pine wood, was connected with three condensers and a scrubber in which to wash the escaping gases with the tar from a previous operation. In all the tests performed with this apparatus the temperature was raised from about 120° C. to 200° C. over a period of from 10 to 15 hours, and the distillate collected separately. The temperature was then raised to 400° C. and the distillate passed into the series of condensers mentioned above.

Twenty-three of the charges consisted of pitch-pine only, dried at a temperature of 60° C. until it lost 10 per cent. in weight. Forty of the charges, consisting of the broken waste from a wood chopping machine, were dried until they lost 18 per cent. in weight before charging into the retort.

The following are the average yields per ton of wood:—

	Pitch pine.	Mixed pine woods.
Turpentine oil	14 gals.	8 gals.
Tar	97 ,,	49 ,,
Acetate of lime	30 lb.	50 lb.
Alcohol and acetone	1½ gals.	2 gals.
Charcoal	500 lb.	370 lb.

Turpentine oils.—The colourless oil obtained during the first distillation of the wood had a sweet pine-like odour and was quite free from the smell of smoke or creosote. It contained 95 per cent. of hydrocarbon oils and 73 per cent., which boiled within the limits of turpentine, had a refractive index of 1·4626 (at 17° C.) and a specific gravity of 0·846 (at 17° C.). In all its properties it is identical with American turpentine.

Tar oils.—Three samples of about 4 kilos. of the tar were distilled from a copper retort with the following results:—

Table I.

Percentage volume of distillates from tar samples.

Temperature	Sample I. Heavy tar.	II. Light.	III. Heavy.	IV. Heavy steam distilled.	IV.(a) Residue from IV.
To 100° C..					
Water	57·6	34·5	29·9	—	33·3
Oil ..	7·3	8·6	4·5	4·2	1·4
100°—150°	1·5	1·1	13·8	—	8·5
150°—200°	7·0	3·3	5·9	—	15·0
200°—280°	3·3	—	8·7	—	*
Residue (solid) ..	23·3	52·5	35·4	—	

* Oil began to crack and turn solid.

Samples I. and II. represent the distillate obtained when working with undried wood, and sample III. when working with artificially dried wood. Frothing was excessive during the early stages of distillation.

A sample (No. I., Table I.), consisting of 4 lbs. (1816 grms.) of heavy tar from the first condenser was distilled from a copper retort. The oils obtained were pale yellow but rapidly turned brown on standing. Table II. shows the result of this distillation.

Table II.

1816 *grms. of tar.*

		Oil.		Aqueous.		
No.	Temp. °C.	Vol. c.c.	Sp. gr.	Vol. c.c.	Sp. gr.	Acid value calculated as acetic acid.*
						grm.
1	89-98	75	0·895	240	1·00	3·46
2	98-98·5	30	0·965	300	1·01	6·12
3	98·5	18		290	1·015	8·00
4	98·5-101	8		145	1·02	10·96
5	101-175	28	0·993	30	1·04	7·78
6	175-220	125	1·001	30	1·003	1·53
7	220-280	60	0·989	10	1·001	nil
Residue		grms. 428				
Remarks		c.c. oil 344 114 grm. residue		c.c. 1045 =57·6 per cent.		Total= 37·85 grm.

* Other acids also present.

The aqueous portions coming over below 98° C. were further fractionated, when 65 c c. of a pale yellow liquid were obtained boiling below 97° C. This fraction contained both methyl alcohol and acetone. On neutralising it with caustic soda a pale yellow oil was precipitated. This oil rapidly polymerised to a dark reddish brown resinous mass, which was extracted with ether, dried and weighed and found to be 5 grms. or 7·7 per cent. of the distillate, and consisted of aldehydic and ketonic bodies. The large proportion of non-tarry matter in the samples examined is probably due to the type of condenser used. In it the retort gases blew through the tar and pyroligneous acid, keeping them constantly churned up. As the proportion of polymerisable bodies in the pyroligneous acid obtained is not nearly so great as that shown above it is evident that they must be dissolved in and retained by the tar. If these substances were separated on a commercial scale it is probable that they would find considerable use as wood preservatives or fillers of porous material.

The oils obtained in the above distillation were then mixed and fractionated.

TABLE III.

Fractionation of oils obtained.

Fraction.	Temperature ° C.	Oil. c.cs.	Spec. grav.	Refractive index.	c.cs. Sol. in water and dil. HCl.	c.cs. Soluble in NaOH.	Loss.	c.cs. Hydrocarbons (left).
1	To—80	5	·900		nil	nil		12
2	80—95	7			nil	nil		
3	95—140	25	·906	1·4646	15	4	4	78
4	140—159	25	·916	1·4847				
5	159—180	51	·921	1·5120				
6	180—200	50	1·021	1·5298	12·5	12·5	4·9	21·1
7	200—217	67	1·020	1·5366	16·7	18·4	5·1	26·8
8	217—250	36	1·007	1·5456	—	6·6	2·8	26·6
9	Residue	30						
Total ..		296			44·2	41·5	16·8	164·5

Each fraction was washed with dilute hydrochloric acid and then with caustic soda. To determine the composition of the resulting creosotes the percentage of monohydric and dihydric phenols in the largest fraction was determined by a modification of Béhal and Choay's method, which consists in converting the methyl ethers into their corresponding phenols. The mono-phenols are distilled off in steam and the dihydroxy-phenols are extracted from the residue with ether. The guaiacol is converted into catechol and the creosol into homocatechol. In the diphenols obtained in these experiments practically no catechol was found showing the absence of guaiacol in the original creosotes. Of the creosote obtained from fraction 6 (Table III.) 75 per cent. proved to be mono-phenols or derivatives of monophenols; the remaining 25 per cent. consists of creosol.

The hydrocarbon oils—insoluble in hydrochloric acid and caustic soda—were then mixed, washed with water, dried over calcium chloride, and subjected to fractional distillation with the results shown in the following table:

TABLE IV.

Fraction.	Temp.	Per cent. vol.	Sp. gr.	Refract. index.	Percentage Residue after oxidation.
1	To 156°C.	13·5	·883	1·4828	0·9
2	156—164	15·5	·890	1·4881	0·8
3	164—184	43·5	·903	1·4972	1·0
4	184—194	9·5	·910	1·5142	8·0
5	Residue	17·5			
Loss		·5			

All the oils obtained were pale yellow in colour, quite free from smell of creosote and did not darken on exposure to light. Fraction No. 2 boils within the limits of turpentine but has a higher specific gravity and a higher refractive index—the specific gravity of pure American turpentine being ·855—·876 and its refractive index 1·4693—1·4732. The drying power also of this oil was not as good as that of turpentine. These facts point to the presence of higher homologues of pinene in the oil. The residue left at the end of the distillation was viscous and dark brown.

Samples of each of the fractions were oxidised as completely as possible with potassium permanganate and the residue steam distilled. Small quantities of a colourless odourless oil were obtained in each case. The quantities obtained were too small to experiment with but were practically certain to be paraffin hydrocarbons. The percentage volume of these hydrocarbons is shown in the last column of Table IV.

The acetyl value of the dried oil was found to be 6·1 (average) proving that the oils do not consist entirely of hydrocarbons.

As stated before the fractional distillation of the crude tar was rendered very difficult by the continued frothing of the mixture. To obviate this, 4 kilos of the tar were distilled in steam at 100° C. until only a trace of oil came over with the water. The first runnings of oil were practically colourless but they gradually darkened as the distillation proceeded till finally they were almost black: 169 c.c. of oil were thus obtained. Washing with dilute acid and caustic soda removed 23 c.c. The hydrocarbon oil was washed, dried and fractionated with the following result:—

Fraction.	Temperature.	Percentage volume.
1	To 156° C.	32
2	156°—164° C.	19
3	164°—184° C.	33
4	184°—194° C.	6
5	Residue	9

These fractions were similar in every respect to those obtained by the previous distillation although the percentage of lower boiling point hydrocarbons was much greater. The residue left after steam distillation was a thick viscous oil which was itself distilled again with the result shown in column IV. (a), Table I.

SUMMARY.

In a properly designed apparatus the fractional distillation of the pine woods available in England is not a difficult matter. The main objection to the process is the great length of time required to complete the distillation. This is due to the bad conductivity of the material inside the retort and increasing the fuel and labour costs and decreasing the capacity of the plant seriously interferes with the success of the operation.

The turpentine obtained is practically indistinguishable from American turpentine and would command an equal price.

The heavy tar has the following composition:—

Phenolic bodies	9·5 per cent.
Basic ,, ...	10·0 ,,
Hydrocarbon oils	36·0 ,,
Pitch residues	25·5 ,,

The phenols consist mainly of monophenols and creosol. The hydrocarbon oils contain small quantities of the paraffins and higher alcohols but appear to consist mainly of pinene and its homologues. They have fair drying properties and would make good turpentine substitutes. It seems likely that commercially it would be feasible to steam distil out hydrocarbon oils from the crude tar and replace them by less valuable coal tar or petroleum residues without destroying the creosoting value of the tar.

In conclusion we wish to express our indebtedness to Messrs. Swan Hunter and Wigham Richardson at whose instigation some of the above experiments were carried out.

Nottingham Section.

Meeting held at Nottingham on Wednesday, October 29th, 1913.

MR. J. T. WOOD IN THE CHAIR.

A CHROMOGENIC ORGANISM CAPABLE OF DECOMPOSING TANNIC ACID.

BY S. R. TROTMAN, M.A., F.I.C.

Abstract.

The discolouration of some leather was traced to the use of a particular sumac, from which a bacillus was isolated which reproduced the original discolourations on sound goods. The organism is a short oval mobile bacillus. It forms a white growth on gelatin without liquefaction, but produces acid. When grown in peptone broth it is also colourless, but in the presence of a little tannic acid a dark brown colour is rapidly produced. Grown in sterile sumac extract, the production of colouring matter is accompanied by a reduction in the amount of tannic acid present.

Discussion.

Mr. J. T. Wood referred to some experiments carried out by himself many years ago on the fermentation of extracts of tannin brought about by a mould (penicillium), and remarked that recently Louis Knudsen in America had referred the action of such moulds to an enzyme, tannase, previously discovered by Fernbach. It would be interesting to know whether Mr. Trotman's bacillus also secreted tannase. So far as he was aware, however, the enzyme did not produce colouring matter. What was the reaction of Mr. Trotman's solutions?

Mr. D. J. Law inquired whether the colour was produced on a precipitate of pure tannin and gelatin, and also whether Mr. Trotman knew what was the nature of the colouring matter.

Mr. Trotman, in reply, said that the reaction of his solutions was strongly acid, and the same colour was produced in gelatin containing tannin as in peptone broth. He was not aware of the nature of the colouring matter.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8d. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Chemical reactions; Apparatus for effecting,——. F. E. Matthews and E. H. Strange, London, and C. A. Pim, Rushgar, Ireland. Eng. Pat. 22,737, Oct. 5, 1912.

The apparatus described in Eng. Pat. 13,051 of 1912 (this J., 1913, 740) is modified by arranging a collecting gutter in the reaction chamber, from which the condensed liquid is returned to the vaporising chamber by a curved tube.—W. H. C.

Agitating or aerating liquids or pulps: Method and apparatus for——. A. C. Howard and Minerals Separation, Ltd., London. Eng. Pat. 22,743, Oct. 5, 1912.

An agitator formed of curved, upright, radial blades and having a circular horizontal plate below, or intercepting them, is rotated with the concave surface of the blades forward, in a vessel with flat sides provided with an inlet and outlet for the pulp and placed in the pulp tank. Either above or below the horizontal plate, or both above and below, the radial blades do not extend inwards quite to the axis. Between the agitator and the containing vessel there may be a number of vertical baffles of expanded metal, lattice-work or the like, so disposed that the flat faces thereof obstruct the rotary movement of the pulp.—W. H. C.

Centrifugal machines. W. W. Richardson, London. Eng. Pat. 26,201, Nov. 14, 1912.

The pulp or liquid is fed through a central pipe into the annular space between two concentric cup-shaped vessels, spaced apart, and rotated together. The liquid, or liquids and solids rise within the annular space, become separated by the centrifugal force and are guided by dividing rings in the upper part into annular collecting channels. Both the dividing rings and the collecting channels are supported from a fixed outer casing.—W. H. C.

Furnaces heated by gaseous or liquid fuel. J. King, jun., Latchford, J. R. Burnett, Stockton Heath, Cheshire, and The Richmond Gas Stove and Meter Co., Ltd., Warrington. Eng. Pat. 27,686, Dec. 2, 1912. Addition to Eng. Pat. 14,277 of 1911 (this J., 1912, 690).

The combustion chambers open directly into the heating chamber of the furnace, and secondary air flues are arranged beneath the floor of the heating chamber. Outlet flues for the products of combustion may also be arranged beneath the floor of the heating chamber. —A. T. L.

Vacuum-dryer. O. S. Sleeper, Assignor to The Buffalo Foundry and Machine Co., Buffalo, N.Y. U.S. Pat. 1,074,903, Oct. 7, 1913.

A horizontal drum, rotating within a chamber, dips into the liquid contained in a pan in the lower part of the chamber. The front wall of the pan is spaced apart from, but the rear and end walls engage with, the periphery of the drum. Liquid is fed to the pan through a number of nipples attached to a manifold, and means are provided for rocking the manifold and the pan.—W. H. C.

[Drying] Kiln. W. Drayton, Shawnee, Ohio. U.S. Pat. 1,075,904, Oct. 14, 1913.

The materials are conveyed through a tunnel kiln on a travelling bed, and air, heated in an air-heating apparatus placed intermediate between the ends of the kiln, is caused to pass over the materials in the opposite direction. The interior of the kiln is divided into a number of separate chambers by portable partitions carried by the travelling bed, and the heated air is conveyed from chamber to chamber by a series of ducts.—W. H. C.

Drying materials in small pieces or in powder; Process and apparatus for ——. Soc. Loy et Aubé. Fr. Pat. 458,878, June 6, 1913.

The material is conveyed through a horizontal rotary drum by longitudinal curved, lifting and forwarding shelves, and hot gases, flowing in the opposite direction, are compelled to take a spiral path and are brought into close contact with the materials, by a spiral partition fixed within the drum.—W. H. C.

Still. H. B. Phillips, Fairmont, N.C. U.S. Pat. 1,076,389, Oct. 21, 1913.

The still comprises a rectangular base portion with a box-like cover containing a furnace and heating coils. The heating fluid is circulated by a pump from these coils through heating coils in the base portion of the still, which are spaced apart so as to form racks for the material to be treated. The still is provided with an outlet for the volatile products and a drain for the liquid products of distillation.—A. T. L.

Solid particles in suspension in a current of gas; Recovery of ——. E. M. A. Béchard. Fr. Pat. 458,393, May 24, 1913.

The current of gas is saturated with steam and then cooled by expansion and by passing through a metal conduit exposed to the air, so that water is condensed upon the solid particles and causes them to settle.
—W. H. C.

Crystallisation in motion; Process for continuous —— with the aid of artificial cooling. Deutsche Solvay-Werke A.-G. Ger. Pat. 263,690, Dec. 5, 1911.

A number of hollow cooling cells are mounted side by side on a shaft rotating in a trough. The cooling medium passes successively through the cells in one direction and the solution to be crystallised flows through the trough in the opposite direction. Between each successive pair of cells is a scraper for removing the crystals, which fall to the bottom of the trough and are discharged by a screw conveyor into the boot of a bucket elevator. Scoops may be attached to the cooling cells so that the latter themselves act as a conveyor for discharging the crystals.
—A. S.

Salt solutions or the like; Crystallisation of ——. J. Straka. Ger. Pat. 265,042, Oct. 9, 1912.

Crystallisation is effected in elastic tubes and the crystals are detached from the tubes by altering the cross-section of the latter by press-rolls or the like.—A. S.

Lixiviating, agitating, and transporting solid substances in liquids; Apparatus for ——. H. Drescher. Ger. Pat. 263,691, Sept. 8, 1911.

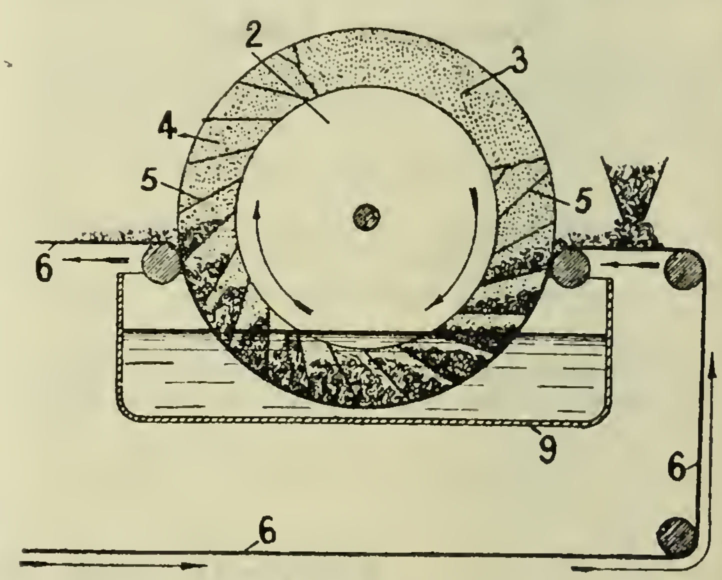
In apparatus of the known type in which a horizontal rotating shaft carries a number of division walls, the latter are provided with openings or have portions cut out at the periphery, to allow of the passage of the solids and liquid, and they also serve as supports for the spiral bars forming the agitator and conveyor. Buckets or scoops may be mounted on the spiral bars to collect and lift the material.—A. S.

Evaporation of liquids; Apparatus for the ——. A. M. Urista. Ger. Pat. 265,723, Aug. 2, 1912.

The liquid circulates through two concentric double-walled cylinders, connected by radial tubes, and the spaces between the different parts of the system are filled with granular refractory material, through which an ignited mixture of fuel and air is led. At the front end of the cylinders, behind the fire-door, is a fire screen also filled with refractory material, and at the other end is a device for exhausting the combustion gases. According to another claim the liquid is circulated through a basket-shaped arrangement of tubes disposed within a casing, the spaces between the tubes and between the tubes and the casing being filled with granular refractory material.—A. S.

Moistening apparatus; Rotating ——. H. A. Povel, Ger. Pat. 265,043, Sept. 4, 1912.

The drum, 2, carries at its periphery open compartments formed by perforated plates, 3, 4, 5. As the drum rotates, these compartments pass below the surface of the liquid in the trough, 9, and are temporarily closed by the endless band, 6, carrying the material to be moistened.—A. S.



Drying air; Method of —— and apparatus therefor. W. Loebel, Leipzig, Germany. Eng. Pat. 29,290, Dec. 19, 1912. Under Int. Conv., Dec. 22, 1911.

See Fr. Pat. 452,272 of 1912; this J., 1913, 741.—T. F. B.

Drying [coated sheets, etc.]; Process of ——. G. H. May, Newburgh, N.Y., and W. M. Grosvenor, Grantwood, N.J. U.S. Pat. 1,075,586, Oct. 14, 1913.

See Fr. Pat. 403,520 of 1909; this J., 1910, 84.—T. F. B.

Drying furnace; Continuous —— with vertical axis. Soc. de Constructions Mécaniques d'Alais. First Addition, dated June 21, 1912, to Fr. Pat. 419,034, Aug. 6, 1910.

See Eng. Pat. 16,262 of 1912; this J., 1913, 816.—T. F. B.

Evaporators. G. W. Heisserman, jun., Philadelphia. Eng. Pat. 5016, Feb. 27, 1913. Under Int. Conv., Feb. 29, 1912.

See U.S. Pat. 1,045,023 of 1912; this J., 1913, 11.—T. F. B.

Gases; Apparatus for separating liquid particles from ——. A. Spiegel, Assignor to Gewerkschaft Messel, Grube Messel, Germany. U.S. Pat. 1,075,736, Oct. 14, 1913.

See Eng. Pat. 4489 of 1911; this J., 1911, 1037.—T. F. B.

Composition for heat-insulating and thermo-electric purposes. Process of making a composition of matter. P. Ferra, Caluire-et-Cuire, France. U.S. Pats. 1,075,773 and 1,075,820, Oct. 14, 1913.

See Eng. Pat. 28,667 of 1910; this J., 1912, 388.—T. F. B.

Chemical reactions; Apparatus for effecting ——. F. E. Matthews, E. H. Strange, and C. A. Pim. Fr. Pat. 458,347, May 24, 1913. Under Int. Conv., June 3, 1912.

See Eng. Pat. 13,051 of 1912; this J., 1913, 740.—T. F. B

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal ash; The melting point of ——. E. J. Constam. Z. Ver. Gas- und Wasserfachmänner in Oesterr. Ung., Oct. 15, 1913. J. Gas Lighting, 1913, 124, 522.

To determine the fusing point of ash, equilateral pyramids, obtained by making a paste, moulding, and drying, were heated in a tube in an electric furnace. The decrepitation, intumescing, and fusion of the pyramids of ash, and the temperature of fusion, can be optically observed, as the tube, closed at one end, has the properties of an absolutely black body. It appears that: (1) the percentage of ash in a coal has no influence on the melting point of the ash; (2) the melting point of the ash is a characteristic of the coal seam; and (3) the melting point of coal ash is in general not affected by coking or the temperature of coking. The investigations gave melting points ranging from 1150° to 1700° C. (2100° to 3090° F.), and the author classifies coal ash into the following groups, viz., (1) readily fusible—below 1200° C.; (2) fusible—between 1200° and 1350° C.; (3) difficultly fusible—between 1350° and 1500° C.; (4) very difficultly fusible—between 1500° and 1650° C.; and (5) refractory—above 1650° C. Chemical analysis shows that, as regards the samples examined, lime, iron, and sulphur (pyrites) lower the melting point, while alumina raises it. Therefore if an ash has been found to be too readily fusible, the addition of alumina or clay, or the admixture of the coal with another coal having a difficultly fusible ash, should serve to give an ash having the required fusing point. It is shown that it is necessary also to pay greater attention to the amount of slate in the coal; for, though slate is generally refractory, it becomes the core of large lumps of clinker which interfere with the working of the furnaces. With regard to the uses of coal, the following limits for the melting point of the ash are named—viz., coke for central-heating plant, above 1300° C.; anthracite for central-heating plant, above 1400° C.; boiler coal, above 1400° C.; locomotive and producer coal, above 1500° C., or fluxing at about 1200° C. Gas coal should have ash with a fusing point not below 1300° C., and should be as free as possible from pyrites and slate. The author is of opinion that the determination of the melting point of the ash will become an important criterion, like the determination of volatile matter and of the proportion of ash, in the valuation of coals, especially gas coals.

Gas for industrial purposes; Development of the use of ——. H. M. Thornton. J. Gas Lighting, 1913, 124, 327—338.

THE following are some of the purposes for which gas heating is now used. *Annealing* metal stampings (nickel-silver, brass, etc.), the finer grades of wire, steel tubes, steel studs for motor and cycle chains, metal backs for buttons, pen nibs, gun barrels and breeches, and also steel bars for making machine parts; *case-hardening and tempering* hand- and machine-tools, gear-wheels, and more especially parts for motor-cars and motor-cycles; *forging* cutlery, file tangs, edge tools, etc., and drop forgings; *melting metals, e.g.*, in the manufacture of jewellery, for castings in brass, aluminium, or various alloys and in type founding; *brazing, blow-pipe and soldering work, e.g.* brazing heavy flanges on copper pipes, and soldering with gas-heated irons; *assaying* in muffle furnaces; *enamelling* on metal, china, and pottery, and gilding on glass; *steam-raising* on a small scale, for numerous purposes; *japanning* in the cycle, bedstead, gas-stove, fire-grate, electrical, tin-ware, brass-hollow-ware trades and many others; for heating furnaces in the *glass-ware industries*; *baking* bread and confectionery; *sugar boiling*; for various processes in *hat manufacture*; *tentering, singeing, calendering and conditioning* in the cotton and woollen industries. Many of these industries are carried on in small towns and there is great scope for the extended industrial use of gas in all parts of the country. The paper includes a list of the industries in the British Isles known to be using gas, with the appliances used or operations carried out in each case.—A. T. L.

Producer gas from wood. G. E. Lygo. Jun. Institution of Engineers. "Times" Eng. Suppl., Nov. 12, 1913. 24.

ALTHOUGH the value of wood as a source for gas producers had long been known it is only recently that gas plant makers have given serious attention to the subject. The higher price of a wood waste plant as compared with an anthracite plant and the low price of anthracite did not induce power users to install them, but with the increased cost of coal, the advent of wood waste suction plants which were reliable in their working has given manufacturers having combustible waste materials of little value and difficult to dispose of, an opportunity of effecting considerable economy. All kinds of wood, from sawdust to pieces 6 in. in diameter, cotton seeds, cocoanut shells, fibre, and dust, sugar cane, coffee husks, rice husks, spent tanning bark, rubber leaf waste, surface peat, etc., might be consumed in the generator and the gas produced used in gas engines.

Wood waste gas plant. The area of the generator was governed by the nature and size of the fuel, but roughly speaking it was two-and-a-half times that required for coal fuel. A deep fuel bed was necessary for large pieces of wood, else air passed through and ignited the gas in the top of the generator. Small, dense fuel, such as sawdust and coffee husks required a comparatively shallow bed, or its resistance would interfere with the working of the engine. A vaporiser was not required, as there was no necessity to keep down the temperature in the combustion zone, and the loss of hydrogen was more than made up by the volatile gases in the fuel. The gas must be cooled and washed immediately it left the generator, else the heavy tar and dust in suspension would be deposited and choke the connecting piping. In Whitfield plants an anti-fluctuator was provided. This was a rectangular box built in two compartments, partly filled with water and separated by a baffle, with one side open to the atmosphere. On the suction stroke of the engine the pressure in the plant was below that of the atmosphere, and consequently the water in the box displaced the gas taken by the engine, and when the suction was released the water fell to its normal level. This ensured a steady flow of gas from the generator. The variation of pressure on the suction stroke rarely exceeded 1 in. of water, whereas 6 in. was not uncommon in plants without the anti-fluctuator. *Fuel value of wood waste.* The calorific value of wood when air-dried was approximately 6000 B.Th.U. per lb. The amount consumed per b.h.p. depended upon the moisture, which amounted to 10 to 20 per cent. in air-dried wood and 30 to 50 per cent. in fresh timber. Fuel which contained excess of moisture had to be dried until it did not exceed 60 per cent., otherwise it was difficult to make the generator fire burn evenly. The gas produced was of higher value than that from anthracite—namely, about 150 to 170 B.Th.U. per cu. ft., as against 120 to 140 B.Th.U. from the latter. When used in a producer, wood at 10s. a ton would be equal to anthracite at 25s. a ton. A steam boiler specially designed to utilise wood waste consumed 6lb. to 10lb. per b.h.p. hour, as against 2½lb. to 3lb. per b.h.p. hour in a producer. A test made with a Whitfield producer supplying an 84 b.h.p. engine coupled to a 105 volts dynamo gave 540 B.O.T. units for 2072 lb. of fuel consumed, or 3·83 lb. of fuel per kw. The test extended over 10 hours, and the fuel, consisting of oak and elm sawdust and chips from working machinery, had no value for other purposes. In one factory before the installation of the producer the same work had been done by a steam plant, when, in addition to the same amount of wood waste, upwards of 500 tons of coal per annum were consumed.

Asphaltum from petroleum. D. T. Day. U.S. Geological Survey. Min. and Eng. World, Oct. 25, 1913. [T.R.]

WITHIN the last few years, the asphaltum trade has been dominated by the increasing production of a kind of asphaltum obtained by boiling down the heavy petroleum, found in California and the region of the Gulf of Mexico, to a semi-solid material which has found wide use for roofing and road binding. In 1912, 333,213 short tons of this oil asphaltum, valued at $3,534,077, were made.

This is a gain of 33·7 per cent. over 1911, and is nearly three times the output of all other kinds of asphalt taken together. Near Lander, Wyoming, is found an oil so viscous that it can be used for roads without refining, but it has not come into use, as asphaltums of the required consistency can readily be obtained by boiling down thinner oils. The proportion of asphaltum contained in the oils of various fields, are:—Coalinga, Cal., 1·89 to 57·42 per cent.; Kern River, 16·2 to 38·7; Sunset-Midway-McKittrick, 11 to 51; Los Angeles, Cal., 13·3 to 42·2; Santa Maria, Cal., 12 to 42; Gulf Region, 0 to 20 per cent. Large amounts of asphaltic residues have already been shipped from California to New York, and the trade is expected to increase greatly on the opening of the Panama Canal.

Patents.

Coal dust and firedamp explosions; Apparatus for preventing the propagation and effect of ——. G. Kahler and F. Junker. Ger. Pat. 264,519, July 31, 1912. Addition to Ger. Pat. 250,702.

Improvements in the apparatus described in the chief patent (see Eng. Pats. 16,440 and 16,441 of 1912; this J., 1913, 526, 819), whereby the blasting charge can be fired only after the pressure water supply is admitted to the sprinklers or spraying device. The circuits for the electro-magnet controlling the pressure water supply and for the shot-firing device are supplied from the same source of electric current: the former is normally closed but the latter is closed by a contact actuated by the pressure water. For example the pressure water acts on a piston on the rod of which is a contact which, when the piston is displaced, engages with two spring contacts, and so closes the circuit of the shot-firing device.—A. S.

Artificial fuel [from sewage sludge]; Manufacture of ——. J. T. Armstrong, London, and J. Mordan, Hughenden, Bucks. Eng. Pat. 22,958, Oct. 8, 1912.

A mixture of sewage sludge with petroleum, glue, water and iron sulphate, with or without some coal dust and/or a small proportion of tar, asphaltum or the like is formed into briquettes.—W. H. C.

Furnace residues and the like; Wet separation of ——. A. Wolski. Ger. Pat. 263,751, Dec. 24, 1912..

Diluted molasses is used as a liquid of medium density for separating coal and ashes from furnace residues.—A. S.

Coke ovens; Continuous working of vertical —— with periodical withdrawal of the coke. J. Lütz. Ger. Pat. 263,767, Aug. 6, 1912.

The oven is in the form of a shaft with an annular coking chamber closed below by a rotary hearth which is movable up and down within a gas-tight casing provided with a side door through which the coke can be discharged. The coal is fed in continuously at the top and, by lowering the hearth, the whole charge is caused to descend slowly whilst coking proceeds, so that the process is continuous except for the period when the coke is being removed. —A. S.

Coke-oven with heating walls composed of vertical flues, each of which is provided with two series of burners. A. von Kamen. Ger. Pat. 263,768, Oct. 31, 1912.

By means of three-way cocks the burners can be placed in communication with the gas supply or with the outer air, so that when necessary air can be admitted to burn any deposit of carbon.—A. S.

Gas producer. J. A. Herrick, New York. U.S. Pat. 1,075,566, Oct. 14, 1913.

The producer comprises a fixed upper section, and a lower one which may be rotated. In the upper section, spaced apart from the side walls, is an annular mixing chamber, open at its lower end to receive the gas, and of less diameter inside than the lower section. Several hollow water-cooled castings, connected together, are embedded in the wall at the lower end of the upper section, and have portions projecting inwards to support both walls of the annular chamber. The upper section and the castings are also provided with openings through which pokers extend into the lower section; the pokers are held rigidly against lateral movement when the lower portion is revolved. —B. N.

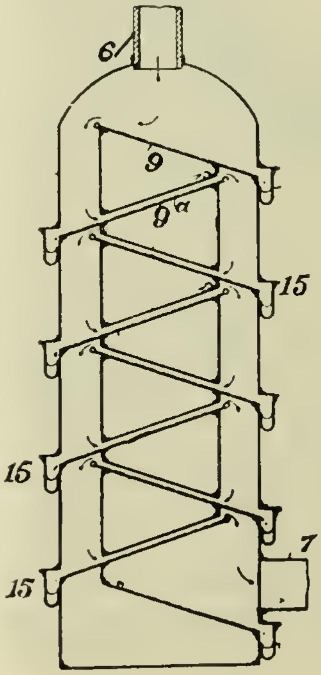
Gas-producer. J. K. Lyons, Pittsburgh, and J. B. Hardie, Crafton, Pa. U.S. Pat. 1,075,716, Oct. 14, 1913.

The producer has a grate of ridge-form supported by bearers from a transverse wall which divides the water-seal trough beneath the producer.—W. H. C.

Ammonia; Recovery of —— in the working of gas producers. F. Müller. Ger. Pat. 264,898, Sept. 7, 1911.

The tarry gases from one zone of the producer are cleaned in the usual way and then mixed with the hot clear gas from the second zone. The mixed gases are then treated directly for the recovery of ammonia.—A. S.

Gas-cleaner. B. Walter, Pittsburgh, Pa., Assignor to G. H. Smith, Aspinwall, Pa. U.S. Pat. 1,074,913, Oct. 7, 1913.



The gas enters the apparatus through the pipe, 6, and passes, as shown by the arrows, over the inclined surfaces of the baffles, 9, 9a, etc., to the outlet, 7. Water is supplied to and flows over the surface of the baffles in a contrary direction and is discharged separately from each baffle surface into the gutters, 15.—W. H. C.

Hydrogen sulphide and ammonia from gases; Separation of ——. L. Bergfeld. Ger. Pat. 263,905, June 28, 1912.

The anode liquid obtained by electrolysis of a salt which is easily oxidisable and of which the oxidation product is easily reducible, is used as absorbent, and is subsequently mixed with the cathode liquid and heated to expel the ammonia and regenerate the original electrolyte. Suitable anode liquids are solutions of iodine or of manganic sulphate obtained by electrolysis of potassium iodide or manganese ammonium sulphate respectively.—A. S.

Gas washer; Centrifugal ——. Berlin-Anhaltische Maschinenbau-A.-G. Ger. Pat. 264,049, Aug. 25, 1912.

The washer consists of a column through which passes a central vertical rotating shaft. The column is divided into superposed chambers by partitions, each of which has a central annular well in which a propeller rotates. The blades of the propeller have uneven edges and are so formed that they raise the washing liquid and then project it outwards in different directions. The inner walls of the wells are lower than the outer ones, so that the washing liquid overflows towards the centre. The washing liquid is introduced at the top of the column and the gas at the bottom.—A. S.

Gas washer. Berlin-Anhaltische Maschinenbau-A.-G. Ger. Pat. 264,050, Oct. 26, 1912.

In apparatus of the type in which the washing liquid is distributed, by means of a form of bucket-wheel, over washing devices (screens, etc.) within a rotating drum, dams are arranged in the buckets to retard the outflow of the liquid and to ensure that it is evenly distributed during both the upward and downward movements of the buckets.—A. S.

[*Mineral*] *Oils contained in waste cleaning and polishing materials ; Recovery and simultaneous purification of the* ——. E. Sack. Ger. Pat. 265,198, Oct. 7, 1911.

The material is extracted with benzene, petroleum spirit, or the like, and the solution of the oil is treated with caustic soda solution (5—10 per cent. NaOH) or solid alkalis or alkaline substances. After allowing to settle, the solution of the oil is separated, filtered and the solvent distilled off. Calcium sulphate may be added to the solution before filtration, or saponifiable substances or other substances capable of subsequently facilitating filtration, may be added before the treatment with alkali.—A. S.

Coal briquettes ; Manufacture of ——. B. Grätz, Berlin. Eng. Pat. 6910, March 20, 1913. Under Int. Conv., Nov. 19, 1912.

See Fr. Pat. 455,348 of 1913 ; this J., 1913, 936. Reference is directed, in pursuance of Sect. 7, Sub-sect 4, of the Patents and Designs Act, 1907, to Eng. Pats. 819 of 1873, 4650 of 1878, 11,218 and 13,675 of 1901, 25,853 of 1902, 9136 of 1907, and 3189 of 1908.—T. F. B.

Peat and similar products ; Process for treating [*removing water from*] ——. The International Nitrogen and Power Co., Ltd. Fr. Pat. 456,958, April 22, 1913. Under Int. Conv., May 1, 1912.

See Eng. Pat. 10,370 of 1912 ; this J., 1913, 590.—T. F. B.

Fuel ; Method and apparatus for making and treating ——. The Vitrified Coal Co., Ltd. Fr. Pat. 458,669, June 2, 1913. Under Int. Conv., Nov. 8. 1912.

See Eng. Pat. 25,698 of 1912 ; this J., 1913, 819.—T. F. B.

Gasifying fuels, especially finely divided fuels ; Process for ——. F. C. W. Timm. Fr. Pat. 458,503, May 28, 1913.

See Eng. Pat. 3035 of 1913 ; this J., 1913, 936.—T. F. B.

Ammoniacal and sulphur compounds from gases ; Processes for extracting ——. J. W. Cobb. Fr. Pat. 458,788, June 3, 1913. Under Int. Conv., June 4, 1912.

See Eng. Pat. 13,141 of 1912 ; this J., 1913, 971.—T. F. B.

Combustible liquid ; Process for producing a ——. E. H. Vidstrand, H. B. Hultgren, and N. F. Hultgren, Stockholm. Eng. Pat. 17,919, Aug. 6, 1913. Under Int. Conv., Aug. 7, 1912.

See Fr. Pat. 457,174 of 1913 ; this J., 1913, 1001.—T. F. B.

Hydrocarbon oils ; Conversion of heavy —— *into lighter hydrocarbons.* C. J. Greenstreet, Webster Groves, Mo., U.S.A. Eng. Pat. 16,452, July 13, 1912. Under Int. Conv., May 13, 1912.

See Fr. Pat. 446,475 of 1912 ; this J., 1913, 203.—T. F. B.

Paraffin ; Production of translucent, uniformly-coloured ——. J. v. Rijn v. Alkemade, Balik Papan, Borneo. U.S. Pat. 1,076,000, Oct. 14, 1913.

See Eng. Pat. 18,925 of 1912 ; this J., 1913, 902.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patents.

Distillation of materials containing cellulose ; Process of destructive ——. Holzverkohlungs-Industrie Akt.-Ges. First Addition, dated April 26, 1913 (under Int. Conv., Mar. 10, 1913), to Fr. Pat. 455,345, Mar. 10, 1913 (this J., 1913, 937).

The wood, before being carbonised, is cut into very small pieces.—G. W. McD.

Meiler-kiln for the carbonisation of wood and peat. M. Fritz. Ger. Pat. 265,041, Aug. 31, 1911.

The kiln comprises a series of adjacent chambers with openings, which can be closed, in the division walls. The working can thereby be conducted more nearly continuously, the charge in one chamber being ignited by the burning charge in an adjacent chamber through the opening in the division wall.—A. S.

Heating liquids by the combustion of a combustible gas ; Apparatus for ——. G. A. H. Méker, Levallois-Perret, France. Eng. Pat. 23,523, Oct. 15, 1912. Under Int. Conv., Oct. 16, 1911.

Water is forced through an ejector nozzle placed in the constricted neck of a tube into which the flame from a burner is drawn by the ejector action. Preferably the burner directs the flame into a cylindrical part of the tube behind the ejector nozzle.—A. T. L.

Gaseous combustion ; Heating by —— *and furnaces therefor.* C. D. McCourt and Bonecourt Surface Combustion, Ltd., London. Eng. Pats. 23,536, Oct. 15, and 24,294, Oct. 24, 1912.

The invention relates to the heating of annealing or melting furnaces of the reverberatory and open-hearth types by the process of "surface-combustion" described in Eng. Pats. 25,808 and 29,430 of 1909, 4364 of 1910, and 19,490 of 1912 (this J., 1910, 1448 ; 1913, 936). The furnace is provided with a "heater" comprising a slab or block of refractory material formed with troughs packed with the porous material in which surface combustion takes place, the heater being provided with ducts for the supply of the combustible mixture to the troughs. The "heater" may be built into the furnace and is arranged to present a large surface for absorbing radiant energy from the combustion products and radiating it to the charge in the furnace directly or after reflection from the walls or roof. In one arrangement, the troughs are formed in the floor of the furnace, the material to be heated being supported a little above the level of the porous layers. The "heater" may be carried on a trolley which runs on the floor of the furnace. In another arrangement, the "heater" is supported in the roof of the furnace by firebrick arches, the combustion products passing below the hearth and serving to heat the air for combustion in tubular recuperators. Or, the troughs of porous material may be arranged in each end of the floor of the furnace, the radiant heat being reflected on to the charge from the roof. The air or gas, or both, may be preheated as described in Eng. Pat. 6732 of 1912 (this J., 1913, 782).—A. T. L.

Heating of various materials ; Kiln for the regular ——. Leflaine et Cie. Fr. Pat. 458,447, May 15, 1913.

Trucks carry the materials slowly through a tunnel kiln, divided into three parts by doors which allow the passage of the trucks. The heating is effected by gas burners in the central portion and the two end portions serve respectively one as a preheater and the other as a cooler. The air for the combustion of the gas passes first through a channel beneath the kiln where it comes in contact with the wheels and flat bottoms of the trucks and serves to cool them whilst itself becoming preheated.—W. H. C.

Metal filaments ; Manufacture of ——. Pope's Electric Lamp Co., Ltd., London. From C. Trenzen, Cologne, Germany. Eng. Pat. 22,548, Oct. 3, 1912.

The filaments are drawn cold from a sintered mixture of tungsten and thorium (or thorium compounds) containing up to 3 per cent. of the latter. The drawing is effected without preliminary treatment of the material. The electrical resistance of the filaments is stated to be 20 per cent. less than that of similarly prepared tungsten filaments. (Reference is directed to Eng. Pats. 3213 and 24,179 of 1906 and 18,467 of 1911 ; this J., 1907, 248 ; 1912, 1187.)—W. E. F. P

Arc light electrodes. Gebr. Siemens und Co., Berlin. Eng. Pat. 7108, March 25, 1913. Under Int. Conv., March 28, 1912.

SEE Fr. Pat. 456,042 of 1913; this J., 1913, 937.—T. F. B.

Arc-lamp electrode. G. M. Little, Pittsburgh, Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,075,484, Oct. 14, 1913.

SEE Eng. Pat. 66 of 1908; this J., 1908, 678.—T. F. B.

Electrode [for arc lamps]. J. L. R. Hayden, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,075,713, Oct. 14, 1913.

SEE Eng. Pat. 18,689 of 1912; this J., 1913, 591.—T. F. B.

Metal [tungsten] filaments. C. A. Hansen, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,075,563, Oct. 14, 1913.

SEE Eng. Pat. 21,505 of 1906; this J., 1907, 1131.—T.F.B.

III.—TAR AND TAR PRODUCTS.

Acetylene; Pyrogenic condensation of ——. R. Meyer and A. Tanzen. Ber., 1913, 46, 3183—3199.

EXPERIMENTS similar to those previously described (this J., 1912, 633), but using a larger and more efficient apparatus consisting of three furnaces heated respectively to 600°, 650°, and 800° C. The yield of tar varied from 27 to 57 per cent. of the weight of acetylene used. In all about 6 kilos. of tarry product have been obtained. The new products isolated are phenanthrene, acenaphthene and small quantities of styrole and hexylene. The last-named substance has not yet been recognised as a common ingredient of ordinary coal tar. The union of acetylene and hydrogen cyanide to form pyridine bases has been again confirmed. By passing ammonia and benzene vapour through an electrically heated tube aniline has been obtained. Some of the aniline was further condensed to carbazole, and a certain quantity of benzonitrile was formed by the action of hydrogen cyanide from the decomposition of aniline, on unchanged aniline, $C_6H_5NH_2+HCN=C_6H_5.CN+NH_3$. It was not found possible to obtain any phenolic substances from acetylene or benzene and water, or from aniline and water.—W. H. P.

Rosaniline and coal-tar "bases." U.S. Customs decisions. Oil, Paint, and Drug Rep., Nov. 3, 1913. [T.R.]

THE Board of U.S. Appraisers have sustained another protest relating to the classification for duty of rosaniline. The importers claimed duty should have been assessed at the rate of 20 per cent. *ad val.* under paragraph 15, Tariff Act of 1909. In harmony with a previous decision the Board overruled the collector's assessment of 30 per cent. *ad val.*, and upheld the contention of the protestant.

In a decision handed down by the Board of U.S. General Appraisers it was held that products or preparations of coal tar, known as bases, and which, after being treated or dissolved in acids are used in dyeing fabrics, are not coal-tar colours or dyes. It is held that there is no such commercial understanding of the words "coal-tar colours or dyes" as includes such bases, therefore the merchandise in question is subject to duty at the rate of 20 per cent. *ad val.*, under the provisions of paragraph 15, Tariff Act of 1909, for all other products or preparations of coal tar, not colours or dyes, and not medicinal. The protest was sustained. The merchandise was assessed at the rate of 30 per cent. *ad val.* under paragraph 15 of the Tariff Act of 1909, under the provision for coal-tar colours and dyes. The claim on the part of the importer was for duty at the rate of 20 per cent. under the same paragraph for "all other products or preparations of coal tar not colours or dyes and not medicinal."

PATENTS.

2.3-[Hydr]oxynaphthoic acid; Manufacture of nitro arylides of ——. A. G. Bloxam, London. From Chem.-Fabrik Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 13,237, June 7, 1913.

OWING to the high temperature necessary, the yield of pure nitro-anilides of 2.3-hydroxynaphthoic acid by heating the acid with a nitraniline and treating with a dehydrating agent, is very small. It is now found that almost quantitative yields of the desired products are obtained by treating the nitro-arylamine salt of 2.3-hydroxynaphthoic acid with a dehydrating agent, in presence of an indifferent solvent or suspending agent. For example, 188 parts of finely ground 2.3-hydroxynaphthoic acid and 135 parts of powdered *m*-nitraniline are suspended in 1200 parts of toluene, the mixture is heated to 60°—70° C., and 60 parts of phosphorus trichloride are gradually added, with stirring; the mixture is boiled under a reflux condenser until evolution of hydrochloric acid has ceased, when water and sodium carbonate are added to produce an alkaline reaction, and the toluene is expelled by means of steam. The residue is filtered, washed, and dried. The resulting *m*-nitranilide melts at 245°—246° C. When the nitroarylides are reduced, amino-arylides are obtained, which possess the power to combine with two mols. of a diazo compound, so long as no other substituent in the arylido residue prevents this.—T. F. B.

Aldehydes and carboxylic acids of the anthraquinone series. Act.-Ges. f. Anilinfabr. Fr. Pat. 456,768, April 16, 1913. Under Int. Conv., Oct. 28 and Nov. 19, 1912.

THE methyl group of methylanthraquinone derivatives can be oxidised to the aldehydic group by means of manganese dioxide in presence of sulphuric acid; further action of the same oxidising agent converts the aldehydic group into the carboxylic group. By starting with a dimethylanthraquinone it is possible to obtain successively the monoaldehyde, the dialdehyde, the aldehyde-carboxylic acid, and finally the dicarboxylic acid. *Example.* A mixture of 256 parts of 4-chloro-1-methylanthraquinone and 200 parts of precipitated manganese dioxide is added to 2500 parts of concentrated sulphuric acid: the temperature rises and is kept at about 40° C. until the reaction is finished, when the product is poured into water. The small quantity of carboxylic acid formed is extracted by means of alkali, and the residue, consisting of 4-chloro-1-anthraquinone-aldehyde, is purified by dissolving in a solution of sodium bisulphite and precipitating with mineral acid. The aldehyde melts at 210° C. If a mixture of 128 parts of the chloromethylanthraquinone, 174 parts of 90 per cent. manganese dioxide, and 1300 parts of 80 to 95 per cent. sulphuric acid be submitted to a temperature of about 60° C., 4-chloro-anthraquinone-1-carboxylic acid (m. pt. 229° C.) is obtained as the principal product.—T. F. B.

Anthraquinone series; Process for preparing nitrogenous condensation products of the ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 265,725, Oct. 5, 1912.

AMINOANTHRAQUINONES are melted with naphthols in presence of zinc chloride at a temperature about 200° C. Well-defined condensation products are obtained, in which two mols. of naphthol are united to one mol. of aminoanthraquinone, with separation of three mols. of water.—T. F. B.

Phenols; Process for making polyhydric —— from chloro substitution products of aromatic hydrocarbons. C. H. Torley and O. Matter. Fr. Pat. 458,136, April 23, 1913.

AROMATIC polychloro compounds are converted into the corresponding polyphenols by heating with water under pressure; the presence of alkali facilitates the reaction, and the time necessary is considerably reduced by the use of metallic copper or other catalysts. For example, 100 parts of *p*-dichlorobenzene are heated with 70 parts of sodium hydroxide in aqueous solution, in presence of copper, at a temperature of 300°—350° C. for five hours. The resulting liquid furnishes, on crystallisation, 70 parts of quinol, as well as a small quantity of its phenyl ether. —T. F. B.

N-Alkyl-p-phenylenediaminesulphonic acids; Process for preparing ——. Chem. Fabr. vorm. Weiler-ter-Meer. Ger. Pat. 264,927, May 24, 1912.

A free *p*-nitroso compound of a secondary or tertiary aromatic amine, of the type, $NO.R.NR_1R_2$ (where R is a phenyl radical or a homologue, R_1 is hydrogen, alkyl, or aralkyl, and R_2 alkyl or aralkyl) is treated with a normal alkali sulphite, and the resulting solution is heated with a mineral acid.—T. F. B.

Tar acids; Process for the manufacture or recovery of ——. I. and S. McDougall and F. Howles. Fr. Pat. 458,857, June 5, 1913.

See Eng. Pat. 8323 of 1912; this J., 1913, 821.—T. F. B.

Preparing oil mixtures suitable for use as lubricating, impregnating, or coating materials. Ger. Pats. 265,598 and 265,600. *See* XII.

IV.—COLOURING MATTERS AND DYES.

Indigo; The products of decomposition of —— in the vat. H. Ehrhardt. J. Soc. Dyers and Col., 1913, **29**, 321—322.

The decomposition of indigo which goes on in a zinc bisulphite-lime vat, and which may amount to as much as 29·8 per cent. in 84 hours, is shown to result in the formation of anthranilic acid, which was found both in the sediment of the vat and also in the indigo obtained by oxidation of the filtered vat; it was isolated from the extracts by diazotising and combining with *β*-naphthol. —J. B.

Diphenylethylene leuco-bases and dyestuffs. VII. Action of methyl- and ethyl-magnesium iodides on Michler's ketone. P. Lemoult. Comptes rend., 1913, **157**, 724—726.

Fecht (Ber., 1907, **40**, 3893) claims to have isolated the carbinol, $CH_3.C(OH)(Dm)_2[Dm{=}C_6H_4.N(CH_3)_2]$, as a product of the interaction of Michler's ketone and methylmagnesium iodide. The author has repeated Fecht's experiments and finds that the chief product is the compound, $CH_2 : C(Dm)_2$, together with small quantities of a polymeride of this compound, and of two compounds melting at 227° and 274° C. respectively. These bodies do not contain oxygen and the author was unable to detect the presence of the carbinol. With ethylmagnesium iodide the sole reaction product was the compound, $CH_3.CH : C(Dm)_2$, a yield of 90 per cent. of the theoretical quantity being obtained. It is concluded that the substance supposed by Fecht to be the carbinol was really a mixture; the transient blue colour attributed by him to the carbinol is produced also with the compounds, $CH_2 : C(Dm)_2$ and $CH_3.CH : C(Dm)_2$.—A. S.

Anilinoquinone and its azine derivatives. F. Kehrmann and M. Cordone. Ber., 1913, **46**, 3009—3014.

The authors do not agree with Willstätter that the labile form of *o*-benzoquinone is colourless, but find that the two forms are dimorphic modifications of the same substance, the stable form being red, the labile light green. When the light green ether solution of *o*-benzoquinone is filtered into petroleum ether, the gradual decolourisation of the solution is noticed as the coloured crystals are formed. Also the glacial acetic acid solution of the red compound is dichroic, appearing olive green in thin layers, red in thick layers. Both forms are therefore represented by the diketone formula. Different anilides of *o*-benzoquinone are formed according to the conditions of the reaction. The trianilide is formed, together with some dianilide, when an appropriate mixture of pyrocatechol and aniline is oxidised with silver acetate in glacial acetic acid solution at the ordinary temperature. The dianilide is proved to be the 4.5-derivative, giving with *o*-phenylenediamine the 2.3-dianilinophenazine, and with *o*-aminodiphenylamine the 2.3-dianilinophenylphenazonium (2-anilinophenylaposafranine), identical with that of Fischer and Hepp (this J., 1896, 192). The production of the latter compound in this way is the first synthesis of a dyestuff of the induline series from an *o*-quinone and an *o*-diamine by the azonium-condensation. Anilino-hydroxyquinone was also prepared, and from it, by condensation with *o*-phenylenediamine, 2-hydroxy-3-anilinophenazine, and by condensation with *o*-aminodiphenylamine, 2-hydroxyphenylaposafranine.—J. B.

Constitution and colour. III. F. Kehrmann. Ber., 1913, **46**, 3036—3040.

When a coloured substance of basic character is combined with an acid or metallic halogenide, the colour change which takes place is usually a deepening of the shade in those cases where the union takes place with the chromophore itself, *e.g.*, the pale yellow phenazine gives an orange yellow hydrochloride, phenanthrenoquinone an orange-red nitrate, red indamine a blue hydrochloride, and the orange diaminofuchsonimine gives magenta. When the formation of the salts of coloured substances having unsaturated chromophores is accompanied by a change of colour in the reverse direction (to the light end of the spectrum), it is probable that a change takes place in the nature of the chromophore, *e.g.*, a change from the ortho- to the para-quinonoid form. For instance the red aposafranone and the red rosindone are para- while their orange salts are ortho-quinonoid. Yellow pheno-naphthoxazone, which gives red salts, probably retains its para-quinonoid structure. This theory also explains why the colour and reactions of the azoxazine, thiazine and safranine dyestuffs in strongly acid solution resemble those of the ortho-quinonoid azoxonium, azthionium and azonium dyestuffs, whereas in neutral or weakly acid solution they are para-quinonoid, providing the necessary amino- or hydroxy-group is present in the para-position. The effect of the position of the auxochrome group on the colour-intensity is shown in the hydroxynaphthoquinones, those in which the hydroxy groups are in the benzenoid ring being much more deeply coloured than those in which they are in the quinonoid ring.—J. B.

Patents.

Sulphide dyestuffs and process for making them. Act.-Ges. f. Anilinfabr. First Addition, dated April 28, 1913, to Fr. Pat. 436,373, Nov. 14, 1911. Under Int. Conv., June 14, 1912.

In place of using 4-hydroxydiarylamine derivatives for preparing sulphide dyestuffs as in the principal patent (this J., 1912, 426), it is now proposed to employ derivatives of 4-hydroxydiarylamine containing sulphur in a position *ortho* to the imino group, and not having a free hydroxyl or sulphonic group in the position 4′. Such derivatives are 4-hydroxythiodiphenylamine, *p*-hydroxy-*p*′-methyl thiodiphenylamine, *p*-hydroxythiophenyl-*a*- or *β*-naphthyl amine, etc.—T. F. B.

Vat dyestuffs of the anthraquinone series and process for making them. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 458,195, May 21, 1913. Under Int. Conv., June 13 and Nov. 16, 1912.

See Ger. Pat. 231,557 of 1912; this J., 1913, 822. Products which appear to be identical with those obtained by nitration, are prepared by treating the sulphonated methylbenzanthrones with oxidising agents.—T. F. B.

Black colouring matters for animal fibres, and processes for obtaining them. R. Vidal. Fr. Pat. 458,545, Aug. 8, 1912.

The condensation products of *m*- and *p*-diamines described in Fr. Pat. 391,465 and its Addition (this J., 1908, 1150; 1909, 1246) can be combined with phenolic compounds to form complex intermediate products, convertible by oxidation into black colouring matters. For example, the condensation product from two mols. of a *p*-diamine and one mol. of a *m*-diamine may be combined with two mols. of phenol, cresol, or naphthol, or with one or two mols. of a diphenol or a dihydroxynaphthalene. The condensation is effected by heating in neutral solutions or in presence of alkali carbonates. Solutions of the resulting products produce black shades on animal fibres previously impregnated with an alkali bichromate or other oxidising agent. —T. F. B.

Disazo dyestuffs especially suitable for making lakes; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pats. 458,619 and 458,650, May 30 and 31, 1913. Under Int. Conv., Feb. 5 and 6, 1913.

(1) The disulphonic acid obtained by treating *m*-dichlorobenzidine ($NH_2 : Cl = 1 : 3$) with fuming sulphuric acid at about 120° C., is tetrazotised and combined with two mols. of 2-naphthol-3.6-disulphonic acid. The lakes prepared in the usual manner from this dyestuff are bluish red in colour and fast to light. They are bluer and purer in shade than those produced from unsulphonated dichlorobenzidine and 2-naphthol-3.6-disulphonic acid. (2) *m*-Tolidine ($NH_2 : CH_3 = 1 : 3$) is converted into a disulphonic acid by treatment with fuming sulphuric acid at 120° C. When this is tetrazotised and combined with 2-naphthol-3.6-disulphonic acid, bluish red lakes similar to those described in the foregoing patent, are obtained.—T. F. B.

Selenophenols and diselenides of the anthraquinone series; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,941, July 27, 1912.

Selenophenols or diselenides of anthraquinone or its derivatives, are obtained by treating negatively-substituted anthraquinone derivatives with alkali selenides or polyselenides. Compared with anthraquinone-mercaptans, the anthraquinone-selenophenols dye deeper shades. The products may be used as dyestuffs or as intermediate dyestuff products (see also Ger. Pat. 256,667 ; this J., 1913, 417).—T. F. B.

Disazo dyestuffs for wool; Manufacture of yellow —— A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4261, Feb. 19, 1913.

See Fr. Pat. 454,631 of 1913 ; this J., 1913, 863.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated April 5, 1913, to Fr. Pat. 402,030, April 14, 1909. Under Int. Conv., April 15, 1912.

See Eng. Pat. 9267 of 1912 ; this J., 1913, 418.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,761, April 16, 1913. Under Int. Conv., April 20, 1912.

See Eng. Pat. 17,322 of 1912 ; this J., 1913, 862.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,374, May 26, 1913. Under Int. Conv., May 31, 1912.

See Eng. Pat. 19,843 of 1912 ; this J., 1913, 938.—T. F. B.

Monoazo dyestuffs insoluble in water; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,641, May 31, 1913. Under Int. Conv., June 7, 1912.

See Eng. Pat. 13,110 of 1913 ; this J., 1913, 905.—T. F. B.

Wool-dye of the anthraquinone series; Yellow ——. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,249, Oct. 21, 1913.

See Ger. Pat. 255,590 of 1911 ; this J., 1913, 356.—T. F. B.

Vat [anthracene] dye. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,329, Oct. 21, 1913.

See Ger. Pat. 248,169 of 1911 ; this J., 1912, 767.—T. F. B.

Disazo dyestuffs; Process for producing ——. Chem. Fabr. Griesheim-Elektron. First Addition, dated March 27, 1913, to Fr. Pat. 444,608, June 4, 1912.

See Eng. Pat. 7675 of 1913 ; this J., 1913, 786.—T. F. B.

Vat dyestuffs of the anthraquinone series; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 458,760, May 24, 1913. Under Int. Conv., Sept. 17, 1912.

See Eng. Pat. 12,152 of 1913 ; this J., 1913, 906.—T. F. B.

Nitrobenzene diazonium derivatives; Process for making stable ——. O. N. Witt. Fr. Pat. 458,493, May 27, 1913. Under Int. Conv., Aug. 2, 1912.

See Eng. Pat. 11,290 of 1913 ; this J., 1913, 821.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Sulphite cellulose digesters for experimental purposes. A. Frohberg. Wochenbl. Papierfab., 1913, **44**, 4069.

In performing sulphite digestions of wood in the laboratory, the results are liable to be vitiated by the catalytic action of the metal fittings of the digester on the sulphurous acid, whereby much sulphuric acid is formed and the consumption of sulphurous acid is increased ; at the same time a brown discolouration of the pulp is produced. Brown discolouration is also produced by the formation of a muddy deposit in the liquor, and the chips of wood become incrusted with calcium sulphate. An examination of such a mud showed 71·8 per cent. of inorganic and 28·2 per cent. of organic matter ; from the dried mud 7·7 per cent. of sulphur and sulphur compounds were extracted, the organic matter consisting of cymene and mercaptans. All metallic fittings of bronze or lead should be silver- or platinum-plated. Possibly porcelain or vulcanite fittings might be employed. The digester should be lined with porcelain tiles, or glazed inside with a good acid-proof enamel. Enamelled digesters with a steam jacket answer very well for indirect heating ; steam coils, unless silvered or platinised, are to be avoided. For heating brick-lined digesters, an enamelled double-walled heating plate may be built into the bottom of the digester. Digesters might be constructed to revolve on an axis at right angles to their main axis ; brick-lined digesters could then be adapted for heating with live steam.—J. F. B.

Cellulose; Saccharification of ——. H. Ost. Ber., 1913, **46**, 2995—2998.

A criticism of the recent paper of Willstätter and Zechmeister (this J., 1913, 822). It is stated that in order to furnish exact proof of the quantitative saccharification of cellulose to dextrose, determinations of the reducing power and optical rotation are insufficient ; it is necessary, especially, to show that the dextrose is not admixed with unfermentable reversion products. The conversion of cellulose quantitatively into dextrose by means of concentrated hydrochloric acid, except possibly in solutions of very low cellulose concentration, is regarded as very improbable and it is pointed out that the use of hydrochloric acid for the purpose was suggested as far back as 1880 (Ger. Pat. 11,836). It is further claimed that Ost and Wilkening (this J.; 1910, 688) obtained a yield of 90—95 per cent. of the theoretical quantity of dextrose from cellulose by hydrolysis with sulphuric acid, not only 56—83 per cent. as stated by Willstätter and Zechmeister.
—A. S.

New variety of Canadian golden flax. Oil, Paint, and Drug Rep., Nov. 3, 1913.

At a recent horticultural show at Winnipeg, C. L. Kane of Lethbridge, Alberta, exhibited a golden flax grown from some seeds of white blossomed flax found in Montana. Tested for oil value, it showed 44·38 per cent. ether extract, compared with 32 to 39 per cent. for brown flax. It matures two weeks earlier than the common kind and threshes out from 19 to 26 bushels to the acre. Experiments with this variety in Montana were not so successful as in Alberta, but Saskatchewan farmers report great success with it.

Sulphuric acid in nitrocellulose. Piest. *See* XXII.

Patents.

Vegetable fibres ; Process of treating ——. N. Beljaeff, Puschkino, Russia. Eng. Pat. 15,581, July 5, 1913.

Raw bast fibres, *e.g.*, flax fibres, are subjected to alcoholic fermentation, generally with beer-yeast, for about 24 hours, then bleached by steeping for about the same period in a 5 per cent. solution of sodium peroxide, and after steeping for about an hour in a 25 per cent. solution of acetic acid, are finally bleached for about 24 hours in a 5 per cent. solution of sodium peroxide. The proportions may be varied to suit the nature of the fibres and dilute sulphuric or hydrochloric acid may be substituted for the acetic acid, also other bleaching agents such as hypochlorites, for the sodium peroxide.—J. F. B.

Bast fibres (flax, hemp, jute, etc.) ; Process of simultaneous subdivision, disintegration and bleaching of ——. L. Dewolf-Wante. Fr. Pat. 458,289, May 23, 1913.

Bast fibres, *e.g.* jute, are immersed for a short time in a mercerising bath of caustic alkali containing an oxidising agent such as sodium hypochlorite, hydrogen peroxide or sodium peroxide, perborate, etc. or potassium permanganate. The fibre may be subjected to a preliminary bleaching *i.e.* treatment with one of these oxidising agents before treatment in the mercerising bath. To any or all of the baths may be added a soap or product of the group of oxidised oils (sulphoricinates), and such a soap or else an emulsion of a fatty substance with a halogenated derivative of a hydrocarbon may be employed as a finishing bath.—J. F. B.

Wood and other fibrous materials ; Method and apparatus for digesting ——. J. C. W. Stanley, Santa Cruz, Cal., Assignor to Stanley Paper Fibre Co., San Francisco, Cal. U.S. Pat. 1,075,795, Oct. 14, 1913.

The fibrous material is immersed in a disintegrating solution and a heating agent is admitted into the interior of the mass which is heated until digestion is complete. The solution is drained off, concentrated and compressed air is then admitted to the digester above the mass of digested material, whereby the excess of solution remaining in the mass is pressed out. Compressed air may also be employed for rapidly discharging the mass of digested material from the digester. The heating arrangement consists of a vertical central steam pipe with other perforated pipes branching out therefrom at different heights, and a condenser connected with the bottom of the vertical pipe into which the solution is ultimately drained.—J. F. B.

Cellulose-containing materials ; Manufacture of a cattle-food, with simultaneous recovery of cellulose, resin, etc., from ——. J. König. Ger. Pat. 265,483, Feb. 15, 1912.

Wood, especially the wood of conifers, is heated, if necessary under pressure, first with dilute alkalis, chiefly ammonia, and then with dilute mineral acid, or first with acid and then with alkali, as far as possible in stoichiometrical proportions. The residue is subjected to the usual bleaching process, and the spent liquors are evaporated, either separately or together, and with or without addition of other substances suitable for use as cattle-food. (See also this J., 1913, 939.)—A. S.

Sulphite-cellulose waste lyes ; Process for utilising the fermentable and reducing carbohydrates in —— *for obtaining alcohol or a reducing agent.* H. B. Landmark. Fr. Pat. 456,871, April 19, 1913. Under Int. Conv., April 19, 1912.

The sulphite liquor is treated with skimmed milk and dilute sulphuric acid, heated until the casein is precipitated and filtered. The filtrate is treated with more sulphite liquor and sulphuric acid, and heated in order to hydrolyse the lactose. The product may be used as a reducing agent, or neutralised and fermented. Whey may be substituted for skimmed milk, and is added to the whole of the sulphite liquor at once, since no casein is precipitated.
—L. E.

Viscose ; Process for the coagulation of and regeneration of cellulose from solutions of ——. J. E. Brandenberger. Fr. Pat. 457,633, July 17, 1912.

Solutions of viscose are coagulated by the action of carbon dioxide (*e.g.*, washed flue gases containing 5—15 per cent. CO_2) and the coagulum is subsequently decomposed by steaming to regenerate the cellulose. The method may be employed in the manufacture of artificial threads or films by squirting the viscose in an atmosphere of flue gases, or in the coating of paper or fabrics by exposing the coated material to the action of such gases.
—J. F. B.

Nitrating machines ; Process for nitrating, and unwinding the reel of paper in centrifugal ——. M. Delpy. Fr. Pat. 458,558, May 29, 1913. Under Int. Conv., June 1, 1912.

The reels of paper situated above the basket of the centrifugal nitrating machine are unwound by the force of jets of the nitrating acid directed obliquely against one or both surfaces of the paper. Two reels may be mounted over one machine.—J. F. B.

Plastic material enclosed between two cellulose films and method of manufacture. J. E. Brandenberger. Fr. Pat. 458,638, May 31, 1913.

Two bands of cellulose film are led over two cylinders mounted in adjustable juxtaposition, which may be heated. The fluid or pasty plastic material (gelatin, resin, oil, paraffin wax, caoutchouc, etc.) is fed into the trough formed by the juxtaposition of the two cylinders and is carried forward by the moving webs of cellulose film, which are thus cemented together by a layer of the plastic material. The compound film is led over a series of drying cylinders and reeled.—J. F. B.

Paper ; Process of bleaching fibres for the manufacture of ——. A. Lannoye. Fr. Pat. 457,006, Feb. 22, 1913. Under Int. Conv., Feb. 18, 1913.

Paper-making pulp is fed continuously, together with a quantity of bleach liquor generally not exceeding three times the dry weight of the pulp, into a kneading machine, in which the pulp is disintegrated and brought into intimate contact with the strong bleaching liquor. The bleached pulp is discharged continuously.—J. F. B.

Cellulosic esters ; Manufacture of ——. H. Dreyfus, Basle, Switzerland. Eng. Pat. 20,852, Sept. 12, 1912.

See Additions of Aug. 5 and Sept. 16, 1912, to Fr. Pat. 432,046 of 1911 ; this J., 1913, 283, 420. Reference is directed to Eng. Pats. 19,330 of 1905, 26,657 of 1909, 20,977 and 20,978 of 1911, and 21,376 and 22,645 of 1912.
—T. F. B.

Cellulose ; Process for preparing solutions of —— *with sulphuric acid and for the production of cellulose products from such solutions.* E. Berl, Brussels. Eng. Pat. 4966, Feb. 27, 1913. Under Int. Conv., June 10, 1912.

See Ger. Pat. 259,248 of 1912 ; this J., 1913, 653.—T. F. B.

Cellulose acetate ; Manufacture of ——. Safety Celluloid Co., Ltd. Fr. Pat. 458,263, May 22, 1913. Under Int. Conv., July 8, 1912.

See Eng. Pat. 15,868 of 1912 ; this J., 1913, 192.—T. F. B.

Process of making roads. [*Use of sulphite-cellulose waste lyes.*] U.S. Pats. 1,075,856 and 1,075,857. *See* IX.

Treating waste sulphite liquor and [*tanning*] *compound obtained therefrom.* U.S. Pat. 1,075,916. *See* XV.

Preparing anhydrides and chlorides of fatty acids, especially for making cellulose esters. Addition to Fr. Pat. 448,342. *See* XX.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Bleaching ; The dynamics of ——. S. H. Higgins. Chem. Soc. Trans., 1913, **103**, 1816—1821.

The author has studied the rate of exhaustion of extremely dilute solutions of bleaching powder in contact with a large excess of brown linen cloth. 51 sq. dm. of linen cloth, prepared by boiling with water under pressure, were placed in a beaker with 750 c.c. of water, and 10 c.c. of bleaching powder solution (sp. gr. 1·04) diluted with 1 litre of water. After two minutes, 10 c.c. of the dilute liquor were withdrawn and titrated with $N/500$ thiosulphate after adding potassium iodide and acidifying. Samples were thus examined at intervals of 5 minutes until the bleach liquor ceased to act. The chlorate value of the liquor was deducted as a constant correction from each titration. The results showed that the velocity coefficient, calculated by the formula $\frac{1}{t}\log\frac{a}{a-x}$, was practically a constant. Hence it is concluded that the exhaustion of the hypochlorite by the colouring matter is a unimolecular reaction, that is, the oxygen is produced directly from the active hypochlorite present in the solution. Similar results were obtained when the experiment was performed with bleach liquor in presence of lime water and in presence of dilute hydrochloric acid, the other conditions being the same. The unimolecular nature of the reaction was further confirmed by the study of the rate of exhaustion in contact with cotton cloth dyed with indigo.—J. F. B.

Caustic soda intended for mercerising ; Necessity of specifying a maximum percentage of carbonate in commercial ——. J. Dominelli. Rev. Gen. Mat. Col., 1913, **17**, 303—304.

The custom of valuing commercial caustic soda on the basis of total alkalimetric strength (percentage of Na_2O) may operate very adversely to the purchaser when the soda is required for mercerising cotton. Sodium carbonate is absolutely devoid of mercerising action upon cellulose and the inclusion of this alkali in the alkalimetric value of the caustic soda is a direct loss to the merceriser. The author suggests the fixation of a maximum limit (*e.g.*, 1·50 per cent.) for this impurity and a proportional allowance in the price when this limit is exceeded. It is also desirable to specify a limit for the percentage of sodium chloride in electrolytic caustic soda, since Hübner (this J., 1909, 228) has shown that the presence of large proportions of salt has an inhibitive influence on the mercerising action of sodium hydroxide.—J. F. B.

Silk ; Some notes on the dyeing of ——. R. Werner. Färber-Zeit., 1913, **24**, 453—456.

The author advocates the use in silk dyeing of only such acid dyestuffs as possess the greatest fastness to light. When all-round fastness is required the mordant dyestuffs are available but their application is difficult in the production of mode shades. Of vat dyestuffs only those of the cold dyeing class can be used, and even here the disadvantage of the presence of caustic soda can only be partially overcome by additions to the bath (*e.g.*, of glucose, water glass, etc.), and by keeping the vat dilute. Working details are given for the application of Algol Yellow R to silk.—J. B.

Straw and bast dyeing. A. Winter. Färber-Zeit., 1913, **24**, 457—460.

Before dyeing very thorough wetting out of the material is necessary to ensure good penetration, hard straws (*e.g.*, rye) requiring more care in this respect than soft straws (*e.g.*, wheat, barley and oats). Bleaching is necessary when light shades are to be dyed and hydrogen peroxide and sulphur dioxide are the usual agents. Bleaching powder can also be employed. When a better bleach is required than that given by peroxide alone, this is followed by a treatment with "Blankit" (hydrosulphite). For loose straw, basic dyestuffs are specially recommended, also the "alum" dyestuffs. These are dyed with 3 to 5 per cent. of acetic acid or 2 per cent. of alum and 2 per cent. of acetic acid. The material is entered cold and the dyestuff is added last. Dyeing requires 3 to 4 hours at 70° C. Acid dyes, dyed without addition or with 5 to 10 per cent. of acetic acid, are recommended for material which is penetrated with difficulty, dyeing being effected at the boil for from 2 to 6 hours, according to the hardness of the water. Substantive dyestuffs all dye straw without addition or in a neutral bath containing Glauber's salt, the material being introduced at 50° C. and dyed for 1 hour at the boil. This method is recommended for straw hats as the cotton stitching is dyed at the same time as the straw. Two-colour effects are now obtained by spray printing. An unlimited number of effects can be obtained in this way, and it is also suitable for discharge work with hydrosulphite, coloured discharges being obtained in the usual way. A typical discharge is made from 150—300 grms. of Hyraldite CW extra (sodium formaldehyde-sulphoxylate), 100 grms. of zinc-white, 480 grms. of water and 20 grms. of wheat starch, the mixture being warmed to 70° C. for 15—20 minutes, cooled, and mixed with 100 grms. of egg-albumin (1 : 1).—J. B.

Products of decomposition of indigo in the vat. Ehrhardt. *See* IV.

Patents.

Dyeing machine. The Psarski Dyeing Machine Co. Second Addition, dated April 5, 1913, to Fr. Pat. 436,936, Nov. 28, 1911 (this J., 1912, 430 ; 1913, 134).

The dyeing machine described *loc. cit.* is provided with receptacles containing samples of the material under treatment, which can be withdrawn from time to time and their shade examined. These receptacles are small cylinders provided with perforations in the top, similar to those in the cover of the machine, and with a spring at the bottom which presses against the mass of material in the machine and keeps the contents of the sample-carrier in position. The sample-carrier fits into a boss in the cover of the machine, and the circulating liquid passes through the sample in the receptacle at the same time and in the same manner as it passes through the mass in the machine.—J. F. B.

Bleaching ; Apparatus for —— *and for preparing bleaching, deodourising, and disinfecting solutions.* O. Sumner, St. Margarets on Thames, Assignor to The International Bleachers' Corporation, Ltd., London. U.S. Pat. 1,075,873, Oct. 14, 1913.

See Eng. Pat. 15,321 of 1912 ; this J., 1913, 288.—T. F. B.

Bleaching ; Apparatus for —— *and for preparing bleaching, deodourising, and disinfecting solutions.* O. Sumner. Fr. Pat. 458,787, June 3, 1913. Under Int. Conv., July 1, 1912.

See Eng. Pat. 15,321 of 1912 ; this J., 1913, 288.—T. F. B.

Violet shades on cotton fibre [*by means of azo dyestuffs*] *; Process for producing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,610, May 30, 1913. Under Int. Conv., June 13, 1912.

See Eng. Pat. 14,150 of 1912 ; this J., 1913, 360.—T. F. B.

Dyeing furs, hairs, feathers, and analogous articles ; Process for ——. Act.-Ges. f. Anilinfabr. First Addition, dated April 28, 1913, to Fr. Pat. 445,880, July 8, 1912. Under Int. Conv., Oct. 19, 1912.

See Ger Pat. 262,692 of 1912 ; this J., 1913, 941.—T. F. B.

Grey shades in printing on fabrics ; Process for producing full ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated May 2, 1913, to Fr. Pat. 453,799, Jan. 30, 1913. Under Int. Conv., May 13 and 30, 1912.

See Ger. Pats. 258,979, 259,293, and 260,848 of 1912 ; this, J., 1913, 654, 749.—T. F. B.

Printing colour. Berger und Wirth. Fr. Pat. 453,646, May 31, 1913. Under Int. Conv., Dec. 24, 1912.

See Eng. Pat. 12,567 of 1913 ; this J., 1913, 1007.—T. F. B.

[*Bleaching compound.*]. *Composition of matter.* U.S. Pat. 1,075,663. *See* VII.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Hydrochloric acid ; Purification of [*removal of arsenic*]—*by refrigeration.* G. A. Le Roy. Read before the Chicago Refrigeration Congress ; through Chem. Trade J., November 1, 1913, 435.

The arsenic frequently present in commercial hydrochloric acid is often removed on the industrial scale, as sulphide. To avoid the objections to this process a freezing method is suggested. The gas prepared in the usual way is first dried by washing with sulphuric acid, silghtly cooled, and then passed through a brine circulating refrigerator, which condenses the arsenious chloride. The arsenious chloride is drawn off from the lower part of the condenser, and the HCl passed into water as usual. It is claimed that other impurities, as Fe, Se, SO_2, and SO_3 are also removed in the refrigeration.

Iron pyrites ; New method for the determination of sulphur in ——. E. Martin. Monit. Scient., 1913, **111**, Nov., 686—688.

The ground sample (0·5 grm.) is treated with *aqua regia* (25 c.c.) and, after several hours, sodium chloride (1 grm.) is added and the mixture evaporated to dryness. The residue is treated with hydrochloric acid (4 c.c.), 50 c.c. of boiling water are added, and then sodium carbonate (4 grms.) in small portions at a time. The filtered solution is made neutral to methyl orange and boiled to expel carbon dioxide. 60 c.c. of barium hydroxide solution (45 grms. per litre) and some phenolphthalein are added, carbon dioxide is passed through until the colour is just discharged, the precipitate filtered off, washed with warm water, and the filtrate, after cooling, titrated with *N*/2 hydrochloric acid. 1 c.c. of acid is equivalent to 0·008 grm. of sulphur.—G. W. McD.

Iron pyrites ; Analysis of ——. E. Martin. Monit. Scient., 1913, **111**, Nov., 688—689.

Finely ground pyrites (3 grms.) is mixed with sulphur (2 grms.), and a mixture of alkali carbonates (8 grms.), and heated in a covered porcelain crucible for ½ hour. The crucible and contents are transferred to a beaker containing 400 c.c. of water and 20 c.c. of hydrochloric acid. After standing for some hours, crystallised sodium acetate (20 grms.) is added. On filtration and washing with acetic acid saturated with hydrogen sulphide, the metals are retained upon the filter as sulphides and are separated in the ordinary manner.—G. W. McD.

Phosphate fields of South Carolina ; A report on the ——. W. H. Waggaman. Bull. U.S. Dept. Agric., No. 18, 1913. 12 pages.

The present unfavourable position of the South Carolina phosphate industry is due to the exhaustion of the more accessible deposits and the discovery of higher grade phosphates in Florida and Tennessee. The output of S. Carolina increased from 12,262 tons of phosphate rock in 1868 to 618,569 tons in 1893, and then steadily decreased to 169,156 tons in 1911. Most of the rock mined at present is used locally in the manufacture of acid phosphate (superphosphate), the high cost of production (3·46 dollars or 14s. 5d. per ton) prohibiting exportation. Contrary to general opinion the deposits are far from exhausted, but the somowhat heavy overburden of soil (sand, clay, and calcareous mud) on much of the land would render working unprofitable until more efficient mining methods are devised.—A. S.

Sodium acetate ; Two isomeric forms of anhydrous ——. D. Vorländer and O. Nolte. Ber., 1913, **46**, 3199—3213.

The authors have confirmed the statements of Miller and Green (J. phys. Chem. 1909, 649 and 655) that the anhydrous salt and not a lower hydrate is formed on heating sodium acetate trihydrate above 58° C., or by cooling the molten trihydrate. This salt is also obtained by dehydrating the trihydrate at low temperatures, and is not identical with the anhydrous salt obtained by dehydrating at over 200° C., or by melting the anhydrous salt and allowing to cool. Sodium acetate I., stable above 198° C., is probably monoclinic. Sodium acetate II., stable below 198° C., is rhombic. Owing to the slowness of the change the form I. can be preserved for a long time at the ordinary temperature. The transition from trihydrate to the form II. and solution takes place at 58·2° C. On crystallising from boiling absolute alcohol the form II. separates, whether I. or II. has been dissolved. The new form II. is a much better condensing agent and takes up water more readily than I., so that when sodium acetate is required for use in organic preparations it is better not to fuse the anhydrous salt as is usually recommended but to dehydrate at 120°—160° C.—W. H. P.

Ammonium peroxide. J. D'Ans and O. Wedig. Ber., 1913, **46**, 3075—3076.

By leading dry ammonia into a solution of pure hydrogen peroxide in pure ether at—10° C., crystals of the substance NH_4HO_2 separate, but on further action they disappear and a heavy oily liquid separates. The ammonium hydrogen peroxide can be separated pure and melts at 14° C. The oily liquid can be solidified at about —40° C., and the crystals may be washed with ether at a low temperature in a specially constructed apparatus. An unweighed quantity consumed equivalent quantities of sulphuric acid and of potassium permanganate, which shows that this substance is true ammonium peroxide. $(NH_4)_2O_2$. It begins to evolve ammonia at —10° C., yielding ammonium hydrogen peroxide, and melts at —2° C. It dissolves slightly in ether and can be crystallised unchanged.—W. H. P.

Antimony pentasulphide ; Analysis of ——. Utz. Gummi-Zeit., 1913, **28**, 126—127.

The author discusses the methods of analysis of antimony pentasulphide ("golden sulphide") and gives results obtained by using tetrachloro-ethylene, trichloro-ethylene and pentachloro-ethane instead of pure carbon bisulphide for the determination of free sulphur. The electrolytic method is recommended for the determination of antimony, the substance being dissolved in saturated sodium sulphide solution and potassium cyanide then added.—H. E. P.

Silicic acid ; Gels of ——. H. Hermann. Silikat-Zeits., 1913, **1**, 185—189.

Further experiments on the action of solutions containing tungstates on silicic acid (see this J., 1912, 1076) have shown that silicic acid gels, whether prepared artificially or in the form of natural minerals (chalcedony, opal, etc.) are attacked by such solutions, with formation of silicotungstic acid, whereas stable compounds of silicic acid, such as kaolin, are not acted upon.—A. S.

Colloidal sulphur and selenium ; New method of preparation of ——. J. Meyer. Ber., 1913, **46**, 3089—3091.

Powdered sulphur or selenium is dissolved in a few c.c. of hydrazine hydrate, and the resulting dark coloured syrupy solution is poured, with vigorous agitation, into several litres of water. The colloidal selenium solution thus produced has a deep red colour and is very stable; it can be boiled for a long time without alteration. The yellowish-white colloidal sulphur solution is less stable. The syrupy solutions obtained at first are not colloidal but true solutions, probably of hydrazonium sulphur or selenium compounds.—A. S.

Salt in British Columbia. Min. and Eng. World, Oct. 25, 1913.

An extensive bed of salt has been discovered at Kwimtsa (Mile 45. on Grand Trunk Pacific Railway) on the Skeena river. So far five holes have been drilled, some more than a mile from others, and all have struck salt, at depths varying from 50 to 250 ft. About 8 tons have been secured. The principal salt wells of Canada are situated in Western Ontario. On account of the long rail haul most of the salt used in British Columbia is imported from California. The presence of salt beds near Vancouver is, therefore, of importance.

Sulphur deposits in New Zealand. Board of Trade J., Nov. 6, 1913.

Important works in connection with the sulphur deposits of White Island, a mountain top jutting out of deep water in the Bay of Plenty, are to be taken in hand, and for this purpose a company has been formed, although operations on the island have been carried on for the past eighteen months. The first shipment of sulphur has been made and contained 75 to 80 per cent. of pure sulphur. The company expects to be able to turn out, within the next few months, pure sulphur to the extent of 500 tons per month.

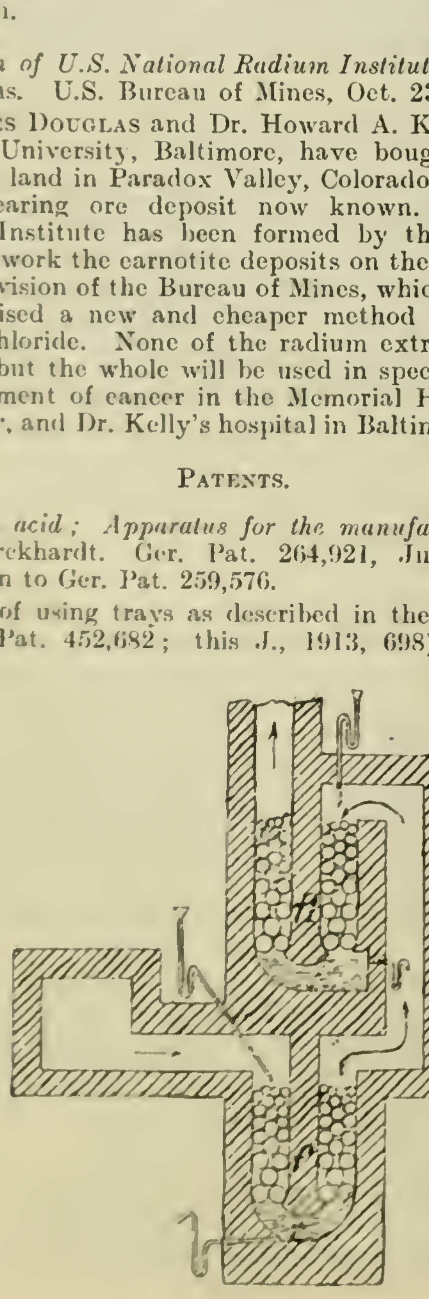
Formation of U.S. National Radium Institute. C. L. Parsons. U.S. Bureau of Mines, Oct. 23, 1913.

Dr. James Douglas and Dr. Howard A. Kelly of Johns Hopkins University, Baltimore, have bought 27 claims of mining land in Paradox Valley, Colorado, the greatest radium-bearing ore deposit now known. A National Radium Institute has been formed by the above and others to work the carnotite deposits on the claims under the supervision of the Bureau of Mines, which is stated to have devised a new and cheaper method of extracting radium chloride. None of the radium extracted will be for sale, but the whole will be used in special clinics for the treatment of cancer in the Memorial Hospital, New York City, and Dr. Kelly's hospital in Baltimore.

PATENTS.

Sulphuric acid; Apparatus for the manufacture of ——. A. Burckhardt. Ger. Pat. 264,921, July 12, 1912. Addition to Ger. Pat. 259,576.

Instead of using trays as described in the chief patent (see Fr. Pat. 452,682; this J., 1913, 698), a series of reaction chambers packed with filling material is used (see Fig.). Each chamber is divided into a gas-inlet and a gas-outlet compartment by means of depending partitions, f, f_1, dipping into shallow layers of liquid.—A. S.



Sulphuric acid; Manufacture of —— in a system of towers R. Heinz, Techn. Bureau f. d. Chem. Industrie, Ges. m. b. H. Ger. Pat. 264,640, Nov. 1, 1911.

Interaction between gases containing sulphur dioxide and nitrous vapours is effected in towers packed with filling material so arranged that the free spaces between the packing are alternately narrower and wider in passing from the bottom to the top of the tower. The frequent changes of velocity in the gas currents thus induced is stated materially to accelerate the production of sulphuric acid. Some of the towers may be only partly packed with filling material and between the two end towers there are one or several towers with no packing material. —A. S.

Hydrochloric acid gas; Manufacture of dry —— from sodium chloride and sulphuric acid. Saccharinfabrik A.-G., vorm. Fahlberg, List und Co. Ger. Pat. 265,045, Feb. 5, 1913. Addition to Ger. Pat. 186,398.

By using a retort, the upper part of which is lined with acid-proof material to below the level at which the fused bisulphate will stand, and the lower part of which is so shaped that it affords sufficient heating surface to maintain the retort at the necessary temperature, it is possible to carry out the process described in the chief patent (Fr. Pat. 384,727; this J., 1908, 502; see also Ger. Pats. 238,570 and 261,411; this J., 1911, 1312; 1913, 826) with sulphuric acid of less than 90 per cent. strength, for example with acid of concentration down to 60° B. (sp. gr. 1·71, 78 per cent. H_2SO_4).—A. S.

Ammonia-soda process. A. Clemm, Mannheim, Germany. Eng. Pat. 16,470, July 17, 1913. Under Int. Conv., Dec. 3, 1912.

The ammonium chloride lye, separated from bicarbonate, is treated with an electrolysed solution of sodium chloride, which solution contains sodium hydroxide and sodium chloride. After expelling the liberated ammonia, the residual liquor is again electrolysed and used afresh for the same purpose. Distillation apparatus of a continuous type is described, in which the mixture of lyes is made to follow an extended path, the vapour space being, if desired, divided into compartments for separating ammonia of different degrees of concentration.—F. Sodn.

Alkalis; Process for utilising natural rocks and obtaining —— by igniting rocks with lime. Chem. Fabr. Rhenania and A. Messerschmitt. Ger. Pat. 264,900, March 7, 1912.

The rock is ignited with limestone or lime, and the product is treated first with a limited quantity of water and then with superheated steam, preferably in an autoclave. —A. S.

Lead oxide; Production of —— and means or apparatus employed therein. W. Innes, Liverpool. Eng. Pats. 15,664, July 4, 1912, and 1589, Jan. 20, 1913.

Molten lead, maintained at constant level in an oxide pot preferably of oblong horizontal section, is atomised by the action of blades or other stirrers which dip into the metal or dross and are made to rotate in a plane other than horizontal. Blasts of heated air or steam, or both, are introduced, and the height of the pot or of an upcast therefrom is such that the atomised material is wholly or partly oxidised whilst in suspension. A steel "wearing piece" may be bolted to the end-wall of the pot, for receiving the impact of the metal dashed against the wall by the stirrer. Several forms of the apparatus showing different types of stirrer are described.—F. Sodn.

Aluminous compounds; Production of ——. H. Spence, W. B. Llewellyn, and Peter Spence and Sons, Ltd., Manchester. Eng. Pat. 22,590, Oct. 4, 1912.

Unground calcined coal measure or like shales are digested with sulphuric acid or with acid solutions of aluminium sulphate, under conditions which prevent any material precipitation of potassium and iron compounds, whilst producing substantially neutral solutions of aluminium sulphate, from which the potassium may be subsequently removed in the form of alum. As in Eng. Pat. 3085 of 1912 (this J., 1913, 363), the digestion is preferably effected in successive stages, but the less exhausted shales are treated under conditions of specific gravity and temperature which prevent precipitation of insoluble iron and potassium compounds, and the more exhausted shales, with solutions of a lower specific gravity than would cause precipitation of an iron salt soluble in water.—F. Sodn.

Chrome alum; Manufacture of ——. J. Hertkorn. Ger. Pat. 265,046, Oct. 29, 1912.

A SOLUTION of chromium sulphate in water, or, in sulphuric acid, is treated with potassium sulphate or ammonium sulphate or potassium or ammonium sulphite or bisulphite, with or without addition of a small quantity of nitrate or nitrite, and then subjected to the action of sulphur dioxide under ordinary or increased air pressure. The chrome alum separates from the solution in ruby red crystals.—A. S.

[*Bleaching compound*] *Matter; Composition of* ——. P. B. Meerbott, Secaucus, N.J., Assignor to J. T. Stanley, New York. U.S. Pat. 1,075,663, Oct. 14, 1913.

A MIXTURE of sodium perborate and boric acid.—B. N.

Calcareous saltpetre, potassium or magnesium chloride, and the like; Apparatus for comminuting ——. H. Pauling, Cologne, Germany, Assignor to Southern Electro-Chemical Co. U.S. Pat. 1,075,722, Oct. 14, 1913.

A MOULD, containing a block of the material, is held detachably in an overturned position by clamps carried on a frame, to which also are attached cutting means adapted to advance into the mould and means for collecting and delivering the particles cut from the block.—F. Sodn.

Carbonitrides which evolve ammonia on treatment with water or acids; Process for obtaining ——. S. Peacock. Fr. Pat. 458,168, May 9, 1913.

SEE Eng. Pat. 11,390 of 1912; this J., 1913, 699. Aluminium carbonitride is similarly obtained from alumina at a temperature of about 1700° C., silicon carbonitride from silica at 1800° C., and magnesium carbonitride from magnesia at about 1600° C.—T. F. B.

[*Phosphate*] *Minerals; Concentration of* ——. K. Gerson and Soc. Alpine Maschinenfabrik Ges. m. b. H. Fr. Pat. 458,625, May 31, 1913.

LOW-GRADE mineral phosphates are ground, heated in a rotary kiln to the temperature necessary to decompose calcium carbonate, then mixed with water, and the solution of lime, calcium sulphate, etc., decanted from the insoluble phosphate.—A. S.

Sodium fluoride and aluminium fluoride; Manufacture of a double compound of —— *with the simultaneous recovery of colloidal silicic acid.* Humann und Teisler. Fr. Pat. 458,750, May 21, 1913.

ALUMINA, aluminium hydroxide, clay, kaolin or bauxite is treated with sodium silicofluoride in presence of a large quantity of hot water, and in the proportions requisite for the production of a double compound of the composition, $2Al_2F_6,6NaF$. After allowing to settle, the colloidal solution of silicic acid is separated from the insoluble double fluoride. The latter is more fusible than artificial cryolite and its use as a substitute for that substance in the manufacture of aluminium, enamels, and opal glass, is claimed.—A. S.

Cyanogen and hydrocyanic acid; Preparation of gases containing —— *from hydrogen, nitrogen and carbon or carbonaceous gases in the electric arc.* Konsortium für Elektrochemische Industrie Ges. m. b. H. Ger. Pat. 263,692, July 1, 1911.

IT has been impossible hitherto to prepare cyanogen compounds from nitrogen, hydrogen, and carbon or hydrocarbons in furnaces of the type successfully used for the electrical production of oxides of nitrogen, owing to the difficulty of maintaining steady flame arcs. According to the present patent long steady arcs are produced and maintained by introducing conducting vapours of metals or metallic compounds into the zone in which the electrical discharge is produced.—A. S.

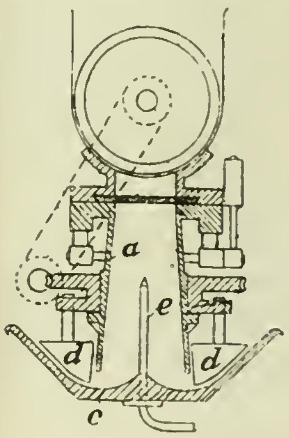
Carnallite; Process for the decomposition of crude ——. Königliche Berginspektion. Ger. Pat. 263,715, May 15, 1912.

THE coarsely crushed carnallite is placed in a vessel with a perforated false bottom and lixiviated with water or a suitable solution so as to remove the magnesium chloride, leaving potassium chloride in the residue. The lixiviating liquid is introduced below the false bottom and discharged from the upper part of the vessel. The residue is then treated with hot liquors, poor in magnesium chloride, these being introduced from above, and clear potassium chloride solution drawn off below the false bottom.—A. S.

Salts separating at different temperatures; Process for separating —— *from solutions.* F. Krupp A.-G. Grusonwerk. Ger. Pat. 264,899, July 8, 1911.

THE solution is cooled progressively whilst passing through a receptacle divided into a number of compartments, and the products separating at different temperatures are withdrawn continuously and independently from the several compartments or from groups of compartments. For example, a right- and left-handed screw conveyor, passing through all the compartments, may be used, the salt separating first being withdrawn in one direction and that separating later, in the other direction.—A. S.

Kieserite nearly free from chlorine; Process for obtaining —— *from potash salt residues or other minerals.* S. Haun. Ger. Pat. 265,044, Feb. 23, 1913.



THE kieserite falls from a washing drum into the tube, *a*, which is closed below by the dish, *c*. The latter is movable vertically and its inner surface is polished or enamelled. As the material accumulates, it is forced to the outer edge of *c*, whence it is discharged continuously by the devices, *d*, on to a conveyor below. A jet of water is delivered upwards through the nozzle, *e*, to wash the kieserite.—A. S.

Magnesium chloride from the final liquors from the manufacture of potassium salts; Process for removing —— *in the form of magnesium silicate.* E. Natho. Ger. Pat. 265,296, Aug. 10, 1912.

THE concentrated liquor is heated with fine sand or the like under pressure in an autoclave.—A. S.

Dissolving crude potash salts and other substances; Apparatus for ——. H. Drescher. Ger. Pat. 265,578, Oct. 10, 1911.

THE material is conveyed through a trough, in the opposite direction to a stream of the solvent, by means of blades mounted spirally on a longitudinal rotating shaft. Fixed or rotating transverse partitions may be disposed within the trough. The blades are shaped to form scoops, with one side cut away so that the material after being lifted, falls out of the scoop in the direction in which it is being conveyed through the trough. In the case of heavy materials, or with a relatively short trough, each scoop has on its inner surface a rib extending from the centre to the inner edge, by means of which a portion of the material is discharged vertically downwards instead of being moved forwards.—A. S.

Radioactive substances containing radium and mesothorium ; Concentration and separation of ——. Kunheim und Co. Ger. Pat. 264,901, June 15, 1912.

IN the concentration and separation of radioactive substances by fractional crystallisation, instead of using the easily soluble chlorides and bromides as hitherto, it is proposed to use the more sparingly soluble (in the cold) salts of the active substances with acids the barium salts of which are less soluble than the corresponding strontium and calcium salts either alone or in the presence of the barium salts. The picrates, bromates, and ferrocyanides have proved particularly suitable, and alcohol, acetic acid, etc. may be used as solvents in addition to water. If both radium and mesothorium be present, the latter separates first.—A. S.

Sulphur and sulphates from sulphur-oxygen compounds ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,920, Oct. 16, 1912.

SOLUTIONS containing sulphites, or bisulphites, or both, either alone or together with thiosulphates, are heated with polythionates.—A. S.

Sulphur and sulphates ; Manufacture of —— by heating sulphites under pressure. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 265,167, Sept. 18, 1912.

A MIXTURE of normal sulphite and bisulphite, in solution or in the solid state, dry or moistened with a little water, is heated under pressure. The sulphites are converted smoothly and completely into sulphate and sulphur according to the equation: $2NaHSO_3+Na_2SO_3=2Na_2SO_4+S+H_2O$.—A. S.

Gas reactions [Production of oxides of nitrogen], Method of producing —— by means of electric flame arcs. Badische Anilin und Soda Fabrik. Ger. Pat. 265,413, Oct. 6, 1912.

WHILST it is known that higher yields of nitric oxide are obtained from air enriched in oxygen than from atmospheric air, the technical utilisation of this fact has been prevented by the high cost due to the large volumes of gases employed. According to the present patent the enriched gas is introduced only at the reaction zone proper, whilst the cheaper and more easily obtainable gas is supplied to the remainder of the furnace chamber. For example in the manufacture of nitric oxide, air enriched in oxygen, or pure oxygen, is supplied to the reaction zone, and air to the space around the same. The apparatus is preferably of the type in which a long arc is produced within a tube: the oxygen or enriched air is supplied in an axial direction and atmospheric air with a whirling motion along the wall of the tube.—A. S.

Neon ; Separation of —— from gases with which it is admixed. G. Claude. Fr. Pat. 456,694, June 24, 1912.

WHEN an electric discharge is produced in a rarefied atmosphere composed of a mixture of neon with other gases, the neon is absorbed much more slowly than the other constituents of the mixture, so that finally a rarefied atmosphere of practically pure neon is obtained. (See also this J., 1911, 736.)—A. S.

Graphite ; Purification of ——. Humann und Teisler. Fr. Pat. 458,441, May 9, 1913.

THE finely ground crude graphite is mixed with an electrolyte furnishing hydroxyl ions in aqueous solution, with or without addition of a protective colloid such as humic acid, and the impurities are removed from the graphite in the form of a colloidal solution. For example the graphite is ground with about 20 times its quantity of water which has been rendered feebly alkaline, and the mixture is allowed to settle.—A. S.

Graphite ; Recovery of —— from pieces of used graphite crucibles. A. Teichmann. Ger. Pat. 263,953, June 25, 1912.

THE pieces are treated with sulphuric, hydrochloric or nitric acid or the like for from 4 to 12 hours, then heated to redness in an oven or in retorts, freed from adhering particles of slag by crushing rolls and screens, and the recovered graphite ground to the desired degree of fineness by a number of pairs of rolls with intermediate screens. The rolls of each pair are rotated at exactly the same speed, and, to ensure this, special claim is made for the use of pairs of rollers of which one is driven by gearing and the other by friction.—A. S..

Electrolytic apparatus [for making hydrogen peroxide]. H. Henkel and W. Weber, Assignors to Henkel und Co., Düsseldorf, Germany. U.S. Pat. 1,074,549, Sept. 30, 1913.

SEE Fr. Pat. 457,696 of 1913 ; this J., 1913, 1010.—T. F. B.

Hydrogen peroxide ; Process for making ——. Henkel und Co. Fr. Pat. 456,796, April 17, 1913. Under Int. Conv., July 26, 1912.

SEE Eng. Pat. 8582 of 1913 ; this J., 1913, 791.—T. F. B.

Hydrogen peroxide ; Process for making ——. Henkel und Co. Fr. Pat. 456,858, April 19, 1913. Under Int. Conv., Jan. 29, 1913.

SEE Eng. Pat. 8890 of 1913 ; this J., 1913, 791.—T. F. B.

Ferroso-ferric oxide ; Manufacture and use of ——. H. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 1,075,709, Oct. 14, 1913.

SEE Fr. Pat. 425,482 of 1911 ; this J., 1911, 1020.—T. F. B.

Alkali metals in the form of nitrates ; Method for extracting —— from minerals. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,076,508, Oct. 21, 1913.

SEE Ger. Pat. 252,278 of 1911 ; this J., 1912, 1179.—T.F.B.

Boron [nitride]; Manufacture of ——. Comp. Franç. pour l'Exploitation des Procédés Thomson Houston. Seventh Addition, dated April 4, 1913, to Fr. Pat. 377,683, May 8, 1907.

SEE Eng. Pat. 21,865 of 1912; this J., 1913, 600.—T. F. B.

Calcium cyanamide ; Treatment of ——. F. W. MacMahon. Fr. Pat. 456,765, April 16, 1913. Under Int. Conv., April 20, 1912.

SEE Eng. Pat. 9412 of 1912 ; this J., 1912, 548.—T. F. B.

Perborates, Electrolytic process for producing ——. Chem. Fabr. Grünau, Landshoff und Meyer A.-G., and K. Arndt. Fr. Pat. 458,550, May 29, 1913. Under Int. Conv., June 25, 1912.

SEE Eng. Pat. 12,536 of 1913 ; this J., 1913, 910.—T. F. B.

Operations using hydrogen or gases containing it, under pressure and at a high temperature ; Process for carrying out ——, *especially for the catalytic production of ammonia.* Badische Anilin und Soda Fabrik. Fr. Pat. 456,963, April 22, 1913. Under Int. Conv., Sept. 21, 1912.

SEE Eng. Pat. 28,200 of 1912; this J., 1913, 1009.—T. F. B.

Operations using hydrogen or gases containing it ; Process and apparatus for carrying out ——. Badische Anilin und Soda Fabrik. Fr. Pat. 458,218, May 21, 1913. Under Int. Conv., June 7, 1912, and May 13, 1913.

SEE Eng. Pats. 29,260 of 1912 and 13,258 of 1913 ; this J., 1913, 1010.—T. F. B.

Hydrogen ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 27,735, Dec. 2, 1912.

SEE Fr. Pat. 453,077 of 1913 ; this J., 1913, 791.—T. F. B.

ADDENDUM.

This Journal, Nov. 15, 1913, page 1009, col. 2, line 21 from bottom, insert name of patentee: "Berlin-Anhaltische Maschinenbau-A.-G., Abteilung Köln-Bazenthal."

Hydrogen ; Manufacture of ——. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés Georges Claude), Paris. Eng. Pat. 7147, March 25, 1913. Under Int. Conv., March 28, 1912.

See Fr. Pat. 453,187 of 1912 ; this J., 1913, 791.—T. F. B.

Preparing a precious-metal-dissolving means. U.S. Pat. 1,076,006. *See* X.

Electrolytic cell. U.S. Pat. 1,075,570. *See* XI.

VIII.—GLASS ; CERAMICS.

Patents.

Alumina ; Manufacture of articles of fused ——. P. H. G. Durville. Fr. Pat. 456,695, June 24, 1912.

Aluminium powder and powdered charcoal are mixed and made into a paste with water containing a little gum or molasses. The mass is formed into the desired shape, dried, and heated to bright redness, when the aluminium and carbon combine, and immediately, the mass is subjected to the action of oxygen. Pure alumina is thus formed which agglomerates, preserving the desired shape. Suitable additions may be made to the original paste in order to produce coloured or crystalline alumina.—T. St.

Ceramic products ; Manufacture of ——. H. H. Randolph. Fr. Pat. 455,837, April 18, 1913.

The fluxes are introduced into the usual mixture of clay and rough sand by means of granite or volcanic ash. Fine silica is also added in order to promote the formation of silicates with lime or other alkaline earth.—H. H. S.

Manufacture of a double compound of sodium fluoride and aluminium fluoride, with the simultaneous recovery of colloidal silicic acid. Fr. Pat. 458,750. *See* VII.

Covering the silvering of glass by galvanic deposition of a protecting metal. Eng. Pat. 13,109. *See* X.

Recovery of iron, steel, etc., from waste enamelled ware. Addition to Fr. Pat. 418,971. *See* X.

IX.—BUILDING MATERIALS.

Magnesian hydraulic limes. I. Dolomite ; Thermal decomposition of normal ——. O. Kallauner. Chem.-Zeit., 1913, 37, 1317.

Dolomite begins to decompose at about 500° C. into calcium and magnesium carbonates. This is also the approximate temperature at which magnesite begins to evolve carbon dioxide (this J., 1913, 361). The decomposition of dolomite reaches a maximum between 710° and 730° C., when the magnesium carbonate formed is immediately decomposed. The calcium carbonate begins to decompose at 875° C., and does so most rapidly at 900°—915° C.—W. H. P.

Hydraulic material [for use as an addition to Portland cement], Clinker from Württemberg oil-shale as ——. O. Schmidt. Tonind.-Zeit., 1913, 37, 1652—1654.

The composition of the clinker is approximately : soluble silica, 22 ; insoluble silica, 21 ; ferric oxide and alumina, 17 ; lime, 25·5 ; and magnesia, 0·5 per cent. respectively, the remaining constituents being ferrous oxide, carbon dioxide, sulphur trioxide, and water. Added in small quantities to Portland cement, the finely ground clinker acts as an efficient retarding agent without producing volume changes like calcium sulphate. Considerable quantities of the material may be added to cement-sand mortars without diminishing the strength of the same after long periods, the strength of mortars containing shale-clinker being even better maintained under water than in air. Thus the tensile strengths, after 28 and 90 days in air, of (1) pure 1 : 3 cement-sand mortar, and (2) of a mortar composed of 3 of sand to 1 of cement containing 30 per cent. of shale-clinker, were (1) 33·5, 33·4, and (2) 32·2, 36·3 kilos. per sq. cm. respectively. The figures in the case of (1) pure cement sand mortar and (2) mortar made from cement containing 40 per cent. of shale-clinker, under water for 28 and 90 days, were (1) 23·4, 30·0, and (2) 20·2, 31·4 kilos. per sq. cm. respectively.—O. R.

Cements ; The testing of —— *with plastic mortar.* F. Schüle. Tonind.-Zeit., 1913, 37, 1707—1709.

Tests with prisms made of a definite size, and containing definite weights of sand and cement gauged to a plastic mortar, confirmed the validity of Féret's formula, β(compression strength)$=k\left(\frac{c}{1-s}\right)^2$, in which c and s are the absolute volumes of cement and sand per unit volume of the freshly prepared mortar, and k is a constant depending on the length of time between gauging and testing. Under the above conditions of testing, the strength of the mortar is unaffected by the proportion of water used in gauging, but varies with the nature of the sand, and it is proposed that series of tests should be made, with typical cements, using German and other standard sands, with a view to rendering possible a comparison of results obtained in different countries. Tests made with German and Swiss standard sands are recorded.—F. Sodn.

Paving brick from blast-furnace slag. F. G. Bolles. U.S. Consular and Trade Reports. Min. and Eng. World, Nov. 1, 1913.

An extensive industry is being developed in the north of England, at Middlesborough, based upon the utilisation of blast-furnace slag. The method pursued in the manufacture of these bricks is as follows : A suitable manufacturing site is selected near the blast furnaces which are to supply the slag, this plant being connected by a railroad upon which the molten slag is carried from the furnace to the moulding machine. The car which carries the slag is of plate steel with a fire-brick lining, the top being covered over with a removable cap, in the centre of which is a hole approximately 18 ins. in diameter, through which the slag is poured when the car is filled at the furnace. At the bottom of this car is a tap similar to those used upon blast furnaces. The car of molten slag is run alongside the wheel, carrying the moulds, and forming the moulding machine, the trough to the tap extending over the moulds ; the clay plug in the tap is knocked out and the molten slag runs into the mould. As soon as it is filled, an operator, by means of a handwheel mounted upon a sheet-steel heat deflector and connected through rods and mitre gears to the centre of the moulding wheel, turns the latter so that the next mould comes under the flow of hot slag, and so on until all the moulds are filled. By the time that the wheel has made a quarter revolution the cast bricks have sufficiently cooled so that they may be dropped out of the moulds by knocking off the catch which holds the bottom in place. As soon as they have dropped to the ground they are taken to the adjoining gas-heated annealing furnaces. These furnaces hold approximately 1100 bricks at one charge. The heat retained in the bricks when they are placed in the furnace, together with a very small amount of fuel, again brings them to a cherry red, and as soon as the furnace has been filled it is closed and allowed to cool gradually, 24 hours usually being required before the bricks are removed. The capacity of the slag car is approximately 3½ tons, from which 360 to 400 paving bricks are made. The bricks weigh about 14 pounds each. These bricks are proving very efficient for street paving and are being exported to the United States, Canada, and many other foreign countries. (See also Baggaley, this J., 1906, 181.)

Patents.

Portland cement; Furnaces or kilns for roasting ——. Beocsini Cementgáyri Unio Részvenytársaság, Budapest, Hungary. Eng. Pat. 11,853, May 21, 1913. Under Int. Conv., May 22, 1912.

A vertical kiln for roasting Portland cement is provided with a rotary grate, which co-operates with the stationary mass of material within the furnace shaft so as to break it up and allow of its uniform discharge through the bars of the grate and between the grate and the surrounding wall. Below the grate is an annular supporting plate for the purpose of regulating the descent of the charge. —W. C. H.

Cement and process of making same; Water-resistant ——. C. Ellis, Montclair, N.J., Assignor to New Jersey Testing Laboratories. U.S. Pat. 1,076,028, Oct. 21, 1913.

Dry, finely ground cement, capable of binding together on exposure, is passed through spray produced by atomising a melted waterproofing substance containing a fatty acid and a wax.—W. C. H.

Cement, lime, dolomite, magnesite, and the like, Burning and sintering ——. F. C. W. Timm. Ger. Pat. 265,144, Nov. 24, 1911.

The finely powdered or fine-grained material, mixed with powdered fuel, and agglomerated to form small lumps, is preheated by hot gases and then burnt or sintered by the combustion of the incorporated fuel by a current of air led through the charge. The air is led first through a layer of small-grained, refractory material disposed above or below the charge, *e.g.*, through a layer of previously sintered material.—A. S.

Kiln for burning limestone. S. Eccettuato. Fr. Pat. 458,514, May 28, 1913.

The hearths on which the fuel is burnt are distributed symmetrically around the burning chamber, and open into it along the principal axes of its cross-section, whether rectangular, elliptical, or oval, the number of hearths being regulated accordingly. The descent of the material is controlled by adjusting a movable platform closing the bottom of the kiln.—H. H. S.

Kiln for burning limestones and particularly cements. S. Eccettuato. Fr. Pat. 458,515, May 28, 1913.

Above the burning zone, and carried independently of it on arches and vaults, is a peripheral space divided into several chambers which communicate below with the burning zone by inclined passages, and above with the chimney. The charge passes down through these and is traversed by hot gases before entering the burning zone. To ensure a good draught the chambers form in section an irregular triangle, while the burning chamber is circular at the top, square in the middle and circular below. As in Fr. Pat. 458,514 (see preceding abstract), a movable platform at the bottom of the kiln controls the descent of the charge.—H. H. S.

Fire bricks or blocks; Manufacture of ——. S. W. Burley, Sittingbourne, Kent. Eng. Pat. 13,072, June 5, 1913.

"Strong earth" and/or loam is finely ground, tempered with the least possible quantity of water, moulded and dried: the resulting products are claimed to be tenacious and fire-resisting.—O. R.

Refractory materials. W. Arthur, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pats. 1,072,413 and 1,072,414, Sept. 9, 1913.

(1). A soft, coherent refractory material, composed largely of fine particles with a felt-like texture and having a specific thermal resistance of about 900 to 1200 ohms per inch cube, is obtained by condensing the vapours produced on fusing a mixture of silica, carbon, and fire-clay. When manganese oxide is also added to the mixture the condensed product obtained is coherent, bluish-grey in colour, has a low specific thermal resistance and temperature coefficient, and also possesses the property of hardening on standing. (2). A mixture of 15 parts of silica, 12 parts of carbon, and 20 parts of titanium oxide is heated to the temperature of the electric arc, and the resulting vapours condensed in an inert environment. The condensed product is a grey, "flabby," coherent material, composed largely of a soft powder and interlacing fibre-like crystals; it has an apparent density of 0·06 to 0·16, and a real density of 2·56, a low heat conductivity, and contains silicon, carbon, oxygen and titanium.—W. C. H.

Stoneware; Artificial ——. R. F. Osborn and J. Roach, Ainsworth, Nebr., Assignors to A. A. Radtke, Chicago, Ill. U.S. Pat. 1,075,932, Oct. 14, 1913.

A vitreous, porous, and anhydrous building material, containing about 93 per cent. SiO_2, and composed of coarse sand particles sintered together at their points of contact so as to form a coherent structure.—O. R.

Roads; Process of making ——. [*Use of sulphite-cellulose waste lyes.*] J. S. Robeson, Au Sable Forks, N.Y. U.S. Pats. 1,075,856 and 1,075,857, Oct. 14, 1913.

(1). Roads comprising clays or clayey matter are treated first with finely divided calcareous material and then with an acidified sulphite waste liquor preparation, preferably containing some sodium lignosulphonate. (2). Salt is substituted for calcareous matter, and the sulphite waste liquor is used in a concentrated form.—O. R.

Wood product [*; Impregnated* ——]. J. A. De Cew, Montreal, Canada. U.S. Pat. 1,075,552, Oct. 14, 1913.

See Eng. Pat. 5411 of 1912; this J., 1913, 535.—T. F. B.

Wood; Preserving ——. W. Schoeller and W. Schrauth, Berlin, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,322, Oct. 21, 1913.

See Ger. Pat. 240,988 of 1910; this J., 1912, 283.—T. F. B.

Wood; Process for impregnating ——. L. Dautreppe, Brussels. U.S. Pat. 1,076,553, Oct. 21, 1913.

See Fr. Pat. 455,556 of 1913; this J., 1913, 946.—T. F. B.

Wood and analogous substances; Process for preserving, treating, and fireproofing ——. J. A. De Cew. Fr. Pat. 458,324, May 24, 1913.

See U.S. Pat. 1,010,122 of 1911 and Eng. Pat. 5411 of 1912; this J., 1912, 29; 1913, 535.—T. F. B.

Fire-brick; Spinel ——. C. A. Mankau, St. Petersburg. U.S. Pat. 1,075,659, Oct. 14, 1913.

See Fr. Pat. 417,293 of 1910; this J., 1911, 29.—T. F. B.

Slag products; Manufacturing ——. C. H. Schol, Allendorf, Germany. U.S. Pat. 1,076,657, Oct. 21, 1913.

See Addition of April 12, 1913, to Fr. Pat. 437,595 of 1911; this J., 1913, 1012.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Pure iron; The critical ranges A2 and A3 of ——. G. K. Burgess and J. J. Crowe. Trans. Amer. Inst. Min. Eng., 1913, 46. 2537—2591.

Using 15 samples of pure iron (C 0·003 per cent.) prepared by various methods, the authors have taken some 130 heating and cooling curves by the inverse-rate and differential methods simultaneously. The samples were heated in a vacuum (0·01 mm. of mercury). To obtain regular curves with sharp bends, it was necessary to remove occluded gases from the samples by premelting in a vacuum, and to use a single piece of iron entirely surrounding, and in contact with, the thermocouple junction; small samples (1·0 grm. or so) gave sharper results than large samples. The apparatus used and its arrangement are described in detail. The curves obtained are considered to give conclusive evidence of the independent existence of A3 and A2. The A2 transformation has not a double cusp, and there do not appear to be other transformations above A3 or below A2 between 300° and 1050° C. The relative amounts of heat evolved at A3 and A2 are approximately 3 to 1 respectively. All preparations of pure iron, even those containing gases, when reduced to the common basis of zero rate of heating or cooling, have the same maximum for the A2 critical range, namely, Ac2=Ar2=768° C.±0·5. The beginning of Ac3 coincides with the beginning of Ar3, the maxima for zero rate being Ac3=909° C. ±1, and Ar3=898° C.±2. The authors consider that the fact that A2 appears to be accompanied by no crystallographic change, such as accompanies A3, requiring a violent rearranging of relatively large crystal masses, and involving a considerable quantity of heat, may account for the sharpness with which Ac2=Ar2, and that the A2 transformation may be merely molecular, not involving the crystallographic structure as such.—T. St.

Steel; The influence of various elements on the absorption of carbon by ——. R. R. Abbott. Trans. Amer. Inst. Min. Eng., 1913, **46**, 2389—2400. (See also this J., 1913, 88.)

To test 208 steels of compositions representing most of the types of modern constructional steel, specimens ¾ in. in diameter and ¾ in. in length, packed in a carburising box, were heated to 900° C., and in duplicate to 1000° C., each for 10 hours. The samples were weighed to the nearest mgrm. before and after, and the increase in weight taken as absorbed carbon. The results indicate that with 0·3 per cent. of carbon, the order of carburising efficiency for different steels was as follows:—(1) Cr 1·04, V 0·18 per cent.; (2) plain carbon steel; (3) Cr 0·46, Ni 3·03 per cent.; (4) Cr 0·09, Ni 3·38 per cent.; these percentages are means of the groups of samples.—T. St.

Steel; Influence of copper upon the physical properties of ——. G. H. Clevenger and B. Ray. Trans. Amer. Inst. Min. Eng., 1913, **46**, 2437—2475.

The authors prepared sound steel ingots, free from blowholes, containing up to 5 per cent. Cu, by adding electrolytic copper to melted mild steel punchings. It was specially important to "kill" the steel before adding the copper, by maintaining it for 20 to 25 minutes in a very fluid condition, and adding a deoxidising agent, such as aluminium, just before pouring. Seven ingots containing Cu 0·165 to 4·512 per cent. and C 0·437 to 0·605 per cent. were thus prepared. All the ingots forged somewhat like machine steel except the one richest in copper, which showed traces of "red-shortness." The sulphur content of the samples diminished with increasing copper, from 0·0385 per cent. in an ingot to which no copper had been added, to 0·0195 per cent. in the ingot containing 4·5 per cent. Cu. Segregation was slightly noticeable with 0·846 per cent. Cu, and with 4·512 per cent. Cu, was very marked, drillings taken from the centre of the bottom of the ingot showing 5·640 per cent. Cu. Immersion of cleaned cylindrical test pieces for 160 hours in 1 : 3 sulphuric acid at 22° C. showed that small percentages of copper up to 0·493 per cent. are protective, but that corrosion increases with larger percentages. With about 2·25 per cent. Cu the corrosion is the same as for a similar steel free from copper. The hardness increases with increasing copper content, as the alloy of copper and ferrite is harder than ferrite, moreover the copper distributes the fibrous cementite more evenly, and gives a finer structure. As the copper content rose from 0 to 4·512 per cent., the point Ar1 was lowered from 730° C. to 635° C., and the elastic limit in both annealed and unannealed specimens increased to more than double the original value. The ultimate strength increased almost in direct proportion to the amount of copper. The elongation decreased up to 1·85 per cent. Cu, and then gradually increased up to 4·512 per cent. Cu, in the annealed specimens, whilst in the unannealed specimens, it decreased throughout. A bibliography is added.—T. St.

Vanadium in steel; Detection and determination of ——. J. A. Pickard. Chem. World, 1913, **2**, 341—342.

Vanadium may be readily detected even in the presence of titanium after dissolving the steel in dilute sulphuric acid (1 : 3), and adding a slight excess of nitric acid (to oxidise iron), by the dark brownish-red colouration developed with hydrogen peroxide. The most sensitive test is Gregory's (this J., 1909, 1202), but the iron must be separated. This test and the hydrogen peroxide test may be developed to serve as colourimetric quantitative tests. The following volumetric method is far more rapid than, and quite as accurate as, the gravimetric methods: 0·5 grm. of ferro-vanadium, or 2·5 grms. of steel, are dissolved in 30 c.c. of dilute sulphuric acid and oxidised with nitric acid; the solution is evaporated until fumes are evolved, then diluted with 100 c.c. of dilute sulphuric acid and made up to 400—500 c.c. with water. The solution is treated at 60°—70° C. with sufficient permanganate to produce a pink colour and this colour is accurately discharged by adding ferrous sulphate. Then 50 c.c. of 10 per cent. sodium phosphate solution are added, the liquid is cooled, treated with an excess of standard ferrous sulphate and the excess titrated back with bichromate; 1 c.c. of *N*/10 ferrous sulphate=0·0051 grm. of vanadium. The interfering effect of chromium may be avoided by performing the first oxidation with permanganate in the cold instead of at 65° C., but care must be taken to produce a permanent colouration.—J.F.B.

Iron and lead; Electrolysis of —— in the soil. Girousse. Comptes rend., 1913, **157**, 705—708.

Electrodes of iron and lead were placed in boxes of wood coated with paraffin wax and filled with earth kept moist; with the circuit open, there was a difference of potential of 0·15—0·2 volt from the lead to the iron. Corrosion of both metals began when the current passed and its extent was proportional to the quantity of electricity passing and independent of the potential difference. The contact-resistance between lead and soil was much greater than that between iron and soil, and under given conditions iron was corroded much more rapidly than lead.—A. S.

Gold [and silver] ores; Experiments on the cyaniding of —— from the Hohen Tauern. R. Sterner-Rainer, Oesterr. Zeits.Berg- u. Hüttenw., 1913, **61**, 451—455. 465—469, 482—486, 526—529, 540—541.

The ores are mixtures of two end-types; only R (surface ore) is free-milling, S being found below the ground-water level.

	Rathausberg (R.).	Siglitz (S.).	
Insoluble	54·44	21·76	
Iron	7·48	26·65	
Copper	1·59	0·05	
Lead	3·72	0·59	
Arsenic	trace	32·03	
Sulphur	5·45	16·65	
Cobalt	trace	Sb 1·87	
Manganese	0·13	Bi 0·15	
Lime	15·89	trace	
Carbonic acid	11·17	MgO trace	
Gold	3·97 oz.	1·01 oz.	2240 lb.
Silver	42·14 ,,	7·18 ,,	

Tests were carried out in "Pachuca" laboratory extractors (air agitation; 0·5 per cent. KCN-solution; time of treatment, 36 hours) (1) with cyanide only, and then with addition of (2) lime, (3) bromine, (4) lead acetate, (5) cadmium acetate, (6) ferricyanide. The results of the first three series follow, A representing the original ore; B, the roasted ore washed free from soluble lime

(R) or acid (S); C, the tailings from B. All figures are percentages.

—		Rathausberg.			Siglitz.		
Material.	Treatment	Cyanide consumption.	Recovery of Au	Recovery of Ag	Cyanide consumption.	Recovery of Au	Recovery of Ag
A.	KCN only	45·7	91·7	22·5	69·9	85·7	46·5
	,, +CaO	24·3	88·2	17·8	43·3	82·0	50·4
	,, +Br	—	98·6	30·8	—	89·7	57·8
B.	KCN only	50·0	74·4	43·0	19·8	80·7	4·0
	,, +CaO	30·1	58·8	39·3	13·8	84·7	4·1
	,, +Br	—	95·1	46·1	—	84·8	3·6
C.	KCN only	83·8	97·4	57·8	39·3	83·8	4·3
	,, +CaO	48·7	78·3	55·1	26·8	86·8	4·2
	,, +Br	—	97·2	56·4	—	86·4	4·0

The gold extraction on the original ore was satisfactory, with a very high cyanide consumption; the recovery of silver was poor in all cases. Between the third and sixth hour of treatment the liquors became poorer in gold; the precipitated metal was dissolved again later, but the best time of treatment was three hours. Ten per cent. of the gold and 20 per cent. of the silver content of the ore (S), is stated not to be removed by lead in the dry assay, but to be soluble in cyanide solution.
—W. R. S.

Aluminium; Action of 3 *per cent. hydrogen peroxide on* ——. Droste. Chem.-Zeit., 1913, **37**, 1317.

Aluminium is slowly attacked by hydrogen peroxide (0·2 grm. dissolved in 250 c.c. of a 3 per cent. solution in 45 days) forming insoluble aluminium hydroxide. No hydroxide remains in colloidal solution. Therefore for liquids which can yield free oxygen or ozone, aluminium vessels are not suitable.—W. H. P.

Gallium; Presence of —— in commercial aluminium, and its separation. C. Boulanger and J. Bardet. Comptes rend., 1913, **157**, 718—719.

Starting with 1·7 kilo. of commercial aluminium, after separating the metals usually present as impurities, by means of hydrogen sulphide in presence of hydrochloric acid or acetic acid, the author obtained finally a product consisting of gallium contaminated with a small proportion of iron, which was removed by boiling with potassium carbonate. The yield was 0·3395 grm. Ga_2O_3, equivalent to 0·017 per cent. Ga on the aluminium taken, whereas Jungfleisch in 1876 obtained only 62 grms. of gallium from 4300 kilos. of Pierrefitte zinc blende. De Gramont has detected gallium in many felspathic rocks, and the authors have detected it in bauxite, so that it may be that gallium always accompanies aluminium in nature.
—A. S.

Osmium-platinum, a new alloy. F. Zimmermann. American Electro-Chemical Society. Min. and Eng. Journal, Nov. 1, 1913.

The author has succeeded in combining platinum and osmium to yield alloys of acid and electrical resistance with great hardness and tensile strength. While the two metals may be combined in almost any proportion, alloys containing from 1 to 10 per cent. of osmium and 99 to 90 per cent. platinum are chiefly used. One part of osmium will take the place of two and a half times its weight of iridium.

Bolivia's metal industry in 1912. Min. and Eng. World, Oct. 25, 1913. [T.R.]

The amount of copper bullion which left Bolivia in 1912 was 4,707,188 kilos. Of this amount France took 4,597,386 kilos.; England, 68,259 kilos; Germany, 31,210; Belgium 10,333. By far the greater part of this total came from the properties of the Corocoro United Copper Mines, Ltd. Bismuth exports from the republic during 1912, as shown by statistics just issued, total 381,502 kilos. Belgium, England, and Germany bought the product. Important discoveries of wolfram are reported from the department of La Paz and the provinces of Inquisidi and South Yungas. Manganese ore running high in bismuth has been found near Oruro, Cochabamba, and Potosi. Exports of wolfram barrilla amounted to 476,540 kilos. There is no export duty on wolfram.

Determination of sulphur in pyrites. Analysis of pyrites. Martin. *See* VII.

Paving brick from blast-furnace slag. Bolles. *See* IX.

Patents.

Iron, steel, etc., from waste enamelled ware; Recovery of ——. T. Goldschmidt. 1st Addition, dated May 5, 1913, to Fr. Pat. 418,971, Aug. 1, 1910 (see this J., 1911, 92).

The compressed strips are passed through a series of pairs of rollers, each moving at the point of contact at a greater speed than the one preceding. This is effected by increasing the speed of rotation, or by increasing the diameter without changing the angular velocity, or by attaching projections.—H. H. S.

Chromium; Process for increasing the yield of —— in the aluminothermic production of carbon-free ferrochromium from chrome-iron ore. T. Goldschmidt A.-G. First Addition, dated April 26, 1913, to Fr. Pat. 453,205, Jan. 15, 1913 (see Eng. Pat. 18,671 of 1912; this J., 1913, 430). Under Int. Conv., Feb. 18, 1913.

The addition of small quantities of metallic oxides (*e.g.*, of Co, Ni, Mo, W, V) to the mixture of chrome-iron ore and aluminium is stated to have a similar effect to that of chromic oxide in increasing the chromium content of the reaction product.—W. R. S.

[*Lead and zinc.*] *Molten bath and means for coating iron articles therewith.* H. J. Lohmann, Jersey City, N.J., Assignor to The Lohmann Co. U.S. Pat. 1,075,583, Oct. 14, 1913.

A small proportion of mercury is added to a molten bath of lead and zinc for the purpose of maintaining the latter in a homogeneous condition.—W. E. F. P.

Iron, steel, and other metals; Process for coating ——. E. Bernheim. Fr. Pat. 458,707, March 31, 1913.

In coating iron, steel or other metals with zinc, copper, etc., the duration of the process is shortened by adding a good heat conductor, such as finely divided aluminium, magnesium, or their alloys, to the mixture of coating agent and inert substance (sand, silicates, or oxides) in which the material is embedded and heated.—W. R. S

Iron; Protection of —— from rust. H. Hanemann and F. Hanaman. Fr. Pat. 458,283, May 23, 1913. Under Int. Conv., June 1, 1912.

By heating iron above 400° C. in gaseous ammonia or its organic derivatives, a rust-proof coating of iron nitride is stated to be formed.—W. R. S.

Gold and silver; Process for the extraction of ——, remaining in iron ores which have been already treated for the removal of sulphur, copper, or other metals. H. M. Leslie, Glasgow. Eng. Pat. 22,909, Oct. 8, 1912.

The material, washed or neutralised to remove soluble salts and acid, is leached with a cyanide solution containing free alkali, in a closed circulatory system in which provision is made for periodically replenishing the cyanide and "protective" alkali decomposed, and for recovering any hydrocyanic acid or volatile cyanogen compounds not reabsorbed by the solution.—W. E. F. P.

[*Gold and silver.*] *Precious-metal-dissolving means; Process of preparing a* ——. H. Foersterling, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,076,006, Oct. 14, 1913.

A "homogeneous, solidified mixture" of sodium cyanide and bromide is dissolved in the presence of an acid solution of hydrogen peroxide.—W. E. F. P.

Metals; Extraction of ——. H. Pape, Oker, Germany. Eng. Pat. 22,715, Oct. 5, 1912.

"A mixture of reducing agents with materials containing reducible compounds and volatile metals," is continuously introduced into the upper part of a short, vertical furnace beneath which is a closed air chamber, the two being separated by a grate which allows of the upward passage of air through the charge and the downward flow of molten products into a movable receptacle within the air-chamber.—W. E. F. P.

Zinc-lead ores; Treatment of refractory ——. P. C. C. Isherwood, Bushey Heath, Herts. Eng. Pat. 22,855, Oct. 7, 1912.

The roasted ore is treated, in two stages, with sufficient dilute sulphuric acid to dissolve the whole of the zinc, being first leached with a portion of the acid in the usual way and then heated under pressure with the remainder. The solution obtained at the second stage is employed, after the addition of fresh acid, for the initial treatment of a further quantity of ore, that obtained at the first stage being electrolysed for the production of zinc and sulphuric acid.—W. E. F. P.

Zinc powder or dust; Method and apparatus for melting ——. E. F. Côte and P. R. Pierron. Fr. Pat. 458,111, July 29, 1912.

The dust from zinc condensers is mixed with 15 to 20 per cent. of its weight of potassium chloride, sodium chloride, calcium chloride, or carnallite, or a mixture of these substances, with or without zinc chloride, and the mixture is heated to 450° to 500° C., with simultaneous crushing and stirring. Drops of molten zinc form in the mass, and run together, so that over 80 per cent. of the zinc present in the dust may easily be recovered in ingot form. The heating is carried out in a horizontal cylinder, traversed by a horizontal rotating shaft on which is mounted excentrically a solid cylinder, one side of which comes into contact with the wall of the hollow cylinder, and thus crushes the charge. On the solid cylinder are fixed blades forming a screw, the axis of which is the rotating shaft. These blades work the charge forward from the feeding end to the discharge end, where the zinc and dross fall into a receiver.—T. St.

Zinc; Extraction of metallic —— *from its ores.* E. F. Côte and P. R. Pierron. Fr. Pat. 458,149, July 30, 1912.

Zinc ores are reduced so as to produce a large proportion of dust, which is then heated with fluxes as described in the preceding abstract. Three examples are given of plant consisting essentially of (1) furnace, (2) condenser where molten zinc is separated, and (3) the cylinder for heating the dust with fluxes. A hopper is attached to this cylinder, so that the proper amount of fluxes can be added and mixed automatically with the zinc dust coming from the condenser, without the zinc dust coming into contact with the air. The furnace for the reduction of the zinc ores may be electrical, or may be a cupola in which briquettes of ore and charcoal are heated by reducing gases produced in a hearth below.—T. St.

Zinc; Process for treating ores of —— *and other means oxidisable by steam at high temperature.* Mineral Products, Ltd. Fr. Pat. 458,431, May 2, 1913. Under Int. Conv., May 1, 1912.

The desulphurised ore is heated in a current of steam and a reducing gas at 800°—900° C.: zinc oxide is stated to be reduced to metal, and the latter at once re-oxidised by the steam and volatilised in a very fine form of oxide, which is recovered by condensation.—W. R. S.

Zinc or copper ores, ashes, refuse; Obtaining pure salts from ——. F. Bourgeot. Fr. Pat. 458,336, Aug. 3, 1912.

Sulphide ores are first roasted, and treated with ozone under pressure to peroxidise iron; with ashes, etc. this is not required. The material is then leached with dilute acid, with the help of an electric current, steam, or ozone under pressure. The dissolved metals are precipitated by an alkali sulphide or sulphite in presence of steam under pressure. From the precipitate zinc is recovered as oxide by distillation and copper as sulphate by roasting and treatment with dilute sulphuric acid.—W. R. S.

Aluminium and zinc; Process for separating ——. A. D. Vialay. Fr. Pat. 458,189, July 31, 1912.

The zinc is volatilised in a vacuum at 1200°—1300° C. —W. R. S.

Aluminium alloy and method of producing the same. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,076,137, Oct. 21, 1913.

Aluminium (60 parts) is melted and heated until it shows a red colour, copper (5 parts) and silver (16½ parts) are added, the temperature is lowered until the red colour disappears, zinc (20 parts) is added, and the mass is thoroughly agitated.—W. E. F. P.

Aluminium; Alloys of ——. C. Sorel. Fr. Pats. 456,881 and 456,882, June 28, 1912.

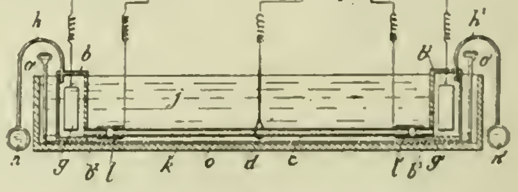
(1) The alloy contains from 4 to 10 per cent. of nickel, manganese (free from iron), and copper or chromium. (2) The alloy contains preferably 1 per cent. of chromium and titanium, and 3 to 5 per cent. of nickel. Other metals such as magnesium, zinc, and tin, may also be added. The alloys may be made by melting the alloying metals in a high-temperature (electric) furnace, and then adding the aluminium in small portions, or the oxides of the alloying metals may be reduced in a crucible furnace in presence of cryolite and a portion of the aluminium, the remainder of the latter being added afterwards.—T. St.

Alloy. W. Rübel, Berlin, Assignor to Rübel Bronze, Ltd., London. U.S. Pat. 1,076,455, Oct. 21, 1913.

An alloy of Fe 31, Ni 32, Al 30 and Mn 7·5 parts by weight. —W. E. F. P.

Electrolytically depositing metal upon the interior of tubes and other hollow articles or the like. G. P. M. Lee and W. A. Brame, London. Eng. Pat. 23,096, Oct. 10, 1912.

The apparatus is provided with anodes, g, g^1, and anode tanks, b, b^1, the latter being connected by extensions, b^2, b^3, and unions, l, l^1, with the tubes, c, the interiors of which are to be plated. The electrolyte is circulated by means of a pump in either direction through the anode tanks and tubes by the connections, n, n^1 and h, h^1. By means of a tray, o, and handles, o^1, the whole may be lifted out of the cleansing solution, j. The positive terminal, a, is connected by branch circuits, through rheostats, e, e^1, and f, f^1, with the anode tanks and the ends of the tubes, c, respectively, and the negative terminal with a floating ring, d, which may be moved along the tube for controlling the deposit. By means of the rheostats, the current supplied to the ends of the tubes may at the commencement be slightly stronger than that supplied to the anodes, so as to force the deposit to the middle portions of the tubes, and then reduced to allow deposition at the ends, or the reverse process may be adopted. With short tubes the application of direct current to them may be dispensed with, as in such cases the current density within each tube will be fairly uniform.—B. N.



Silvering of glass by the galvanic deposition of a protecting metal; Covering the ——. J. J. Declere, A. L. E. Grésy and G. Pascalis, Paris. Eng. Pat. 13,109, June 5, 1913. Under Int. Conv., June 6, 1912.

The cathode is in the form of a comb, the teeth consisting of insulated brass rods sliding in a brass conducting bar forming the back of the comb to which the current is supplied, and above this is a second bar for raising or lowering the teeth. The lower ends of the latter are tipped with a soft metal, such as tin, where they make contact by their weight with the silvering of the glass. The circuit is closed by hanging anodes as soon as the electrolyte covers the silvering, but the anodes for supply of metal consist of strips carried by wooden frames with interposed blocks of lead-antimony alloy.—B. N.

Metals; Electrolytic cleansing of ——. L'Hospied et Cie. and C. H. Thompson. Fr. Pat. 458,524, May 28, 1913. Under Int. Conv., Jan. 1, 1913.

The metals are cleansed in a solution in which during electrolysis the hydrogen cathions, and the anions from hydrochloric, nitric, sulphuric, hydrofluoric, hydrobromic, or chromic acids are liberated by an alternating current. The objects are placed in the bath without any metallic connection with the electrodes, and are separated from the latter by porous or perforated partitions.—B. N.

Tungsten; Manufacture of chemically pure ——. C. H. Fischer, Charlottenburg, Germany. Eng. Pat. 23,475, Oct. 14, 1912.

Pure, anhydrous, granular tungstic acid is prepared by adding a solution of an alkali tungstate to boiling acid (hydrochloric acid containing about 4 per cent. of nitric acid); or by treating the tungstate solution with ammonium sulphide, filtering, pouring the filtrate into an acid bath to produce a polysulphide of tungsten, and roasting the latter. It is stated that, by reduction with hydrogen, tungstic acid thus prepared yields pure, crystalline, ductile metal.—W. E. F. P.

[Tungsten.] Wires; Method of drawing refractory ——. A. J. Liebmann, Assignor to N. Hofheimer, New York. U.S. Pat. 1,076,590, Oct. 21, 1913.

The (tungsten) wire is passed continuously through a bath of liquid hydrocarbon (gasoline) within which the metal is rendered incandescent, by means of an electric current, with the object of causing it to become coated with graphite, after which it is drawn through a diamond die.—W. E. F. P.

Ductility; Process for imparting —— to metals. The Westinghouse Metal Filament Lamp Co., Ltd. Second Addition, dated May 10, 1913, to Fr. Pat. 445,208, June 7, 1912 (this J., 1912, 1186; 1913, 240). Under Int. Conv., May 13, 1912.

The metal (tungsten or molybdenum) is heated and cooled under high pressure by embedding it in a fusible thermic mixture which is ignited, and by slow cooling and solidification exerts the required pressure. The metal is prevented from dissolving in the mixture by a tube or coating of suitable resisting material, or by previously saturating the mixture with the metal.—W. R. S.

[Smelting] Furnace; Oil-fired ——. K. Schmidt, Heilbron-on-Neckar, Wurtemberg. Eng. Pat. 11,384, May 15, 1913.

A smelting furnace comprises a cylindrical heating chamber into which the material is charged from above through a central orifice. The burners are arranged around the charging shaft and are directed downwards on to the charge. The invention consists in arranging the axes of the burner nozzles on the surface of an imaginary cone and with a lateral inclination so as to produce a powerful vortex.—A. T. L.

Crucible furnace. V. Coppée. Fr. Pat. 456,803, June 26, 1912.

The portable furnace consists of a cylindrical metal shell lined in the upper part with refractory material, the lower part being provided with burners. The crucible is suspended by its upper edge, and the refractory lining is hollowed out to follow the shape of the crucible. The products of combustion circulate round the crucible, into which they are finally deflected by the cover before escaping through a hole in the latter. The cover is lined inside with asbestos or other refractory material, which becomes incandescent and serves to heat the contents of the crucible by radiation. The cover is attached by means of a socket to an upright rod secured to the side of the furnace, so that it can be first raised bodily, and then swung round horizontally.—T. St.

Melting furnaces and cupolas; Method and apparatus for preventing the formation of carbon monoxide in ——. E. Schürmann. Fr. Pat. 458,242, May 22, 1913.

The furnace is provided with two wide-mouthed tuyères situated diametrically opposite to each other at the level of the fusion zone. Each tuyère is connected with a separate regenerator, both of which are in communication with a common blower. The direction of the air stream is determined by a valve, and is changed periodically. The air blown into the furnace for the most part passes horizontally directly across the furnace, and subsequent reduction of the carbon dioxide formed is avoided. The fusion of the charge is completed by closing the outlet connected with the regenerators, and arranging the valve near the blower so that air passes simultaneously through both tuyères, and so upwards through the furnace.—T. St.

Roasting furnaces. A. Gaillard. Fr. Pat. 458,418, April 11, 1913. Under Int. Conv., April 13, 1912.

A multiple-hearth mechanical roaster in which each hearth projects from under the next higher one, so that the hearths can be charged independently from separate hoppers. The ore remains on the same hearth until completely roasted, when it drops down an inclined plane into cars below the lowest floor.—W. R. S.

Alkali metals by electrolysis; Preparation of ——. B. Loisel and A. Nacivet. Fr. Pat. 456,688, June 24, 1912.

In the electrolysis of salts or oxides of alkali metals, similar electrodes are used, and at regular intervals the current is reversed, thus producing an automatic cleansing of the cathode.—B. N.

Metals [Copper]; Separation of —— in ores. A. M. G. Sébillot. Fr. Pat. 456,828, April 18, 1913.

Rich sulphide ores, such as copper pyrites, are roasted, without the addition of fuel, in a shaft furnace having openings in its walls so that air passes horizontally through the charge. The escaping gases after passing through a dust chamber are mixed with air and steam and led over perforated shelves carrying catalytic agents, *e.g.*, metallic oxides or fragments of quartz. Dilute sulphuric acid collects in a lead-lined receptacle below the shelves. The uncondensed gases are drawn off by means of a fan. The ore from the shaft furnace is subjected to a second roasting in a reverberatory furnace, crushed, and lixiviated with the dilute sulphuric acid, obtained as above, in a long trough, divided into compartments communicating at the bottoms, and supplied with stirring gear, the ore and acid passing in opposite directions. Where ores of volatile metals are roasted, condensing chambers, cooled by means of water, are provided. Mixed sulphides of copper and iron are first treated with very dilute sulphuric acid to remove the iron. The iron sulphate solution is allowed to crystallise, and the crystals, after being dried at 100° C., are roasted to give sulphuric acid, the iron oxide remaining forming a pure iron ore. The lixiviating apparatus may be similarly used with cyanide solution for the treatment of such residues as contain precious metals.—T. St.

Easily oxidisable bodies [metals], Protection of —— by the use of gaseous nitrogen. R. P. Pictet. Fr. Pat. 456,957, April 22, 1913.

Iron and zinc are preserved from oxidation when in the melted state by surrounding them with an atmosphere of pure nitrogen. Melted metals may be contained in bulk without oxidation, in a vessel shaped like a converter, by blowing in nitrogen through holes in the base, and feeding a small current on to the surface of the metal. In operations such as casting, puddling, the joining together of metallic tubes, etc., protection by nitrogen prevents the formation of films of oxide.—T. St.

Sulphide ores; Treating —— in preparation for roasting. A. G. Andersson. Fr. Pat. 458,442, May 10, 1913.

Thorough removal of sulphur is ensured by crushing the ore to a fine powder which is agglomerated into porous lumps and dried as described in Fr. Pat. 458,066 (this J. 1913, 1018).—W. R. S.

Ores; Process for extracting metallic sulphates, sulphides or oxides from ——, and apparatus therefor. R. D. Lance. Fr. Pat. 458,816, Aug. 17, 1912.

The finely divided ore is heated with strong sulphuric acid to 300°—400° C. in a circular furnace, after leaving which it is extracted with hot brine. The insoluble residue is separated in a filter-press of special construction, and the solution freed from iron by adding the oxide of a metal present in the ore, such as copper or zinc, and injecting hot air, which precipitates ferric hydroxide. The filtered liquor is now treated with a solution containing $3CaO,NaCl,15H_2O$ and $Ca(ONH_4)_2$, obtained by dissolving calcium hydroxide in a 10 per cent. solution of sodium chloride saturated with ammonia: calcium sulphate and soluble ammonium compounds of copper or zinc oxide are formed. The former is filtered off, ammonia recovered by boiling the filtrate, and the precipitated hydroxide converted into oxide by calcination.
—W. R. S.

Furnaces; Operation of regenerative —— adapted more especially for the manufacture of steel. N. E. Maccallum, Phœnixville, Pa., U.S.A. Eng. Pat. 30,079, Dec. 31, 1912. Under Int. Conv., Jan. 16, 1912.

See U.S. Pat. 1,057,564 of 1913; this J., 1913, 492.—T.F.B.

Carbon content of iron, steel, and the like iron alloys; Rapid process of and apparatus for determining and controlling the ——. E. Szász, Diósgyör, Hungary, Eng. Pat. 7693, April 1, 1913. Under Int. Conv., April 15, 1912.

See Fr. Pat. 455,738 of 1913; this J., 1913, 948.—T. F. B.

Titanium; Method of raising the alloying qualification of —— [for treating iron or steel]. H. Goldschmidt and O. Weil, Assignors to T. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 1,075,782, Oct. 14, 1913.

See Ger. Pat. 235,461 of 1909; this J., 1911, 1019.—T.F.B.

Case-hardening material. Method of making case-hardening material. H. Rodman, Edgewood, Pa., Assignor to Rodman Chemical Co. U.S. Pats. 1,076,235 and 1,076,453, Oct. 21, 1913.

See Eng. Pat. 8596 of 1913; this J., 1913, 980.—T. F. B.

Zinc; Process and apparatus for recovering —— from slags, ores, and other zinciferous materials. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 5438, March 4, 1913. Under Int. Conv., March 7, 1912.

See Fr. Pat. 455,086 of 1913; this J., 1913, 871.—T. F. B.

Ores; Treatment of ——. N. H. M. Dekker, Paris. U.S. Pat. 1,075,409, Oct. 14, 1913.

See Eng. Pat. 18,488 of 1911; this J., 1912, 930.—T. F. B.

Lead alloy. C. P. McConnell, Assignor to Western Electric Co., New York. U.S. Pat. 1,075,661, Oct. 14, 1913.

See Eng. Pat. 25,090 of 1912; this J., 1913, 663.—T. F. B.

Roasting furnaces or the like; Agitating device for ——. M. van Marcke de Lummen, Cologne, Germany. U.S. Pat. 1,076,297, Oct. 21, 1913.

See Eng. Pat. 13,551 of 1912; this J., 1913, 755.—T. F. B.

Metals; Process for refining ——. The Titanium Alloy Manufacturing Co. Fr. Pat. 456,783, April 17, 1913. Under Int. Conv., April 17, 1912.

See U.S. Pat. 1,056,125 of 1913; this J., 1913, 430.—T.F.B.

Metals; Process for preparing products for refining ——. The Titanium Alloy Manufacturing Co. Fr. Pat. 453,734, April 17, 1913. Under Int. Conv., April 17, 1912.

See U.S. Pat. 1,029,672 of 1912; this J., 1912, 993.—T.F.B.

Concentrating apparatus for separating metals, minerals, and other substances. W. E. Cox and H. M. Morris. Fr. Pat. 458,541, May 29, 1913.

See Eng. Pat. 5975 of 1912; this J., 1913, 755.—T. F. B.

Alkali metals; Castner apparatus for the manufacture of —— by electrolysis of molten alkali compounds. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Fr. Pat. 458,731, May 9, 1913.

See Eng. Pat. 1933 of 1913; this J., 1913, 948.—T. F. B.

Separation of thallium and rare metals from lead ores, with the simultaneous production of sublimed white lead. Ger. Pat. 264,526. *See* XIII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Ozone; Production of ——. J. R. Quain, London. Eng. Pat. 22,854, Oct. 7, 1912.

The electrodes are provided with insulating silica envelopes, containing a quantity of mercury which is vaporised during the action (see also Eng. Pat. 3905 of 1906; this J., 1906, 992).—B. N.

Electrolytic diaphragms. H. A. Wagner, East Orange, N.J., U.S.A. Eng. Pat. 16,048, July 11, 1913.

Diaphragms for use in the electrolysis of solutions of sodium chloride, etc., are composed of pumice, charcoal, manganese dioxide or other porous material (with or without palladium black or other hydrogen-absorbing substance), through which finely divided mercury is disseminated, for example, by moistening the material with a solution of mercuric chloride and then treating it with formaldehyde.—W. E. F. P.

Cells; Electrolytic ——. C. W. Marsh, Greenwich, Conn., Assignor to Hooker Electrochemical Co., New York. U.S. Pats. 1,075,362, 1,075,363, 1,075,364, and 1,075,660, Oct. 14, 1913.

(1) The apparatus, for the electrolysis of alkali salt solutions, comprises a number of units arranged in series, each consisting of several superposed cells having a common body. Each cell is provided with an anode compartment open at one side only, with a substantially vertical pervious cathode and diaphragm disposed across the opening. An anode connection extends horizontally through the wall of the cell, opposite to the cathode, and is connected in series with the cathode in the adjacent cell. (2) The cell comprises concentric anode and cathode compartments, with a pervious cathode and diaphragm separating them, the cathode and diaphragm being bent so as to provide substantially radial recesses communicating respectively with the anode and cathode compartments. Anodes are placed in the recesses, which are in open lateral and end communication with the inner anode compartment. Means are provided for maintaining a constant level of electrolyte in this compartment. (3) The arrangement is similar to that described under (2), but the cathode compartment is the central one, and the upper and lower walls of the recesses present non-conducting surfaces. (4) The apparatus comprises a symmetrical cell-body,

having therein a number of superposed chambers for electrolyte, each of the chambers being provided with opposite lateral side openings of like form and area. A perforated cathode and diaphragm, adapted to cover one of the openings, extends into the chamber at a number of points, and a composite anode structure covers the other opening. The individual anodes project into the chamber between the cathode extensions, and the anode and cathode structures are interchangeable.—B. N.

Cell; Galvanic ——. M. L. Kaplan, Brooklyn, N.Y. U.S. Pat. 1,075,479, Oct. 14, 1913.

HYDRATED manganese peroxide, produced as a dark blue, dense, fine powder by the oxidation of manganese carbonate with a solution of potassium permanganate, is used as a depolariser.—B. N.

Cell; Electrolytic ——. A. H. Hooker, Niagara Falls, N.Y., Assignor to Hooker Electrochemical Co., New York. U.S. Pat. 1,075,570, Oct. 14, 1913.

A HIGH amperage cell for the electrolysis of alkali chloride solutions, comprises an insoluble anode, and a permeable cathode with an interposed diaphragm in contact therewith. The electrodes are vertically disposed, the horizontal dimension of the cathode being more than six and a half times the vertical; or several electrodes and diaphragms may be used, the aggregate horizontal dimensions of the cathodes being more than thirteen times the vertical dimension of one cathode.—B. N.

Cell; Electrolytic ——. G. W. Stone, Niagara Falls, N.Y., Assignor to Hooker Electrochemical Co., New York. U.S. Pat. 1,075,609, Oct. 14, 1913.

THE cell has a U-shaped body of concrete with external reinforcing metallic members, and is provided with an anode compartment having a non-pervious interior facing. Separable cathode chambers are provided, with metallic frame-members secured to the body and surrounding the chambers and engaging therewith to retain them in position.—B. N.

Furnace; Electric —— with closed space. Helfenstein Elektro Ofen G. m. b. H. Fr. Pat. 456,926, April 21, 1913. Under Int. Conv., April 27, 1912.

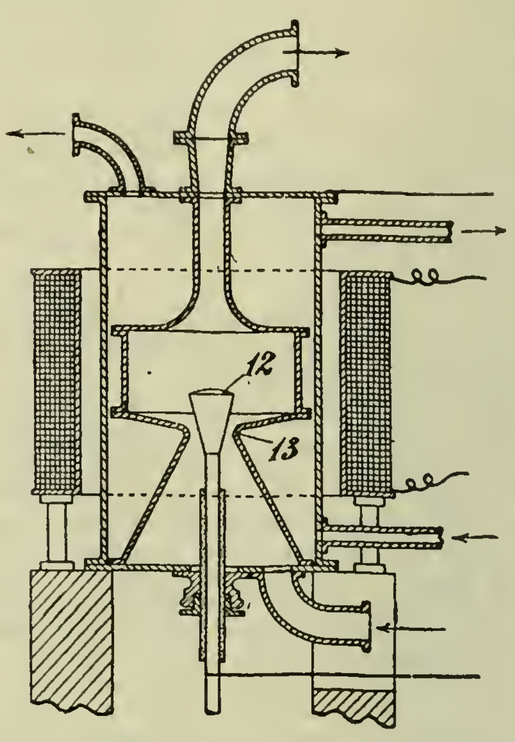
THE furnace is provided with charging towers along its whole length, the lower part of each tower being conical in form with the greatest diameter at the bottom. Between the charging vessels are funnel-shaped spaces, containing material similar to the charge, in which the electrodes are placed, the latter passing through relatively narrow slits in the bottoms of the chambers. The material thus descends in the towers towards the faces of the electrodes, and the gases formed are aspirated into the towers, from which they are conveyed by suitable exit pipes.—B. N.

Furnaces; Electric arc ——. E. de Loisy. Fr. Pat. 458,403, Aug. 5, 1912.

DIPHASE currents, with separated phases, are employed for the production of the arcs, each phase feeding a pair of electrodes, and the four electrodes being arranged in the bath in a straight line.—B.N.

Furnace; Electric —— with rotating flame for the treatment of gases or vapours. I. Moscicki. Fr. Pat. 458,636, May 31, 1913. Under Int. Conv., June 1 and Aug. 8, 1912.

THE arc is produced by a high-tension alternating current, and rotates under the influence of a magnetic field. The central electrode, 12, is surrounded by the external electrode in the form of a tube, the arc forming at each alternation at the place, 13, where the gas enters the furnace. By displacing the electrode, 12, longitudinally, the size of the opening between the two electrodes may be modified and the speed of the gas varied. Under the combined action of the passage of the gas and the magnetic field, the arc is displaced, and its length is thus greatly increased. In a modified form, the electromagnet is provided with two internal poles, the lower one producing a divergence of the lines of force in the lower part of the furnace, and thus causing a more rapid displacement of the arc towards the periphery of the furnace. In a further modification the inner electrode is increased in diameter but has a short conical portion, so that with little displacement of the arc in the direction of the axis of rotation, a great elongation of the flame is produced. The tube, 13, may also be provided on its periphery with regularly-disposed notches, or the interior electrode may be furnished with grooves, or the latter electrode may be disposed eccentrically within the electrode, 13, so that with an internal electrode of small diameter, a cross-section sufficient for the passage of the gas may be obtained in spite of the narrowness of the slit. The electrode, 13, at the point where the arc is formed, may consist of a separate circular piece, easily replaced, and fixed by means of a ring.—B. N.



Product, permeable to electric currents of high frequency and impermeable to currents of low frequency. Vedovelli Priestley et Cie. Fr. Pat. 458,676, June 2, 1913.

GUM, or other agglutinant, such as gum lac varnish, rubber solution, etc., is worked up with metallic powders, so that the particles of the powders are near to but without touching each other. Being impermeable to low frequency currents, the material may in this case serve as an insulating medium.—B. N.

Electric arcs; Methods and apparatus for producing elongated ——. F. H. A. Wielgolashi, Christiania. Eng. Pat. 2165, Jan. 27, 1913.

SEE U.S. Pat. 1,054,886 of 1913; this J., 1913, 432. —T. F. B.

Electric arcs for the treatment of gases: Method and apparatus for the production of elongated ——. F. H. A. Wielgolaski, Christiania. Eng. Pat. 2214, Jan. 27, 1913.

SEE U.S. Pat. 1,061,892 of 1913; this J., 1913, 665.—T. F. B.

Furnace; Electric-transformer ——. J. Bally, Grenoble, France. Eng. Pat. 16,011, July 11, 1913. Under Int. Conv., July 12, 1912.

SEE Fr. Pat. 446,028 of 1912; this J., 1913, 148.—T. F. B.

Furnace; Electric ——. I. Rennerfelt, Halmstad, Sweden. U.S. Pat. 1,076,518, Oct. 21, 1913.

SEE Fr. Pat. 444,947 of 1912; this J., 1912, 1188.—T. F. B.

Refractory, electrically-conducting moulded bodies ; Process for the production of ——. G. Egly, Treptow. Assignor to Gebr. Siemens und Co., Lichtenberg, Germany. U.S. Pat. 1,075,634, Oct. 14, 1913.

See Fr. Pat. 446,142 of 1912 ; this J., 1913, 143.—T.F.B.

Electro-osmotic process for dehydrating vegetable, animal, and mineral substances under pressure. Ges. f. Elektro-Osmose m. b. H. First Addition, dated May 8, 1913, to Fr. Pat. 449,358, Oct. 12, 1912.

See Eng. Pat. 10,873 of 1913 ; this J., 1913, 833.—T. F. B.

Separation of hydrogen sulphide and ammonia from gases. Ger. Pat. 263,905. *See* IIa.

Preparation of gases containing cyanogen and hydrocyanic acid from hydrogen, nitrogen, and carbon or carbonaceous gases in the electric arc. Ger. Pat. 263,692. *See* VII.

Method of producing gas reactions by means of electric flame arcs. [*Production of oxides of nitrogen.*] Ger. Pat. 265,413. *See* VII.

XII.—FATS ; OILS ; WAVES.

Stearic and oleic acids ; Solidifying and melting points of mixtures of ——. R. Meldrum. Chem. News, 1913, **108**, 199—201.

Dalican's method, in which the mixture is constantly stirred, was found to give concordant results for the solidifying point, the maximum difference in readings for any given mixture being 0·3° C. for mixtures containing up to 70 per cent and 0·7° C. at 80 per cent. of oleic acid. The determination of the solidifying point with a stationary thermometer, without stirring, gave concordant results lower than those given by Dalican's method ; the rise in temperature on solidification was also less. Results of comparative experiments with the thermometer bulb, straight tube, and capillary tube methods of determining melting points are also given. The author has devised a new method of determining melting points in which a column of fatty acid is drawn into the arm of a small U-tube and allowed to solidify : the temperature at which the level of the melted acids is equal in both tubes is taken as the melting point.—R. G. P.

Melting point [*of fats*] *; Determination of* —— *by thermometer bulb method.* R. Meldrum. Chem. News, 1913, **108**, 233—224.

Variations obtained by this method are shown to be due to errors of manipulation, for in the author's experience the m. pt. of fats is not affected by repeated remelting and solidifying. The essential point is the uniformity with which the thermometer bulb is coated with the fat in sufficient quantity to form two drops. If the first falling drop appears opaque the coating is too thick and the thermometer should be heated or cooled 5° to 10° C. and its bulb re-coated by a rapid dip into the fat. It is also necessary to remove the fat from the apex of the bulb by means of filter paper ; otherwise the readings will be too high. In the case of very soft mixtures it is advisable to cool the bulb to 0° C. or —5° C. and then to make a rapid dip. Too thin a film of fat will cause the drop to form too slowly and the m. pt. to be too high. A suitable apparatus for the determination is a test tube, 7 in. by 1 in., which is passed through a bung in a beaker about 7 in. by 3 in. The thermometer with the attached fat is fixed centrally in the test tube, whilst a glass stirrer is moved continually up and down in the water round the outside of the tube. The speed of heating should be at about the rate of 1° C. in two minutes, and the larger the bulb of the thermometer the more gradually should the temperature be raised. With fairly pure substances such as stearic acid and spermaceti, the m. pt. thus obtained should be within 1° C. of the true m. pt. —C. A. M.

Esterase [*lipase*] *in pig's liver ; Partial purification of the* ——. G. Peirce. J. Biol. Chem., 1913, **16**, 1—3.

100 grms. of pig's liver were ground with sand and water, the solution strained, and diluted to 1 litre, toluene being added as a preservative. After incubation at 37° C. for 1 day and allowing to stand for several weeks, it was filtered until clear. The 10 per cent. crude enzyme solution thus obtained was dialysed in collodion bags for 5 or 6 days, filtered, half-saturated with ammonium sulphate, filtered till clear, then fully saturated with ammonium sulphate and again filtered till clear : the filtrate was inactive. The precipitate was dissolved in water and the solution dialysed till free from sulphate. A 20 per cent. enzyme solution was purified in the same way. The lipolytic activities of the different solutions (expressed as parts of ethyl butyrate hydrolysed per hour per 1 part of solid substance in the enzyme solution) were : crude 10 per cent. solution, 10 ; dialysed 10 per cent. solution, 90 ; partially purified 10 per cent. solution (half saturation with ammonium sulphate omitted), 165 ; purified 20 per cent. solution, 217. The solid substance in this last preparation is at least 50 times and probably 100 times as active as that in the clear lipase solution prepared by Kastle and others (this J., 1904, 628).—A. S.

Determination of cocoanut oil in butter by Polenske's method. Sundberg. *See* XIXa.

Patents.

Oils ; Machinery for extracting —— *or for expressing liquids from materials generally.* J. E. Bibby, Birkenhead. Eng. Pat. 22,699, Oct. 5, 1912.

The material is pressed in an annular chamber between two rings, mounted upon races of rollers, and revolving eccentrically one within the other, so that at a certain position they approach and exert great pressure. Perforations and grooves for the escape of the oil are provided in the crushing ring, whilst a screw conveyor may be used for feeding the material into the space where the rings are most widely apart.—C. A. M.

Lubricating, impregnating, or coating materials ; Process for preparing oil mixtures suitable for use as ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pats. 265,598, May 8, 1909, and 265,600, April 8, 1910. Additions to Ger. Pat. 263,278.

In the preparation of lubricants or impregnating or coating agents from thickened tar oils as described in the principal patent (see this J., 1913, 918), it is proposed to replace the mineral oils (1) by liquid or solid waxes of animal or vegetable origin, or (2) by resins, resin oils, or ethereal oils.—T. F. B.

Preparing solid elastic oxidation products from linseed oil or other drying fatty oils. Ger. Pat. 263,656. *See* XIV.

Substitution of hydrogenated oil for oleo-margarine in the manufacure of margarine. Fr. Pat. 458,611. *See* XIXa.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Pine oils. Helch. *See* XX.

Patents.

White lead ; Process of producing ——. E. Euston, St. Louis, Mo. U.S. Pat. 1,075,143, Oct. 7, 1913.

Basic lead carbonates, containing respectively less than and more than 11·3 per cent. CO_2, are mixed together in such proportions as to yield a mixture containing from 11·3 to 14·5 per cent. CO_2. The basic carbonate containing the lower percentage of carbon dioxide is obtained by passing the gas into a solution of basic lead acetate which is kept alkaline. The higher carbonate is produced when the solution is allowed to become acid.—E. W. L.

Lead ores ; Separation of thallium and rare metals from ——, *with the simultaneous production of sublimed white lead.* J. B. Hannay and Deutsche Felsen-Oel Ges. Franzen und Co. Ger. Pat. 264,526, Dec. 14, 1912.

The ore is heated intensely on a deep bed of coke, under non-oxidising conditions, whereby it is rapidly volatilised, and the vapours on leaving the furnace are mixed with a quantity of air sufficient for complete oxidation and then led through a series of settling chambers where they are slowly cooled and fractionally condensed. The products may be subjected to the same process a second time to effect further purification. An automatic feeding device is described by which ore and coke can be supplied continuously without opening the furnace. It is stated that by this process thallium and the rare metals can be recovered separately and that the sublimed white lead has approximately the composition, $3PbSO_4,PbO$.—A. S.

Lithopone resistant to light and to the weather ; Manufacture of a ——. G. Engelmann. Ger. Pat. 264,904, Aug. 13, 1912.

The lithopone during the precipitation process is treated with sulphur dioxide gas or with compounds of sulphur dioxide in non-alkaline solution ; or the lithopone, after ignition, may be quenched with water into which sulphur dioxide is led.—A. S.

Butadiene and its homologues ; Process for preparing [resinous] polymerisation products of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,925, April 16, 1912.

Butadiene or a homologue thereof is polymerised by addition of a halide of boron, or a mixture of boron halides, with or without the use of a diluent. The products are not caoutchouc-like in character, but are viscous, soft, plastic, or even brittle, according to the temperature and amount of boron halide used ; they may serve as substitutes for resins or shellac.—T. F. B.

Colouring matter from spent oxide from gas purification ; Process for making a ——. C. J. H. Madsen. Fr. Pat. 458,564, May 29, 1913. Under Int. Conv., June 7, 1912.

See Ger. Pat. 261,000 of 1912 ; this J., 1913, 834.—T. F. B.

Producing disazo dyestuffs specially suitable for making lakes. Fr. Pats. 458,169 and 458,650. *See* IV.

Preparing oil mixtures suitable for use as lubricating, impregnating, or coating materials. Ger. Pats. 265,598 and 265,600. *See* XII.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Analysis of antimony pentasulphide. Utz. *See* VII.

Patents.

Caoutchouc or caoutchouc-like substances ; Process for accelerating the vulcanisation of natural or artificial ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,530, May 17, 1913. Under Int. Conv., Nov. 15, 1912.

Vulcanisation is accelerated by the addition of a small quantity of piperidine or its homologues to a rubber mixing containing sulphur. For example, if 0·5 part of piperidine be added to a mixing consisting of 100 parts of Para rubber and 10 parts of sulphur, a product containing about 3·5 per cent. of combined sulphur can be obtained by heating at 135°—145° C. for 15 minutes. 100 parts of rubber obtained from β-γ-dimethylbutadiene, 40 parts of sulphur, and 0·75 part of piperidine, heated at 160°—165° C. for 2 hours give a hard rubber containing about 25 per cent. of combined sulphur ; without piperidine the product contains only about 12 per cent. of combined sulphur.—E. W. L.

Caoutchouc, gutta-percha and like substances ; Treatment of ——. L. Feval and J. de la Fresnaye, Paris. Eng. Pat. 17,582, July 31, 1913.

Castor oil heated to 140°—150° C. does not dissolve caoutchouc or gutta-percha, although it is an efficient solvent of their resins. De-resinification is therefore effected by heating 100 kilos. of Jelutong, Almadina, or other similar gum, or Hankang gutta-percha, with 100 kilos. of castor oil under atmospheric or reduced pressure. The solution of the resins is complete when all the water is driven off. The rubber or gutta-percha then floats on the surface of the oil whence it is removed and passed through a press or suitable drying machine to remove excess of oil, the last traces of which are removed by extraction with alcohol, acetone, etc. The solution of resins in castor-oil can be used in soap manufacture and in waterproofing mixtures. A mixture of castor-oil and alcohol or acetone, etc., may be used in place of castor-oil.—E. W. L.

Linseed oil or other drying fatty oils ; Process for preparing solid, elastic oxidation products from ——. S. Mitscherlich and O. Sprenger. Ger. Pat. 263,656, Oct. 20, 1909.

By adding a small quantity of acetic acid or one of its homologues to linseed oil or other drying oil, before oxidation, products are obtained which are stated to be permanently elastic and suitable for use as rubber substitutes, etc. An increase in the amount of acid gives rise to a softer product, and a decrease to a harder product. —T. F. B.

Plastic compositions and articles comprising synthetic rubber and methods of making same. F. E. Barrows, Washington, U.S.A. Eng. Pat. 23,648, Oct. 16, 1912. Under Int. Conv., Oct. 30, 1911.

See Fr. Pat. 449,811 of 1912 ; this J., 1913, 500.—T. F. B.

Caoutchouc-like material ; Manufacture of a ——. K. Delbrück and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,195, Oct. 21, 1913.

See Eng. Pat. 13,591 of 1912 ; this J., 1913, 204.—T. F. B.

Caoutchouc ; Substance similar to —— *and process of making same.* K. Delbrück and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,196, Oct. 21, 1913.

See Addition of Dec. 18, 1912, to Fr. Pat. 441,655 ; this J., 1913, 667.—T. F. B.

Caoutchouc or substances analogous to caoutchouc ; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss. Fr. Pat. 458,216, May 21, 1913. Under Int. Conv., May 30, 1912.

See Eng. Pat. 12,773 of 1912 ; this J., 1913, 706.—T. F. B.

Rubber ; The reclaiming of waste ——. O. A. Wheeler and E. D. and B. Loewenthal, Chicago. Eng. Pat. 29,878, Dec. 28, 1912.

See Fr. Pat. 452,482 of 1912 ; this J., 1913, 706.—T. F. B.

Production of βγ-dimethyl-αγ-butadiene. Addition to Fr. Pat. 417,275. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Hides ; Disinfection of anthrax-infected ——. G. Abt. Bull. Soc. d'Encour., 1913, 120, 248—289.

An account of an investigation of two proposed methods for sterilising hides, and also of previous methods used, together with a bibliography. The anthrax spores used were either in the skins of dead guinea-pigs or dried upon glass slips together with horse-serum ; after the disinfection process, the spores were tested for survival by inoculation into guinea-pigs. The first method studied, that of Seymour-Jones (this J., 1912, 35), consists in soaking the hides in a solution of mercuric chloride (1 : 5000) containing 1 per cent. of formic acid for 1—2 days and then washing in brine. The spores of Algerian anthrax on glass were more easily killed by this solution than those of French anthrax. The presence of formic acid and hydrochloric acid slightly lowered the disinfecting power of mercuric chloride in high dilutions, but an increase in strength of the acid increased the disinfection; the acids could not be replaced by common salt. Subsequent treatment with ammonium sulphide or sodium sulphide rather hindered disinfection, but a strong solution of sodium sulphide or a mixture of lime and realgar (arsenic disulphide) increased it. With spores on skins, disinfection was complete after exposure for varying periods up to 26 days, using dilutions of the disinfectant of 1 : 3000—1 : 5000 and no neutralisation. The second method studied was that of Schattenfroh and Kohnstein (this J., 1911, 1127) in which the hides are soaked in hydrochloric acid of 2 per cent. strength. With spores on glass, this gave rather varying results and was not improved by neutralisation. With spores on skins, disinfection failed several times after 48 hours contact. No other acid could replace the hydrochloric acid. The general conclusion is that for the disinfection of large batches of skins as a preventive measure, the method of Seymour-Jones gives good results, provided the depilation is done with quicklime, a mixture of lime and realgar, or a strong solution of sodium sulphide. This method appears to be a little more economical than others which have been used. For the disinfection of suspected hides, the method of Schattenfroh-Kohnstein is reliable.—J. H. J.

Sulphite-cellulose; Action of lactic acid on ——. F. Abraham. Collegium, 1913, **11**, 599—603.

The author shows that the analysis of sulphite cellulose liquors by the "filter-bell" method, presents difficulties not experienced with the ordinary tanning extracts. Variations in the strength of the liquor for analysis have a great effect on the results of analysis, and the author recommends that solutions of sulphite cellulose for analysis should be of a concentration corresponding to 3·5 grms. of "tannin" per litre. The use of lactic acid for swelling hide is known and the increased tanning effect observed by Stutzer (this J., 1913, 877) on adding lactic acid to sulphite-cellulose extract is considered to be due entirely to the hide-powder becoming swollen by the acid and thus acquiring greater absorptive power for tannin.—D. J. L.

Patents.

Sulphite liquor and [tanning] compound obtained therefrom, Process of treating waste ——. H. H. Hurt, Covington, Va., Assignor to J. S. Robeson, Au Sable Forks, N.Y. U.S. Pat. 1,075,916, Oct. 14, 1913.

A tanning composition is made by treating the waste lyes with a salt of a sesquioxide combined with an acid capable of forming insoluble calcium salts, and removing the insoluble calcium salt formed. The resulting solution contains the organic matters of the wood-liquor substantially in their original relative ratios and composition, is substantially free from lime and contains alumina or other sesquioxide base in amount equivalent to the lime in the original liquor.—J. F. B.

Adhesive [from waste products of breweries]; Process for obtaining an ——. H. Kücl le. Ger. Pat. 264,291, June 12, 1912.

Yeast or other brewery waste product is mixed with sulphurous acid, phenol, boric acid, or other substance which arrests fermentation, and the mixture is concentrated in a vacuum, the alcohol evolved being collected. The products may be used as adhesives, and are said to remain homogeneous and not to ferment nor decompose, even after long keeping.—T F. B.

Glue; Manufacture of ——. Processes for making glue. H. C. Heide, London. From Perkins Glue Co., Lansdale, Pa., U.S.A. Eng. Pats. 571 and 572, Jan. 8, 1913. Additions to Eng. Pat. 24,692, Nov. 6, 1911.

See First and Second Additions to Fr. Pat. 436,297 of 1911; this J., 1913, 761.—T. F. B.

Conversion of leather waste into a fertiliser. Fr. Pat. 458,674. *See* XVI.

XVI.—SOILS; FERTILISERS.

Chemical manures in Russia. Board of Trade J., Oct. 30, 1913.

The imports of chemical manures into Riga were greater in 1912 than ever before. Imports of raw phosphate show a decrease. Kainite, potash salts, and Chilian nitrate come from Germany, and Thomas phosphate mainly from Belgium, the Netherlands, and the United Kingdom. Superphosphate comes principally from Sweden and Germany, but also from the Netherlands and the United Kingdom. There is a demand for this product, of which the importation has increased in the last few years. Formerly, about two-thirds of the total Russian import of fertilisers entered by way of the Baltic ports. Now the proportion is only something over a half, while Riga's share alone is about 32 per cent. There is a large importation by way of the western frontier. Russia's consumption of these artificial fertilisers has made great strides since 1900. The demand increases year by year, and at present the home production cannot, it is stated, cover more than about a third of the total amount required.

Sulphate of ammonia.—Up to the present this has only been made in one chemical factory in Poland, but the output was sufficient to meet the demands of the market. Large chemical plants are, however, in course of construction in South Russia for the production of this article, which will probably lead to a fall in the price, thereby creating a serious competitor to the use of nitrate of soda.

Phosphate fields of South Carolina. Waggaman. *See* VII.

Influence of shading tobacco [during growth] on various constituents of the leaves. Stutzer and Goy. *See* XX.

Patents.

Fertiliser containing dicalcium phosphate and which does not form dust; Manufacture of a ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 456,786, April 17, 1913. Under Int. Conv., April 26, 1912.

A crude phosphate is treated with nitric acid and in the resulting solution a precipitate of dicalcium phosphate is produced by addition of lime. The whole is then evaporated under reduced pressure to obtain a product composed of particles of dicalcium phosphate coated with calcium nitrate.—A. S.

Leather waste; Conversion of —— into a fertiliser. Moise und Co. Fr. Pat. 458,674, June 2, 1913.

The leather waste, freed from fat if necessary, and finely-divided, is extracted with water at a temperature not exceeding 50°—70° C., in order to recover the greater part of the tannin, and then disaggregated in the known way by treatment with steam under pressure, or with acids or alkalis.—A. S.

Phosphorites; Art of converting ——. H. V. Dunham, Bainbridge, N.Y., Assignor to Nacirema Chemical Co., Vermont. U.S. Pat. 1,076,200, Oct. 14, 1913.

See Eng. Pat. 19,044 of 1911; this J., 1912, 942.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Advisability of grinding the upper part of the ——. I. H. Morse. Louisiana Planter, 1913, **50**, 383—384.

It is advised by the author as a means of making sugar manufacture in Louisiana profitable under the conditions produced by the abolition of the sugar duty in the United States that the upper part of the cane, which has a much lower sugar content than the middle and bottom parts, should not be ground, but should be used for the manufacture of table syrup, or should be employed as a stock fodder. In Louisiana the cane contains approximately 13·50 per cent. of sucrose in the lower part, and 8·0 per cent. in the upper part. By grinding all the cane, the average sucrose content of which is 11·63 per cent., there would be a loss under the new conditions, whereas by crushing only the lower part, which represents about two-thirds of the total weight of the stalk, there would be a profit of about $0·60 per ton.—J. P. O.

Raffinose; Determination of —— in the sugar beet. L. Nowakowski and J. Muszynski. Zapiski, 1913, **1**, 21; Centr. Zuckerind., 1913, **21**, 1748.

In determining the raffinose content of the beet, satisfactory results were obtained with solutions resulting from the aqueous digestion process of extraction when the usual double polarisation method with the application of the Herzfeld formula, was employed. The reliability of this process was proved by the addition of known amounts of raffinose to the extract, the difference between the raffinose added and that found never exceeding 0·2 per cent. With solutions prepared by the alcoholic extraction process, however, results higher than the truth were obtained, owing to the formation of a compound of lead with raffinose when basic lead acetate was used for clarification, the direct reading especially being thus decreased. Trustworthy results may be obtained when no basic lead acetate is used, and the inversion reading is determined after the elimination of the alcohol, but this method is too tedious for ordinary practice.—J. P. O.

Non-sugars; Influence of optically active —— [in sugar analysis]. O. Kopetzki. Westnik Sacch. Prom., 1913, 749; Centr. Zuckerind., 1913, **21**, 1545. (Compare also this J., 1910, 968; and 1909, 1215.)

It is held by the author that in the case of beet products the difference between the direct and the double polarization (Clerget) methods is caused by the presence of dextro-rotatory substances other than raffinose, dextrose, or asparagine, the amount of which varies according to the climatic conditions, the state of preservation of the roots, and the method of manufacture. These substances are not precipitated by basic lead acetate, but may be eliminated by boiling with barium hydroxide; they reduce Fehling's solution, and they hinder the crystallisation of sucrose. —J. P. O.

Saturation; Influence of the rapidity of —— on the purity of [beet] juice. V. Staněk. Z. Zuckerind. Böhm., 1913, **38**, 64—72. (Compare also this J., 1913, 247.)

It has long been suspected in practice that when carbonatation is carried out rapidly, the resulting clarified juices are purer than when the gas is passed in comparatively slowly. Beet diffusion juice of 89·6° purity was treated with 2 per cent. of lime in mixers from which exactly equal amounts were run into two saturation tanks. After heating the tempered juice to 86° C., it was carbonatated, but in one case the rate of saturation was about half that in the other. Directly the carbonatation was finished, and before the scums had settled, samples were taken from both tanks, filtered, saturated to a final alkalinity of 0·01 per cent. CaO, boiled, and re-filtered. Analyses of the juices and scums obtained by (*a*) rapid, and by (*b*) slow carbonatation, gave the following figures, demonstrating the greater clarifying effect of the more rapid process: *Juices.* Quotient of purity, (*a*) 95·00, (*b*) 94·35; colour (Stammer) per cent. on the dry susbtance, (*a*) 10·0, (*b*) 12·1. *Scums.* Non-sugars per cent. on the dry substance, (*a*) 0·21, (*b*) 0·09; organic substances and water of hydration, (*a*) 12·13, (*b*) 11·49. During slow saturation coloured decomposition products of the soluble non-sugars, and probably also of the sugars, are formed by the action of the lime and of the calcium saccharate, and a certain amount of the organic matter precipitated by the lime is re-dissolved. —J. P. O.

Sugar of the hexobiose group, gentiobiose; Biochemical synthesis of a ——. E. Bourquelot, H. Hérissey, and J. Coirre. Comptes rend., 1913, **157**, 732—734.

Emulsin of almonds (0·25—0·5 grm. per 100 c.c.) was allowed to act upon a concentrated solution of dextrose (40—50 grms. per 100 c.c.) in presence of thymol, phenol, or toluene, and the solution was subsequently heated to destroy the enzyme, diluted, and the undecomposed dextrose destroyed by fermentation with top-fermentation beer yeast. After fermentation was ended, the solution still possessed reducing properties and was dextro-rotatory, the rotatory power being increased by boiling with sulphuric acid. When the solution was heated with phenylhydrazine acetate, an osazone was formed. These results indicate that a reducing, non-fermentable sugar had been synthesised from the dextrose, and the authors succeeded finally in isolating therefrom gentiobiose in a pure state (this J., 1902, 1159).—A. S.

Explosion at the [dextrin] works of Messrs. J. Laing, Son & Co., Holt Town, Manchester, March 11, 1913; *Circumstances attending an —— which occured.* J. Jackson, H.M. Superintending Inspector of Factories. [Cd. 7101.]

As a result of the explosion 8 men were injured, of whom 3 subsequently died. The initial cause of the explosion was a fire in a fan casing, due either to an open gas jet or to the ignition tube of the engine itself. The flame was driven along a hot air duct, setting up an explosive wave within the duct, which finally exploded the contents of the stoves, either by firing directly the dust at the bottom of the stoves or by causing the evolution of inflammable gases (by destructive distillation of the dust on the trays and racks) which were fired by the flame and immediately propagated an inflammation. Seven samples of dust (starch, flour, dextrin) from the factory, taken the day following the explosion, were examined by R. V. Wheeler in the manner described previously (this J., 1913) as to their ignition temperature and capacity for forming explosive waves. The lowest temperatures at which ignition could be effected lay between 520 and 650° C. All the samples when present as a cloud in the air, were capable of propagating flame rapidly. Experiments were carried out in a spherical brass bomb of about 5 litres capacity. The samples of dust were strewn loosely at the bottom of the bomb. On rapidly revolving a small straight-bladed fan that passed through the side of the bomb, the dust was thrown into suspension in the air inside, and, on passing an electric spark at the centre, ignition took place and flame spread throughout the mixture. Both the pressure produced, and the rapidity with which that pressure was developed, showed these dusts as most dangerous substances when raised in suspension in the air. The following recommendations are made: (1) Gas engines, oil engines, gas producer plants and steam boilers should not be placed in rooms or parts of the premises which communicate directly with rooms where inflammable dusts are liable to be generated. (2) Exhaust and plenum fans used in connection with places where inflammable dusts are liable to be generated should be kept thoroughly clean and free from accumulation of dust and oil, to prevent the possibility of a hot bearing firing such an accumulation, and so causing an explosion. (See also this J., 1912, 599.)—G. W. McD.

Gum arabic in tragacanth gum; Determination of ——. O. Frey. Apoth.-Zeit., 1913, **28**, 787.

Only traces of gum tragacanth dissolve in an ammoniacal solution of copper oxide, whereas gum arabic and similar gums dissolve practically completely. By utilising this fact and carrying out at the same time a control test with tragacanth gum of known purity, the proportion of gum arabic in an adulterated sample of tragacanth can be determined. Tests with known mixtures containing 30 and 20 per cent. respectively of Senegal and Kordofan gums gave results accurate to within 1—2 per cent. Two commercial specimens of gum tragacanth were found to contain 40—50 per cent. of gum arabic.—A. S.

Cellulose; Saccharification of ——. H. Ost. *See* V.

Patents.

Drying sugar, light granulated or other like material; Apparatus for ——. M. Blake and R. H. Smart, Greenock. Eng. Pat. 23,019, Oct. 9, 1912.

The material is carried from a measuring box or hopper by a screw conveyer to one or a series of reciprocating or jigging drying troughs, the whole being enclosed in a casing, preferably removable in sections. The material is dried in passing along the troughs each of which is heated, either (1) by a chamber fixed below, and movable with the trough, and supplied with steam by flexible pipes, or (2) by a chamber of which the bottom and sides are stationary whilst the trough itself forms the top, and side plates fixed to the trough overlap the walls of the chamber so as to permit free reciprocating motion of the trough, and at the same time to prevent excessive escape of hot air or steam from the chamber. Chambers of the latter kind may be heated either by a blast of air, or by heating pipes, or directly by Bunsen burners. The moist air is removed from the casing by a fan.—J. H. L.

Sugar beet; Method and apparatus for extracting the juice of the —— by continuous lixiviation in a single vessel. P. J. Wolff. First Addition, dated May 14, 1913, to Fr. Pat. 423,487, Dec. 9, 1910 (this J., 1911, 824).

Before admission of a fresh charge of slices, the preceding charge is forced towards the top of the diffusion vessel either by introducing a certain volume of juice below the grating (*loc. cit.*), or by a vertically movable grating. In the latter case, the inlet for the slices is situated a short distance above the bottom of the diffuser, and the grating is moved to a level below this inlet just before a fresh charge is admitted, the juice outlet being closed during charging. The grating is then moved to a level above the inlet, and is kept in this position until the juice has been withdrawn.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Soy industry; Japanese ——. G. Kita. Woch. Brau., 1913, 30, 549—552, 559—561. (See also Suzuki and others, this J., 1907, 1062; Yoshimura 1909, 1058; Mitsuda, 1909, 1059.)

The methods of manufacture of soy (sauce) and the character of the product vary according to the place of production. There are two main methods which differ in that wheat is employed as an adjunct in one but not in the other. The former, which is described in outline below, is the most generally employed. The wheat is roasted until the grains have burst and the husks have become somewhat charred, and is then coarsely ground. The soya beans are softened by boiling or heating under pressure with water, and, after separation from the water, are mixed with the ground wheat, and placed in small boxes. The latter are stacked in a special room ("*koji muro*") of which the temperature and ventilation are well under control. The material in the boxes is inoculated, or allowed to become infected, with *Asperg. oryzæ* (or sometimes with other moulds) and mixed from time to time. The temperature is kept near 35° C. The mould rapidly develops and after three days the material ("*soya koji*") is removed from the boxes and mixed with salt water (20° B., sp. gr. 1·162) in a large vat. Here it is exposed to the action of the enzymes of the mould and also of yeasts and bacteria present in the mash, but the transformations which occur usually require a year for their completion. The mash becomes darker in colour and acquires a more and more uniform, thick consistence. Finally it is filtered, the pressed cakes, after washing, being used as fodder. The filtrate is heated and then allowed to settle, or filtered. The final product is a brownish-red liquid of characteristic aroma and flavour (for composition see Yoshimura, this J., 1909, 1058). The relative proportions (by volume) of the raw materials employed are approximately 1 part each of soya-beans, wheat and salt, and 2 parts of water. The essential processes have undergone little change, although considerable advances have been made, in recent years, in the kind of plant employed and in the knowledge of the chemical transformations which occur in the mash.
—J. H. L.

Furfural; Action of fermenting yeast on ——. Formation of furyltrimethyleneglycol. II. C. J. Lintner and H. J. v. Liebig. Z. physiol. Chem., 1913, **88**, 109—121.

The substance formed, together with furyl alcohol, by the action of fermenting yeast on furfural (see this J., 1911, 915) is furyltrimethyleneglycol $C_4H_3O.CHOH.CH_2.CH_2OH$. It is lævorotatory, and forms diacetyl, dinitrobenzoyl and diphenylcyanate derivatives. It is probably produced as the result of an aldol condensation between furfural and acetaldehyde (an intermediate product of fermentation), followed by reduction.—J. H. L.

Chloral hydrate; Reduction of —— by yeast during alcoholic fermentation. C. J. Lintner and H. Lüers. Z. physiol. Chem., 1913, **88**, 122—123.

In view of the reduction of furfural by fermenting yeast (see this J., 1911, 915 and preceding abstract) the authors carried out experiments with other aldehydes. Salicylaldehyde proved too strong an antiseptic, and vanillin and *m*-nitrobenzaldehyde gave inconclusive results, but chloral hydrate, at a concentration of 0·5 per cent. (at higher concentrations it checked fermentation) was reduced, to the extent of 40 per cent., to the corresponding alcohol, trichloroethyl-alcohol, CCl_3CH_2OH.—J. H. L.

Patents.

Fermented liquids; Treatment of ——. C. H. Fleming, Southport, Lancs. Eng. Pat. 29,609, Dec. 23, 1912.

In the conditioning of beer in barrels, with a top pressure of gas, the gas pipe which passes upwards from the top of each barrel is enlarged at one part, or has an enlarged vessel inserted, to serve as a trap for solid matter carried up with the bubbles produced by fermentation of the beer. The object is to prevent clouding or discolouring of the beer when it is nearly or completely conditioned.—J. H. L.

Brewery grains; Proces of raising the nutritive value of —— and also of treating spent hops, malt dust, dust obtained in cleaning cereals and the like, and obtaining a food for cattle. M. Hamburg, Bishops Stortford, Herts. Eng. Pats. 29,996, Dec. 30, 1912, and 14,808, June 26, 1913.

Ten parts of pressed and washed yeast are heated to from 50° to 60° C., and stirred until a liquid mass is obtained; this is mixed with 90 parts of wet grains, spent hops, malt dust, or the like, and the mixture is pressed and dried at a low temperature. The yeast may also be mixed with the grains, or with the other substances and a suitable quantity of water, before it is heated.—W. P. S.

Fermentation vat. U. Deinhardt. First Addition, dated May 14, 1913, to Fr. Pat. 450,164, Nov. 5, 1912 (see Eng. Pat. 25,275 of 1912; this J., 1913, 444).

The inclined vessel previously described, is fitted internally with a tube through which a cooling agent from a refrigerating apparatus is passed, the vessel itself being filled with water.—L. E.

Grape marcs; Process of treating —— for the extraction of various useful products. E. Disdier. Fr. Pat. 458,344, May 24, 1913. Under Int. Conv., July 9, 1912.

The pressed marc is dried, *e.g.*, in the apparatus described in Fr. Pat. 436,057 of 1911 (this J., 1912, 374), and is then separated into stalks, skins (and pulp), and seeds, by sifting and winnowing. The skins and pulp serve for the preparation of wines, spirits, sugar, honey, potassium bitartrate, etc. The oils and tannin are extracted from the seeds, or the latter are converted into a substitute for coffee, by washing, drying, roasting, and grinding, or they may be used for imparting colour and aroma to spirits.—L. E.

Filtering and lixiviating ; Apparatus for ——. [*Preparation of wort.*]. A. Rockmann. Ger. Pat. 264,138, Feb. 21, 1913.

The apparatus is intended more particularly for the preparation of wort from malt grist. It consists of a closed outer drum within which are two fixed concentric perforated drums, the inner one of which extends through one of the end walls of the outer drum and serves as receptacle for the material to be filtered or lixiviated. In the other end wall are fixed a number of perforated pipes arranged concentrically in the space between the two perforated drums: outside the outer drum these pipes are provided with cocks and are connected with a central inlet pipe. As the outer drum rotates, the cocks engage with fixed projections, so that as they ascend they are closed and as they descend they are opened. The outer perforated drum is composed of a number of pairs of perforated plates with filter-cloth between.—A. S.

Dried yeast with a characteristic flavour ; Process for obtaining ——. Versuchs- und Lehranstalt für Brauerei. Ger. Pat. 264,996, June 12, 1912.

Fresh yeast is mixed with autodigested yeast and the mixture rapidly dried (*e.g.* on heated cylinders). The flavour is stronger the larger the proportion of autodigested yeast.—A. S.

Diastatic products ; Process of and apparatus for producing —— *and the product obtained thereby.* J. Takamine, New York. Eng. Pat. 3096, Feb. 6, 1913.

See U.S. Pat. 1,054,626 of 1913 ; this J., 1913, 444.—T.F.B.

Malt ; Process of and apparatus for manufacturing ——. J. von der Kammer, Wilmersdorf, Germany. Eng. Pat. 3164, Feb. 6, 1913.

See Fr. Pat. 454,534 of 1913 ; this J., 1913, 880.—T. F. B.

Fermentation vessels ; Process of treating large ——. H. Held, Nuremberg, Germany. U.S. Pat. 1,076,424, Oct. 21, 1913.

See Eng. Pat. 21,293 of 1909 ; this J., 1910, 836.—T. F. B.

Utilising the fermentable and reducing carbohydrates in sulphite-cellulose waste lyes for obtaining alcohol or a reducing agent. Fr. Pat. 456,871. *See* V.

Process for obtaining an adhesive [*from waste products of breweries*]. Ger. Pat. 264,291. *See* XV.

Yeast combination for use as food for animals. Eng. Pat. 2848. *See* XIXA.

XIXa.—FOODS.

Cocoanut oil ; Determination of —— *in butter by Polenske's method.* T. Sundberg. Z. Untersuch. Nahr. Genussm., 1913, 26, 422—424.

The author recommends that the results obtained by Polenske's method (this J., 1904, 387) be taken to indicate percentages of cocoanut oil referred to the butter fat present, and that they be calculated to percentages of the mixed fat. For example, if 27 per cent. of cocoanut oil calculated upon the percentage of butter fat be found the percentage calculated upon the mixture would be $\frac{27 \times 100}{100+27}=21\cdot3$ per cent. Good results are thus obtained with mixtures containing as much as 30 to 40 per cent. of cocoanut oil.—C. A. M.

Petroleum in foods. Oil, Paint, and Drug Rep., Nov. 3, 1913. [T.R.]

Petroleum to the extent of 20 per cent. has recently been found at Cincinnati in the cream fillers of wafers in sandwich form. The Dept. of Agriculture is taking proceedings to ascertain whether such filling is a violation of the Food and Drugs Act. The petroleum is used as a substitute for coconut oil or butter.

Patents.

Yeast combination for use as a food for animals. F. Gothard, Winshill, Staffs. Eng. Pat. 2848, Feb. 4, 1913.

The cattle food is prepared by drying and grinding a mixture of yeast, 50, peat moss, 25, and hop meal, 25 per cent.—W. P. S.

Cream and similar substances ; Process of treating ——. E. H. Stanley, Cleveland, Ohio, Assignor to Stanley Patents Co. U.S. Pat. 1,075,514, Oct. 14, 1913.

The cream or other substance is inoculated with lactic acid bacteria and then aerated continuously while the bacteria develop and produce the desired flavour. —W. P. S.

Milk, beer, and other liquids ; Process of sterilising —— *by ozone.* A. Magits. Fr. Pat. 458,569, May 29, 1913. Under Int. Conv., June 1 and 29, and Sept. 5, 21, and 29, 1912.

The milk, or other liquid, is passed through an injector together with a supply of ozone and is collected in a chamber. The ozone is formed by electrolysing a solution of sodium carbonate and ozonising the oxygen thus obtained. The dynamo supplying the current for the ozoniser is connected by means of a governor-control with the regulating valve on the pipe through which the milk is admitted to the apparatus; in this way, the quantity of ozone admitted is regulated according to the volume of milk entering the apparatus. The sterilised milk may then be conducted to a separator.—W. P. S.

Milk and the like ; Process of drying ——. C. H. Meister. Ger. Pat. 264,992, Sept. 16, 1911.

The milk or other liquid is projected outwards in the form of a thin layer by centrifugal action or by pressure and dried by the action of currents of steam, from a jet distributor, above or below or both above and below.—A. S.

Margarine ; Process for the manufacture of ——. Flakes A./S. Fr. Pat. 458,413, April 2, 1913. Under Int. Conv., Oct. 10, 1912.

The mixture of fat and serum (milk or other liquid) is emulsified by passing it between moving surfaces. The latter may consist of discs, cylinders, or the like, which are mounted in a series and rotate at about 3000 revolutions per minute. The distance between the discs diminishes gradually until it is less than 100 micro-mm.—W. P. S.

Margarine ; Substitution of hydrogenated oil for oleomargarine in the manufacture of ——. A. G. Déveaux. Fr. Pat. 458,611, May 30, 1913.

The use of hydrogenated oil in place of oleo-margarine for the preparation of margarine is claimed.—W. P. S.

Alimentary [*milk*] *products ; Manufacture of* ——. P. Müller, Vilbel, Assignor to H. Finkelstein and L. F. Meyer, Berlin. U.S. Pat. 1,075,720, Oct. 14, 1913.

See Fr. Pat. 412,256 of 1910 ; this J., 1910, 1031.—T. F. B.

Albumins ; Method of restoring coagulated —— *to the original state.* A. H. Rasche, Charlottenburg, Germany. U.S. Pat. 1,076,232, Oct. 21, 1913.

See Eng. Pat. 28,613 of 1912 ; this J., 1913, 621.—T. F. B.

Chocolate ; Process for making porous ——. R. Dierbach. Fr. Pat. 458,507, Aug. 7, 1912.

See Eng. Pat. 15,120 of 1912 ; this J., 1913, 157.—T. F. B.

Manufacture of a cattle-food, with simultaneous recovery of cellulose, resin, etc., from cellulose-containing materials. Ger. Pat. 265,483. *See* V.

Raising the nutritive value of brewer's grains, treating spent hops, malt dust, dust obtained in cleaning cereals and the like, and obtaining a food for cattle. Eng. Pats. 29,996 and 14,808. *See* XVIII.

XIXB.—WATER PURIFICATION; SANITATION.

Nitric acid in water; Detection of small quantities of ——. S. Rothenfusser. Chem.-Zeit., 1913, **37**, 897.

Rothenfusser's reagent (diphenylamine with acetic and hydrochloric acids) forms a delicate test for nitric acid in water. A drop of the reagent is mixed with 20 c.c. of concentrated sulphuric acid; 10 c.c. of the water are then added and in presence of 1 or 2 mgrms. or even less of nitric acid, a blue colour quickly appears. If the water is carefully poured on the surface of the acid reagent a blue layer forms at the junction of the two liquids. The purest sulphuric acid, preferably prepared by the contact process, should be used. Another reagent for this purpose may be prepared as follows:—1 grm. of diphenylamine is dissolved in 100 c.c. of sulphuric acid, and to 1 c.c. of this solution 1 drop of hydrochloric acid (sp. gr. 1·19) is added and then sufficient sulphuric acid to make 100 c.c. Twenty c.c. of this reagent with 10 c.c. of the water give a permanent blue colour in presence of nitric acid.

Patents.

Waters; Purification of natural —— by exposure to sunlight or to artificial light. A. Koch. Fr. Pat. 456,953, April 22, 1913. Under Int. Conv., April 23, 1912.

The water is allowed to run down a long glass plate, beneath which is a reflector for the blue rays. To condense the light on the surface of the water, a series of prisms is employed, and between these prisms and the water is a glass plate which only permits the blue rays to pass. When using artificial light, the water is passed into a deep and narrow vessel, in the centre of which is suspended the source of light; the water then escapes at the bottom. The vessel is kept filled with the water and the walls are furnished with a reflecting surface.—J. H. J.

Sewage; Decantation and filtration of —— after mechanical sedimentation or septic fermentation. A. Valabrègue. Fr. Pat. 456,712, March 19, 1913.

The decantation and filtration are done in the same tank, which is in the form of a pair of inverted cones, side by side, each of which is divided into central and side portions by a double partition wall at right angles to the sides. The sewage enters at the centre of the cones where it deposits the heavy matter which falls to sumps at the bottom, from which it can be removed by pipes when required. The clarified liquid passes between the partition walls into the side portions. At the top of these side portions, a layer of filtering material is supported, and the sewage passes through the material from below upwards. The filter material can be cleaned by reversing the flow.—J. H. J.

Septic tanks and nitrifying filters. L. J. Porsain. Fr. Pat. 458,352, May 26, 1913.

The septic tank contains an inner wall near the outlet end with an opening in its centre through which the sewage has to pass. In front of the submerged exit pipe is a large baffle-plate extending the whole width of the tank but not quite from top to bottom. The effluent from the tank passes into an enclosed filter apparatus containing three shallow filter-beds placed one above the other, with collecting trays in between. The effluent is distributed over each bed in definite quantities by a tipping bucket. Below the last bed is a straining chamber. Air is aspirated through the filter from the bottom upwards.—J. H. J.

Ultra-violet rays; Treatment of liquids by ——. C. Boltshauser. Fr. Pat. 458,521, March 28, 1913. Under Int. Conv., May 28, 1912.

A mercury vapour lamp or other source of ultra-violet rays is used. The liquid to be treated passes by a small pipe through the centre of the length of the lamp, in such a manner as not to touch the walls of the lamp. The annular space between the pipe and the lamp is traversed by the rays, and contains a liquid for filtering or cooling the rays, or it may be rendered vacuous. The pipe containing the liquid to be treated may be made to re-traverse the lamp outside, either lengthwise or spirally, or to pass into an outer encircling tube at a determined distance from the lamp.—J. H. J.

Sterilisation; Process and apparatus for ——. T. Grosseron. Fr. Pat. 458,675, June 2, 1913.

The apparatus consists of two concentric horizontal cylinders containing water in the annular space. The outer cylinder may be heated directly by a fire, or steam may be passed through the annular space. The material is introduced at one end of the apparatus into the inner chamber and a cover is clamped on over this end so that the apparatus can be used as an autoclave. A little water is placed in the bottom of the inner chamber, and when the annular space is sufficiently heated, this water commences to vaporise but does not condense on the material to be sterilised, as both are at the same temperature; also no condensation takes place on the walls of the inner chamber.—J. H. J.

Sewage or foul waters; Apparatus for separating floating matter and sediment from ——. B. Kaibel, Darmstadt, Germany. Eng. Pat. 7499, March 29, 1913. Under Int. Conv., April 11, 1912.

See Fr. Pat. 456,425 of 1913; this J., 1913, 1028.—T. F. B.

Sewage and other liquids; Centrifugal treatment of —— and apparatus for use therein. J. Bromet, F. Thorman, and H. C. Wood. Fr. Pat. 458,443, May 13, 1913. Under Int. Conv., Oct. 7, 1912.

See Eng. Pat. 22,836 of 1912; this J., 1913, 839.—T. F. B.

Manufacture of artificial fuel [from sewage sludge.] Eng. Pat. 22,958. *See* IIa.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Pyraconitine; a contribution to the study of the aconite alkaloids. H. Schulze and A. Liebner. Arch. Pharm., 1913, **251**, 453—467. (See this J., 1913, 211.)

Carefully dried aconitine (obtained from *Aconitum Napellus*) when heated to 192° C. in a current of dry hydrogen lost about 8 per cent. of its weight. The residue was extracted with ether and obtained in a crystalline form. The effect of the heat under these circumstances is to convert the aconitine into pyraconitine. Japaconitine likewise can be converted into the same substance. The characters of pyraconitine as observed by the authors differ considerably from those recorded by Dunstan and Carr (J. Chem. Soc., 1894, **65**, 176). The base crystallises from ether or alcohol and has the composition $C_{32}H_{43}NO_9$. It melts at 171° C. and has $[\alpha]_D = -112{\cdot}2$ in alcohol. The hydrochloride crystallises from water and melts with decomposition at 167° C. after being dried. The hydrobromide melts at 240° C., and decomposes at 242° C.; it has $[\alpha]_D = -105{\cdot}87°$ in water. The hydriodide melts with decomposition at 157°—158° C.—F. Shdn.

Tobacco; Influence of shading —— [during growth] on various constituents of the leaves. A. Stutzer and S. Goy. Biochem. Zeits., 1913, **56**, 220—229.

Since 1900 the practice of shading tobacco plants from direct sunlight has been extending in America. The authors found, in the case of plants cultivated in an experimental garden in Germany, that such screening diminished by about 20—30 per cent. the average weight of leaves (dry substance) obtained from each plant, and increased the nitrogen content of the leaves. In the lower ripe leaves of the shaded plants, which were yellowish in colour, the proportion of nicotine (referred to the total dry substance or to the total nitrogenous matter) was lower than in the corresponding leaves of unshaded plants. In the upper leaves, which were green, shading increased the actual percentage of nicotine (from 1·08 to 1·35), but diminished the proportion of the latter relatively to the total nitrogenous matters (from 8·0 to 5·1 per cent. in terms of nitrogen). Factors which tend to increase the production of nicotine in the tobacco plant are (1) unimpeded access of sunlight, (2) high temperatures, (3) plentiful nitrogenous manure and (4) insufficiency of water in the soil. The proper burning of tobacco depends upon its content of potash; this was found to be increased by shading, from 6·08 to 7·86 per cent. of the dry substance of the lower leaves, and from 4·11 to 6·11 per cent. of the upper leaves.—J. H. L.

Tobacco plant; Enzymes of the ——. J. du P. Oosthuizen and O. M. Shedd. J. Amer. Chem. Soc., 1913, **35**, 1289—1309.

EXPERIMENTS were made with two different kinds of Kentucky tobacco, viz., White Burley (a light-coloured variety) and Yellow Pryor (dark coloured). Samples of seed, green leaves at various stages of growth and cured leaves were tested and also samples of the soil; the midribs and stems of the leaf were not used. It was found that invertase, diastase, emulsin, and reductases were present in the seed and in the leaf at all stages of growth and after curing. Lipase, inulase and a proteolytic enzyme also were probably present. The soil gave negative results in most of the tests for enzymes. The green leaf contained oxidases at all stages of growth, the amount decreasing from the "topping" stage to maturity. The cured leaf gave negative results in all cases when tested for oxidases with phenolphthalin (this J., 1902, 280), but leaf cured with a green colour gave a positive result with guaiacum tincture. The results indicate that the oxidase is used up in the curing process. The enzymes must play an important part in the curing and fermentation of tobacco. In the early part of the curing process starch is saccharified by the diastase, and the resulting sugar is probably decomposed by the aid of the oxidising enzymes. The presence of invertase indicates that sucrose is probably present in the plant. The decrease in the protein content during ripening of the plant and during curing and fermentation, and the formation of amino-compounds in the latter processes are probably due to the proteolytic enzyme, whilst the decrease of nitrates and nicotine may be due to the reductases. Tests with emulsin showed that the green and cured leaf contain a small quantity of a glucoside, and the aroma of tobacco may be due partly to the formation of an aromatic substance by the enzymic decomposition of glucosides. (See also this J., 1899, 1161; 1901, 598; 1908, 1181; 1909, 1277.)—A. S.

Enzymes in Kentucky tobacco grown in Italy. F. Traetta-Mosca. Gaz. chim. ital., 1913, **43**, II., 431—437.

THE presence of oxidase, peroxidase, catalase, invertase, amylase, lipase, emulsin, and a proteolytic enzyme was detected in the green leaves. Dried unfermented leaves, however, gave negative results when tested for enzymes, and the author concludes that the fermentation of tobacco is produced by micro-organisms or by enzymes secreted by them.—A. S.

Tobacco; Proteolysis of the germinating seeds [" *germogli* "] *of Kentucky* ——. F. Traetta-Mosca. Gaz. chim. ital., 1913, **43**, II., 445—452.

Two kilos. of the germinating seeds were ground, mixed with 3 litres of water and 10 c.c. of acetic acid, and the mixture, after the addition of toluene, was kept for 1 month at 40° C. It was then filtered, the filtrate concentrated to about 700 c.c. on the water-bath and examined for the presence of the products of hydrolysis of proteins. Lysine, histidine, arginine, glutamine, leucine, and aspartic acid were detected. Choline was also present, having been formed probably by the action of proteolytic enzymes on lecithin.—A. S.

Laevulose in leaves of Kentucky tobacco grown in Italy. F. Traetta-Mosca. Gaz. chim. ital., 1913, **43**, II., 428—430.

200 KILOS. of dried tobacco leaves were exhausted with ether, dried, finely powdered, and placed in a dialyser, the outer water of which was changed twice a day during 4 days. The solution obtained reduced Fehling's solution: it was evaporated under diminished pressure, and the residue washed with ether, dissolved in water and decolourised with animal charcoal. The resulting lævorotatory solution was again evaporated under diminished pressure, and the residue was shown to contain lævulose by preparing from it the calcium compound and phenylglucosazone (m. pt. 204° C., $[\alpha]_D^{20} = -89{\cdot}46$) and by Seliawanoff's resorcinol-hydrochloric acid test.—A. S.

Tobacco grown in Italy; Ether extract of the leaves of Kentucky ——. F. Traetta-Mosca. Gaz. chim. ital., 1913, **43**, II., 440—445.

THE author succeeded in isolating a white substance, in the form of scales, which was soluble in boiling alcohol and boiling acetone, insoluble in cold alcohol, melted at 62°—63° C., and gave the Liebermann-Burchard reaction for phytosterol (red colour changing to blue and green, on adding sulphuric acid, drop by drop, to a solution of the substance in chloroform, to which a few drops of acetic anhydride have been added): it contained: C 75·76, H 15·70, O 8·54 per cent. A resinous substance, to which the aroma of the tobacco is attributed, was also isolated. This was a semi-solid substance, soluble in alcohol, petroleum spirit, pyridine, and acetic acid, insoluble in dilute alkalis and contained: C 77·88, H 10·70, O 11·42 per cent. It formed a bromine derivative, m.pt. 118° C., with decomposition, containing 64·68 per cent. Br and no oxygen, and on oxidation with nitric acid yielded an acid, $C_8H_{12}O_4$, m. pt. 55°—56° C., of the type of hexahydrophthalic acid.—A. S.

Pine oils. H. Helch. Pharm. Post, 1913, 838. Chem. and Drug., 1913, **83**, 715.

THE following figures represent a number of oils distilled from several coniferous trees.

		Sp. gr.	Rotation.	Esters. per cent.	Bromine. value.
1	*Pinus Pumilio*	0·876	—18°	12·2	212
2	,, ,,	0·860	—12°	5·7	242
3	,, ,,	0·863	—16°	5·3	240
4	,, ,,	0·871	— 8°	7·2	242
5	,, ,,	0·872	— 6°	4·7	243
6	,, ,,	0·876	— 6°	10·5	235
7	*Pinus sylvestris*	0·882	— 2°	7·2	240
8	,, ,,	0·875	+ 5°	6·3	255
9	*Abies excelsa* (cones) ..	0·863	—68°	6·9	238
10.	*Abies excelsa* (leaves) ..	0·876	—44°	6·4	240
11	*Pinus sibirica*	0·912	—42°	30·3	110
12	,, ,,	0·912	—45°	36·7	114
13	,, ,,	0·913	—38°	37·0	122
14	Turpentine ..	0·867	—32°	3·0	263
15	,, ..	0·870	— 3°	0·9	268
16	,, ..	0·911	+11°	8·4	246
17	,, ..	0·938	—27°	10·5	227

The author also states that the oil from *Pinus Pumilio* should not yield more than about 10 per cent. distilling below 165° C.

Chemical action of light. XXVII. Autoxidations. V. G. Ciamician and P. Silber. Ber., 1913, **46**, 3077—3084.

THE action of light on some ketones and cycloketones in presence of oxygen is described. The reaction products detected were: formaldehyde and acetic acid from acetone; adipic and caproic acids from cyclohexanone; acetylvaleric acid, $CH_3.CO.(CH_2)_4COOH$, and œnanthic, adipic, and formic acids from *o*-methylcyclohexanone, a heptylic acid, $CH_3.(CH_2)_2.CH(CH_3).CH_2COOH$, b. pt. 215°—216° C., and a pimelic acid,

$$COOH.(CH_2)_2.CH(CH_3).CH_2.COOH,$$

m. pt. 97° C., from *m*-methylcyclohexanone; a heptylic acid, b. pt. 217°—219° C., and pimelic acid, m. pt. 97° C., from *p*-methylcyclohexanone; and a ketone-glycol, $(CH_3)_2C(OH).CH(OH).(CH_2)_2.CO.CH_3$, a hydroxydiketone, $(CH_3)_2C(OH).CO.(CH_2)_2.CO.CH_3$, acetone, and lævulinic, formic, acetic and carbonic acids from methylheptenone. —A. S.

Paraformaldehyde; Preparation of crystalline ——. F. Pollack. Celluloid-Ind. (Beilage zur Gummi-Zeit.), 1913, **14**, 18.

According to the author crystalline paraformaldehydes can be obtained, without the numerous precautions specified by Auerbach and Barschall (this J., 1907, 1294), by dissolving amorphous paraformaldehyde in sulphuric acid, filtering, and allowing the solution slowly to crystallise. Different products, identical with those of Auerbach and Barschall (*loc. cit.*), are obtained according to the concentration of the acid, *e.g.*, 25 per cent. acid yields α-, 40—50 per cent. acid yields β-, and 70—80 per cent. sulphuric acid yields γ-polyoxymethylene.—A. S.

Cocaine imports and exports. Chem. and Drug., Nov. 15, 1913. [T.R.]

The following figures show the imports, exports, and re-exports of cocaine and cocaine salts into and from the United Kingdom during 1911 and 1912, together with the sources from which drawn and the destinations, as shown by the Annual Statement of Trade:—

Imports from	1911.	1912.
	Oz.	Oz.
Germany	15,173	10,760
Peru	21,631	1,541
Other foreign countries	189	1,336
Total from foreign countries	36,993	13,637
Total from British possessions	2,355	200
	39,348	13,837
Value	£14,232	£5,080

Exports declared as "Foreign Make," to	1911.	1912.
	Oz.	Oz.
Germany	27,778	3,150
Other foreign countries	200	45
Total to foreign countries	27,978	3,195
Total to British possessions	1,466	2,251
	29,444	5,446
Value	£8,326	£2,374

Exports declared as "British Make"	1911.	1912.
	Oz.	Oz.
Total to foreign countries	3,329	2,686
Total to British possessions	228	957
Total	3,557	3,643
Value	£1,798	£1,555

Transport of ether. Oil, Paint, and Drug Rep., Nov. 3, 1913.

An investigation is being held by the U.S. Dept. of Commerce into fires at sea with a view to ascertain whether better regulations in connection with the transport of inflammable materials are required. The particular subject under enquiry is the transport of ether, which, by reason of the type of vessel employed, has to be taken to some extent by passenger vessels. Proposals to bring them into line with the regulations for the transportation of gasoline meet with opposition from New York chemists as unnecessarily drastic, and the matter has been remitted to the law officers for further consideration.

Camphor industry in Formosa in 1912. Board of Trade J., Oct. 10, 1913.

There was an increase in the export of camphor from 5,613,718 lb., valued at £354,530, during 1911, to 8,649,319 lb., valued at £553,550, during 1912. The exports went principally to the following countries:—United States, 2,370,289 lb., Germany, 2,243,366, Japan, 1,693,969, United Kingdom, 1,003,086, France, 943,536, India, 322,290, Austria-Hungary, 72,783 lb.

Exports to the United Kingdom and Austria-Hungary were more than double the figures for 1911, exports to France increased nearly 70 per cent., while those to India nearly trebled. The most remarkable increase, however, was the export to Japan, which rose from 5,950 lb. in 1911 to 1,693,969 lb. in 1912. The increased export from Formosa seems to have taken place notwithstanding a decrease in the production, which was stated to be only about 5,500,000 lb., so that stocks in hand have been drawn on, and re-manufacture of camphor oil has taken place. The output of camphor for 1913 is estimated as likely to exceed 6,750,000 lb. From 1913 some 3,000 acres annually for 12 years are to be planted with young trees; the cost for the first year is placed at about £11,750. It is considered that the camphor resources of the island will be equal to all future demands.

Patents.

Hydrastinine and its homologues; Manufacture of the salts of ——. P. A. Newton, London, and The Mersey Chemical Works, Ltd., Bromborough, Cheshire. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,505, Dec. 21, 1912. Addition to Eng. Pat. 29,901, Dec. 23, 1910 (see Ger. Pat. 234,850 of 1910; this J., 1911, 923).

Products analogous to those described in the principal patent, are obtained by treating with condensing agents the acidyl derivatives of N-alkylhomopiperonylamines and treating the resulting bases with acids. For example, formylmethylhomopiperonylamine (obtained by treating methylhomopiperonylamine with aqueous formic acid and then eliminating the elements of water) is boiled with phosphorus pentoxide in benzene or toluene solution, the solvent is distilled off, the residue is decomposed with water, and the solution is treated with excess of alkali and extracted with benzene. From the benzene solution, which contains the hydrastinine base, the salts are obtained by treatment with acids.—T. F. B.

Salicylic acid; Anhydride of —— and process of preparing the same. E. Kopetschni, Mannheim, Germany, L. Karczag, Szolnok, Austria-Hungary, and O. Fodor, Berlin. U.S. Pat. 1,075,581, Oct. 14, 1913.

Salicylic acid chloride is converted into salicylic anhydride by agents capable of eliminating hydrochloric acid. The anhydride has a m. pt. between 90° and 100° C., is easily soluble in ether, acetone, glacial acetic acid, ethyl acetate, and benzene, and is converted into salicylanilide by boiling with aniline.—T. F. B.

Salicylic acid from phenol prepared by the monochlorobenzene process; Production of ——. C. Torley and O. Matter. Fr. Pat. 458,724, April 28, 1913.

The mixtures of sodium phenoxide with sodium hydroxide or sodium chloride, obtained by heating monochlorobenzene with sodium hydroxide in the dry state, or in presence of water is converted directly into salicylic acid, without isolating the phenol. According to the method used, the cooled melt is pulverised or the solution is evaporated to dryness, and the product is treated with carbon dioxide to form sodium salicylate, which is converted into salicylic acid by the usual process.—T. F. B.

βγ-Dimethyl-αγ-butadiene; Production of ——. Badische Anilin und Soda Fabrik. First Addition, dated April 14, 1913, to Fr. Pat. 417,275, June 18, 1910. Under Int. Conv., May 14, 1912.

Improved yields of dimethylbutadiene are obtained if the process of heating pinacone or pinacoline with dehydrating catalysts, described in the principal patent (see this J., 1911, 38), is carried out under reduced pressure. For example, a yield of 80 per cent. of the theoretical yield is said to result by heating pinacone or pinacoline in presence of alumina to 450° C., under a pressure of 20 mm. —T. F. B.

Anhydrides and chlorides of fatty acids; Process for preparing ——, *especially for making cellulose esters.* H. Dreyfus. First Addition, dated April 18, 1913, to Fr. Pat. 448,342, Sept. 16, 1912. (See this J., 1913, 421.) Under Int. Conv., Oct. 3 and Nov. 29, 1912.

Anhydrides of fatty acids are prepared by allowing sulphuric anhydride, preferably in the liquid or gaseous state, to act upon a salt of the fatty acid at a low temperature. The sulphuric anhydride is kept in a state of fine subdivision, and the mixture is agitated during the reaction, whilst the anhydride should be added at such a rate that excess of free sulphuric acid is not formed. The fatty acid anhydride may be recovered by distillation, *in vacuo* or otherwise. Further, the sulphuric anhydride may be replaced by chlorosulphonic acid with equally good results; in this case, it may be desirable to add a diluent such as acetic acid.—T. F. B.

Lactide; Process for making ——. Chem. Werke vorm. Dr. H. Byk. Fr. Pat. 456,824, April 18, 1913.

Lactic acid is gradually heated, preferably *in vacuo*, to temperatures above 135° C., in such a manner that when the temperature reaches 150° C., the product does not distil; the temperature is finally raised gradually to about 200° C. The mass thus obtained is almost insoluble in water and in most organic solvents, but is soluble in chloroform: it appears to consist of a polyacetyllactic acid, and can be converted into lactide by heating to 250°—300° C.; if low pressures are used, lactide distils over. The yield of lactide is increased, whilst the temperature used may be reduced, if, before the final heating, a small quantity of aluminium, zinc, or magnesium, or an oxide, phosphate, or carbonate of one of these metals, is added to the crude product. For example, when zinc oxide is used, a temperature of about 200° C. is sufficient. The distillation of the lactide may be carried out in presence of a current of carbon dioxide, or a hydrocarbon or other solvent may be added to the crude product, and the lactide separated from the resulting solution by crystallisation.—T. F. B.

Tobacco of all kinds; Process and apparatus for reducing the quantity of nicotine in ——. Soc. La Denicotina. Fr. Pat. 456,840, June 27, 1912.

The tobacco is placed in a vessel under reduced pressure and there subjected to the action of ammonia gas. After the excess of ammonia has been removed by means of an exhaust pump, ether is admitted to extract the nicotine. The ether is now drawn off, treated with a metallic salt, such as ferrous sulphate, to precipitate the nicotine, and then, while still charged with other extractives, is employed for the extraction of fresh charges of tobacco. The ether still remaining in the tobacco is removed by exhausting the vapours from the vessel and passing them through a condenser. The tobacco is, finally, heated for 48 hours at 30°—35° C., in order to decompose ammonium salts present, and the ammonia thus liberated is recovered.—W. P. S.

6-Methyl-2-phenylquinoline-4-carboxylic acid and 8-methoxy-2-phenylquinoline-4-carboxylic acid; Preparation of derivatives of ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 458,162, May 3, 1913. Under Int. Conv., May 9, 1912, and Feb. 20, 1913.

The acids mentioned in the title are converted into their methyl and ethyl esters by the usual processes. 6-Methyl-2-phenylquinoline-4-carboxylic acid forms an ethyl ester of m.pt. 76° C. and a methyl ester of m.pt. 91° C., whilst 8-methoxy-2-phenylquinoline-4-carboxylic acid furnishes an ethyl ester of m.pt. 109° C. and a methyl ester of m.pt. 102° C.—T. F. B.

Propylene from acetylene and methane; Process for preparing ——. A. Heinemann. Fr. Pat. 458,397, May 27, 1913. Under Int. Conv., May 28, 1912.

The union of acetylene and methane to form propylene can be effected to a much greater extent and at lower temperatures than in the known methods, by the aid of suitable catalysts. These consist of a mixture of a base-metal catalyst, such as iron, copper, nickel, silver, etc., with a rare-metal, such as platinium, iridium, or palladium. The contact substance may be prepared by depositing copper, electrolytically or otherwise, on pumice stone or other porous substance, immersing the product in a solution of a platinium salt, drying, and reducing if necessary. Another method consists in depositing the rare metal on a wire, ribbon, or foil of the base metal. The union of the acetylene and methane is accelerated by heat, or by the silent electric discharge, or by the use of actinic light rays.—T. F. B.

Glycerol; Synthetic manufacture of ——. A. Heinemann. Fr. Pat. 458,398, May 27, 1913. Under Int. Conv., May 28, 1912.

Propylene is converted into a dichloropropane by treating it with chlorine or a chlorine compound, under the influence of actinic rays. The product is converted into propenyl chloride by heating it with an alkali metal, alkali compound, magnesium, etc., and this is chlorinated to form trichloropropane. On heating the latter with water, with or without an alkaline substance, glycerol is produced.—T. F. B.

Esters of aliphatic hydroxy-acids; Process for making ——. Chem. Werke vorm. Dr. H. Byk. Fr. Pat. 458,645, May 31, 1913. Under Int. Conv., June 3, 1912.

The use of high temperatures, heretofore necessary in the preparation of esters from alcohols and aliphatic hydroxy-acids, is said to be obviated by using a suitable catalyst, consisting of an acid substance or a heavy metal compound, such as is used for esterifying acids with alcohols. Aluminium sulphate and titanic anhydride are stated to be especially suitable. Thus, ethyl lactate may be obtained in almost theoretical yield by heating lactic acid or the anhydro compound (prepared by heating the acid to 170°—180° C.) with alcohol in which about 2 per cent. of gaseous hydrogen chloride has been dissolved. Similarly, polyglycollide, which is also insoluble in alcohol, is converted into ethyl glycollate by heating for some hours with alcohol and a catalyst. Lactide or its lower polymer, or diglycollide (obtained by distilling anhydrolactic acid and polyglycollide, respectively) are converted into esters by boiling with alcohols under a reflux condenser: this conversion is much more complete and rapid if a catalyst be present.—T. F. B.

Perfumes; Process for extracting ——. A. Hesse. Fr. Pat. 458,673, June 2, 1913. Under Int. Conv., June 5, 1912.

It has already been proposed to use phthalic esters as solvents for perfumes (see Ger. Pat. 251,237; this J., 1912, 1054). Other solvents with analogous properties may also be used. In general, these properties should be solubility in alcohol, insolubility in water, and freedom from odour which might militate against the subsequent use of the products; further, the solvents should not be too volatile, a boiling point of about 90° C. being the minimum. To this class of solvents belong benzyl alcohol, phenylethyl alcohol, terpineol, geraniol, citronellol, and simple and mixed ethers of these alcohols, as well as their esters. The application of these solvents to the extraction, by enfleurage or maceration, of rose leaves, cassie flowers, tuberoses, and jasmine flowers, is described in detail in the specification.—T. F. B.

Glycol ; Process for making ——. Soc. Anon. d'Explosifs et. de Prod. Chimiques. Fr. Pat. 458,733, Aug. 13, 1912.

Monochlorhydrin or monobromhydrin is converted into glycol by saponification by means of an alkali carbonate or bicarbonate. For example, a mixture of 160 parts of monochlorhydrin, 170 parts of sodium bicarbonate, and 350 parts of water is heated gently, to maintain a steady but slow evolution of carbon dioxide ; when this has ceased, the liquid is distilled and the residue, consisting of glycol and sodium chloride, is submitted to distillation at the ordinary or at reduced pressure, or with the aid of superheated steam. A yield of 90 per cent. and over is said to be possible.—T. F. B.

Camphene ; Process for preparing ——. Rheinische Gummi- und Celluloidfabrik. Ger. Pat. 264,246, Dec. 17, 1912.

Pinene halogen hydrates are converted into camphene by heating with ammonia in presence of a phenol. The reaction is complete in 5 to 6 hours at a temperature of 180°—220° C. A small excess of ammonia over the theoretical amount is necessary for complete dehalogenation.—T. F. B.

Camphor from alcoholic or ethereal solutions containing water ; Process for separating ——. K. Kubierschky. Ger. Pat. 264,653, April 11, 1912.

A solvent for camphor, of high boiling point, *e.g.*, a mineral oil, is added to the solution to be distilled ; the solvent should be one which is not volatile with the alcohol or ether, so that it remains in the still as residue : the camphor can be recovered from it by crystallisation. —T. F. B.

Vaccines ; Preparation of —— *from pathogenic germs or the products of their metabolism.* W. Fornet. Ger. Pat. 264,300, Aug. 25, 1912.

The bacteria are cultivated in a culture liquid containing dialysable nitrogenous compounds in addition to the usual nutrient salts, and the culture liquid is subsequently dialysed against a solution of approximately the same composition but without the dialysable nitrogenous compounds.—A. S.

Monomethylamine ; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 264,528, Dec. 14, 1912.

Monomethylamine is obtained by reducing with molecular hydrogen an acid solution of hydrocyanic acid or a cyanide, or of hydroferrocyanic acid or a ferrocyanide, in presence of a metal of the platinum group as catalyst. The best results are said to be obtained with hydroferrocyanic acid. —T. F. B.

Ethane from ethylene and hydrogen ; Process for preparing pure —— *by aid of catalysts.* Elektrochemische Werke G. m. b. H. Ger. Pat. 265,171, Oct. 16, 1912.

To effect the combination of the unaltered ethylene and hydrogen in the gaseous mixture resulting from the passage of these gases over a catalyst, the product is again passed over the catalyst under pressure. The reaction is stated to be quantitative and instantaneous. Nickel or a metal of the platinum group may be used as catalyst.—T. F. B.

Ethane from ethylene and hydrogen ; Process for preparing —— *in presence of a catalyst.* Elektrochemische Werke G. m. b. H. Ger. Pat. 265,297, Oct. 16, 1912.

Before submitting the ethylene to the action of the catalyst, it is freed from known contact poisons, and then thoroughly washed with concentrated sulphuric acid in order to remove the contact poisons of undetermined composition. It is advisable after this washing, to pass the purified ethylene over solid sodium hydroxide to remove traces of sulphur dioxide.—T. F. B.

Nitriles ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,647, Dec. 12, 1912.

See Ger. Pats. 259,363 and 259,364 of 1912 ; this J., 1913, 673.—T. F. B.

Erythrene ; Process for producing ——. The Mersey Chemical Works, Ltd., Bromborough, and P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4076, Feb. 17, 1913. Addition to Eng. Pat. 27,555, Nov. 26, 1910.

See Ger. Pat. 262,884 of 1912 ; this J., 1913, 924.—T. F. B.

Erythrene ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 458,677, June 21, 1913. Under Int. Conv., June 6, 1912.

See Ger. Pat. 263,016 of 1912 ; this J., 1913, 924.—T. F. B.

Beta-gamma-dimethylerythrene ; Process for producing ——. F. Hofmann, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,575, Oct. 21, 1913.

See Addition of April 11, 1912, to Fr. Pat. 425,582 of 1911 ; this J., 1912, 1007.—T. F. B.

Nitroaminophenylarsinic acid. Dinitrophenylarsinic acid. L. Benda, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pats. 1,075,537 and 1,075,538, Oct. 14, 1913.

See Eng. Pats. 24,668 and 24,667 of 1912 ; this J., 1913, 841.—T. F. B.

Hexamethylenetetramine salts of the α-phenylquinoline-γ carboxylic acids. R. Schwabe, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,076,160, Oct. 21, 1913.

See Eng. Pat. 23,365 of 1912 ; this J., 1913, 213.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic plates ; Film-like coating for antihalo ——. Union Photographique Industrielle Etabl. Lumière et Jougla Réunis. Fr. Pat. 458,301, Aug. 3, 1912.

In preparing removable backings for anti-halo plates it is customary to use glycerin in order to prevent the gelatin from becoming brittle and to give it the necessary flexibility. The hygroscopic properties of glycerin and its tendency to cause bacterial growth in the gelatin, are serious disadvantages. It is proposed now to remedy these by replacing the glycerin by a sugary or gummy substance, preferably glucose, 5 to 20 per cent. of which may be mixed with the paste of gelatin, gall, and non-actinic colouring matter.—T. F. B.

Photographs ; Process for treating [colouring] ——. A. M. Sandig. Fr. Pat. 456,787, April 17, 1913.

See U.S. Pat. 1,067,198 of 1913 ; this J., 1913, 807.—T.F.B.

Dyestuffs used in photography ; Process for sensitising —— *by means of thiosinamine derivatives.* A. Just. Fr. Pat. 458,401, May 27, 1913. Under Int. Conv., June 13, 1912.

See Ger. Pat. 256,186 of 1912 ; this J., 1913, 673.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Nitrocellulose ; Sulphuric acid in ——. Piest. Z. angew. Chem., 1913, **26**, 661—663.

Sulphuric acid in guncotton is determined as follows : 20 grms. of nitrocellulose are decomposed on the steam bath with 70 c.c. of nitric acid (sp. gr. 1·4) and 1 grm. of KNO_3, evaporated to dryness, and carefully incinerated. The ash is dissolved in dilute hydrochloric acid, the solution filtered and the sulphuric acid precipitated with barium chloride. A number of samples of stable guncotton all contained sulphuric acid, in quantities ranging from 0·02 to 0·07 per cent. (as SO_4). For testing the stability of guncottons the author prefers to use α-naphthylamine test papers, for preparing which 0·6 grm. of sulphanilic acid and 0·5 grm. of α-naphthylamine are dissolved in 100 c.c. of water which has been acidified with a little acetic acid. Equal parts of this solution and glycerin are mixed and narrow strips of filter paper dipped therein for about half their length. One grm. of guncotton is placed in a test-tube and a strip of the test paper fixed with its lower edge 2 cm. above the cotton. The test is carried out at 60° C. and the time noted when the test paper acquires a red colouration. For the determination of sulphuric acid in cotton before nitration, 10 grms. of cotton are treated with 50 c.c. of nitric acid and 0·5 grm. of potassium nitrate in the manner described above for guncotton; samples examined by the author contained less than 0·01 per cent. and the washed, stabilised guncottons prepared from these samples contained less than 0·1 per cent. of sulphuric acid. In the case of stabilised products, the author considers there is no evidence of the presence of cellulose sulphuric esters, and the small quantities of sulphuric acid found are to be attributed to mineral sulphates. Unstabilised products contain more sulphuric acid, corresponding to the less perfect washing. Any nitro-sulphuric esters possibly formed, are decomposed by the hot washing process, but the sulphuric acid is not completely eliminated until the cotton is pulped and thoroughly washed; after this operation only traces of calcium sulphate from the washing waters remain.—J. F. B.

Powders; Contributions to the study of modern ballistic ——. C. Girard and P. Iooss. Monit. Scient., 1913, **111**, Nov., 677—685.

Determinations were made of the solubility of nitroglycerin in rosin oil, oleic acid, castor oil, colza oil, maize seed oil, poppy seed oil, mustard seed oil, linseed oil, areca nut oil, olive oil, cottonseed oil, neatsfoot oil, and hempseed oil. At 30° C., the percentage solubility, by weight, rises in the order given from 5·6 to 17·95 per cent. The addition of nitro-compounds, such as mono-, di-, or trinitrobenzene or mononitronaphthalene, to these oils, makes them better solvents for nitroglycerin. In cold castor oil the following results were obtained for percentage solubility by weight of the compounds mentioned:—diphenylamine (46), diphenylurea (almost insoluble), vaseline (35), trinitrobenzene (2), trinitrotoluene (3), equimolecular mixture of trinitrotoluene, trinitrobenzene, dinitrobenzene, and diphenylamine (very soluble), equimolecular mixture of trinitrobenzene and trinitrotoluene (3·5), mononitrobenzene and monitrotoluene (soluble in all proportions). The following results were obtained for percentage solubility, by weight, in vaseline. Diphenylamine (22·5 at 50° C.), diphenylurea (almost insoluble), castor oil (15 at 50°), mononitronaphthalene (19 at 80°), dinitrobenzene (3 at 90°), trinitrobenzene (0·5 at 90°), equimolecular mixture of trinitrotoluene and diphenylamine (2 at 90°), equimolecular mixture of trinitrobenzene and diphenylamine (very soluble), equimolecular mixture of dinitrobenzene and trinitrotoluene (8 at 90°), mononitrotoluene (all proportions), mononitrobenzene (50 at 50°), equimolecular mixture of mononitrobenzene and mononitrotoluene (105 at 50° C.).—G. W. McD.

Patents.

Treating apparatus [Drying apparatus for explosive substances]. J. Aspinwall, Newburgh, N.J., Assignor to E. I. du Pont de Nemours Powder Co. U.S. Pat. 1,075,805, Oct. 14, 1913.

A drying chamber for explosive materials is constructed with fixed side and end walls and with a roof of hinged flaps which are lifted up if an explosion takes place. The materials are carried through the chamber by a conveyor.
—W. H. C.

Explosives. C. J. Weld-Blundell. Fr. Pat. 458,372, May 26, 1913.

Propellants consisting either of nitrocellulose alone, or mixtures of nitrocellulose, nitroglycerin and diphenylamine (0·1—1 per cent.) are rendered moisture-proof by treatment with camphor (2 per cent.). The explosive is then dipped in an aqueous solution (20 per cent.) of a metallic tartrate or oxalate, preferably potassium tartrate, leaving, after spinning and drying, 0·2—2 per cent. of tartrate covering the grains, whereby it is stated, the powder is rendered flameless and smokeless.—G. W. McD.

Explosives containing, as a base, nitrates, chlorates, or perchlorates. Soc. d'Electro-Chimie. Fr. Pat. 458,547, Aug. 8, 1912.

The addition of cork dust to nitrate, chlorate or perchlorate explosives is stated to prevent hardening on storage. The following proportions are mentioned:—Potassium chlorate (88 parts), petroleum (11), and cork dust (1 part).
—G. W. McD.

Explosives; Process of obtaining a liquid mixture of aromatic nitro-compounds suitable for the manufacture of —— from the residues obtained in the production of pure trinitrotoluene. Dynamit-A.-G. vorm. A. Nobel und Co. Ger. Pat. 264,503, Sept. 14, 1910.

The residues obtained during the preparation of pure trinitrotoluene by recrystallisation from alcohol or other solvent, are nitrated with a mixed acid rich in sulphuric and poor in nitric acid. A liquid consisting mainly of a mixture of isomeric trinitro-derivatives of toluene is obtained, suitable for use as an explosive and more especially for incorporation with collodion cotton for the production of plastic explosives.—A. S.

Explosives; Plant for raising and conveying liquid ——. S. Viesi. Fr. Pat. 456,900, April 21, 1913.

See Eng. Pat. 10,895 of 1913; this J., 1913, 991.—T. F. B.

Explosives from glycols or their oxides; Manufacture of ——. F. E. Matthews, E. H. Strange, and H. J. W. Bliss. Fr. Pat. 458,309, May 23, 1913. Under Int. Conv., May 30, 1912.

See Eng. Pat. 12,770 of 1912; this J., 1913, 712.—T. F. B.

Explosive compound. C. F. Dippel. Fr. Pat. 458,464, May 27, 1913. Under Int. Conv., May 27, 1912.

See U.S. Pat. 1,045,515 of 1913; this J., 1913, 381.—T.F.B.

Process for nitrating, and unwinding the reel of paper in centrifugal nitrating machines. Fr. Pat. 458,553. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Copper; Determination of —— as cuprous sulphide. C. Beck. Chem.-Zeit., 1913, **37**, 1330.

In the conversion of cupric into cuprous sulphide by heating with sulphur, it is not necessary to use a current of reducing gases: equally accurate results are obtained with an inert gas such as carbon dioxide.—A. S.

Radium; Quantitative determination of —— by the emanation method. E. Ebler. Z. angew. Chem. 1913, **26**, 658—661.

The fusion method previously described (see this J., 1912, 586), though excellent for the valuation of solid materials poor in radium, is not suited for the estimation of radium in liquids and readily soluble preparations. For this purpose Strutt's method is well adapted, particularly for the estimation of quantities of radium between 10^{-12} and 10^{-4} grm., depending on the complete boiling out of the emanation from the liquid under diminished pressure and subsequent transference into an ionisation chamber for measurement of the saturation current. The apparatus for carrying out these operations is described and illustrated. A boiling-flask fitted with a reflux condenser is half-filled with the clear acidified liquid, and the contents are boiled for 15—30 minutes while a current of filtered, emanation-free air is sucked through until all the emanation is expelled. The apparatus is then closed, exhausted and allowed to remain for one or more days at rest for the accumulation of the emanation over a measured time. This emanation is transferred to a spherical vessel by exhausting the latter, placing it in communication with the upper part of the condenser, boiling the liquid and finally displacing all the emanation by admitting warm saturated brine to the boiling-apparatus. After allowing the emanation in the spherical vessel to remain for 5 minutes for the dissipation of the unstable thorium and actinium activities, the more stable radium emanation is measured in an emanation-electrometer by comparison with a known standard (*loc. cit.*). The emanation is first transferred from the collecting vessel to an ionisation chamber where it is left for 4 hours to come into equilibrium, during which time the central electrode is kept charged with a high positive potential. The electrometer is then fitted to the chamber and the fall in potential per unit of time is taken as a relative measure of the saturation current. For small quantities of liquid it is sometimes more convenient to expel the emanation at the beginning and end of the generation period by means of a current of air, in which case vessels of the nature of tubular wash-bottles are used, with tubes which are sealed off at the ends.—J. F. B.

Lead in organic material; Detection and determination of ——, and the separation of lead sulphate and calcium sulphate by means of ammonium acetate. E. Erlenmeyer. Biochem. Zeits., 1913, **56**, 330—340.

The organic matter is burnt in a porcelain dish, the powdered ash together with the dish (which may retain a large proportion of the lead as silicate), digested for 24 hours with 20 per cent. sodium carbonate solution, the residue washed with 5 per cent. sodium carbonate and digested for 10 hours with 5*N* nitric acid; water is added, the mixture filtered (the filtrate containing most of the lead), and the residue, if containing carbon, again ignited (preferably in oxygen) and fused for 45 minutes with ten times its weight of sodium potassium carbonate (1 : 1), in the same dish as before; the whole is then digested for 24 hours with 5 per cent. sodium carbonate solution, the residue dissolved in nitric acid, and the solution mixed with the previous filtrate containing lead. The mixed solutions are evaporated on the water-bath, the residue digested for 2 hours with about 500 c.c. of water, with frequent stirring, then made distinctly alkaline with ammonia, acidified again with acetic acid, and digested for 2 hours on the water-bath; after filtering and washing with 2 per cent. acetic acid, the filtrate is evaporated, powdered ammonium bichromate added (to make a 10 per cent. solution), and the mixture digested for 3—4 hours on the water-bath and allowed to stand for 12 hours; the mixture is again filtered, the residue washed with dilute acetic acid, the lead chromate dissolved in concentrated nitric acid, the solution diluted, filtered, the residue washed, sulphuric acid added to the filtrate, this evaporated until sulphuric acid fumes appear, diluted, allowed to stand for some hours, diluted again, and the precipitate washed with 4 per cent. sulphuric acid, filtered off, and weighed as lead sulphate. Any residue remaining from the second treatment with nitric acid is digested, together with the ignited filter, for some hours with concentrated nitric acid, the excess of which is removed by evaporation and the residue heated with sulphuric acid until white fumes appear; after cooling and diluting, the mixture is filtered, the residue warmed for some hours with half-saturated ammonium acetate solution (made alkaline with ammonia), and the resulting solution treated with hydrogen sulphide; any precipitate is washed with water containing ammonium sulphide and converted into sulphate and weighed. With 3—4 kilos. of animal matter, the method gives results of 98—99 per cent. accuracy. For the qualitative detection of lead simplified processes are described, and it is shown that lead sulphate may be separated from calcium sulphate, even in large excess, by repeated treatment with a mixture of equal volumes of 96 per cent. alcohol and half-saturated ammonium acetate solution (alkaline with ammonia).
—F. Sodn.

Determination of sulphur in pyrites. Analysis of pyrites. Martin. *See* VII.

Analysis of antimony pentasulphide. Utz. *See* VII.

Detection and determination of vanadium in steel. Pickard. *See* X.

Determination of raffinose in the sugar beet. Nowakowski. *See* XVII.

Influence of optically active non-sugars [*in sugar analysis*]. Kopetzki. *See* XVII.

Determination of gum arabic in tragacanth gum. Frey. *See* XVII.

Determination of cocoanut oil in butter by Polenske's method. Sundberg. *See* XIXa.

Detection of small quantities of nitric acid in water. Rothenfusser. *See* XIXb.

XXIV.—MISCELLANEOUS ABSTRACTS.

Catalysis; The influence of foreign substances on the activity of ——. C. Paal and A. Karl. Ber., 1913, **46**, 3069—3074.

In a previous communication (this J., 1911, 715) it was shown that the activity of palladium as a catalyst in hydrogenations was remarkably diminished when it was deposited on aluminium, iron, copper, zinc, silver, tin or lead. It is now shown that the oxides, hydroxides, and carbonates of these metals behave in a similar manner. Lead carbonate (basic) entirely prevents hydrogenation, while zinc oxide, zinc carbonate, aluminium hydroxide and ferric hydroxide greatly reduce it. Cadmium carbonate is also an anti-catalyst. On the other hand, magnesium oxide, like metallic magnesium, does not reduce the catalysis, but rather, on account of its greater surface increases it.—W. H. P.

Books Received.

Die Verwendung der seltenen Erden. Eine kritische Uebersicht. Von Dr. C. Richard Böhm. Veit und Comp.'s Verlag. Leipzig. 1913. Price M. 4.50. Bound M. 5.50.

Volume (8¾ by 5¾ ins.), containing 107 pages of subject matter and 10 illustrations. The subject matter is classified as follows:—I. Employment of the rare earths in science. II. Employment in technology. III. The rare metals and their preparation. IV. Purifying acetylene. V. The rare earths in analysis. VI. Physiological action of the rare earths and proposals based thereon. VII. Oxides and compounds of the rare earths for incandescence lights. VIII. The metals of the rare earths and their uses, etc. The work is dedicated to Dr. C. Duisberg.

La Soudure Autogène. Rédigé par l'Institut Scientifique et Industriel. 1913. Mois Scientifique et Industriel, 8 and 10, rue Nouvelle, Paris. 9e. Price 2 fr. 75.

Volume (9½ by 6¼ ins.), containing 108 pages with 83 illustrations, and an alphabetical index of subjects. The text is subdivided as follows:—I. General definitions, etc. II. Welding at the forge. III. Oxyhydrogen welding. IV. Oxy-acetylene welding. V. Welding by the aid of oxygen gas. VI. Welding with the aid of gaseous mixtures. VII. Electric welding. VIII. Alumino-thermic welding, and welding by recasting. IX. Comparison of different modes of welding. X. Cutting by means of the blowpipe.

Chemical German: An Introduction to the Study of German Chemical Literature. Including rules of nomenclature, exercises for practice and a collection of extracts from the writings of German chemists and other scientists, and a vocabulary of German chemical terms and others used in technical literature. By Francis C. Phillips, Professor of Chemistry in the University of Pittsburgh. The Chemical Publishing Co., Easton, Pa., U.S.A. 1913. Price 2 dollars. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

Volume (9 by 6¼ ins.), containing 186 pages of subject matter (extracts from eminent German chemists and writers), with 3 pages of "Notes," and a "Vocabulary of chemical terms and others used in German Chemical Literature," covering 50 pages, and 2 pages of "Abbreviations frequently found in German scientific literature."

Publications de la Société de Chimie-Physique. (1) L'Etude Physico-Chimique des Sels Chromiques. Par A. Senéchal. (2) L'Additivité des Propriétés Diamagnétiques, et son Utilisation dans la Recherche des Constitutions. (Conférence faite le 23 avril 1913). Par M. Paul Pascal. Librairie Scientifique A. Hermann et Fils, 6, rue de la Sorbonne, 6, Paris. 1913. Prices, respectively 2 fr. and 1 fr.

Pamphlets (9½ by 6¼ ins.) containing respectively 28 and 26 pages of subject matter.

Economic Minerals and Mining Industries of Canada. Dept. of Mines, Ottawa. Government Printing Bureau. No. 230.

Pamphlet of 77 pages, 10 by 6½ ins., containing sections on: Mineral Production of Canada in 1912, Economic Minerals and Associated Industries, Metallic and Non-Metallic Minerals, Cement, Clays and Clay Products, Stone, Lime, Slate, Statistics and Mining Laws, Bounties, and Ore and Fuel Testing Laboratories; and illustrated by 19 plates and a mineral map of Canada.

Review of the Trade of India in 1912—1913. Wyman and Sons, Ltd., Fetter Lane, E.C. [Cd. 6960.] Price 1s. 1d.

Annual blue book of 95 pages, 13 by 7½ ins., giving imports and exports, with general summary and an appendix.

The Magnetic Sands of Natashkwan, County of Sagerenay, P.Q., Canada. By G. C. Mackenzie. Canada Dept. of Mines, Ottawa. No. 145.

Book of 57 pages, 8½ by 5½ ins., illustrated by 22 photographs, 9 drawings, and 3 maps.

Traité de Chimie Minérale. By H. Erdmann. Translated from the 5th German Edition by A. Corvisy. Vol. II. Metals. A. Hermann et Fils, 6, Rue de la Sorbonne, Paris. Price 10 fr.

Volume containing 34 pages, 9½ by 6 ins. The subjects are treated in the following order:—Alkali metals. Alkaline-earth metals. Magnesium group. Earth metals. Iron group. Tin group. Noble metals. The text contains 76 figures and three coloured plates of spectra.

Les Progrès de la Chimie en 1912. A. Hermann et Fils, 6 Rue de la Sorbonne, Paris. Price 7 fr. 50.

A translation into French of the "Annual Reports on the Progress of Chemistry for 1912. Vol. IX.," issued by the Chemical Society, London. Contains 411 pages, 9 by 5¾ ins.

Introduction à la Chimie des Complexes. By G. Urbain and A. Sénéchal. A. Hermann et Fils, 6, Rue de la Sorbonne, Paris. Price 15 fr.

Volume of 477 pages, 10 by 6½ ins. The work deals with the chemistry of complex minerals and mineral substances, and is subdivided as follows:—Part 1. I. Perfect and imperfect complexes. Double salts. II. Stability of complexes. III. Fundamental relationships. IV. Reversible electrochemical transformations. Electro-affinity. Part 2. I. Historical. II. Isomerism and polymerism of the electrolytic complexes according to Werner. III. Disintegration of the complex molecule. IV. Complexes of platinum. V. Cobaltic complexes. Part 3. I. Physico-chemical analysis of solutions of imperfect complexes. II. Concealment of radicals in imperfect complexes (chromic chlorides). III. Hydrated complexes, chromi-ammines. IV. Complex copper-ions. Part 4. Double salts. Isomorphism.

Treatise on Chemistry. By H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Volume II. The Metals. New edition completely revised by the Right Hon. Sir Henry Roscoe and others. Macmillan and Co., Limited, St. Martin's Street, London, Bombay, Calcutta, Melbourne. 1913. Price 30s. net. Also The Macmillan Company, New York, Boston, Chicago, Dallas, San Francisco, and The Macmillan Co. of Canada, Ltd., Toronto.

Volume (9 by 6 ins.), containing 1445 pages of subject matter with 212 illustrations, and an alphabetical index of subjects. The matter is classified and grouped according to the following scheme. A list is given first, of the works, journals, etc., used in this volume, with the abbreviated titles adopted. Then follow a table with the atomic weights of the elements, International atomic weights (1913), and a brief chapter on the Metals. I. Determination of the atomic weights of the metals. II. Valency of the elements. Their classification. III. Crystalline form of metals. IV. Colloidal solutions of metals. V. Alloys and amalgams. VI. Constitution of salts, acids and bases. VII. Metallic oxides, hydroxides, and salts. VIII. Solubility, fusibility and volatility of salts. IX. Generic properties of salts. X. Chemical change and the law of mass action. XI. Spectrum analysis. XII. Crystallography. XIV. Systematic description of the metals and their derivatives, including XV. The radio-active elements. (Phenomena of radio-activity. The products of radio-active change. Radium. Actinium. Thorium. Uranium.) In this, the fifth edition of the work, the introductory and physical portions have been revised and improved, the chapter on crystallography has been re-arranged and brought up to date, whilst the results of research in the field of radio-activity have been placed in clear light.

A Dictionary of Applied Chemistry. By Sir Edward Thorpe, C.B., LL.D., F.R.S., Emeritus Professor of Chemistry, Imperial College of Science and Technology, South Kensington, London, etc., etc. Assisted by eminent contributors. Revised and enlarged edition. In five volumes. Vol. V. Longmans, Green and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. Price 45s. net.

Volume (9¼ by 6¾ ins.), containing 830 pages of subject matter with 21 illustrations. It commences with a table of abbreviations of the titles of journals and books, and a list of the contributors. The first subject treated of in Vol. V. is sodium, and amongst the articles described in considerable detail, commencing with "Sodium," are "Soils," "Specific gravity," "Spectrum analysis," Starch, Sugar, Sulphur, Sulphuric acid, Synthetic drugs, Tobacco, Triphenylmethane colouring matters, Vegeto-alkaloids, Water, Waxes (Animal and Vegetable), Wine, Wood (Destructive distillation of), Zinc. (See also this J., 1913, 676; and 1912, 1098, 561 and 155.)

Legierungs-Metalle. Ihre Bestimmung und kritische Beleuchtung der vorgeschlagenen Analysengänge nebst ihrer Verwendung. Von Ernst Pancke. Wilhelm Knapp's Verlag. Halle a. S. 1913. Price M. 3.80. Bound M. 4.40.

Volume (9⅞ by 6¾ ins.), containing 82 pages of subject matter. The metals which are considered with special attention to their alloys are tin, lead, antimony, copper, zinc, arsenic, bismuth, aluminium, nickel, cadmium and mercury. A series of calculation tables is given at the end of the book.

Journal of the Society of Chemical Industry.

No. 23, Vol. XXXII. DECEMBER 15, 1913. No. 23, Vol. XXXII.

Birmingham Section.

Meeting held at Birmingham University on Thursday, October 30th, 1913.

MR. H. T. PINNOCK IN THE CHAIR.

NOTE ON THE SATURATED ACIDS OF LINSEED OIL.

BY R. S. MORRELL, M.A., PH.D.

In the literature on linseed oil it is stated that in addition to linolenic, linolic, and oleic acids there are present in the oil, stearic, palmitic, myristic, and arachidic acids.

The occurrence of stearic acid was indicated by Haller (Comptes rend., 1906, **146**, 239), who, by the alcoholysis of linseed oil from different sources, separated by fractional distillation the methyl esters of stearic, palmitic, and arachidic acids. The method did not allow a quantitative separation of the esters, but he concluded that stearic acid was present in appreciable quantities, while traces of arachidic acid were found. The occurrence of stearic acid in linseed oil seemed worthy of further investigation, because of its relationship to the unsaturated acids present in contradistinction to the 16 carbon atom acid, palmitic acid. The insolubility of the lead salt of stearic acid in turpentine and in light petroleum is a matter of some practical importance.

Haller (Comptes rend., 1905, **144**, 462) obtained by the alcoholysis of castor oil the methyl esters of ricinoleic, dioxystearic, and stearic acids, but no ester of palmitic acid, and therefore it seemed of importance to estimate the amounts of stearic and palmitic acids present in linseed oil.

It is well known that when linseed oil is heated with lead oxide a solid separates out, especially if the oil be thinned with turpentine or light petroleum. It is remarkable that no systematic investigation of this deposit has been published. It was found that the deposit consisted chiefly of the lead salts of saturated aliphatic acids and was of the same composition as the lead salts obtained from linseed oil by saponification and by extraction of the lead salts of the unsaturated acids by light petroleum and ether.

It is of interest to note that the lead salts obtained from linseed oil by precipitation from the soap solution always contain a large amount of water (about 20 per cent.). The water can be removed by fusing the salts, but a certain amount of oxidation occurs during the process. In order to extract the soluble lead salts, the best way is to centifuge the water-charged lead soap with light petroleum, whereby the water and insoluble salts of the saturated acids are easily separated from the petroleum solution. Filtration is useless owing to the presence of an emulsion.

The yield of lead salts obtained was 8·2 per cent. of the oil taken, which corresponds to 6 per cent. of saturated acids. It was the same as that given by treatment of linseed oil with a definite amount of lead oxide and precipitation by 14 times its volume of turpentine. The lead salts contained 25·6—26·7 per cent. lead (lead stearate requires 26·8). They were completely insoluble in turpentine and in light petroleum at 15° C., and at 65° C. only 0·52 per cent. was soluble in the latter solvent. Lead stearate is insoluble in turpentine at 15° C. and the solubility of lead palmitate in the same solvent at 15° C. is 0·106.

The acids obtained melted at 52°—54° C. and their molecular weights varied between 268—282; the iodine value was 5.0—8.0. The examination of the acid was conducted on the lines of a separation of stearic from palmitic acid in the presence of traces of oleic acid. Heintz (J. prakt. Chem., 1855, 661), Hehner and Mitchell (Analyst, 1896, 21), Kreis and Hafner (Ber., 1903, **36**, 2766), Holde and Ubbelohde (Ber., 1905, **38**, 1250), and Fachini (Chem. Zent., 1910, **2**, 397), have investigated the methods of separation of the three acids, and de Visser (Rec. Trav. Chim., 1898, **17**, 182), Carlinfanti and Levi-Malvano (Gazetta, 1909, **39**, 353), have examined the properties of mixtures of stearic and palmitic acids with other acids. Kreis and Hafner (*loc. cit.*) obtained the best results by a combination of the methods proposed by Hehner and Mitchell and Heintz, but their careful work was not free from error, because in the examination of lard, daturic acid ($C_{17}H_{34}O_2$, m. p. 55°—56° C.), discovered by them, was proved by Holde and Ubbelohde to be a mixture of acids. If only three aliphatic acids are present the melting points and molecular weights admit of a very fair estimate of the quantities of the acids present, which can be checked by reference to the work of de Visser and Carlinfanti on the melting and solidifying points of known mixtures of the acids.

The investigation of the acids obtained from the insoluble lead salts of linseed oil was carried out according to the methods suggested by the above authorities. The separation was most successful with the method of Kreis and Hafner, using about 30 grms. of the mixed acids for each operation. The yield of acid frozen out from the alcoholic solution was 45 per cent. It contained 39 per cent. of stearic acid, m. p. 69° C., molecular weight 283, and on analysis it gave 76·25 per cent. carbon and 12·8 per cent. hydrogen (stearic acid requires 76·0 per cent. and 12·7 per cent. respectively). From the filtrate by fractional precipitation with alcoholic magnesium acetate in acid solution 12·7 per cent. stearic acid, m. p. 69° C., was obtained. By fractional precipitation with the same reagent in alkaline solution an acid was obtained which amounted to 22·6 per cent. of the original acids. After careful recrystallisation from alcohol it gave an acid with a constant melting point 58°—60° C. and a molecular weight 276·4. It corresponded to de Visser's eutectic mixture of 47·5 per cent. stearic and 52 per cent. palmitic acid (solidifying point 56°—57° C.).

In only one experiment was it possible to isolate palmitic acid with any degree of purity. A small quantity of a saturated acid, molecular weight 260·8, m. p. 58° C., was obtained from the filtrate after treatment with magnesium acetate and subsequent precipitation by lead acetate. An analysis of the acid gave 75·5 per cent. carbon and 12·49 per cent. hydrogen (palmitic acid requires 75 per cent. and 12·5 per cent. respectively).

The filtrate from the magnesium acetate fractional separation was found to contain a small quantity of an unsaturated acid (4 per cent., calculated to oleic acid), and a crystalline acid with a constant melting point 50°—51° C., molecular weight 270·8, amounting to 8 per cent. of the original acids. It was impossible to say what this acid was, although it approached in properties the second eutectic mixture of de Visser (29 per cent. stearic and 71 per cent. palmitic acid, *loc. cit.*).

No daturic, myristic, or arachic acids were detected.

The composition of the mixed acids may be summarised as follows:—

	Per cent.
Stearic acid—actually separated	51·7
present in eutectic mixture	12·7
Palmitic acid, present in eutectic mixture	20
Residual eutectic mixture	8
Oleic acid	4
	96·4

The methods of separation of the saturated acids are very tedious and new methods are much wanted. By careful working satisfactory results as to stearic acid are obtainable, but for palmitic, arachidic, and myristic acids further investigation of their derivatives is necessary. I desire to express my thanks to Messrs. Mander Bros for permission to communicate the results of this investigation.

Discussion.

Mr. F. H. Alcock inquired if the insoluble part of the lead compound had been separated from the soluble part by means of ether, as was done in pharmacy when testing *Emplastium Plumbi*, though he feared it was an imperfect method. If such solvents were effective the list could be extended to such comparatively new solvents as carbon tetrachloride, ethylene dichloride, and acetylene tetrachloride. Linseed oil could be obtained fairly pure in commerce, although there was no doubt that its composition was complicated and variable. Dr. Morrell had said that he attached some importance to the separation of the constituents of the oil by the barium and magnesium salts method, but had he tried the silver salts method of fractionation? It was necessary to examine carefully this and other oils like olive oil for arachis oil, and if it was shown that arachis acid was a normal constituent of these oils it would then become a question of amount before adulteration could be certified.

Mr. F. R. O'Shaugnessy alluded to the extraction of fatty matter from sewage sludge by ether. The ether extract was evaporated and the residue again treated with ether, but about 10 per cent. remained insoluble. A change apparently took place in the drying process: and he wondered whether the residue was a resinous body. Could Dr. Morrell throw any light on this?

The Chairman inquired what effect the removal of the acids from linseed oil had on the drying properties.

Dr. Morrell, in reply, said there was a drawback in the use of ether as a solvent, because of the difficulty in getting a bright solution, owing to the lead salt remaining in suspension. He preferred to extract with light petroleum on a centrifugal apparatus. He had not tried carbon tetrachloride as a solvent, nor had he examined the silver salts of the saturated acids. He was surprised not to find arachidic acid, but probably he was using the purest form of linseed oil. He had no facts to enable him to give a definite opinion as to the drying power. The acids were, of course, only present in small quantities—about 6 per cent.—and their removal ought to tend in the direction of improvement.

Scottish Section.

AN AUTOMATIC GAS-SAMPLING APPARATUS, WITH SOME OBSERVATIONS ON SAMPLING.

BY THOMAS GRAY, D.SC., PH.D.

The operation of taking a sample of gas over a period of some hours, which is frequently carried out during tests of efficiency of combustion and of gas production, is seldom conducted with sufficient care to ensure accuracy. According to the method most commonly employed, a bottle or sampling tube, filled with mercury, water, or an aqueous solution of glycerin or of magnesium chloride, is connected to the gas supply, and the liquid is allowed to run from the bottle, the rate of flow being regulated by means of a stopcock or screw-clip, so that the gas enters the bottle at a uniform rate during the whole period of the test. If mercury is used as the confining liquid the alteration of pressure, caused by the falling level, necessitates constant attention to the adjustment of the rate of flow, in order to secure even approximately uniform sampling, and this regulation is generally not sufficiently accurate to ensure good results.

Making use of the well-known principle of the Mariotte bottle, G. N. Huntly[*] has devised a simple gas-sampling tube, from which the flow of mercury takes place uniformly: the only drawback to the use of this apparatus—probably a trifling one in practice—is the difficulty of setting the stopcock initially, so that the desired volume of gas will be collected during the period of sampling.

If any liquid other than mercury is used, the variation of the suction as the level falls is less serious, and regulation of the rate of flow consequently presents less difficulty, but a new error is introduced by the solvent action on the gas—particularly if a large proportion of carbon dioxide is present. It is commonly assumed that concentrated aqueous solutions of glycerin and of magnesium chloride have no appreciable solvent action on the ordinary industrial gases but, while this statement may be accepted for short periods of contact, considerable alteration of composition may take place if the gas is allowed to stand for some hours in contact with these solutions, particularly if it is shaken with the confining liquid. With the object of determining the magnitude of this error, a mixture of air and carbon dioxide, containing between 11 and 12 per cent. of the latter gas—a proportion frequently found in flue-gas—was confined over aqueous solutions of glycerin and magnesium chloride for varying periods and subsequently analysed. The solutions were prepared by dissolving pure glycerin and crystallised magnesium chloride in water, in the proportions of one part by weight to one part of water and 2 parts to 1 of water; the stronger solution of magnesium chloride was saturated at ordinary temperatures and the more concentrated glycerin solution contained the maximum proportion of glycerin which could be conveniently employed, on account of the high viscosity and consequent slow rate of movement through the capillary tubes of the sampling apparatus. Ordinary gas-sampling tubes, attached to reservoirs, were filled with the solutions, the gas was passed into these till the tubes were half full, taking care to avoid shaking, and they were then allowed to stand at room-temperature for the stated periods. In one test, with the more concentrated solution in each case, the gas was vigorously shaken with its own volume of the confining liquid for 5 minutes. The results of the analyses appear below:—

Table 1.

Showing the composition of a gaseous mixture, confined over aqueous solutions of magnesium chloride, 1 part $MgCl_2 . 6H_2O$: 1 part water, and of glycerin, 1 part: 1 part water, by weight.

Specific gravity of magnesium chloride solution 1·213 at 15° C.

Specific gravity of glycerin solution 1·128 at 15° C.

	Temp. of solution.	CO_2.	O_2.	N_2.
Composition of the original gas	..	11·42	6·69	81·89
After ½ hour over magnesium chloride solution	20° C.	11·29	6·72	81·99
After ½ hour over glycerin solution	21° C.	11·24	6·73	82·03
After 1 hour over magnesium chloride solution	20·5° C.	11·21	6·73	82·06
After 1 hour over glycerin solution	22° C.	11·17	6·75	82·08
After 24 hours over magnesium chloride solution ..	20° C.	9·32	6·95	83·73
After 24 hours over glycerin solution	19° C.	7·86	7·16	84·98

Table 2.

Showing the composition of a gaseous mitxure, confined over solutions of 2 parts $MgCl_2 . 6H_2O$ in 1 part water, and of 2 parts glycerin in 1 part water, by weight.

Specific gravity of magnesium chloride solution 1·292, of glycerine solution 1·173 at 15° C.

	Temp. of solution.	CO_2.	O_2.	N_2.
Compos. of orig. gas	..	11.42	6.69	81.89
After ½ hour over magnesium chloride solution	16·5°	11·36	6·74	81·90
After ½ hour over glycerin solution	17°	11·32	6·75	81·93
After 1 hour over magnesium chloride solution	16·5°	11·32	6·71	81·91
After 1 hour over glycerin solution	16·5°	11·23	6·78	81·99
After 24 hours over magnesium chloride solution....	15·5°	11·13	6·75	82·12
After 24 hours over glycerin solution	15·5°	10·51	6·81	82·68
After 5 minutes shaking with its own vol. of magnesium chloride solution	17°	9·73	6·92	83·35
After 5 minutes shaking with own vol. glycerin solution	17°	7·61	7·18	85·21

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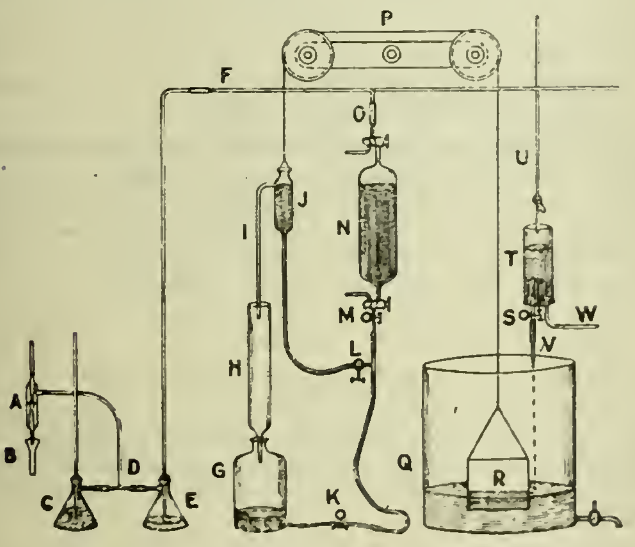
[*] This Journal, 1910, p. 312.

An examination of the results shows that the composition of the gas was not seriously affected by contact for one hour with any of the solutions, and that the change was practically negligible, even after standing for 24 hours over the more concentrated solution of magnesium chloride. On the other hand, shaking the gas with the solutions, and simple contact with the more dilute solutions for a period of 24 hours, caused a very decided alteration of the composition. The magnesium chloride solution shows a distinct advantage over the glycerin solution of the same strength, but against this must be set the tendency to crystallise at low temperatures, from which the glycerin is free. The results indicate that the ordinary industrial gaseous fuels and the products of their combustion, may be stored for short periods over the more concentrated solutions of glycerin and magnesium chloride, without fear of any considerable change of composition, but that prolonged contact and agitation with the confining liquid should be avoided.

If the results of the analysis of a gas are required for the estimation of the efficiency of gas production or of the heat losses in flue gas, it is desirable to exclude all possibility of any alteration of composition, by using mercury as the confining liquid. The volume of gas, V, produced from one kilogramme of coal, is usually calculated with the help of the equation :—

$$V = \frac{C}{(M+K+K_1)\ 0{\cdot}536 + \frac{S}{10}}$$

where C is the weight of carbon gasified per 100 kg. of coal, S is the number of grammes of free carbon per cubic metre of gas, and M, K, and K_1 are the percentages of methane, carbon dioxide, and carbon monoxide in the average sample of the gas. It is evident that any considerable error in the value of K will have a serious influence on the result, especially in the case of a flue-gas, the gaseous carbon-compounds of which consist almost entirely of carbon dioxide. The difficulty of handling large volumes of mercury, on account of its high specific gravity, practically precludes its employment in many cases but, provided the sampling proceeds with sufficient regularity, a sample of relatively small volume may be assumed to represent the bulk.



With the object of securing an average sample of gas, taken at a uniform rate, over any specified period which may be varied at will, the author has constructed the apparatus illustrated. In designing this apparatus the desirability of using only such appliances as are available in an ordinary chemical laboratory, was kept in view. It consists essentially of an ordinary gas-sampling tube, N, which may be filled with mercury from the bottle, G, attached to a reservoir, J, which is counterpoised by a vessel, R, floating in water in a tank, Q, the float being connected with J by means of a cord which passes over the pulleys, P.

The float may be a tinned-iron vessel, or a glass bottle, containing the necessary quantity of water or lead shot to establish the balance. The height of the tank must be greater than the length of the sampling tube, N, the overflow tube, I, should be slightly longer than N, and the length of the wider tube, H, which merely serves to prevent loss of mercury by splashing, should slightly exceed that of I.

The jet, V, under a pressure which may be regulated by adjustment of the overflow, W, through which the excess of water from U escapes to waste, delivers sufficient water during the specified period to raise the level in the tank to a height equal to the length of the sampling tube. As the water-level rises, the reservoir, J, is steadily lowered, drawing the gas uniformly into the sampling tube and the mercury, thus displaced, escapes through the overflow tube, I, to the bottle, G. By means of a suction pump, A, discharging into the drainpipe, B, a rapid current of gas is drawn along the tube, F, which is connected to the flue or gas-main, a suitable filter being interposed, if necessary, to retain any solid particles. The connection, O, between the sampler and the tube, F, is preferably made of capillary tubing from 3 to 4 inches long, to prevent the diffusion of gas backwards from N into F: if desired, a small non-return mercury valve may be inserted at this point.

The flasks, C and E, serve to indicate that the gas is passing freely along the tube, F, and, at the same time, act as a safety valve ; so long as the tube, F, remains clear the gas passes through E but, if an obstruction occurs, air is drawn through the bottle, C, thus preventing the pump from drawing the mercury out of the sampling tube and discharging it into the drain.

To start the apparatus, the tube, F, is connected with the gas-supply and a rapid current of gas is drawn through F by means of the filter-pump. The rubber tube, connecting the jet, V, with the water-supply, is then closed by the clip, S, and water is allowed to run into T and to overflow freely through W, the height of which has previously been adjusted to the desired level. Water is now run from the tank, Q, till the top of the overflow tube, I, is at the level of the shoulder of the gas tube, N—it is desirable to use sampling tubes with square shoulders in place of the customary rounded ones—and J and N are now filled with mercury by raising the bottle, G, after which the clip, K, is closed and the bottle is replaced in the position shown. The capillary, O, is finally filled with mercury by raising the reservoir, J, the lower stop cock of the sampling tube is closed, and J is then lowered to its former position. The sampling tube and the capillary, O, are, at this stage, completely filled with mercury, J is filled to the overflow tube, which is level with the point where the capillary joins the shoulder of the gas tube, N, and the operation of sampling may now be commenced by opening the lower stopcock of the gas tube and starting the flow of water from the jet by slipping the clip, S, up the glass tube into the position shown in the sketch. The suction-pump and the water-supply to T remain in operation during the whole period of the test and the apparatus requires no further attention.

The period of sampling may be varied in a number of different ways :—

(1) Jets may be constructed to deliver the requisite quantity of water in the specified times ; these are easily drawn from glass tubing in a blowpipe flame, the final adjustment being effected by altering the head of water in T.

(2) Tanks of various diameters may be employed.

(3) The height of the sampling tube, N, may be varied.

(4) Two or more sampling tubes may be attached at different points to the tube, F, and, by means of T-tubes, to J and G, these being used in rotation.

In one of these ways, or by a combination of them, the operation of the apparatus over any period may be arranged for.

In an alternative form of the apparatus the water tank and float are replaced by a cheap clock, of the form operated by a falling weight, the mercury reservoir taking the place of the weight. In this case it is desirable to close the bottom of the reservoir with a doubly bored cork and to pass the overflow tube through one of the perforations, instead of sealing it into the side, as shown ; the adjustment of the volume of mercury, to correspond with the original clock-weight, is then easily effected by raising or lowering the overflow but, if a reservoir with a sealed-in tube is employed, the necessary balance may be established by an alteration of the weight of the pendulum bob.

A stop is fixed on the chain of the clock, so that when the reservoir is pulled up into the highest position, the top of the overflow tube is on the level of the point where the capillary joins the shoulder of the sampling tube, N. When in this position the apparatus is filled with mercury from the bottle, G, the lower stopcock of the gas tube and the clip, K, are closed and G is replaced. The stopcock may then be opened and the apparatus set in operation by starting the pendulum.

This form of the sampling apparatus, while more compact than the one previously described, lacks the flexibility of the other. A limited amount of regulation is possible by moving the bob of the pendulum: larger variations of the period of sampling may be arranged by gearing, by increasing the length of the sampling tube, or by connecting two or more sampling tubes, as already explained.

Both forms of the apparatus have been in regular use for several years and have proved highly satisfactory.

The author desires to express his thanks to a former assistant, Mr. James McQueen, for assistance given in verifying the results of the gas analyses, which appear in this paper.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Ovens, kilns and the like. C. Dressler, London. Eng. Pat. 23,863, Oct. 18, 1912.

A tunnel oven of the type in which goods (tiles, pottery, bricks, &c.) are subjected to heat produced by the combustion of fuel, or to hot air which has previously been drawn over and amongst the goods in the cooling zone of the oven, is provided in the cooling zone with one or more cooling pipes arranged longitudinally and through which cold air is drawn for the purpose of abstracting still residual surplus heat from the air or fuel passing over these goods. The heated air issuing from the cooling pipes may then be utilised for drying or preheating fresh goods. The invention may be applied to ovens of the kind described in Eng. Pats. 18,114 of 1910 and 8228 of 1912 (this J., 1911, 1254; 1913, 792).—H. H.

Vacua; Apparatus for the production of——. E. S. G. Rees, Wolverhampton. Eng. Pat. 26,307, Nov. 15, 1912.

A rotary vacuum apparatus, more particularly for maintaining a vacuum in steam surface condensers, is provided with a double impeller, one side of which draws a comparatively small quantity of cold water from the condenser casing, whilst the other side draws a larger volume of warm water from the hot well. The hot and cold jets issuing radially from the impeller are caused to impinge one against the other as they cross an annular chamber connected with the condenser, so that the breaking up of the jets into small particles entrains a large volume of air and vapour from the condenser. The mixed liquids and vapours enter a rotating ejector-wheel on the opposite side of the entraining chamber, and are discharged through converging passages into a duct leading to the hot well. It is stated that the apparatus may be applied to the exhaustion of sugar-boiling pans or to multiple-effect evaporators. (See also Eng. Pats. 4810 and 22,490 of 1906, 23,696 of 1908, 21,555 of 1909 and 24,436 of 1910.) —H. H.

Vacuum; Production of a —— *by means of low temperatures.* J. E. Lilienfeld. Fr. Pat. 458,346, May 24, 1913. Under Int. Conv., Aug. 6, 1912.

Incandescence lamp bulbs and Röntgen tubes, in which hydrogen is likely to be present, cannot be completely exhausted by the known method of connecting them with a receptacle cooled by means of liquid hydrogen, as the hydrogen does not condense readily. This difficulty is overcome by introducing oxygen or carbon dioxide into the receptacle and causing combination to take place by means of the electric current or an incandescing metal. The resulting water vapour or mixture of water vapour and carbon monoxide is easily condensed by means of low temperatures.—W. H. C.

Separators; Electrostatic ——. J. Kraus and E. Oppen, Brunswick, Germany. Eng. Pat. 6336, March 14, 1913. Under Int. Conv., March 14, 1912.

The particles of the material are separated by a surface, permanently charged electrostatically, acting through an air gap; the attracted particles being carried away by a movable dielectric body arranged between the charged surface and the particles.—B. N.

Centrifugal machines. W. W. Richardson, St. Austell, Cornwall. Eng. Pat. 13,071, June 5, 1913. Addition to Eng. Pat. 26,201, Nov. 14, 1912.

In the apparatus described in the chief patent (this J. 1913, 1055), the dividing rings are replaced by two or more concentric inverted cup-shaped vessels of different heights, which are rotated about the inner vessel. Water is supplied to the outer compartment and the material to be separated, to the inner ones.—W. H. C.

Nodulating materials; Method of ——. L. P. Ross, Standish, N.Y., Assignor to Northern Iron Co. U.S. Pat. 1,076,705, Oct. 28, 1913.

The material is heated to "an adhesive condition" in an inclined kiln oscillated so that the material is rolled backwards and forwards over the concave surface of the kiln lining.—A. S.

Filter; Chemical ——. C. S. Bradley, New York. U.S. Pat. 1,077,037, Oct. 28, 1913.

The filtering surface is made of hollow filter bricks to the interior spaces of which, communicating one with another, suction or pressure can be transmitted.—W. R. S.

Filters or diaphragms; Process for making acid-resisting material for ——. Metallbank und Metallurgische Ges. Akt.-Ges. Fr. Pat. 456,524, Apr. 10, 1913.

The material, intended more particularly for filtering gases containing acids in suspension, is prepared by heating cotton or similar fabric, out of contact with air, to a temperature of from 200° to 350° C., for from a few minutes to a week, according to the temperature employed. Cotton cloth weighing 350 grms. per sq. metre and having a tensile strength of 2300 kilos. per metre, when heated to 300° to 400° C. for periods of from 10 mins. to 3 hours, showed a loss of weight of from 68 to 76 per cent., and the tensile strength was reduced to 30 to 35 kilos. per metre. The material retains its flexibility.—H. H.

Washing and cooling warm gases and condensing vapours; Process and apparatus for ——. G. F. Jaubert. Fr. Pat. 456,580, June 22, 1912.

The hot gases are first subjected to the action of a warm liquid at such a temperature that it is raised nearly to its boiling point by contact with the hot gas, and the partially cooled gases are then subjected to the action of a cold liquid. For the purpose of washing, the gases are brought into contact with downwardly flowing streams of liquid, but for cooling or condensing, the gases are passed through pipes. The hot liquid flowing away from the apparatus, is cooled to say 50° or 60° C. by passing it through a chamber where it meets a counter current of air, the warm water being then again used in the apparatus.—H. H.

Dryers. E. E. Perkins. Fr. Pat. 456,668, Apr. 15, 1913, Under Int. Conv., Apr. 15, 1912.

Air is circulated in a closed drying chamber by means of a set of heating pipes arranged inside the chamber near the bottom of one of the side walls, and by a similar set of refrigerating pipes near the top of the opposite wall. The refrigerating pipes may be mounted upon adjustable supports so that their distance from the floor of the chamber can be varied for regulating the rate at which the air circulates.—H. H.

Drying drum. F. Haas, Ges. m. b. H. Fr. Pat. 458,135, April 21, 1913.

To allow of the use of a gas at a high temperature in drying inflammable materials, part of the hot gases from a furnace is passed through a horizontal rotary drying drum provided with helical conveyor blades and acts directly upon the wet material. The remainder of the hot gases is passed through a pipe disposed centrally in the front end of the drum to a tubular radiator which is shorter than the drum and is arranged axially near the discharge end. That portion of the hot gases which acts directly, travels very slowly through the first portion of the drum owing to the greater cross-section and is consequently rapidly cooled, so that there is no danger of igniting the material. The other part is cooled less rapidly at first and serves to complete the drying indirectly by means of the radiator. The gases are subsequently circulated around the exterior of the drum before passing to the stack.—W. H. C.

Extractor; Universal ——. O. Wilhelm, Apparatebauanstalt, Gelbgiesserei und Kesselschmiede. Fr. Pat. 457,057, Apr. 8, 1913. Under Int. Conv., Dec. 31, 1912.

A large double-walled rotary drum, having inlet and outlet passages for liquids and vapours in the trunnions, is provided with a number of peripheral openings to which detachable filter-tubes projecting radially into the drum can be attached. When the filter-tubes are not required, they can be removed through manholes, and the openings closed by curved plates leaving a smooth inner surface to the drum, which is then adapted for use with grinding balls or similar grinding means. A longitudinal scraper for detaching material adhering to the walls of the drum is also provided.—H. H.

Washing or lixiviation of granular or powdered materials; Process and apparatus for the continuous ——. K. J. Beskow. Fr. Pat. 457,132, Apr. 25, 1913. Under Int. Conv., Apr. 26, 1912.

The material is spread in a thin layer over a circular filter-bed of sand, etc., by horizontally rotating arms carrying scrapers extending nearly to the surface of the filter. The scrapers form furrows in the granular material which is slowly carried round the apparatus, and removed by a screw conveyor after it has made one complete circuit. The washing liquid is run in at a point adjacent to the supply hopper, and the solution of the soluble matter is drawn off separately from different portions of the filter.—H. H.

Concentrating solutions; Method of ——. E. Monti, Turin, Italy. Eng. Pat. 21,287, Sept. 18, 1913.

See Fr. Pat. 447,379 of 1912; this J., 1913, 302.—T. F. B.

Concentrating, drying, lixiviating, or crystallising materials that can be handled with a shovel; Apparatus for ——. M. Prager, Berlin. Eng. Pat. 24,326, Oct. 24, 1912.

See Fr. Pat. 449,572 of 1912; this J., 1913, 525.—T. F. B.

Concentrating, drying, and crystallising materials; Apparatus for ——. M. Prager, Berlin. Eng. Pat. 24,414, Oct. 25, 1912. Addition to Eng. Pat. 24,326, Oct. 24, 1912.

See Addition to Fr. Pat. 449,572 of 1912; this J., 1913, 525.—T. F. B.

Calcining or treating material in granular form; Processes and apparatus for ——. C. D. McCourt, Streatham Common. Eng. Pat. 25,628, Nov. 8, 1912. Under Int. Conv., Jan. 23, 1912.

See Fr. Pat. 450,733 of 1912; this J., 1913, 587.—T. F. B.

Drying rooms. E. E. Perkins, Chicago. Eng. Pat. 8855, April 15, 1913. Under Int. Conv., April 15, 1912.

See Fr. Pat. 456,668 of 1913; preceding.—T. F. B.

Separating deposited matter from liquids; Apparatus for ——. B. Kaibel, Darmstadt, Germany. U.S. Pat. 1,077,476, Nov. 4, 1913.

See Eng. Pat. 11,137 of 1912; this J., 1913, 585.—T. F. B.

Furnace in which industrial residues are burnt. L. Félizat, Salon, France. U.S. Pat. 1,078,038, Nov. 11, 1913.

See Eng. Pat. 4935 of 1911; this J., 1912, 324.—T. F. B.

Absorbers and separators for gases and vapours. Smith's Patent Vacuum Machine Co., Ltd. Fr. Pat. 459,432, June 17, 1913. Under Int. Conv., June 22 and Dec. 10, 1912.

See Eng. Pats. 14,652 and 28,510 of 1912; this J., 1913, 780, 969.—T. F. B.

Absorbing vapours, Apparatus for ——. P. Schou. Fr. Pat. 459,589, June 23, 1913. Under Int. Conv., July 1, 1912.

See Eng. Pat. 16,510 of 1912; this J., 1913, 275.—T. F. B.

Distillation; Process and apparatus for continuous ——. F. Raschig. Fr. Pat. 459,477, June 20, 1913. Under Int. Conv., Oct. 26, 1912.

See Ger. Pat. 260,060 of 1912; this J., 1913, 692.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Carbonization of coal in vertical retorts. O. B. Evans. J. Gas Lighting, 1913, **124**, 587—591.

Temperatures and pressures were observed at different parts of the retort, and analyses were made of gases taken from the core and also of gases distilled at low temperatures. Vertical pipes filled with coal were also heated for different periods and the sections of the core examined. It was evident that gas coal becomes plastic at 700° F. (371° C.) and the mass solidifies again at 825° F. (441° C.). The plastic envelope around the uncoked coal is about ¾ in. thick and causes a drop in pressure of the gas which passes through it of about 30 ins.

With 10 cb. ft. of gas passing per sq. in. per hour the resistance of coal carbonized at 1000° F. (538° C.), is about seven times that of coal carbonized at 1400° F. (760° C.), or twice that of coal dust, or 85 times that of screened lump coal. Coke formed at 825° F. (441° C.), and broken up, is not agglomerated by heating to 1400° F. (760° C.). The maximum pressure in the core occurs when the temperature is between 800° (427° C.) and 1000° F. (538° C.). It depends on the free space in the charge and the pressure may vary by 40 ins. in a distance of 5 ins. horizontally. It is considered that during carbonization there is a zone of high pressure at an intermediate position between the retort wall and the plastic envelope which surrounds the core of uncarbonized coal. Part of the gas travels up through the coke which is outside of the plastic envelope and part passes through the envelope and up through the green core. The high-pressure zone travels towards the axis of the retort more rapidly than the plastic envelope, and its temperature decreases with the time of carbonization.—A. T. L.

Oils and tars for power purposes. E. J. Constam and P. Schläpfer. J. Gas Lighting, 1913, **124**, 596—598.

The authors made exhaustive investigations of a large number of oils and tars, the behaviour of which in Diesel engines was either known or specially observed. The oils examined included 109 samples of petroleum (Galician, German, Roumanian, Russian, North and South American, East Indian and Japanese), various coal-tar oils, and 74 samples of tar. The determinations included specific gravity, behaviour on cooling to 32° F. (0° C.) and 5° F. (—15° C.), flash point (close and open tests), self-ignition temperature, viscosity, distillation test, proportions of water, ash, sulphur, asphaltum, free carbon, naphthalene and mechanical impurities, and the calorific power. In summarizing their results, the authors divide oils and tars into three classes: (1) suitable for all Diesel engines at any load; (2) suitable with special arrangements; (3) unsuitable. The first class includes petroleums and gas oils from which the lighter constituents have been removed, petroleum distillates and lignite tar oils. They should contain over 10 per cent. of hydrogen and no mechanical impurities, and the net calorific power should be over 18,000 and 17,460 B.Th.U. per lb. for petroleums and lignite tar oils respectively. The second class includes coal-tar oils, vertical retort and chamber oven tars, water-gas and oil-gas tars, certain coke-oven tars and certain crude petroleums. Coal-tar oils should contain less than 1 per cent. of water, 0·05 per cent. of ash and 0·3 per cent of mechanical impurities, yield less than 3 per cent. of residue on coking and have a net calorific power over 15,480. The third class comprises horizontal and inclined retort tars. Some of these may, however, be used under certain conditions.—A. T. L.

Mixed fuels [alcohol and benzol] for motor driving. W. R. Ormandy. J. Gas Lighting, 1913, **124**, 580.

A four-cylinder Maudslay engine with cylinders of 90 mm. bore and 130 mm. stroke and compression space about one-quarter of the total cylinder volume, was tested with different fuels with the following results:—

Fuel used	Power (petrol=100).	Volume of fuel used (petrol=100).
	per cent.	per cent.
Petrol	100	100
Benzol	98·25	84·5
Benzol (1 part) and methylated spirit (1 part)	99	96·3
Benzol (1 part) and methylated spirit (2 parts)	92	108·9
Benzol (1 part) and methylated spirit (3 parts)	91·5	124·5

The sp. gr. of the petrol was 0·710, and of the methylated spirit 0·815. Two qualities of benzol were used, viz., 90 per cent., with sp. gr. 0·885, and 50—90 per cent.; with sp. gr. 0·875. Both benzols gave the same results when mixed with alcohol, and further experiments showed that "straight run" naphtha (80°—160° C.) could be used. In the above tests, the engine was run at 1000 revs. per min., but in another engine it was found possible to run satisfactorily at 2000 revs. per min. The jacket of the induction pipe must be kept at 160° F. (71° C.).—A. T. L.

Gasoline from natural gas; Condensation of ——. G. A. Burrell and F. M. Seibert. J. Ind. Eng. Chem., 1913, **5**, 895—898.

According to the experience of the U.S. Bureau of Mines, natural gas consists mainly of paraffin hydrocarbons, with small quantities of nitrogen, carbon dioxide, and water vapour, and sometimes hydrogen sulphide and possibly other sulphur compounds. The total paraffin content can be determined by the usual methods, but the separate determination of the several paraffin hydrocarbons is difficult. The authors have used a method of fractional distillation at low temperatures. The gas was liquefied by means of liquid air (—190° C.), and methane removed by means of a Töpler pump: two fractionations at this temperature were usually sufficient to obtain pure methane. A mixture of ethane and propane was obtained in a similar manner at —130° C., whilst the residue when allowed to volatilise yielded almost entirely propane. In the production of gasoline by condensation, three factors come into play, viz., condensation of vapours, liquefaction of gases, and solution of gases in the condensed hydrocarbons. For determining the suitability of natural gas for gasoline manufacture, sp. gr. determinations and solubility tests are inconclusive in many cases, and the safest course is to test with an experimental compressor and condenser (see also this J., 1913, 999). There are about 200 plants for the manufacture of gasoline from natural gas in the United States, many working on as little as 125,000 cb. ft. of gas per 24 hours: a plant of this capacity costs about 10,000 dols. (about £2000). The residual gas, after the removal of the condensable portion, has a high calorific value, unless it be diluted with air owing to leakage during the process: some residual gases have been found to contain 40—50 per cent. of air.—A. S.

Abel-Pensky and Pensky-Martens flash-point testers; Investigations with the U.S. Bureau of Mines modification of the ——. I. C. Allen and A. S. Crossfield. Tech. Paper 49, U.S. Bureau of Mines. J. Ind. Eng. Chem., 1913, **5**, 908—910.

The Abel-Pensky and Pensky-Martens apparatus have been modified as follows:—To ensure the volume of the oil and of the vapour mixture above the oil remaining constant, the cup has been fitted with an annular overflow cup into which excess of oil flows through a small opening on a level with the filling point. The Abel-Pensky apparatus has been fitted with a paddle-wheel stirrer, and an automatic slide has been fitted to the Pensky-Martens cup, the clockwork being raised on posts above the hot bath in order to prevent deterioration of the spring. As modified the two forms of apparatus are identical except for the heating arrangements: the cups, opening devices, and stirrers are interchangeable. Either gas or oil ignition burners may be used. The modified apparatus are considered to fulfil the conditions of accuracy and approximate reproduction of actual working conditions better than other forms of apparatus. They have been officially adopted by the National Fire Protection Association, and Independent Petroleum Marketers' Association (U.S.A.), and are being considered for adoption by committees on tests of the National Petroleum Association, American Chemical Society, American Society for Testing Materials, and the International Petroleum Commission.—A. S.

Asphaltum: Detection of pitches in ——. G. Halphen and J. Spiess. Les Matières Grasses, 1913, **6**, 3267—3272.

One grm. of the sample is dissolved in 25 c.c. of cold carbon bisulphide, the solution filtered into a glass dish, 70 mm. diam. and 25 mm. deep, and allowed to evaporate spontaneously. In the case of asphaltic compositions a quantity of the sample corresponding to 1 grm. of bitumen is taken. The residue after evaporation of the solvent is examined after 24 hours. Judan, Trinidad and American bitumens give brilliant, glossy homogeneous residues the surface of which shows numerous fissures. Other bitumens (*e.g.*, Letto-Manopello, Albanian) give similar glossy residues, but without the fissures. Petroleum pitch leaves a dull black residue with a lighter, brownish semi-transparent corrugated depression in the centre. In some cases the corrugations are only very slightly marked, but the paraffin-wax-like surface is conclusive. These characteristics may be detected in mixtures of asphaltum with 20 per cent. and upwards of petroleum pitch. Smala (a hard petroleum pitch of Russian origin) shows iridescence and coloured rings in the lighter-coloured centre, whilst the numerous fine corrugations have a radial form more pronounced at the circumference. Schist (shale) pitch gives a black residue softer than the preceding, and with a surface covered with small projections and depressions. These are also found in the case of mixtures of asphaltum with 10 per cent. of schist (shale) pitch. Hard stearic acid pitch leaves a brilliant black residue the surface of which is furrowed with intersecting wave-like depressions, whilst semi-soft stearic acid pitch yields a black unctuous residue.—C. A. M.

Patents.

Furnace for burning refuse from wood-working and/or coal, coke, and the like. E. G. Stockton, Burton-on-Trent. Eng. Pat. 26,943, Nov. 23, 1912.

The furnace has two grates, one horizontal and the other inclined, each provided with a separate air supply. (Reference is directed to Eng. Pat. 3321 of 1880.)—W. H. C.

Combustion of liquid fuel. C. D. McCourt, Streatham Common, Surrey, and Bonecourt Surface Combustion, Ltd., London. Eng. Pats. 28,477 and 28,478, Dec. 10, 1912.

The process of surface combustion described in Eng. Pat. 29,430 of 1909 (this J., 1910, 1448) is applied to the combustion of liquid fuel, a fine spray of fuel together with air in the proportion required for complete combustion being projected directly into a bed of incandescent granular refractory material. To prevent large drops of fuel from collecting upon the walls of the inlet passage, the formation of the spray mixture is effected at a point in close proximity to the bed. The heat may be transmitted either directly from the bed, or the hot burnt products may be passed through a similar refractory bed in contact with the body to be heated. When steam is employed for atomising the fuel, it may be generated in a waste heat boiler such as is described in Eng. Pat. 11,865 of 1910 (this J., 1911, 731). The air supply and also the liquid fuel may be preheated by passage through tubes imbedded in the refractory material in the manner described in Eng. Pat. 6732 of 1912 (this J., 1913, 782.)—H. H.

Combustion of furnace gases; Process for detecting incomplete —— by means of a catalytic substance. H. Felser. Ger. Pat. 266,046, March 10, 1912.

The waste gases are passed over a catalytic substance, where they are completely burnt, and the resulting rise of temperature is measured by means of a differential pyrometer, preferably a differential thermo-element. By this method it is possible to ascertain the amount of combustible products in the gases from the movement of the galvanometer needle, and to regulate the firing of the furnace accordingly.—T. F. B.

Gas and coke; Apparatus for making ——. H. Nelson, Essen-Rüttenscheid, Germany. Eng. Pat. 26,201, Nov. 15, 1912. Under Int. Conv., Nov. 17, 1911. Addition to Eng. Pat. 14,376 of 1912 (this J., 1913, 970)

In an annular vertical coke oven as described in the chief patent, the stopper closing the bottom of the annular coking chamber is sealed against the central part of the oven by means of a stuffing-box, and the central part contains a water receptacle from which the water can escape when the stopper is lowered, whereupon the coke is quenched from inside and the resulting vapours drawn off through the water receptacle.—H. H.

Gas producers. J. E. Bousfield, London. From H. A. and C. H. A. Stuart, Perth, W. Australia. Eng. Pat. 23,853, Oct. 18, 1912.

The producer is of the down-draught type and suitable for burning bituminous coal and supplying gas to an engine or for heating purposes. The fuel column is supported by a rotating hearth and comprises an incandescent zone resting on this hearth, a combustion zone above it where air and steam are admitted through a vertical ring-shaped grate, and an upper zone of fresh fuel extending up to the feeding hopper. The vertical grate may be continuous with the refractory lining of the producer, or formed by a downward extension of the feeding hopper of smaller diameter than the refractory lining; or it may be in the form of a truncated cone connecting the bottom of the hopper with the top of the refractory lining. In each case, air and steam are admitted to the annular space around the vertical grate. The steam may be generated in a jacket surrounding the gas outlet pipe, or in open troughs formed on the outer wall of the lower part of the feeding hopper which is within the producer. A valved outlet from the upper part of the producer is used for starting the producer fire with an up-draught, and for allowing the escape of some of the tarry gases when the producer is not working at its full capacity. (Reference is directed to Eng. Pats. 2017 of 1895, 13,764 of 1903, 10,733 of 1904, 1295 and 7499 of 1906, and 342a of 1907; (this J., 1896, 104; 1904, 780; 1905, 490; 1906, 464, 1082; 1907, 1231).—A. T. L.

[Oil] Gas producers. G. M. S. Tait, Washington, D.C., U.S.A. Eng. Pat. 500, Jan. 7, 1913.

The producer is of the type in which oil vapours are drawn downwards through a bed of incandescent refractory material by a suction device connected with the space beneath the incandescent material. An open annular trough in the upper part of the producer is kept filled with oil from a constant-level tank, and air is admitted centrally at the top of the producer and also through inlets near the surface of the oil. The quantity of air is regulated so that partial combustion takes place on the surface of the oil, vaporizing the latter, and maintaining the heat of the incandescent material.—A. T. L.

Gas; Process of making ——. G. J. Weber, Kansas City, Mo. U.S. Pat. 1,076,849, Oct. 28, 1913.

The fuel column in a gas-producer comprises an upper unignited portion and a lower ignited portion burning with a down-draught. Air, or air mixed with steam, is introduced with a whirling motion at the top of the ignited fuel and the gases pass downwards and outwards through the the incandescent fuel in the form of an "annular flaring sheet." Water may be introduced within the fuel column so as to produce steam which passes with the gases through the fuel.—A. T. L.

Testing gas with miners' safety lamps; Apparatus for ——. W. Baxter, Bolton-upon-Dearne, Yorks. Eng. Pat. 27,264, Nov. 27, 1912.

A mixture of inflammable gas and air in known and adjustable proportions is introduced at the top of an observation chamber containing a number of miners' safety lamps and drawn off at the bottom by an injector. A uniform gas mixture is obtained by introducing the gas into the downwardly flowing air through a number of holes pierced horizontally through the vertical gas supply pipe. The gas is withdrawn at the bottom of the observation chamber through openings arranged round the circumference, so that the gas which has passed over or through one lamp shall not pass over another. The lamps are placed above openings in the floor of the chamber provided with packing at the edges, so that the testing flames can be adjusted by hand without escape of gas. The chamber is fitted with a series of stop-cocks of varying aperture capable of admitting known proportions of inflammable gas. The apparatus is first standardised by opening, say, the 4 per cent. tap and adjusting the regulator cock on the gas outlet pipe until the size of the cap above the flame in one of the lamps is equal to that previously obtained when the lamp burned in a known 4 per cent. mixture of the gas and air. —H. H.

Paraffin filter cake; Removal of oil from ——. A. F. G. C. P. J. von Groeling, Vienna. Eng. Pat. 16,167, July 10, 1912.

To increase the proportion of oil expelled from crystallised paraffin in filter-presses, the clamping devices for the filter-cloths at the centre of the plates are sunk below the surfaces of the plates, in order to obtain very thin filter-cakes, viz., from 8 to 15 mm. The plates may be cooled by the circulation of cooling liquid within them, or the whole filter-press may be contained in a refrigerating room. To obtain further separation of oil, the cakes may be remelted, then recrystallised, and pressed. The press in this case may even be slightly warmed. (Reference is directed to Eng. Pat. 2042 of 1879.)—H. H.

Cracking heavy [mineral] oils; Processes of ——. C. Ellis, Montclair, N.J., U.S.A. Eng. Pat. 25,631, Nov. 8, 1912. Under Int. Conv., Apr. 1, 1912.

THE oil is sprayed or injected, preferably in a preheated condition, into contact with a mass of heated refractory material in granular form contained in a chamber capable of withstanding considerable internal pressure. Air is injected into the chamber at a point adjacent to but below the point of oil injection in quantity sufficient to effect the combustion of a small proportion of the oil which has been vaporised by contact with the heated refractory material. The combustion and cracking of the oil take place in contact with the refractory material in the lower portion of the chamber at a considerable pressure, thus minimising the development of fixed hydrocarbon gases, and the vaporised oil is then condensed and separated in a series of condensing chambers.—H. H.

[Petroleum] Oils; Process for refining and purifying ——. D. F. Lasher, Orange, Tex. U.S. Pat. 1,075,481, Oct. 14, 1913.

THE oil is treated with acid and alkali, washed, and then passed through the ashes of rice hulls.—H. H.

Liquid fuels; Method for enabling —— that are not readily inflammable to be utilised in oil engines and apparatus therefor. Akt.-Ges. "Weser," Bremen, Germany. Eng. Pat. 25,913, Nov. 11, 1912. Under Int. Conv., Feb. 28, 1912.

THE compressed air employed for injecting fuel into the cylinders of Diesel and similar engines is preheated by arranging the air supply pipe in direct proximity to the exhaust pipe from the cylinder, and the heat of the exhaust gases is further utilised to heat water which is employed for heating the liquid fuel at a point in advance of, in, or beyond, the fuel pump.—H. H.

Bitumen or bitulithic materials; Method of treating ——. F. O. Kaempf, Toronto, Canada. U.S. Pat. 1,077,081, Oct. 28, 1913.

THE material is powdered, and softened by mixing with water emulsified with a heavy oil. The plastic mass is then given any desired form and allowed to harden by the evaporation of the water.—A. T. L.

Briquettes; Manufacture of —— [with use of sulphite cellulose lyes]. A. G. Bloxam, London. From Hoesch und Co., Pirna on Elbe, and M. Platsch, Frankfort, Germany. Eng. Pat. 5810, March 8, 1913.

SEE Fr. Pat. 455,099 of 1913; this J., 1913, 864.—T. F. B.

Combustible substances in an agglomerated form; Method of manufacturing ——. M. Rossi, Barcelona, Spain. Eng. Pat. 11,228, May 13, 1913.

SEE Fr. Pat. 457,783 of 1913; this J., 1913, 1000.—T. F. B.

Coke ovens. Dr. C. Otto und Co., G.m.b.H., Dahlhausen on Ruhr, Germany. Eng. Pat. 10,684, May 6, 1913. Under Int. Conv., Aug. 31, 1912.

SEE Ger. Pat. 258,248 of 1912; this J., 1913, 647.—T. F. B.

Oil-gas for internal combustion engines; Method of generating ——. F. H. Bates, Philadelphia. Eng. Pat. 29,276, Dec. 19, 1912.

SEE U.S. Pat. 1,046,541 of 1912; this J., 1913, 77.—T. F. B.

Oil-gas; Method of generating ——. F. H. Bates, Philadelphia. Eng. Pat. 29,278, Dec. 19, 1912.

SEE U.S. Pat. 1,046,542 of 1912; this J., 1913, 77.—T. F. B.

Gas-producers working with high-pressure blast; Water seal for ——. A. von Kerpely, Vienna. U.S. Pat. 1,078,148, Nov. 11, 1913.

SEE Eng. Pat. 29,182 of 1912; this J., 1913, 278.—T. F. B.

Gas-producer; Suction ——. M. F. Derrick. Fr. Pat. 459,651, June 11, 1913. Under Int. Conv., June 17, 1912.

SEE Eng. Pat. 14,153 of 1912; this J., 1913, 860.—T. F. B.

Gas producers. C. H. T. Alston and P. T. Houston. Fr. Pat. 459,798, June 30, 1913.

SEE Eng. Pat. 8056 of 1912; this J., 1913, 819.—T. F. B.

Hydrocarbon oils; Process of changing heavy non-drying —— into drying hydrocarbon oils. C. J. Greenstreet, Webster Groves, Mo., U.S.A. Eng. Pat. 17,057, July 22, 1912.

SEE Fr. Pat. 446,475 of 1912; this J., 1913, 203.—T. F. B.

Distilling petroleum and other hydrocarbon oil; Process of and apparatus for ——. C. W. Turner, Brooklyn, N.Y., U.S.A. Eng. Pat. 25,832, Nov. 11, 1912.

SEE U.S. Pat. 1,046,683 of 1912; this J., 1913, 78.—T. F. B.

Hydrocarbons of higher boiling-point; Process and apparatus for converting —— into those of lower boiling-point. L. G. Leffer, Wevelinghoven, Germany. Eng. Pat. 4140, Feb. 18, 1913.

SEE Fr. Pat. 454,580 of 1913; this J., 1913, 861.—T. F. B.

Decolourising the ammonium sulphate prepared from the sulphur compounds of coal distillation gases. Ger. Pat. 266,192. *See* VII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Coal; Distillation of —— at low pressures. A. Pictet and M. Bouvier. Comptes rend., 1913, **157**, 779—781; Ber., 1913, **46**, 3342—3353.

THE authors' experiments were made with a bituminous coal from Montrambert (Loire) which on distillation under ordinary conditions yielded 15—18 per cent. of non-condensable volatile matter and 15—20 per cent. of condensable products, of which 5 per cent. was tar. Charges of 3—5 kilos. of the coal were distilled in a vertical, cylindrical cast iron retort, closed hermetically and connected with condensers and with three water pumps. A partial vacuum of 15—17 mm. was maintained and the retort was heated gradually to 450° C. Thirty kilos. of coal were distilled altogether and there were obtained about 1·5 per cent. of an acid aqueous liquid free from ammonia and about 4 per cent. of a clear brown tar ("vacuum tar"), lighter than water, free from phenols, but containing a notable quantity of bases, chiefly secondary bases. After removing these and then fractionating, the earlier fractions resembled petroleum distillates, whilst the later fractions had an odour of terpenes and of menthol. No solid hydrocarbons were present, and on oxidation the fractions yielded exclusively aliphatic acids. When distilled in an iron tube packed with coke and heated to bright redness, the tar yielded a gas similar to illuminating gas, ammoniacal liquor, and a tar similar to ordinary coal tar. It is concluded that in the ordinary distillation of coal the greater part of the hydrogen and methane of the gas, of the ammonia, and of the phenols and aromatic hydrocarbons of the tar are secondary products formed by the decomposition of the products (hydro-aromatic hydrocarbons, etc.) formed at first.—A. S.

Tungsten lamps; Blackening of —— and methods of preventing it. I. Langmuir. Amer. Inst. Elect. Eng., Oct. 10, 1913. Met. and Chem. Eng., 1913, **11**, 615.

The blackening of tungsten lamps has been usually attributed to the presence of residual gases in the bulbs. Of the gases present, however, water vapour is the only one that produces perceptible blackening, and in well-exhausted lamps no appreciable improvement could be effected by removing the water vapour more completely. Experiments showed that in well-made lamps blackening is due to volatilisation of the filament, which increases rapidly with rise of temperature and at constant temperature is proportional to the surface of the filament and independent of the size of the lamp bulb. The vapour pressure of tungsten and the efficiency of a tungsten lamp at different temperatures are shown in the following table:—

Efficiency watts per candle.	Temperature absolute.	Vapour pressure, mm.
1·0	2400	0·00000005
0·4	2800	0·00003
0·2 (m. pt.)	3540	0·080
— (b. pt.)	5200	760

The volatilisation may be largely prevented by introducing an inert gas into the bulb; preferably nitrogen, as with this gas the loss of heat by convection is much less than with hydrogen. The loss of efficiency in presence of an inert gas at high (atmospheric) pressure is much greater for small wires (*e.g.*, 0·002 in diam.) than for those of greater diameter (0·005 in. or more), hence the finer wire should be coiled into a tightly wound helix or otherwise concentrated into a small space. If the bulb be suitably designed the convection gas currents can be directed in such a manner that what blackening does occur is mostly on parts of the bulb other than the part through which the light is transmitted. (See also following abstract.)—A. S.

[*Tungsten*] *Lamps; Nitrogen-filled* ——. I. Langmuir and J. A. Orange. Amer. Inst. Elect. Eng., Oct. 10, 1913. Met. and Chem. Eng., 1913, **11**, 613—615.

The construction of nitrogen-filled lamps according to the principles outlined in the preceding abstract is described. The wire is used in the form of a tightly coiled helix in order that a larger effective diameter may be obtained without diminishing the electrical resistance of the wire. This has the additional advantage that should one part of the filament volatilise more rapidly than another, this portion owing to loss of mechanical strength will sag more rapidly and the resulting more rapid loss of heat by convection and radiation will then prevent local overheating. The filament is in the lower part of the bulb, the height of which is preferably considerably greater than its diameter, so that as the convection currents travel vertically upwards, the bulb does not become unduly heated and any deposit or blackening is on the upper part remote from the part through which the light is transmitted. A number of types of nitrogen-filled lamps have been made:—(1) Large units of very high efficiency consuming 0·4—0·5 watt per candle with a life of 1500 hours or more: these take currents of 20—30 ampères and hence must be run on a low-voltage circuit. (2) Small units taking currents of 10 ampères or less at voltages of as low as 4 or 5: the specific power consumption, with a life of 1000 hours, ranges from 0·6 to 1·0 or even 1·25 watt per candle according to the current used. (3) Lamps to run on standard lighting circuits (110 volts): large units of this type (of several thousand candle power) consume 0·5 watt per candle or less. At present high efficiencies in nitrogen-filled lamps can only be obtained in the case of lamps taking large currents.—A. S.

Patents.

Fuel; Apparatus for distilling ——. H. Koppers, Essen Ruhr, Germany. Eng. Pat. 7601, Mar. 31, 1913.

A vertical retort is provided with internal shields or plates which support a thin layer of fuel against the walls of the retort and form a central space for the escape of gases. At the lower part of the retort, the shields are not perforated and steam is passed between them and the retort walls. The lower part of the retort is heated to a higher temperature, so that the fuel, as it descends, is first heated at a low temperature to give a high yield of tar, and afterwards at a high temperature in presence of steam, so as to give a high yield of ammonia.—A. T. L.

Arc lamp electrode. F. R. Crane, jun., Assignor to H. Jampolis and G. N. Nelson, Chicago, Ill. U.S. Pat. 1,075,768, Oct. 14, 1913.

The electrode has the following percentage composition:—comminuted carbon or lampblack, 75; soda ash, 12·5; cast-iron filings, 5; metallic magnesium, 5; clay as a binder, 2·5 per cent.—H. H.

Peat; Treatment [*wet-carbonisation*] *of* ——. T. Rigby, Dumfries, and Wetcarbonizing, Ltd., London. Eng. Pat. 17,427, July 26, 1912.

See Fr. Pat. 455,896 of 1913; this J., 1913, 937.—T. F. B.

Electric incandescent lamps; Manufacture of [*removal of oxygen from*] ——. Naaml. Vennootsch. Philips' Metaal-Gloeilampenfabriek, Eindhoven, Holland. Eng. Pat. 1340, Jan. 16, 1913. Under Int. Conv., Dec. 6, 1912.

See Fr. Pat. 453,375 of 1913; this J., 1913, 744.—T. F. B.

Incandescent filaments; Manufacture of ——. G. Dobkevitch, Assignor to Soc. Internationale de la Lampe Electrique O.R., Paris. U.S. Pat. 1,076,873, Oct. 28, 1913.

See Fr. Pat. 401,307 of 1908; this J., 1909, 1080.—T. F. B.

Production of a vacuum by means of low temperatures. Fr. Pat. 458,346. *See* I.

III.—TAR AND TAR PRODUCTS.

Triphenylthiocarbinol. D. Vorländer and E. Mittag. Ber., 1913, **46**, 3450—3460.

Triphenylthiocarbinol is prepared from triphenylchloromethane by the action of an alcoholic solution of sodium ethoxide saturated with hydrogen sulphide. Its acidity is hardly so great as that of hydrogen sulphide or methylmercaptan, and it bears the same relation to triphenylcarbinol that hydrogen sulphide bears to water. Its alkali salts are only stable in the presence of an excess of caustic alkali. The SH-group is readily split off, *e.g.*, by concentrated sulphuric acid cold, or by boiling dilute alkali. The methyl, acetyl and benzoyl derivatives show the same characteristics and are decomposed by alcoholic silver nitrate. Triphenylthiocarbinol gives triphenylmethane on reduction with sodium and alcohol; chlorine converts it into triphenylchloromethane. Triphenylmethyldisulphide is obtained by acting on the thiocarbinol in alkaline alcoholic solution with sulphuryl chloride, according to the method of Courant and Richter (Ber., 1885, **18**, 3178). It is rather less stable than the carbinol.—J. B.

Oils and tars for power purposes. Constam and Schläpfer. *See* IIa.

PATENTS.

Tar; Apparatus for the continuous distillation of ——. Gebr. Keller, Baugeschäft, A.-G., Lucerne, Switzerland. Eng. Pat. 14,046, June 17, 1913. Under Int. Conv., Feb. 8, 1913.

TAR contained to a certain depth in the still is kept at a constant temperature, sufficiently high to distil off water, light oils and heavy oils, and a fraction of the pitch is withdrawn and fresh tar introduced at regular intervals. The heat is supplied by circulating hot oil, *e.g.*, anthracene oil, through a pipe extending through the still and enlarged to form hollow plates exposing a large heating surface to the tar. Near the top of the still is a funnel-shaped deflector to prevent foam spurting over into the condenser.—J. B.

Bromo-aminoanthraquinones; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 265,727, Feb. 17, 1911. Addition to Ger. Pat. 263,395.

THE elimination of the sulphonic group of the bromo-aminoanthraquinonesulphonic acids mentioned in the principal patent (this J., 1913, 938) as well as of 1-bromo-2-aminoanthraquinone-3-sulphonic acid, is effected by means of a strong acid, such as sulphuric acid of 66° B. (sp. gr. 1·842), monohydrate, or slightly fuming acid, preferably in presence of mercury or a mercury salt, or by means of a more dilute, aqueous sulphuric acid in presence of mercury or a mercury compound. The products differ from those described in the principal patent in that the bromine is replaced by an arylamino group on treatment with an arylamine, proving them to be α-halogen derivatives of anthraquinone.—T. F. B.

Tar; Apparatus and process for the continuous distillation of ——. Gebr. Keller Baugeschäft A.-G. Fr. Pat. 459,996, June 18, 1913. Under Int. Conv., Feb. 8, 1913.

SEE Eng. Pat. 14,046 of 1913; preceding.—T. F. B.

Tar acids; Manufacture of ——. I. and S. McDougall and F. Howles, Manchester. U.S. Pat. 1,077,287, Nov. 4, 1913.

SEE Eng. Pat. 8323 of 1912; this J., 1913, 821.—T. F. B.

Aldehydes of the anthraquinone series; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 10,791, May 7, 1913. Under Int. Conv., Oct. 28, 1912.

SEE Fr. Pat. 456,768 of 1913; this J., 1913, 1060.—T. F. B.

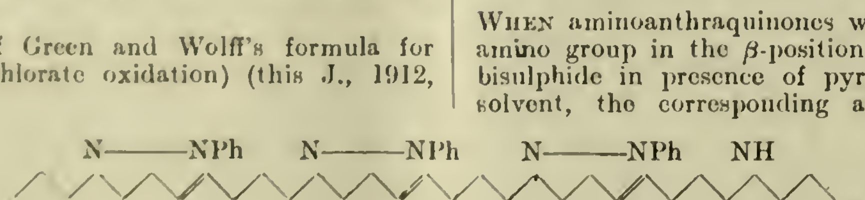
Nitro-arylamines of 2.3-hydroxynaphthoic acid; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 458,953, June 7, 1913. Under Int. Conv., Aug. 2, 1912.

SEE Eng. Pat. 13,237 of 1913; this J., 1913, 1060.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Aniline Black; The constitution of —— *Part IV*. A. G. Green and W. Johnson. Chem. Soc. Proc., 1913, 29, 276—278.

IN further support of Green and Wolff's formula for Aniline Black base (chlorate oxidation) (this J., 1912, 1116):



(where Ph = C_6H_5) the following data have been obtained: (1) On oxidation of Aniline Black with lead peroxide and sulphuric acid a yield of benzoquinone is obtained, which corresponds with that required on the assumption that all the mono- and di-substituted benzene nuclei, but not the tri-substituted, will yield benzoquinone. (2) In presence of an excess of mineral acid Aniline Black absorbs one molecule of sodium nitrite corresponding with the formation of a monodiazonium salt. Hence the terminal nitrogen atom forms an amino- and not an imino-group, and the chain must be an open one. (3) Titrations with hydrochloric acid have shown that Aniline Black, in common with Emeraldine and Nigraniline, yields a non-hydrolysable dihydrochloride and a trihydrochloride, in which one molecule of hydrogen chloride is readily hydrolysed. Two of the nitrogen atoms are therefore strongly basic (quinonoid), whilst a third is weakly basic (amino-group). Leucoemeraldine, which contains no quinonoid nitrogen, does not give a stable hydrochloride. (4) Nigraniline does not condense with secondary aromatic amines, but only with primary amines. (5) The variety of Aniline Black produced in solution by oxidation with chromic acid and known as "Single bath black," or "Bichromate black," has given results which indicate that it is the hydroxy-analogue of ordinary Aniline Black, the amino-group of the latter being replaced by a hydroxyl group. It is less basic than ordinary Aniline Black, forming a non-hydrolysable dihydrochloride, but not a trihydrochloride. On oxidation it gives a yield of benzoquinone consistent with the formula suggested. In the formulæ suggested, the colouring-matters are represented as anhydro-bases, but in both cases analysis indicates the presence of $1H_2O$ more, a fact explainable on the assumption that one phenylazonium group is present as an hydroxide or two such groups as an oxide.

Thioflavones. S. Ruhemann. Ber., 1913, **46**, 3384—3394.

A GENERAL method for the preparation of thioflavones consists in condensing a metallic thiophenoxide with phenylpropiolic ester, converting the condensation product into arylthiocinnamic ester by means of acid, hydrolysing the ester, and decomposing the resulting acid by heat into carbon dioxide and arylthiostyrole. The thioflavone is obtained quantitatively from the latter by the action of phosphorus pentachloride followed by aluminium chloride. The thioflavones differ from the flavones, which may be prepared in an analogous manner (Ber., 1913, **46**, 2188), in not fluorescing in sulphuric acid solution, and in a greater resistance against the action of alkali.—J. B.

PATENTS.

Anthracene series; Manufacture of derivatives of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7483, March 29, 1913.

SEE Ger. Pat. 264,010 of 1912; this J., 1913, 1003. On treatment with alkalis, the chloro-anthrapyridones are converted into hydroxyanthrapyridones.—T. F. B.

Dyestuffs [; *Sulphide* ——]. E. T. Scheutz, Kalmar, Sweden. Eng. Pat. 8693, April 12, 1913.

A DRY mixture of a sulphide dye, sodium sulphide and sodium carbonate, with or without the addition of sodium chloride, is packed into air-tight vessels.—J. B.

Condensation products of the anthraquinone series, Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 459,043, June 9, 1913. Under Int. Conv., July 20, 1912.

WHEN aminoanthraquinones which contain at least one amino group in the β-position, are treated with carbon bisulphide in presence of pyridine or other indifferent solvent, the corresponding anthraquinonyl-thiourea is produced. Some of the products are dyestuffs; thus, the compound from 1.2.4-triaminoanthraquinone dyes cotton violet-brown shades from the vat.—T. F. B.

Vat [anthracene] dyestuffs and intermediate products for making these. Badische Anilin und Soda Fabrik. Fr. Pat. 458,949, June, 7, 1913. Under Int. Conv., Jan. 29 and May 3, 1913.

COMPOUNDS which dye wool lemon-yellow shades from acid baths, and which are suitable for use in making lakes, are obtained by treating aceanthrenequinone or its halogen derivatives with hydroxylamine. They appear to be oximes. On treatment with acids, such as acetic or sulphuric acid, new products are obtained which are probably imines of anthracene-1.9-dicarboxylic acid. They are yellow substances which are converted by alkaline reducing agents into solutions dyeing cotton pure yellow shades. Besides these products, other new compounds are also formed, according to the conditions of the acid-treatment: they are soluble in sodium carbonate solution, and appear to consist of anthracene-1.9-dicarboxylic acid itself and its halogen derivatives, and also of the monoamides of these carboxylic acids. They are readily converted into the yellow imino-compounds by boiling with ammonia. A further series of dyestuffs is obtained by fusing these imino-compounds with alkalis, and treating the products with oxidising agents, such as air: in this case green vat dyestuffs are formed.—T. F. B.

Halogenated anthracridones; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 459,105, June 11, 1913. Under Int. Conv., Jan. 16 and Feb. 22, 1913.

HALOGEN derivatives of anthracridones are produced by treating with halogens in presence of nitrobenzene, trichlorobenzene, or other suitable solvent, such derivatives of 1-arylaminoanthraquinones as contain a methyl group in the *o*-position to the imino group, either in the aryl or in the anthraquinonyl nucleus. The products dye vegetable fibres fast bright shades from the hydrosulphite vat. A number of dyestuffs are described, giving shades varying from red, bluish-red, and violet to red-brown. In all the examples given the temperature of the reaction lies between 150° and 170° C.—T. F. B.

Dyestuffs insoluble in water; Process for producing —— in a finely divided condition. Badische Anilin und Soda Fabrik. Ger. Pat. 265,536, Nov. 3, 1912. Addition to Ger. Pat. 222,191 (see this J., 1910, 1003).

DYESTUFFS of the indigo or thioindigo classes may be obtained in colloidal form, miscible with water, and in solutions from which they cannot be separated by filtration, by blowing air through cold solutions of their leuco-compounds to which sulphite-cellulose waste lyes have been added. The treatment is carried out in such a manner that the leuco compound is oxidised but the dyestuff is not precipitated. It is stated that the resulting liquids can be evaporated or the colouring matter precipitated by known means without loss of solubility.—T. F. B.

Halogen derivatives of the carbazanthraquinone series; Manufacture of —— and their conversion into vat dyestuffs. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 459,143, Aug. 27, 1912.

PHTHALYL chloride can be condensed with polyhalogen derivatives of carbazole, in presence of aluminium chloride, to form either carbazanthraquinone derivatives or products which can be converted into these by treatment with sulphuric acid or other condensing agents. These halogenated carbazanthraquinones can be condensed with amino-compounds, forming a series of vat dyestuffs. The condensation of trichlorocarbazole with phthalyl chloride gives rise to a trichlorocarbazanthraquinone; on condensing this with various amines, the following dyestuffs are formed:—with aniline, olive-green; with anthranilic acid, green; with benzamide, reddish-brown; with α-aminoanthraquinone, grey; with 1-amino-2-methylanthraquinone, greenish-grey.—T. F. B.

Vat dyestuffs of the anthracene series; Process for producing ——. L. Cassella und Co., G.m.b.H. Fr. Pat. 459,256, Aug. 30, 1912.

WHEN a diaminoanthraquinone is condensed with a quinone such as benzoquinone or α-naphthoquinone, in solution in alcohol or acetic acid, products are formed which contain in the anthraquinonyl nucleus a free amino-group; this is susceptible of combining with chloro-anthraquinones, forming anthrimides which possess valuable vat-dyeing properties. When the primary condensation products are treated with alkali hydrosulphites, vats are produced, but these have little affinity for the fibre, fugitive shades being formed. The condensation product from 1·5-diaminoanthraquinone, benzoquinone, and β-chloroanthraquinone dyes red-brown shades from the hydrosulphite vat, fast to light, washing, and chlorine. Other dyestuffs prepared similarly dye claret, red-brown, and brown shades.—T. F. B.

[Azo] dyestuffs; Process for making yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 459,468, June 19, 1913. Under Int. Conv., July 1, 1912.

YELLOW dyestuffs which may be used for dyeing silk or wool or for preparing lakes, are obtained by combining the tetrazo compounds of diaminotriphenylmethane or its derivatives with pyrazolone or its derivatives.—T. F. B.

Vat dyestuffs; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning Ger. Pats. 265,195 and 265,196, March 23 and June 15, 1912. Additions to Ger. Pat. 263,382 (see Fr. Pat. 447,592 of 1912; this J., 1913, 226).

(1) THE halogen-arylidoquinones, obtained by condensing halogen-quinones and their substitution products with arylamines and their substitution products, are treated with metallic sulphides, with or without addition of a diluent. The products do not contain free sulphur. (2) In carrying out the process described above, a metallic sulphydrate may be used in place of the sulphide.—T. F. B.

Wool dyestuffs; Process for preparing yellow to brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 265,197, July 7, 1912. Addition to Ger. Pat. 263,655 (see Fr. Pat. 443,809 of 1912; this J., 1912, 979).

1-CHLORO-2.4-DINITROBENZENE is condensed with a phenoxy- or phenylamino-diaminodiphenylamine-*m*-sulphonic acid, which may or may not be substituted in the phenoxy- or phenylamino-group. The phenoxy or phenylamino compounds may be obtained, for example, by condensing an aminodiphenylether-*m*-sulphonic acid or an amino-diphenylamine-*m*-sulphonic acid with 1-chloro-2.4-dinitrobenzene and reducing the products.—T. F. B.

Green mordant dyestuffs and process for making them. Manuf. de Matières Colorantes, anc. L. Durand, Huguenin et Cie. Fr. Pat. 459,681, June 25, 1913. Under Int. Conv., July 26, 1912.

A NEW series of dyestuffs, especially suitable for printing on cotton, is obtained by treating with fuming sulphuric acid, chlorosulphonic acid, or other dehydrating agent with a similar action, the "sulphorhodols" produced by condensing mono- or disulphonic acids of pyrogallol with amino-*m*-hydroxybenzoylbenzoic acids in which the amino group is substituted (see U.S. Pats. 1,002,825 and 1,003,257; this J., 1911, 1204, 1205). The sulphonic group or groups in the pyrogallol nucleus appear to be eliminated in the process. If the sulphorhodols contain no other sulphonic groups than these, basic dyestuffs are formed. Some of the products furnish very fast green shades on a chrome mordant. They can also be printed with tannin, with which similar shades are produced. From these properties it appears that their constitution is dissimilar to that of the dyestuffs described in Fr. Pat. 443,377 (see this J., 1912, 979).—T. F. B.

Vat dyestuff of the anthraquinone series; Process for preparing a yellow ——. R. Wedekind und Co. m. b. H. Ger. Pat. 265,647, Oct. 6, 1912. Addition to Ger. Pat. 257,832.

DIBROMO-2-HYDROXYANTHRAQUINONE is converted into a yellow vat dyestuff, very similar to that obtained from 1-chloro-2-hydroxyanthraquinone according to the chief patent (this J., 1913, 481), by melting it alone or after addition of sodium carbonate or other substance which combines with acid, and then treating the product with chlorine or bromine.—T. F. B.

Vat [anthracene] dyestuffs; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co. G.m.b.H., Frankfort on Maine, Germany. Eng. Pats. 20,367, Sept. 6, 1912, and 6269, March 13, 1913.

See Fr. Pat. 459,256 of 1912; preceding.—T. F. B.

Azo colouring matters; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 25,906, Nov. 11, 1912.

See Fr. Pat. 450,713 of 1912; this J., 1913, 593.—T. F. B.

Azo colouring-matter. E. Ulrichs, Reval, Russia, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,077,655, Nov. 4, 1913.

See Fr. Pat. 456,614 of 1913; this J., 1913, 1005.—T.F.B.

Anthraquinone dyes; Green —— and process of making them. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,077,115, Oct. 28, 1913.

See Fr. Pat. 446,751 of 1912; this J., 1913, 131.—T. F. B.

Azo dyestuffs; Manufacture of basic ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6279, March 13, 1913.

See Fr. Pat. 456,236 of 1913; this J., 1913, 938.—T. F. B.

Monoazo dyestuffs; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,168, April 30, 1911. Under Int. Conv., May 1, 1912.

See Fr. Pat. 457,840 of 1913; this J., 1913, 1004.—T. F. B.

Azo colours suitable for use as pigments. H. Clingenstein, Mülheim, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,076,819, Oct. 28, 1913.

See Eng. Pat. 13,110 of 1913; this J., 1913, 906.—T. F. B.

Vat [indigoid] dyestuffs and intermediate products therefor; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 459,628, June 24, 1913. Under Int. Conv., Aug. 9, 14, and 29, 1912.

See Eng. Pat. 21,915 of 1912; this J., 1913, 745.—T. F. B.

Sulphurised [sulphide] dyestuffs fast to chlorine; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 11,096, May 10, 1913. Under Int. Conv., May 14, 1912.

See Fr. Pat. 457,535 of 1913; this J., 1913, 1005.—T. F. B.

Azo dyestuffs; Brown ——. K. Schirmacher and H. Elvert, Assignors to Farbwerke vorm. Meister Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,077,492, Nov. 4, 1913.

See Addition of Dec. 9, 1912, to Fr. Pat. 441,044 of 1912; this J., 1913, 650.—T. F. B.

Amino-azo bases; Manufacture of diacidyl and higher acidylated compounds from ——. H. Reinhardt, Assignor to Kalle und Co. A.-G., Biebrich, Germany. U.S. Pat. 1,076,840, Oct. 28, 1913.

See Ger. Pat. 253,884 of 1912; this J., 1913, 79.—T. F. B.

Disazo dyes for cotton; Diazotisable ——. W. Herzberg, Wilmersdorf, and W. Lange, Treptow, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,078,503, Nov. 11, 1913.

See Fr. Pat. 448,581 of 1912; this J., 1913, 418.—T. F. B.

Disazo dyes for cotton; Diazotisable ——. W. Herzberg, Wilmersdorf, and W. Lange, Treptow, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,078,504, Nov. 11, 1913.

See Fr. Pat. 449,012 of 1912; this J., 1913, 480.—T. F. B.

Anthraquinone series; Blue dyes of the ——. W. Herzberg, Wilmersdorf, and G. Hoppe, Treptow, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,078,505, Nov. 11, 1913.

See Eng. Pat. 13,019 of 1912; this J., 1913, 528.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Hydrocellulose; Fatty acid esters of —— and their hydrolysis. A. Stein. Z. angew. Chem., 1913, **26**, 673—677.

In the case of hydrocellulose prepared by Girard's method, elementary analysis is not sufficiently accurate to determine the quantity of water chemically combined as the result of hydrolysis. Hydrocellulose esters of propionic, butyric and valeric acids have been prepared by the action of the acid anhydride upon Girard's hydrocellulose in presence of concentrated sulphuric acid. The products closely resembled cellulose acetates in their general properties; esterification proceeded easily until triacyl compounds were produced. The author has also prepared a series of acetic and butyric esters of hydrocellulose, using mono- and trichloroacetic acids as catalysts. The products were for the most part soluble in chloroform, but contained small variable quantities of combined chlorine; the acetates thus obtained gave numbers considerably below those required by a cellulose triacetate, the highest product showing only 52·49 per cent. of combined acetic acid. A number of samples of commercial cellulose acetates were also analysed, two of which showed abnormally high values, 65·5 to 66·0 per cent. of combined acetic acid. These values would appear to confirm the view that hydroxyl groups are formed as the cellulose molecule is hydrolysed. For the analysis of cellulose acetates, the ester is treated with sulphuric acid, diluted with an equal volume of water, for two days and the acetic acid is distilled over at constant volume in a current of steam free from carbon dioxide. For the complete hydrolysis of the esters of higher homologues a stronger acid is required (1·8 : 1 for butyrates and 3 : 1 for valerates). The water in the steam generator should be boiled thoroughly and sodium hydroxide added; volatile acids are also produced at the expense of the hydrocellulose residue. To correct the results, distillation is carried on for a considerable time after the acetic acid has distilled over; at this stage the volatile acidity per 100 c.c. of distillate becomes practically constant. This constant is then applied as a correction for the volatile acidity of the volume of distillate obtained before constancy was reached. To avoid errors of titration, each increment of distillate should be added to the liquid which has already been titrated.—J. F. B.

Longleaf pine; Experiments on the conversion of —— into paper pulp by the soda and sulphate processes. S. D. Wells. J. Ind. Eng. Chem., 1913, **5**, 906—907.

The tests were made in a small rotary autoclave of about 2 gallons capacity and in a vertical digester of 60 gallons capacity. The wood of the long-leaf pine (*Pinus palustris*) whilst not suitable for the manufacture of white paper, will yield "Kraft" paper equal or superior to that now on the market, and the high specific gravity of the wood ensures a greater yield per cord than is obtainable from any other important pulp-wood. The sulphate process gives pulps of better quality and in higher yields than the soda process. The following conditions gave the best results:—

Caustic soda charged per 100 lb. of "bone dry" chips, lb.	15
Sodium sulphide charged per 100 lb. of "bone dry" chips, lb.	7·5
Initial concentration NaOH in liquor, grms. per litre	26·5
Initial volume of liquor per lb. of chips, gallons	0·68
Total duration of digestion, hours	3·5
Duration of digestion at maximum steam pressure, hours	3·0
Maximum steam pressure, lb. per sq. in.	100

A yield of 49 per cent. (on the weight of the wood) of crude pulp was obtained, and the paper prepared from this showed a strength of 45 lb. per 0·005 in. of thickness on the Mullen tester, weighed 45 lb. per ream of 500 sheets, 24 by 36 by 0·005 in., and withstood 1200 double folds before breaking in a Schopper folding tester.—A. S.

Pulp woods; Length of fibres of pulps produced from different kinds of ——. C. Beadle and H. P. Stevens. Papermaker, 1913, 45, 150—157.

The authors record measurements of the lengths of entire fibres in various wood pulps, both commercial varieties and a series of experimental pulps prepared by the U.S. Dept. of Agriculture. The values here quoted represent averages of ten or more measurements: *Commercial pulps.*—Soda pulps: "Wermbohl A," bleaching, 2·816 mm.; ditto "O," strong, not bleaching, 2·848. Sulphite pulps: Mitscherlich, "Tilsit 1a," bleaching, 2·936; ditto "I b," not bleaching, 3·414; Ritter-Kellner, "Greaaker Swan," bleaching, 3·088; ditto "Viking," not bleaching, 3·252; "Waldhof C," bleaching, 2·350; ditto Aspen, bleached sulphite, 0·90 mm. *Experimental pulps.*—Red Maple, 0·78; Aspen, 0·98; Red Alder, 1·08; Beech, 1·18; Bald Cypress, 1·34; Tulip tree, 1·54; Sycamore, 1·65; Cotton Gum, 1·66; Engelmann Spruce, 2·31; Hemlock, 2·36; Incense Cedar, 2·41; Jack Pine, 2·41; Lodgepole Pine, 2·50; Tamarack, 2·61; Western Hemlock, 2·62; Red Spruce, 2·76; Loblolly Pine, 2·86; Scrub Pine, 2·90; Grand Fir, 3·13; Douglas Fir, 3·32; White Fir, 4·02; Longleaf Pine, 4·28 mm.—J. F. B.

Paper half-stuffs and paper; Relations between hygroscopic moisture in —— *and the humidity of the air.* K. Fenchel and K. Cornely. Wochenbl. Papierfab., 1913, 44, 4323—4327.

Samples of various papermaking half-stuffs and papers were exposed in a closed chamber to the action of air of determined degrees of relative humidity at a constant temperature. The humidity of the air was regulated by means of calcium chloride solutions of suitable concentrations or solid calcium chloride: an electric fan inside the chamber served to promote a thorough mixture of the atmosphere. The experiments were begun with relatively dry atmospheres and the degree of humidity was increased in stages of about 10 per cent. A period of 1 to 3 hours sufficed for the establishment of equilibrium. Finally the sample was dried at 105° C. for the determination of the absolute moisture. For degrees of relative humidity between 40 and 80 per cent. the curves expressing the relations between humidity of the atmosphere and percentage of moisture in the pulp are practically straight lines; the values for hygroscopic moisture in the pulps under the same atmospheric conditions vary with the nature of the fibre and its previous treatment; paper which has been dried at 100° C. absorbs less than air-dried paper. Other experiments were carried out in an atmosphere fully saturated with moisture; in these it was found that the percentage of moisture absorbed is considerably affected by the absolute tension of the vapour, *i.e.*, depends greatly on the temperature of the saturated atmosphere. The chamber was so insulated that variations in temperature did not exceed 0·5° C. over a period of 14 days. In a saturated atmosphere the absorption of moisture takes place rapidly at first but is continued over a very long period, so that constant weight is not attained even in 14 days; after 17 days at 18° C. bleached cotton half-stuff contained 16·5 per cent. of moisture and ground spruce wood pulp, 22·35 per cent. Experiments on the rate of absorption and loss of moisture when pulp was transferred from an atmosphere at 50 per cent. humidity to one at 70 per cent., and then back again, showed that moisture is absorbed more rapidly than it is lost; 2 hours were sufficient for the establishment of equilibrium with the moister atmosphere, but on returning to the drier atmosphere, the original weight was not restored in so short a time.—J. F. B.

Paper pulp; Apparatus for testing the degree of beating of ——. E. W. L. Skark. Papierfabrikant, 1913, 11, 1358.

A measured quantity of pulp from the beating engine (50 c.c.) is diluted with water to 500 c.c. and poured into a tap funnel fitted with a wire cloth sieve. The tap is then opened and the volume of water collected at equal intervals of time (1, 5 or up to 30 seconds) is noted. Curves plotted with volumes of water as ordinates and time intervals as abscissæ then illustrate the degree of fineness of the pulp and its rate of draining on the paper-machine wire. Provided the concentration of the pulp is constant, these curves are comparable with each other and afford an indication of the state of preparation of the stuff. When the concentration of the pulp is variable, the curves may be corrected to a standard concentration after a determination of the dry substance has been made. —J. F. B.

Printing papers; The "mineral sizing" of —— *with sodium silicate and magnesium sulphate.* A. Frohberg. Wochenbl. Papierfab., 1913, 44, 4250—4252.

"Mineral sizing" consists in the production of a colloidal precipitate, generally by the interaction of sodium silicate and aluminium sulphate, in the paper-pulp. The author has attempted to substitute magnesium sulphate for a portion of the aluminium sulphate. The use of magnesium sulphate alone as a precipitating agent for the silicate is not practicable, on account of the alkaline reaction of the product. The best results in respect of yield are obtained with a mixture of the following composition: SiO_2 0·500, Na_2O 0·517, MgO 0·337, Al_2O_3 0·067, SO_3 0·823 part. With these proportions, considerably over 90 per cent. of the total silica, magnesia and alumina appear in the precipitate, but the latter becomes alkaline. A more acid precipitate may be obtained by increasing the aluminium sulphate until it is equivalent to 0·134 part Al_2O_3, but this advantage is obtained with a loss of magnesium oxide, only 55 per cent. of the quantity employed being recovered in the precipitate. The combined magnesium and aluminium "mineral sizing" may be improved by the use of starch; basic dyestuffs are not suitable for papers treated in this manner, but substantive dyestuffs may be employed.—J. F. B.

Paper dust explosion. Times Eng. Supplement, 1913, Dec. 3, 24.

Much interest has been aroused in France by M. Bonn's report upon an explosion of paper dust which occurred at a factory at Lille in May last. Although similar explosions of carbonaceous dusts, such as flour, sugar, starch, and cork, have been recorded in France and elsewhere, this appears to be the first occasion in which paper dust has been concerned. At the factory in question the edges of paper rolls are ground, and the resulting dust is collected in a dust chamber which is periodically emptied. The explosion occurred on one of the occasions of emptying. A sample of the dust was sent to the experimental station at Liévin and tested, with the result that it was shown to be extremely inflammable, and capable of producing an explosion in a closed space when mixed with air and exposed to flame, the degree of inflammability being equal to that of finely powdered Liévin coal, containing 30 per cent. of volatile matter. (See also this J., 1906, 55.)

Patents.

Fabrics and other materials; Drying and treating ——. W. M. Grosvenor, Grantwood, N.J. U.S. Pat. 1,076,976, Oct. 28, 1913.

The material moving in one direction is subjected to the action of a current of drying medium moving in a counter direction in such a manner that the drying medium is repeatedly brought into, and removed from, contact with the material and, while out of contact with it, is heated to restore the heat lost by evaporation; moisture is then removed from the drying medium and the latter again passed through the material as before. When the material is sufficiently dried it is conditioned by treatment with the same drying medium after the latter has been cooled and partially deprived of the moisture absorbed by it. —J. F. B.

Binding medium [from cellulose] for making plastic material suitable for moulding or shaping; Process for manufacturing a ——. L. Grote, London. Eng. Pat. 23,728, Oct. 17, 1912.

Cellulose—*e.g.*, cotton-wool—(50 parts) is soaked in a mixture of sulphuric acid, 720, water, 400, and glacial acetic acid, 200 parts for from 12 to 20 hours. The solution is diluted with water, the "fluid-like" cellulose material separated from surplus acid by filtration and decantation, washed, dried and powdered. Five parts of the powdered material are then mixed with glacial acetic acid. 100, acetic anhydride, 100, acetone, 50, carbon tetrachloride 50, and chemically pure glycerin, 5 parts. The mass thus obtained may be mixed with suitable loading or filling material for moulding into the desired objects.—E. W. L.

Threads, filaments and the like from cellulose solutions; Machines for spinning ——. P. Girard, Lyons, France. Eng. Pat. 4596, Feb. 22, 1913. Under Int. Conv., Feb. 23, 1912.

In spinning artificial threads the strains produced by the reciprocating guide-motion in winding the threads on bobbins are minimised by maintaining the distance between the intermediate guide and the reeling guide constant, the intermediate guide partaking of the reciprocating motion as one piece with the reeling guide. Friction is also diminished by employing an intermediate guide of triangular section with light rollers at the points of the triangle and a reeling guide which is also fitted with a light rolling device at its operating point.—J. F. B.

Acetylcellulose plastic masses; Process of making ——. W. G. Lindsay, Caldwell, N.J., Assignor to The Celluloid Co., New York. U.S. Pats. 1,076,215 and 1,076,216, Oct. 21, 1913.

Acetylcellulose, soluble in acetone, is incorporated with camphor and methyl or ethyl alcohol, the proportion of alcohol being about 1—1·5 times that of the camphor and 0·5 that of the acetylcellulose. When ethyl alcohol is used, the mixture is heated.—J. F. B.

Cellulose formate solutions; Process for preparing ——. Internationale Celluloseester-Ges. m. b. H. Ger. Pats. 265,852 and 265,911, Jan. 5, 1913.

(1.) Solutions of mono- or polyhydric phenols are used as solvents for cellulose formate. (2.) A solution of chloral hydrate or a chloral alkyloxide (alcoholate) is used as solvent.—T. F. B.

Paper; Manufacture of ——. J. Lewthwaite, Oregon, U.S.A. Eng. Pat. 25,283, Nov. 4, 1912.

The shake-frame of the machine is constructed in two sections with primary and secondary pivotal bearings which are rocked simultaneously. The first section of the frame with the breast-roll receives a uniform lateral shake throughout its length, whilst the second section, supported at one end by the secondary pivotal bearing and at the other end by fixed bearings, receives a gradually diminishing shake. The secondary bearing is situated some distance, *e.g.*, 7 ft., in advance of the breast roll, so that the stuff is subject to a maximum vibration for a large portion of its travel.—J. F. B.

Paper pulp or any liquids containing matter in suspension; Centrifugal strainers for straining ——. H. N. Fearnley and B. Geen, London. Eng. Pat. 25,849, Nov. 11, 1912.

In centrifugal straining apparatus, more particularly of the type which consists of a pair of co-axial drums, the inner of which forms the straining screen, the reversal of the flow of pulp through the screen for the purpose of keeping the slits clear is produced by means of stationary baffles arranged both inside and outside the revolving drum forming the screen and in close proximity thereto.—J. F. B.

Sulphite pulp process; Reclaiming system in a ——. C. B. Thorne, Hawkesbury, Ont., Canada. U.S. Pat. 1,076,078, Oct. 21, 1913.

The upper end of the digester is connected with a receptacle having a gas outlet at its upper end and a liquor outlet at its lower end; the gas outlet is connected with a condenser and the liquor outlet with a cooler and pump. Two fresh-liquor-making towers are also provided, the pump being arranged to discharge liquor into the top of one of them, whilst gas is conducted from the condenser into the bottom of the other.—J. F. B.

Paper-pulp; Apparatus for bleaching ——. E. D. Jefferson, Boston, Mass. U.S. Pat. 1,077,883, Nov. 4, 1913.

The apparatus consists of a kier, a tank, a pipe connecting the bottom of the tank with the bottom of the kier and another pipe leading from the bottom pipe to the top of the kier. Bleaching liquor is blown by means of compressed air from the tank into the top of the kier and the liquor is forced through the pulp in the kier back into the tank. Valves controlled by the level of the liquid, are provided for operating the opening and closing of the air and liquor pipes in the required order.—J. F. B.

Sulphite-cellulose; Process for removing resin from unbleached ——. Aflenzer Graphit- u. Talksteingewerkschaft G. m. b. H. Ger. Pat. 265,260, Dec. 1, 1912.

After the liquor has been blown off, the pulp is washed and then mixed with a suspension of talc or asbestos dust, or a mixture of both, preferably together with some petroleum, and heated in the boiler under a low pressure, after which it is centrifuged and washed.—T. F. B.

Sulphite-cellulose waste lyes; Process for obtaining the organic and inorganic constituents of ——. R. W. Strehlenert. Ger. Pat. 266,096, Aug. 9, 1912.

The sulphurous acid in the waste liquors is oxidised by heating in an autoclave to a high temperature under pressure, in presence of air or oxygen, whereupon the sulphuric acid formed precipitates the lignin-substances. Before the oxidation process, a soluble acid salt, such as sodium bisulphate, may be added to the waste lye. The precipitated substance may be used as a fuel, having a calorific value of 6000—7000 Cals. It is stated that the solution which remains is so free from solids that it can be safely run into any drain or stream.—T. F. B.

Sulphite-cellulose waste lyes; Process for rendering —— *innocuous.* R. Blochmann. Ger. Pat. 266,112, July 7, 1912.

The hot waste lyes containing sulphurous acid are treated with a metal, such as iron or zinc, and a sufficient quantity of calcium carbonate, or lime or other base to combine with the free acid. This treatment results in the reduction of the sulphur dioxide to hydrogen sulphide, which combines with the iron, forming sulphide; the sulphurous acid is recovered from this by roasting.—T. F. B.

Fibrous matter; Process of, and apparatus for, separating —— from admixed particles and adhering matter. J. J. Werst, Delft, P. M. H. L. Collée, and J. M. Egmond, Rotterdam. Eng. Pat. 24,057, Oct. 21, 1912.

See Fr. Pat. 449,059 of 1912; this J., 1913, 482.—T. F. B.

Solutions of carbohydrate esters, especially pyroxylin; Method of obtaining ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, U.S.A. Eng. Pat. 22,622, Oct. 4, 1912.

See Fr. Pat. 449,607 of 1912; this J., 1913, 509.—T. F. B.

Celluloid and like compositions; Manufacture of ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, U.S.A. Eng. Pat. 22,623, Oct. 4, 1912.

See Fr. Pat. 449,606 of 1912; this J., 1913, 508.—T. F. B.

Artificial silks and a celluloid like product; Manufacture of ——. C. Schrager, London, and R. D. Lance, Livry, France. Eng. Pat. 8283, April 8, 1913. Under Int. Conv., April 9, 1912.

See Fr. Pat. 453,652 of 1912; this J., 1913, 785.—T. F. B.

Viscose; Process for making artificial moulded products from ——. B. Borzykowski. Fr. Pat. 459,125, May 23, 1913. Under Int. Conv., Dec. 21, 1912.

See Eng. Pat. 12,090 of 1913; this J., 1913, 975.—T. F. B.

Process for making acid-resisting material for filters or diaphragms. Fr. Pat. 456,524. *See* I.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Alizarin Red dyeing. R. Haller. Kolloid-Zeits., 1913, **13**, 255—264.

The author discusses the process of dyeing Alizarin Red from the colloid-chemical point of view. Calcium alizarate and aluminium alizarate (Liechti and Suida, this J., 1885, 587) were dissolved in ricinoleic acid and the yellowish-orange and light red solutions were found to be of a colloidal character when examined ultramicroscopically. A mixture of calcium and aluminium alizarates, or a mixed calcium-aluminium alizarate, when dissolved in ricinoleic acid gives a deep red solution of a bluish tinge, and examination of the absorption spectrum indicates that a different substance is present, not merely a mixture of the coloured calcium and aluminium compounds. The formation of Alizarin Red on the fibre is considered to be due to the combination of colloidal aluminium hydroxide with the alizarin, and solution of the resulting aluminium alizarate and of calcium alizarate in the ricinoleic acid or polyricinoleic acids formed by the decomposition of Turkey-red oil on drying the oil-prepared material. The brightening of the red produced by the steaming process is attributed to an increase of the degree of dispersion of the calcium-aluminium alizarate in the melted fatty material. (See also this J., 1913, 81.)—A. S.

Chrome mordant generated in the presence of the printing colour. A. Scheurer. Sealed Note No. 1398, June 22, 1903. Report thereon by C. Holzach. Bull. Soc. Ind. Mulhouse, 1913, **83**, 654—658.

A mixture of a soluble chromate and glucose is applied to the fibre and on steaming green chromium oxide is formed. The mixture is stable and mordant dyestuffs can be applied along with it. The report states that the process anticipates Ger. Pat. 203,131 (this J., 1908, 1202). The suitability of a number of mordant dyestuffs for printing along with chromates has been investigated. The chief advantage of the chromate method of mordanting is that neutral or alkaline solutions can be used, thus permitting of the use of chalk or analogous resists under Aniline Black.—J. B.

Paramine Brown, shaded by means of chrome colours. J. Heilmann et Cie. and M. Battegay. Sealed Note No. 1856, Aug. 31, 1908. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1913, **83**, 658—661.

The Paramine Brown mixture is printed as usual and along with it a chrome mordant (*e.g.*, chromium lactate) and a colour capable of being fixed by chromium salts (*e.g.*, Alizarin Yellow R, Persian berries, etc.). The chromium salts do not injuriously affect the development of the brown. The report states that the modern method of shading Paramine Brown is by means of Fuscamine. —J. B.

Paramine Brown, shaded by means of o-hydroxynitroso or o-quinoneoxime dyestuffs. J. Heilmann et Cie. and M. Battegay. Sealed Note No. 1936, Oct. 9, 1909. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1913, **83**, 661—665.

Dyestuffs of the classes mentioned in the title can be incorporated in the ordinary oxidation mixture for Paramine Brown, and a wide degree of shading is possible by the use of different mordants, for example Naphthine S (the bisulphite compound of nitroso-β-naphthol) gives red, yellow and green shades with chromium, nickel and iron mordants respectively. The report refers to Bistre T, produced by steaming a mixture of nitroso-β-naphthol and *p*-phenylenediamine on the fibre, described by C. Schoen, in a sealed note dated Oct. 23, 1902.—J. B.

Red lakes; Printing fast —— *on wool and silk.* Soc. pour l'Ind. Chim. à Bale and E. Kopp. Sealed Note No. 717, Dec. 27, 1892. Report thereon by C. Favre. Bull. Soc. Ind. Mulhouse, 1913, **83**, 650—651.

The barium lake of the disazo dyestuff from nitrobenzidine, salicylic acid and 1.4-naphtholsulphonic acid is printed with gum and steamed for one hour. The report states that the shade obtained is a little faster to soap but a little less bright than that obtained by means of the ordinary Ponceaux.—J B.

Alizarin Red; Coloured discharges on —— *with developing colours.* M. Freiberger. Sealed Note No. 1019, March 11, 1898. Report thereon by F. Binder. Bull. Soc. Ind. Mulhouse, 1913, **83**, 651—653.

The diazotisable dyestuff (*e.g.*, Diamine Azo Blue R) is printed on the Alizarin Red ground together with caustic soda, steamed for 5 minutes at 99°—100° C., diazotised and developed with β-naphthol.—J. B.

Metallic powders [*on textiles*]; *Note on the printing of* ——. J. Frossard and C. Rebert. Bull. Soc. Ind. Mulhouse, 1913, **83**, 648—649.

In Stephan's process for printing metallic powders phenol and formaldehyde are used, together with Sericose (acetylcellulose) as a thickening agent, and Battegay (this J., 1913, 422) considers that fixation is due to the formation of a resinous condensation product of phenol and formaldehyde. The authors have found that the formaldehyde may be dispensed with and that "sericose" is a good fixing agent in itself. The paste is made up with a mixture of phenol, alcohol and acetone as solvents. The prints are perfectly fast and the process has been in use since 1911.—J. B.

Patents.

Cotton for dyeing and bleaching; Process for preparing ——. A. J. Dronsfield, Assignor to E. L. Martin, Providence, R.I. U.S. Pat. 1,077,263, Nov. 4, 1913.

Cotton from the bale is beaten up, the loose, non-parallel fibres are formed into a lap of uniform density, a number of laps are superposed upon each other with a spray of moisture between the surfaces in contact, in such a way that the moisture will not interfere with the diffusion of the dye through the mass, the compound lap is compressed, then dyed or bleached.—J. F. B.

Padding machine: Impregnating with reduced vat dyes and other frothy liquors on the tissue printing or ——. A. Zingg, Fratte di Salerno, Italy. Eng. Pat. 7547, March 31, 1913. Under Int. Conv., Dec. 5, 1912.

In a padding machine for dealing with frothy liquors (*e.g.*, reduced vats) the upper rubber squeezing roller is mounted obliquely over the lower brass roller instead of vertically above it. The squeezing surface is thus brought close to the surface level of the liquor.—J. B.

Fabrics: Dyeing and preserving textile ——. E. T. Scheutz, Kalmar, Sweden. Eng. Pat. 8687, April 12, 1913.

The fabric (*e.g.*, fishing net) is immersed in a solution of a metallic salt immediately after dyeing, and without rinsing, the alkali left in the fabric from the dyebath serving to fix a certain amount of metal as an insoluble compound. The method is applicable only to such dyestuffs as are unaffected by metallic salts.—J. B.

Dyeing machine. W. McK. Morris, Bordentown, N.J. U.S. Pat. 1,076,305, Oct. 21, 1913.

The yarn is hung in the dye-vat on sticks of oval cross-section, supported between an upper and a lower horizontal wall of round sticks, spaced apart to allow of circulation of the dye-liquor.—J. B.

Dyeing yarn in hanks, fabrics, etc.; Machine for ——. W. Schlbach. Fr. Pat. 459,196, June 13, 1913. Under Int. Conv., June 14, 1912.

The material to be dyed is placed in a cage which can be raised from or lowered into the dye-vat. The cage is made to fit as closely as possible to the sides of the vat, and the material is so arranged in the cage that the whole acts as a kind of piston, in constantly agitating the liquor. When hanks are to be dyed, they are hung obliquely in the cage. The machine may consist of two vats, the cages being suspended from opposite ends of a beam, so that one is raised whilst the other is lowered.—T. F. B.

Dye-baths which dye animal and vegetable fibres directly orange or red-brown shades; Process for preparing ——. A. and E. Lederer. Ger. Pat. 264,915, March 15, 1913.

Fibres are dyed orange or red-brown shades in solutions prepared by heating with alkalis compounds of the furfurane group, especially furfural; the fibres may be subsequently soured. The shade and depth of the dyeing depends on the method of preparing the bath, *viz.*, time of heating, concentration, and nature of alkali. The colouring matter is precipitated from the solutions by acids. The hot dye-baths dye wool and silk without mordants; cotton is also dyed, but in fainter shades. —T. F. B.

Yellow shades on the fibre [by means of azo dyestuffs]; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 264,916, July 30, 1912.

The fibre is impregnated with a 1-aryl-3-methylpyrazolone and developed by means of diazotised 4-chloro-3-amino-1-toluene. Clear yellow shades, fast to washing, light, and chlorine, are obtained.—T. F. B.

Dyeings [with azo dyestuffs]; Process for producing fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ge.. Pat. 265,524, March 13, 1912.

Fibres are impregnated with a suitable amino-compound, diazotised, and the colours developed with di-1-aryl-5-pyrazolones, obtained by reducing tetrazo compounds of aromatic diamines to hydrazines and condensing these with β-ketonic acid esters. Fast shades are said to be produced.—T. F. B.

Dyeings on the fibre fast to rubbing, water, and washing; Process for producing ——. J. Weller. Ger. Pat. 266,343, March 9, 1913.

The fibre is impregnated with a cold solution of a dyestuff in a concentrated or somewhat diluted volatile organic acid, and the solvent is allowed to evaporate. The process may be applied to the colouration of skins, hairs, feathers, etc., and also made-up goods. The concentration of the acid should be at least 20 per cent.—T. F. B.

Bleaching fibrous materials; Process for ——. Luftbleiche Ges. m. b. H. Fr. Pat. 459,209, June 13, 1913.

See Ger. Pat. 262,047 of 1912; this J., 1913, 824.—T. F. B.

Velvet, plush, and other materials used in tapestry and for like purposes; Process for rendering —— *impermeable to dust.* J. Mendess. Fr. Pat. 459,048, June 10, 1913.

See Eng. Pat. 12,128 of 1912; this J., 1913, 360.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur production in Sicily. Oil, Paint, and Drug Rep., Nov. 10, 1913. [T.R.]

According to the report of the Compulsory Sicilian Sulphur Combine for the sixth working year from August 1, 1911, to July 31, 1912, the total production of sulphur was 366,457 tons, against 391,908 tons in 1910–11. This decrease is due, in part, to the closing of 16 mines. The total exports amounted to 447,638 metric tons in 1911–12 against 445,584 metric tons in 1910–11, while the stock on hand on July 31, 1912, was 444,381 metric tons. France took 112,897 tons; Italy, 72,686; Austria, 37,265 tons; Germany, 28,869; Sweden, 25,339; Russia, 22,838; and England, 20,674 tons. Sales for future delivery made during the working year amounted to 526,767 tons. The total production during the first six months of 1913 is given at 164,947 tons, while the exports during the same period amounted to 263,585 tons, and the stock on hand on June 30, 1913, was 346,760 metric tons.

Boric acid; Titration of ——. E. B. R. Prideaux. Z. anorg. Chem., 1913, **83**, 362—368.

Following the work of Friedenthal and Salm (Z. Elektrochem., 1907, **13**, 128) on indicators, the author employs "tropäolin O" (sodium *p*-benzene-azoresorcinolsulphonate) for the direct titration of boric acid without the addition of mannitol or of glycerin (see this J., 1904, 699). Soda is first neutralised by standard hydrochloric acid in the presence of methyl orange or *p*-nitrophenol, excess of sodium chloride not materially interfering with the accuracy of the method. The indicator is introduced as a 0·04 per cent. solution. The method is recommended for the estimation of boric acid in the commercial acid and in alkali borates.—H. H. S.

Alumina; Determination of —— *in bauxite.* W. Trautmann. Z. angew. Chem., 1913, **26**, 702—703.

Half a gram of the finely crushed bauxite is fused with sodium peroxide and a small amount of sodium carbonate. The melt is dissolved in as small a volume of water as possible and filtered into a graduated 500 c.c. flask. The filter is incinerated, the ash ground in an agate mortar, and the fusion repeated. The melt is dissolved and added to the first solution. The volume is made up to 500 c.c. and an aliquot portion filtered, strongly acidified with hydrochloric acid, carefully neutralised with ammonia, boiled, and filtered under pressure. The precipitate is washed once with faintly ammoniacal ammonium nitrate solution, rinsed back, dissolved in excess of nitric acid, re-precipitated with ammonia, and collected on the filter previously used. It is washed a few times with the above solution, and before igniting strongly, treated with 2 c.c. of hydrofluoric and 15 drops of sulphuric acid. After the acids are driven off, the residue is strongly heated.—W.R.S.

Lead salts; Double decomposition of sparingly soluble ——. F. Auerbach and H. Pick. Z. Elektrochem., 1913, **19**, 827—831.

When lead carbonate is treated with potassium carbonate the reversible reaction

$$3PbCO_3+K_2CO_3+2H_2O \rightleftarrows 2PbCO_3, Pb(OH)_2+2KHCO_3$$

takes place. At a given temperature the concentration of potassium (K) plotted against the equivalent percentage of $\frac{1}{2}$ CO_3 (*i.e.* at 0 per cent. $\frac{1}{2}$ CO_3 the solution contains only $KHCO_3$, at 100 per cent. only K_2CO_3) gives a smooth curve for solutions which are in equilibrium with both normal and basic lead carbonate. With sodium carbonate the equilibrium is complicated by the formation of a third solid phase

$$3PbCO_3, Pb(OH)_2, Na_2CO_3.$$

The three solids can coexist when the solution is about 0·08 *N* with regard to sodium, which is present to about 65 per cent. as carbonate and to 35 per cent. as bicarbonate. Normal lead carbonate cannot exist in contact with pure sodium carbonate at any concentration. If sodium sulphate is also present the results can only be represented graphically by a solid triangular diagram. This shows, for instance, that if lead sulphate be added to 0·1 *N*-sodium carbonate, white lead is first formed. (It is in fact an excellent laboratory method of obtaining pure white lead to digest lead sulphate with excess of dilute sodium carbonate.) On adding more lead sulphate the white lead is converted into the double salt, and finally into normal carbonate. In none of the systems studied was lead sulphate a stable phase and it can only be formed in presence of free carbonic acid, according to the following equation :—

$$PbCO_3+Na_2SO_4+CO_2+H_2O \rightleftarrows PbSO_4+2NaHCO_3.$$

Similar experiments with lead chromate and alkali carbonates gave somewhat different results. Owing to the great insolubility of normal and basic lead chromates, they are stable over a very large range of concentrations for the solutions, and the carbonates are only stable in a small region where the solution is poor in chromate.—W. H. P.

Lead in bismuth subnitrate and carbonate ; Detection of ——. G. Guérin. J. Pharm. Chim. 1913, **8**, 422—424.

In order to detect lead in bismuth subnitrate, 10 grms. are boiled for 3 minutes with 50 c.c. of a 5 per cent. solution of ammonium nitrate. When cold, the filtrate is tested by a few drops of potassium chromate solution. For the carbonate, 10 grms. are boiled with 100 c.c. of a 5 per cent. solution of ammonium nitrate, till the volume is reduced to 30—40 c.c., when the whole is evaporated to dryness on the water bath. 100 c.c. of water are added to the residue, and the mixture boiled again till the volume is about 40 c.c., when it is cooled and filtered. The filtrate is tested with potassium chromate solution. 1 mgrm. of lead as sulphate, carbonate or arsenate can be readily detected.—F. Shdn.

Silicates ; Hydrothermal formation of ——. P. Niggli and G. W. Morey. Carnegie Inst., Washington, Geophys. Lab., Rept. 17. Z. anorg. Chem., 1913, **83**, 369—416.

An essay on the hydrothermal synthesis of silicates, that is their formation by the action of steam on the components at high temperature and pressure. It is accompanied by a bibliography, and an index to minerals, of 81 papers arranged in chronological order, beginning from Schafhäutl's preparation, in 1845, of crystalline quartz by heating gelatinous silica with water.—H. H. S.

Carbon dioxide ; Action of —— *on boron sulphide.* N. D. Costeanu. Comptes rend., 1913, **157**, 934—935.

The action of carbon dioxide on boron sulphide is similar to its action on silicon sulphide (this J., 1913, 750). Boric anhydride is formed, with deposition of sulphur and evolution of carbon monoxide according to the equation : $B_2S_3+3CO_2=B_2O_3+3CO+3S$. The reaction commences feebly at 300° C. and is retarded by formation of layers of boric anhydride on the surface of the sulphide. At the temperatures used, *i.e.*, up to 650° C., boron trisulphide showed no signs of volatilisation. The preliminary preparation of the sulphide was effected by passing a mixture of hydrogen and hydrogen sulphide, in the proportion of 4 : 1, over boron in a porcelain tube heated to 1500° C. Dull white crystals about 1 cm. long were thus obtained. —H. H. S.

Radium industry in the United States. E. H. Heinrichs. Min., and Eng. World, Nov. 8, 1913. [T.R.]

The Standard Chemical Co., of Pittsburgh, owns the largest carnotite deposits in the world ; the mines in Colorado cover an area of 1100 acres. About 1 grm. of radium per month is being produced by the company.

New method for preparing realgar, and a source of error in the separation of arsenic and tin. Caron and Raquet. *See* XXIII.

Radioelements as indicators in analytical chemistry. [*Determination of the solubility of lead chromate and sulphide.* Paneth and Von Hevesy. *See* XXIII.

Patents.

Phosphoric acid from natural phosphates ; Process for separating ——. M. M. Haff, Assignor to T. L. Willson, Ottawa, Canada. U.S. Pats. 1,076,497 and 1,076,499, Oct. 21, 1913.

(1) One hundred parts of natural phosphate and 60 parts of a non-felspathic aluminium silicate are fused in an electric furnace, and the volatilised phosphoric acid is recovered. (2) Sufficient excess of free silica to prevent vaporisation of lime, is used instead of non-felspathic aluminium silicate. —O. R.

Acids ; Preparation of inorganic —— *from their salts by heating in presence of silicic acid.* E. Natho. Ger. Pat. 265,835, Sept. 7, 1912.

A mixture of equivalent proportions of the salt and of silica with a small quantity of water is heated in an autoclave. The reaction is complete at from 600°—800° C. —A. S.

Alkali salts ; Apparatus for the electrolysis of —— *with the aid of a movable mercury cathode.* Bosnische Elektrizitäts-A.-G. Ger. Pat. 265,414, March 19, 1912.

In apparatus, *e.g.*, of the Kellner type, in which a single bath is divided into anode and cathode compartments and in which the mercury is caused to circulate by means of gas or liquid under pressure, claim is made for disposing the circulating device outside the bath.—A. S.

Ammonia-soda ; Distillation process for the manufacture of ——. R. Timm. Ger. Pat. 265,686, Oct. 10, 1912.

The ammoniacal liquor passes through a coil in the lower part of the condenser, thence to the distilling column in which the free or loosely combined ammonia is expelled and finally to the still where it is distilled with lime. The condensed water from the condenser is used, whilst still hot, for slaking the lime, and the vapours from the slaking vessel pass to the upper part of the distilling column, mixing with the vapours evolved therein and passing on to the condenser.—A. S.

Common salt ; Manufacture of ——. International Salt Co., Ltd., London, A. W. Brown, Belfast, J. H. Webster, Carrickfergus, Ireland, and A. G. Salmon, London. Eng. Pat. 17,300, July 25, 1912.

Salt is melted, cooled and stirred and whilst partially cooled but still liquid, is introduced into a revolving pan. Whilst the latter revolves, a stationary rake is lowered into it, which stirs and breaks up the cooling salt, so that it solidifies in a granular form. The cooled salt may be removed by means of a scoop, which can be introduced into the revolving pan so as to empty the same automatically. —O. R.

Nitrates [*from caliche*] *; Extraction of* ——. H. L Sulman, H. F. K. Picard, and W. Broadbridge, London. Eng. Pat. 23,591, Oct. 15, 1912.

The crude material is ground and classified in a cold, saturated solution of caliche, whereby solution is prevented. The treatment may be effected in a rotary grinder, such as a tube mill, provided with doors for the removal of earthy and stony matter. The concentrate obtained is then treated with hot liquor in a series of mixers, suitably heated so as to effect progressive, differential solution of the nitrates, whilst keeping common salt undissolved as much as possible. The pulp, after the treatment with hot liquor, is subjected to vacuum filtration, the filter being enclosed in a chamber, which is maintained at a temperature sufficient to prevent crystallisation of salts in the filter. The hot liquor from the filter is passed to crystallisation tanks, from which, after separation of nitrate crystals, the mother liquor is returned to the solution mixer.—O. R.

Aluminium sulphate: Method of preparing ——. H. F. D. Schwahn, Belleville, Ill. U.S. Pat. 1,077,309, Nov. 4, 1913.

WET aluminous material is treated with a mixture of sulphur dioxide and ozonised air, with the formation of aluminium sulphate and basic iron sulphate: the mass is lixiviated with water, and ozonised air is passed into the solution until the last traces of iron sulphates are converted into insoluble, basic ferric sulphate, which is then separated from the aluminium sulphate solution.—O. R.

Salts of aluminium with formic acid alone or with formic and acetic acids together; Process for preparing sparingly soluble ——. A. Friedländer. Ger. Pat. 263,865, Sept. 5, 1906.

DRY aluminium hydroxide is heated with formic acid or with a mixture of formic and acetic acids, in absence of water. Similar products are obtained by heating the known monobasic compounds of aluminium and formic or acetic acid in a closed vessel, with a sufficient quantity of acetic or formic acid, respectively, to saturate the second valency. The products are much less easily soluble —T. F. B.

Calcium cyanamide; Manufacture of —— by the action of nitrogen on calcium carbide. Ing. Barzano e Zanardo. Fr. Pat. 456,826, April 18, 1913. Under Int. Conv., April 19, 1912.

THE calcium carbide, before treatment with nitrogen, is mixed with such a quantity of calcium cyanamide that a friable product is obtained, instead of a compact mass. The heat of reaction is fully utilised in heating successive charges, the carbide being intimately mixed, either in the reaction chamber itself (which may be rotary) or in a separate compartment, with a portion of the highly heated cyanamide from an immediately preceding operation.—F. SODN.

Metallic nitrides or cyanides [e.g., aluminium nitride]; Process and apparatus for preparing —— with oxides, or mixtures forming oxides, carbon or hydrocarbons, and nitrogen or gases containing nitrogen. W. Zänker. Fr. Pat. 458,519, May 28, 1913. Under Int. Conv., May 29, 1912.

THE reaction mixture, supported on a bed of refractory material, is conveyed through a tunnel kiln on trolleys, the gas containing nitrogen (*e.g.*, producer gas) passing in the opposite direction. The space within the furnace is divided into preheating, reaction, and cooling zones, the reaction zone being heated electrically, and there are end compartments, closed by shutters which allow the trolleys to be introduced and withdrawn without exposing the interior of the furnace to the outer air. Contact between the entering gases and the cooling product may be avoided by introducing the gases through flues disposed in the walls and arch of the cooling section, or the cold gases may be blown directly on to the hot product as it leaves the central zone, so as to cool it rapidly below the decomposition temperature.—F. SODN.

Hydrocyanic acid by synthesis: Processes of manufacture of —— from nitrogen and hydrocarbons. Soc. d'Electro-Chimie. Fr. Pat. 458,546, Aug. 8, 1912.

A MIXTURE of nitrogen, hydrogen, and hydrocarbons (for instance, 60, 32, and 6 per cent. respectively) is heated to a high temperature, *e.g.*, by means of the electric arc, and, after absorbing the hydrocyanic acid formed and adding sufficient nitrogen to maintain, with the hydrogen liberated, the concentration of the latter most favourable to the reaction, the heating is repeated. The gases circulate continuously from the gas-holder, through the furnace, cooling apparatus, and absorption apparatus, back to the gas-holder, and, when this is filled, are passed out of the circuit.—F. SODN.

Radioactive liquids; Process and products allowing of obtaining economically large quantities of ——. H. Farjas. Second Addition, dated Aug. 3, 1912, to Fr. Pat. 456,990, July 1, 1912 (this J., 1913, 1028).

RADIOACTIVE minerals or concentrates are mixed with plaster ["stuc"], which is so prepared as to become impervious or porous, according as it is desired to utilise both emanation and radiation or to obtain only a maximum of emanation.—F. SODN.

Silicates: Process of disintegration of ——. [*Extraction of nickel from garnierite.*] Mineral Products, Ltd. Fr. Pat. 458,432, May 2, 1913. Under Int. Conv., May 1, 1912.

SILICATES are treated with superheated steam under pressure, so as to produce metallic oxides and silicic acid. The process refers particularly to the decomposition of garnierite for the extraction of nickel.—F. SODN.

Ammonium sulphate prepared from the sulphur compounds of coal-distillation gases; Process for decolourising the ——. F. Dahl. Ger. Pat. 266,192, Sept. 12, 1912.

THE brown colour of ammonium sulphate, in the preparation of which the sulphur compounds of coal gas are used, is due to iron-thiocyanogen compounds; it can be permanently removed by treatment with a solution of a nitrogen compound, such as ammonia or uric acid. —T. F. B.

Hydrogen peroxide; Preparation of pure and highly concentrated —— from an alkaline-earth peroxide. Bariumoxyd Ges. m. b. H. Fr. Pat. 458,158, April 30, 1913. Under Int. Conv., May 1, 1912.

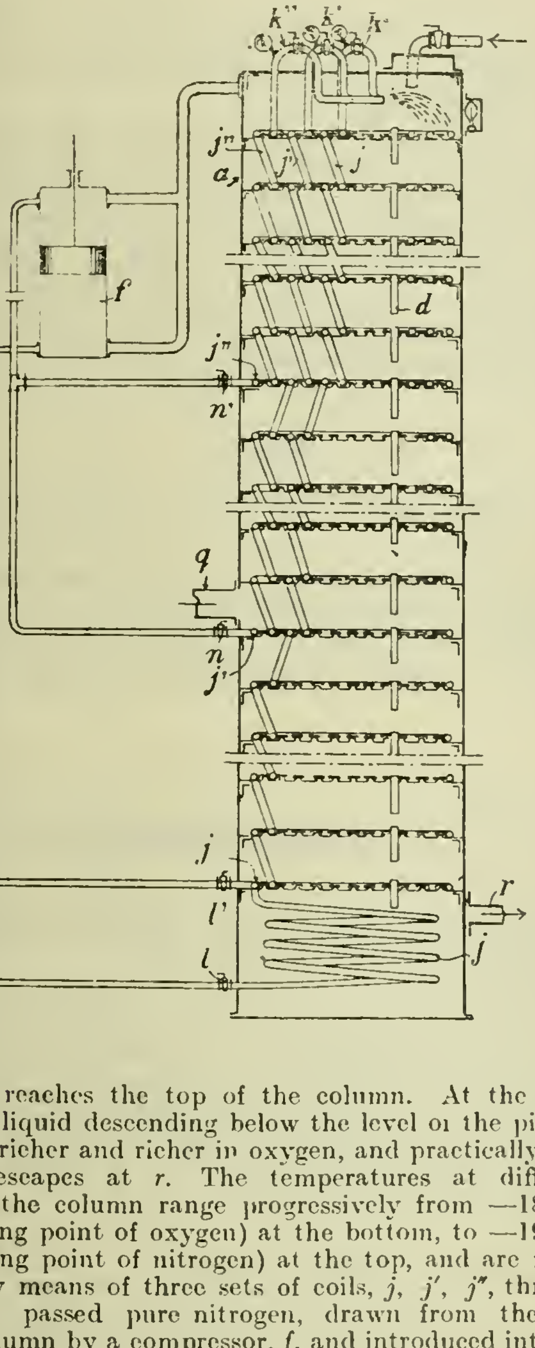
BARIUM peroxide or other metallic peroxide giving insoluble or sparingly soluble salts with phosphoric acid is treated with concentrated phosphoric acid (cooled if necessary), in sufficient quantity to effect complete decomposition. Sulphuric or other suitable acid may replace part of the phosphoric acid, the peroxide, for instance, being added to the phosphoric acid until precipitation is complete, the precipitated phosphate decomposed by adding sulphuric acid, further quantities of peroxide added to react with the phosphoric acid liberated, and so on. A stable product containing 10—30 per cent. of hydrogen peroxide is obtained.—F. SODN.

Hydrogen, Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 27,117, Nov. 25, 1912.

IN the manufacture of hydrogen by the interaction of carbon monoxide and steam in the presence of a hot catalytic agent, oxygen or air is passed into the catalytic chamber and combines with a portion of the hydrogen: the resulting combustion generates sufficient heat to render the process continuous, and the steam, which is formed, again takes part in the reaction and serves to reduce the quantity of steam needed from an external source.—O. R.

Gaseous mixtures [air]; Process and apparatus for the separation of —— into their constituents. R. P. Pictet. Fr. Pat. 457,031, July 2, 1912.

THE figure shows diagrammatically an apparatus for separating oxygen and nitrogen from air. The air, previously cooled to a temperature slightly above the liquefying point, is forced at a slight pressure through a pipe, *q*, into a tall fractionating column, *a*, where it passes upwards through a series of perforated trays and meets a descending stream consisting mainly of liquid nitrogen, which dissolves out the oxygen so that practically pure nitrogen reaches the top of the column. At the same time the liquid descending below the level of the pipe, *q*, becomes richer and richer in oxygen, and practically pure oxygen escapes at *r*. The temperatures at different parts of the column range progressively from —182° C. (the boiling point of oxygen) at the bottom, to —195° C. (the boiling point of nitrogen) at the top, and are maintained by means of three sets of coils, *j*, *j′*, *j″*, through which is passed pure nitrogen, drawn from the top of the column by a compressor, *f*, and introduced into the coils at pressures varying from 4·5 atmos. for the bottom coil to 1·2 atmos. for the top coil according to the temperature desired. The pressures are regulated by the cocks, *l*, *l′*, *n*, *n′*. The nitrogen in the coils causes the liquid in the trays to boil and itself becomes liquefied in the process, ultimately issuing in the liquid form from the pipes, *k*, *k′*, *k″*, at the top.—H. H.



Separation of mixtures of gases [air]; Process and apparatus for the ——. R. P. Pictet. First Addition, dated April 28, 1913 to Fr. Pat. 457,031, July 2, 1912.

In the apparatus described in the chief patent (see preceding abstract) in order to avoid trouble caused by the deposition of solid carbon dioxide, the lower part of the column is made conical and connected by a suitable valve with a vessel below. The mixture of liquid oxygen and solid particles of carbon dioxide collects in the lower vessel, and from time to time after closing the valve and placing the vessel in connection with an oxygen gasholder, nitrogen is liquefied in a coil contained in the vessel. The heat of liquefaction of the nitrogen serves to vaporise any liquid oxygen present. After the oxygen is removed, the solid carbon dioxide is emptied out and the vessel then again placed in communication with the rectifying column.—W. H. C.

Sulphuric acid: Manufacture of ——. A. Burkhardt, Berlin-Wilmersdorf. Eng. Pat. 29,568, Dec. 23, 1912.

See Fr. Pat. 452,682 of 1912; this J., 1913, 698.—T. F. B.

Furnace [for burning pyrites, etc.]. W. A. Hall, New York. U.S. Pat. 1,076,763, Oct. 28, 1913.

See Eng. Pat. 20,759 of 1912; this J., 1913, 1009.—T. F. B.

Sulphurous gases evolved from industrial furnaces; Process for utilising ——. D. Péniakoff. Fr. Pat. 459,926, Sept. 19, 1912.

See Eng. Pat. 21,476 of 1912; this J., 1913, 424.—T. F. B.

Metals and metal oxides: Process for preparing —— in a minutely divided state. H. Kast, Berlin. Eng. Pat. 19,006, Aug. 19, 1912.

See Ger. Pats. 256,962 and 263,648; this J., 1913, 426, 1011.—T. F. B.

Aluminium nitride and certain other nitrides; Process for the manufacture of ——. Soc. Générale des Nitrures, Paris. Eng. Pat. 10,975, May 9, 1913. Under Int. Conv., May 10, 1912.

See Fr. Pat. 457,650 of 1913; this J., 1913, 1010.—T. F. B.

Aluminium nitride; Process for the manufacture of ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,078,313, Nov. 11, 1913.

See Eng. Pat. 8348 of 1912; this J., 1912, 875.—T. F. B.

[Ammonium] sulphite; Process of oxidising —— by means of air or other oxidising gas. E. Collett, Christiania. U.S. Pat. 1,076,747, Oct. 28, 1913.

See Eng. Pat. 3124 of 1913; this J., 1913, 867.—T. F. B.

Ammonia; Process for producing pure ——. Badische Anilin und Soda Fabrik. Fr. Pat. 458,950, June 7, 1913. Under Int. Conv., Aug. 12, 1912.

See Eng. Pat. 25,259 of 1912; this J., 1913, 909.—T. F. B.

Alkalis from silicate rocks; Method of recovering ——. *Method of recovering alkalis from silicates.* S. Gelléri, Budapest, Assignor to A. Hambloch, Andernach, Germany. U.S. Pats. 1,078,495 and 1,078,496, Nov. 11, 1913.

See Ger. Pats. 247,496 and 258,702; this J., 1912, 686; 1913, 602.—T. F. B.

Hydrosulphites; Electrolytic process for making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 459,318, May 27, 1913. Under Int. Conv., July 6, 1912.

See Eng. Pat. 13,901 of 1913; this J., 1913, 977.—T. F. B.

Nitrogen; Electric furnace for the fixation of ——. E. K. Scott. Fr. Pat. 459,660, June 25, 1913. Under Int. Conv., June 26 and July 9, 1912.

See Eng. Pats. 14,871 and 16,014 of 1912; this J., 1913, 872.—T. F. B.

Sulphur and sulphates; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 459,713, June 26, 1913. Under Int. Conv., Sept. 17 and Oct. 15, 1912.

See Ger. Pats. 264,920 and 265,167 of 1912; this J., 1913, 1068.—T. F. B.

Hydrogen peroxide from the peroxide of an alkaline earth; Manufacture of pure, highly concentrated ——. Bariumoxyd Ges. m. b. H., Hönningen on Rhine, Germany. Eng. Pat. 10,292, May 1, 1913. Under Int. Conv., May 1, 1912.

See Fr. Pat. 458,158 of 1913; preceding.—T. F. B.

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Boron nitride ; Manufacture of ——. R. Heyder, Assignor to General Electric Co., New York. U.S. Pat. 1,077,712, Nov. 4, 1913.

SEE Eng. Pat. 21,865 of 1912 ; this J., 1913, 600.—T. F. B.

Silicious material of low density. W. C. Arsem, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,077,950, Nov. 4, 1913.

SEE Eng. Pat. 19,927 of 1912 ; this J., 1913, 790.—T. F. B.

Oxygen and hydrogen ; Electrolytic device for generating ——. R. Moritz, Wasquehal, France, Assignor to L. Heller and Son, New York. Reissue No. 13,643, Nov. 11, 1913, of U.S. Pat. 981,102, Jan. 10, 1911.

SEE Fr. Pat. 397,319 of 1908 ; this J., 1909, 799.—T. F. B

Hydrogen under pressure ; Process of working with ——. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,077,034, Oct. 28, 1913.

SEE Fr. Pat. 444,455 of 1912 ; this J., 1912, 1126.—T. F. B.

Nitrogen from the atmosphere ; Apparatus for obtaining ——. O. Frank and O. Fincke, Berlin. U.S. Pat. 1,078,423, Nov. 11, 1913.

SEE Eng. Pat. 10,718 of 1912 ; this J., 1912, 1032.—T. F. B.

VIII.—GLASS ; CERAMICS.

Glass containing copper ; Colouration of ——. A. Granger. Comptes rend., 1913, **157**, 935—938.

THE glasses studied were those of commercial application, having an acidity of 2·5—3·5 SiO_2. Blue is developed with high alkali content, as in the glass of formula : 0·75 Na_2O, 0·25 CaO, 0·05 CuO, 2·5—3·5 SiO_2, the acidity having no appreciable influence on the colour within the limits assigned, except that lower silica content tends to allow a surface deposition of metallic copper when the melt is run into a cold metal mould. This reduction to metal by rapid cooling is incidentally suggested as a method of obtaining copper-red. Replacement of CaO in the formula above by PbO, ZnO, BaO or MgO does not affect the blue tint, but magnesia is regarded as unsuitable for the manufacture of glass. Potash may be substituted for soda. Alumina may be added up to 0·1 equivalent, but above that amount produces a greenish glass. Boric oxide also tends to give a green colouration and renders the glass less transparent ; it is stated that boric glass some millimetres thick is almost opaque. If the alkali content of a blue glass be reduced and the heavier oxides increased, the blue proportionately decreases and the tendency to green increases. Increase of copper above 0·05 CuO acts in the same way. The production of a green without a trace of blue, however, is difficult within the commercial limits of fusibility unless iron oxide be added. A formula for such a glass is : 0·7 Na_2O, 0·15 CaO, 0·15 CuO, 0·0—0·25 Al_2O_3, 1·0 B_2O_3, 2·5 SiO_2.—H. H. S.

Optical glasses ; Double refraction of —— *and the influence thereon of chemical composition and shape.* E. Zschimmer and H. Schulz. Ann. Physik, 1913, [4], **42**, 345—396. Chem. Zentr., 1913, **2**, 1709.

THE strains produced during the cooling of lead glasses after annealing are greatest when the content of PbO is between 40 and 60 per cent. Extrapolation from the experimental results indicates that a glass containing about 76 per cent. PbO would show no double refraction, whatever method of cooling was used.—A. S.

Pottery glaze free from lead zinc, and barium. W. Rudolph. Z. angew. Chem. 1913, **26**, 703.

BORIC acid may be used as a substitute for heavy metals in the manufacture of easily fusible glazes (Seger cone 010—08) the composition of which is given as follows : (0·1—1·0 Na_2O, 0·0—0·5 K_2O, 0·0—0·65 CaO, 0·0—0·45 MgO) (0·2—0·8 Al_2O_3, 1·0—2·0 B_2O_3) (1·5—8 SiO_2).
—W. R. S.

Lead ; Determination of small quantities of ——*, obtained by extraction, in cooking utensils covered with lead glaze.* P. A. Meerburg. Chem. Weekblad, 1913, **10**, 752—758. Chem. Zentr., 1913, **2**, 1775.

A COMPARISON of the Dutch and German official methods (Z. anal. Chem., 1910, **49**, 741 ; this J., 1910, 353, 950) showed that the latter is the better. The Dutch method is open to the objections that the standard solution (1 mgrm. Pb, 1 drop of acetic acid and 1 drop of a 10 per cent. chromate solution in 100 c.c.) cannot be satisfactorily compared with the test-liquid, the colour and character of the turbidity being different in the two cases ; and that sodium chloride and other substances interfere in the colourimetric determination of lead.—A. S.

PATENTS.

Ovens, kilns and the like. Eng. Pat. 23,863. *See* I.

Glass ; Liquid for cleaning ——. H. Schroer, Düsseldorf, Germany. Assignor to C. Gossweiler, Olten, Switzerland. U.S. Pat. 1,077,860, Nov. 4, 1913.

SEE Eng. Pat. 222 of 1913 ; this J., 1913 488.—T. F. B.

IX.—BUILDING MATERIALS.

Wood ; Preservation of —— *with fluorides.* R. Nowotny. Z. angew. Chem., 1913, **26**, 694—700. (See also this J., 1912, 434.)

DETAILED tables are given showing the mode of application and comparative efficacy of various preservatives in actual practice, the observations extending over a period of six years. Fluorides (*e.g.*, NaF and $ZnF_2,2HF$) are much stronger antiseptics than copper sulphate or zinc chloride ; they have the advantage over creosote in being colourless and odourless, and are recommended for scaffolding and mining timber.—W. R. S.

Roads ; Action of calcium chloride on ——. F. R. Newman. J. of Phys. Chem., 1913, **17**, 703—706.

THE usefulness of calcium chloride for laying dust depends only on the presence of free calcium chloride in the soil ; very little calcium chloride is adsorbed by sand or by soil, and consequently it can be washed out readily. Thus there appears to be no basis for the claim that two dressings with calcium chloride are sufficient to keep a road free from dust for the whole summer.—T. F. B.

PATENTS.

Bricks and other refractory products having spinel as a binding medium ; Process of manufacture of ——. K. A. Mankau, St. Petersburg. Eng. Pat. 23,725, Oct. 17, 1912. Addition to Eng. Pat. 14,981, June 22, 1910.

SEE Fr. Pat. 449,363 of 1912 ; this J., 1913, 489.—T. F. B.

Refractory and heat-insulating material. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 25,370, Nov. 5, 1912.

SEE U.S. Pat. 1,072,414 of 1913 ; this J., 1913, 1070.—T.F.B.

Wood ; Process and apparatus for impregnating ——. L. Dautreppe, Brussels. Eng. Pat. 6179, March 12, 1913.

SEE Fr. Pat. 455,556 of 1913 ; this J., 1913, 946.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Pig-iron and steel; Rapid determination of manganese, vanadium and titanium in presence of one another in ——. C. W. Wright. Chem. News, 1913, **108**, 248—249.

The method is an extension of that given by H. Brearley ("Analysis of Steel Works Materials," p. 90) for the determination of vanadium, and is stated to give results sufficiently accurate for most works purposes. 1·1 grm. of the sample is dissolved in 35 c.c. of nitric acid (sp. gr. 1·2), the filtered solution heated with sodium bismuthate to destroy organic matter, cleared with sulphurous acid and cooled; an excess of bismuthate is then added, the solution filtered through asbestos, and the filter washed with dilute nitric acid (3 per cent.). After the addition of an excess of $N/10$ ferrous sulphate, the liquid is titrated with $N/20$ permanganate (2 or 3 drops per sec.) until a distinct retardation of the rate at which the pink colour disappears is noted, this change indicating the point at which the oxidation of the vanadium commences; the reading is then taken, the titration continued to a permanent pink tint, and the quantities of vanadium and manganese calculated. Titanium is determined, in the titrated liquid, by the hydrogen peroxide method, the colour comparison being made with a solution of a similar steel or pig-iron, free from vanadium and titanium, which has reached a similar stage, and to which the quantity of vanadium found in the assay is added before the standard titanium solution.—W. E. F. P.

Zinc-iron alloys; The structure and properties of —— prepared by fusion under pressure. U. Raydt and G. Tammann. Z. anorg. Chem., 1913, **83**, 257—266.

A series of alloys was prepared containing from 26·6 to 96—97 per cent. Fe by melting the metals in an electrically heated bomb under pressure of hydrogen (55 to 60, rising to 110—130 atmospheres). The loss in zinc was normally about 35 per cent. The examination of the alloys showed that with up to 80 per cent. Fe, the constituents were the compound, $FeZn_3$, and a solid solution of zinc in iron, containing up to 20 per cent. Zn. Microscopically the alloys with between 26 and 80 per cent. Fe showed white crystals of the solid solution surrounded by dark crystals of $FeZn_3$. All the alloys were magnetic at the ordinary temperature. The transformation temperature was 647° C ± 7° for alloys with from 26 to 67 per cent. Fe, rising to 771° C. as the iron content was increased. The hardness of the saturated solid solution was between 4 and 5 on Mohs' scale, exceeding slightly that of iron. The alloy with 96 per cent. Fe could be forged cold, but was more brittle than iron. Hot forging caused loss of zinc. The alloy with 80 per cent. Fe was markedly more brittle and could not be worked cold, and the alloys richer in zinc, and containing $FeZn_3$, were still more brittle.—T. St.

Iron-cobalt; The system ——. R. Ruer and K. Kaneko. Ferrum, 1913, **11**, 33—39.

The melting point falls from 1594° C. for pure iron down to a minimum at 1475° C. (40—30 per cent. Fe), then rises to 1491° C. for pure cobalt. The curve for the δ-γ transformation rises from 1420° C. for iron to 1493° C. with 15·5 per cent. Co, and is then horizontal to 22 per cent. Co. Alloys with over 22 per cent. Co crystallise at once into the γ-modification. The γ-β transformation curve rises from 875° C. for pure iron to 920° C. for 85 per cent. Fe. At this point it joins the β-α transformation curve. This rises from 767° C. for pure iron to a maximum of 983° C. for 55 per cent. Fe, and then drops to 873° C. for 30 per cent. Fe. From the cobalt side, the curve for loss of magnetic properties falls in a straight line from 1107° C. to 888° C. for 25 per cent. Fe, and cuts the curve from the iron side between 30 and 25 per cent. Fe. Sections of the alloys with from 100 to 30 per cent. Fe showed large polygons, which had apparently disintegrated at the transformation points. Alloys with from 20 to 0 per cent. Fe contained only large polygons, usually with twinning planes. The alloy with 25 per cent. Fe was not so homogeneous as the others. As at this concentration two curves intersect, it is probable that there are two crystal modifications in equilibrium at this point.—T. St.

Iron-copper; The system ——. R. Ruer and K. Fick. Ferrum, 1913, **11**, 39—51.

The liquidus curve of Fe-Cu alloys falls almost regularly from the melting point of iron (1524° C.) to 1440° C. (74 per cent. Fe), and then very gradually to 1410° C. (25 per cent. Fe), after which it drops rapidly to 1084° C. for 100 per cent. Cu. The δ-γ transformation temperature rises from 1420° C. with 100 per cent. Fe to 1475° C. with 95 per cent. Fe. The transformation was not observed in alloys with less iron. The γ-β transformation was considerably affected by the previous heat-treatment of the alloy, due no doubt to a strong tendency to undercooling. With all alloys containing more than 10 per cent. Fe, the curve fell from 875° C. for iron to 810° C. with 96 per cent. Fe, and then became horizontal. The β-α transformation was investigated magnetically. The change was still distinct with 5 per cent. Fe, but was scarcely perceptible with 3 per cent. Fe. Magnetic properties were observed at the ordinary temperature with 2, but not with 1 per cent. Fe. The curve fell from 767° C. for iron to 758° C. with 1 per cent. Cu, and then is horizontal. When equal weights of copper and iron were melted together, and then allowed to cool, no separation took place if the iron contained less than 0·08 per cent. C, but when carbon was added, the melt, in general, separated into an upper iron-rich layer and a lower copper-rich layer. This is ascribed to the effect of carbon in removing the oxide films which prevent the separation of the two constituents. The equilibrium diagram indicates that the iron-rich constituent contains 74 per cent. and the copper-rich constituent 29 per cent. Fe, but in the experiments values differing from these were obtained owing to incomplete separation of the two layers. Microscopically the iron-rich alloys with up to 8 per cent. Cu, and also the copper-rich alloys with up to 2·5 per cent. Fe were completely homogeneous. The specific electrical resistance of iron rises sharply with addition of copper up to 1 per cent., then with increasing copper falls, first quickly, then more slowly. The specific resistance of copper increases very rapidly with addition of iron up to 0·5 per cent., and then more slowly with further additions.—T. St.

Ferric oxide; Reduction of —— by ferrous sulphide. L. T. Wright. Eng. and Min. J., 1913, **96**, 825—826.

The author states that the reaction between ferrous sulphide and ferric oxide is not correctly represented by the equation commonly given in text-books (Roberts-Austen, Introduction to Metallurgy, 4th Edit., p. 348): $FeS+3Fe_2O_3=7FeO+SO_2$. It is stated that magnetic iron oxide is commonly present in copper mattes along with ferrous sulphide and that these two compounds do not interact at furnace temperatures; that magnetic oxide and not ferrous oxide is produced by melting together ferrous sulphide and ferric oxide; and that nearer 10 mols. than 3 mols. of ferric oxide are required to oxidise the sulphur of ferrous sulphide. The reaction may possibly be represented by the equation: $FeS+10Fe_2O_3=7Fe_3O_4+SO_2$.—A. S.

Copper covered or copper clad steel. J. O. Handy. J. Ind. Eng. Chem., 1913, **5**, 884—895.

A brief description of the manufacture, properties, and uses of steel covered with a layer of copper either by alloying or welding, and including extracts from patent specifications and a bibliography of U.S., English, German, French and Belgian patents on the subject. It is stated that a union capable of withstanding mechanical working can be obtained both by the alloying method, in which the copper is melted, and by welding, when the copper is only rendered plastic by heating, for example, to 950° C. Melted copper dissolves iron very rapidly, and since the electrical conductivity of copper is diminished by the solution of iron therein, the welding process is more satisfactory for the manufacture of copper-clad wire. Sheets of copper-clad steel exposed to the moist, acid atmosphere of Pittsburgh, U.S.A., showed very little corrosion, even after 2 years. Copper-clad wire is now largely used, but the use of other forms of copper-clad steel might advantageously be extended in many directions, especially for constructional purposes.—A. S.

Copper ; Deoxidising action of some metals on industrial ——. P. Jolibois and P. Thomas. Rev. Mét., 1913, **10**, 1264—1270.

THE samples were prepared by melting together copper containing cuprous oxide, and the various metals or their copper alloys. Arsenic and antimony have no deoxidising effect ; tin, zinc, magnesium, and lead reduce the cuprous oxide. Lead does not form solid solutions with copper, but separates in the free state and hence the metal is rendered brittle, but this may be counteracted by addition of arsenic, the lead forming a solid solution with copper arsenide.—W. R. S.

Copper ; Rapid refining of —— with a rotating cathode. C. W. Bennett and C. O. Brown. J. of Phys. Chem., 1913, **17**, 685—694.

THE authors have devised an apparatus for refining copper electrolytically, especially for laboratory demonstration purposes ; the cathode, which has an effective surface of about 100 sq. cm., is rotated at the rate of about 5500 revs. per minute. Using a current density of about 70 amps. per 100 sq. cm., about 125 grms. of copper can be deposited in 1½ hours. Experiments were carried out on the refining of copper containing about one per cent. of each of the impurities usually found in the commercial metal, and satisfactory results were obtained, arsenic being the most difficult to remove, though the amount of this remaining in the refined product was very minute. The statement of Kiliani that the silver, present as impurity in copper anodes, dissolves in neutral copper sulphate electrolytes, was not confirmed.—T. F. B.

Copper rich "kalchoids" (copper-tin-zinc alloys). S. L. Hoyt. Inst. of Metals, Aug., 1913. [Advance proof.]

THERMAL and micrographic examination of Cu-Sn-Zn alloys containing up to 50 per cent. Zn and 30 per cent. Sn, showed no fundamental difference in the behaviour of these alloys in solidifying, from that of Cu-Sn and Cu-Zn alloys The eutectoid surface has a maximum corresponding to Cu 66, Sn 17, Zn 17 per cent., and 590° C. The addition of tin to the brasses caused the visible breakdown of the β solid solution, the amount of tin necessary varying with the zinc content and with the rate of cooling. Solid Cu-Sn alloys with from about 12 to 26 per cent. Sn show two heat effects, one at 590° C., corresponding to the inversion $\beta \rightleftarrows \alpha+\gamma$, and one at 525° C., corresponding to the inversion $\gamma \rightleftarrows \alpha+\delta$. The former, which is very weak compared to the latter, becomes more marked as the β content increases, but disappears entirely when the tin content reaches 25 per cent.—T. ST.

Nickel-copper-silver alloys ; Ternary ——. P. De Cesaris. Gaz. chim. ital., 1913, **43**, II., 365—379.

THE author examined 85 alloys by the method of thermal analysis and the results are given in a table, and also in a triangular diagram in which the isotherms from 1425° to 1100° C. at intervals of 25° and from 1100° to 800° C. at intervals of 100° are plotted. In all cases solid solutions of nickel and copper separate first, followed by a secondary separation of silver or a solid solution of silver and copper. During the secondary separation the composition of the liquid changes until it coincides with that of the binary copper-silver eutectic, which is the most fusible constituent of the ternary system. The immiscibility in the liquid state observed in the binary alloys of silver and nickel persists in the ternary system up to a copper content of 50—55 per cent. Micrographic examination confirmed these results, the only constituents which could be detected being the nickel-copper solid solution, silver (or silver-copper solid solution) and silver-copper eutectic. Of the following alloys :—

	(1)	(2)	(3)	(4)	(5)	(6)
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Silver .	40	20	18	30	20	10
Copper.	40	50	50	50	55	60
Nickel .	20	30	35	20	25	30

Nos. 1, 2 and 3 were composed of two layers, whilst Nos. 4, 5, and 6 were homogeneous.—A. S.

Amalgams containing silver and tin. W. A. Knight and R. A. Joyner. Chem. Soc. Proc., 1913, **29**, 282—283.

IT was again shown that the ageing of alloys of silver and tin is not due to superficial oxidation. A bar of alloy does not age appreciably even after fifteen days at 115° C., whereas filings of the same bar are aged after half an hour at 100°. Hence it is concluded that ageing is not due to any uncatalysed change in the Ag_3Sn contained in the alloy. It was also proved that ageing is not due to absorption of oxygen by the filings.

The equilibrium of the metals silver, tin, and mercury at temperatures of 63°, 90°, 166°, and 214° C. has also been studied. The liquidus has been completely determined at these temperatures, and consists of a line roughly parallel to the Sn-Hg side of the equilateral triangle. At 63° this line only extends about one-tenth of the distance across the diagram, whereas at 214° it stretches nearly the whole way across. The solidus has not, as yet, been determined accurately, but there are good reasons for considering that, commencing at the point Ag_3Hg_4, it extends across the diagram roughly in the direction of Ag_3Sn. It has been proved that the substances represented by points on the solidus must be solid solutions.

Carbides of manganese. S. Hilpert and J. Paunescu. Ber., 1913, **46**, 3479—3486.

THE well-known stable carbide, Mn_3C (6·83 per cent. C), is formed when the metal is melted in contact with excess of carbon ; while a compound, MnC_2 (30·38 per cent. C), has also been described. The authors have obtained products of intermediate carbon content by carburetting the pure powdered metal (made from manganese amalgam) in the electric furnace at definite temperatures between 600° and 900° C. with pure methane (from aluminium carbide), or with a mixture of equal volumes of methane and hydrogen. With methane the product contained from 5 per cent. C (at 600°) to 28 per cent. (at 900° C.) after 5 hours. A definite equilibrium was attained at each temperature after an average time of 9 hours, when using a mixture of methane and hydrogen, the carbon content ranging from 6 per cent. at 600° to 15 per cent. at 900° C. These proportions do not correspond to simple compounds. Below 800° C. no action occurs in the absence of a trace of carbide or other suitable catalyst. The products containing up to about 7 per cent. C are magnetic, fairly stable in moist air, and completely soluble in dilute acid with evolution of methane. The more highly carburetted products are non-magnetic, unstable in moist air, and with dilute acids yield deposits of carbon and fatty material in addition to a gaseous mixture of saturated and unsaturated hydrocarbons.—J. R.

Manganese and cobalt ; The alloys of ——. K. Hiege. Z. anorg. Chem., 1913, **83**, 253—256.

THERMAL examination of Mn-Co alloys indicated an unbroken series of solid solutions. The melting point of manganese is 1260° C., and that of cobalt 1525° C. The curve showed a minimum at about 1160° C. and 30 per cent. Co. The micro-structure of the alloys with up to 40 per cent. Co consisted of homogeneous crystallites. In alloys richer in cobalt (up to 80 per cent. Co) the crystallites had inner and outer zones of different compositions, but could be rendered homogeneous by annealing at 1000° C. for 5 hours, embedded in magnesia as a protection against oxidation. With 90 per cent. Co a longer time or a higher temperature appeared to be necessary to render the crystals homogeneous. Alloys with more than 40 per cent. Co showed marked magnetic properties, which increased in intensity with the cobalt content. The transformation temperature (on cooling) was 1150° C. for cobalt, and dropped regularly to 950° C. for an alloy with 40 per cent. Mn.—T. St.

Molybdenum-cobalt alloys. U. Raydt and G. Tammann. Z. anorg. Chem., 1913, **83**, 246—252.

Alloys containing up to 65 per cent. Mo were obtained by melting the metals together; richer alloys were unobtainable by heating to 1800° C. Alloys with 83 and 90 per cent. Mo were obtained by the thermite process, but they contained appreciable quantities of aluminium and silicon. The results of the thermal investigation can be summarised as follows, working from the cobalt side of the diagram:—Melting point of cobalt, 1480° C.: from 0 to 28 per cent. Mo, solid solution of molybdenum in cobalt; 28 to 37 per cent., solid solution and eutectic; eutectic with 37 per cent. Mo, m. pt., 1332° C.: 37 to 62 per cent., eutectic and the compound MoCo, m. pt., 1484° C.; above 62 per cent., the compound, MoCo, and either primary molybdenum or a solid solution poor in cobalt. No evidence of a second compound was obtained. The micro-structure of the alloys confirmed the thermal results. The solid solution of molybdenum in cobalt forms polyhedra. The compound, MoCo, appears in the eutectic in long needles, and the primary molybdenum as rounded crystallites enclosed in the crystals of MoCo. The alloys containing 83 and 92 per cent. Mo showed white crystallites of primary molybdenum in a dark ground. Magnetic properties were observed only in the alloys with not more than 60 per cent. Mo. The transformation point of cobalt is at 1134° C. With increasing molybdenum up to 28 per cent. (the concentration of the saturated solid solution) the temperature of the change drops to 750°—780° C.—T. St.

Palladium and nickel; The alloys of ——. F. Heinrich. Z. anorg. Chem., 1913, **83**, 322—327.

Cooling curves and microscopic appearance both indicate that palladium and nickel form a continuous series of solid solutions. The equilibrium diagram shows a flat minimum between 40 and 60 per cent. Pd. The alloys are all more quickly attacked by concentrated nitric acid than the individual metals, and palladium more quickly than nickel, the alloy with 6 per cent. Pd being most quickly attacked of all. Alloys with up to 87 per cent. Pd possess magnetic properties but the magnitude falls rapidly from about 40 per cent. Pd. The transformation temperature varies but little for alloys with up to 40 per cent. Pd, but falls rapidly with higher percentages. Pd-Ni alloys can be forged to a certain extent, the nickel-rich alloys being somewhat more easily worked. The hardness of the alloys is not much different from that of the components, but increases somewhat with increasing palladium content.—T. St.

Aluminium-tin; The binary system ——. R. Lorenz and D. Plumbridge. Z. anorg. Chem., 1913, 83, 243—245.

The equilibrium diagram corresponds to the simple eutectic type, no compounds being formed. The eutectic contains 98 per cent. (atomic) Sn, and melts at 229° C. —T. St.

Zinc-tin, zinc-cadmium, tin-cadmium; The binary systems —— and the ternary system zinc-tin-cadmium. R. Lorenz and D. Plumbridge. Z. anorg. Chem., 1913, **83**, 228—242.

The binary Zn-Sn, Cd-Zn, and Sn-Cd alloys all belong to the class in which the constituents separate in practically the pure state. The Zn-Sn eutectic contains 13·5 per cent. (atomic) Zn, and melts at 199° C. That of Cd-Zn contains about 73·5 per cent. (atomic) Cd, and melts at 263° C. That of Sn-Cd contains 30 per cent. (atomic) Cd and melts at 177° C. The ternary Sn-Cd-Zn alloys give a single eutectic containing Sn 71, Cd 25, Zn 4 per cent. (atomic), the melting point being 163° C. An arrest is shown at 120° C. corresponding to the formation of the compound Sn_4Cd in the solid alloys.—T. St.

Thallium, tin, zinc, and nickel; The alteration of the properties of —— at the polymorphic transformations. M. Werner. Z. anorg. Chem., 1913, **83**, 275—321.

Thallium. The transformation temperature of thallium falls almost uniformly from 226° C. at a pressure of 1 kilo. per sq. cm. to 220° C. at 3000 kilos. per sq. cm. The electrical resistance of newly drawn "hard" wire is about 7·5 to 8 per cent. greater than that of "soft" wire, which has been heated through the transformation point.

Tin. The heat of transformation of tetragonal to rhombic tin amounts to about 0·02 calorie per grm., the corresponding change in volume being about 0·00017 c.c. per grm. The electrical resistance curve of tin, and the thermoelectric curve of the tin-nickel-thermoelement both show change points at 160° C. *Zinc.* The transformation point of zinc as determined from cooling curves and by electrical resistance measurements is 304° C. The thermoelectric curves of the zinc-platinum and zinc-iron-thermoelements give change points at 300° C. No transformation point at 170° C. was shown by determinations of the upper elastic limit at different temperatures.

Nickel. The transformation temperature was found from cooling curves to be 352° C., the heat of transformation being about 0·013 calorie per grm. Electrical resistance and magnetic permeability measurements both gave 365° C., and the thermoelectric curve of the nickel-copper thermoelement gave 355° C. No alteration in volume accompanies the transformation, and "hard" and "soft" wires do not give different transformation points by the resistance measurements. It appears therefore that no re-orientation of the crystalline structure takes place at the transformation point.—T. St.

Passivity of metals. G. Senter. Faraday Soc., Nov. 12, 1913. [Advance proof.] (See also succeeding abstracts.)

The author gives an outline of the more important phenomena of passivity, and discusses the various theories which have been advanced to account for them. It is probable that no one theory will account for all the phenomena. The oxide-film theory is deficient in many respects, yet doubtless in some cases of electrolysis the formation of insoluble films on the electrodes is responsible for behaviour generally attributed to passivity. Of the other theories the one in which the passive metal is assumed to be of a different (higher) valency has not met with much support recently, since it fails to account for numerous specific actions of anions, and for the sudden changes of condition which are often observed. A more popular theory is the hydrogen activation theory according to which the normal state of the metal is passive, and it only becomes active under the influence of a catalyst which is presumed to be hydrogen or hydrogen ions. This explains the remarkable activating effect of nascent hydrogen, but it is difficult to reconcile the activating effect of free halogens with the assumption that iron free from hydrogen is necessarily passive. The sudden changes of condition are not so readily explained, however, by any other theory. Other suggestions are that passivity is due to the accumulation of a charge of gaseous oxygen which only reacts slowly with the metal. This theory accounts for the removal of passivity by rising temperature; it is not inconsistent with the fact that the reflecting power of polished iron is unaltered on its becoming passive, and it is compatible with the observation that the curve of gradually increasing activity does not correspond with that of gradually increasing passivity. It is however defective in many other respects. It does not account for the behaviour of chromium in hydrogen iodide, for the action of alkalis, for the fact that iron becomes passive on heating in nitrogen and for the fact that some metals which combine readily with oxygen under other conditions can become passive, when they presumably must combine with it very slowly. Another view is that the main process at an anode is not the formation of metal ions but the discharge of anions and that when this takes place slowly the anode is passive, and finally Le Blanc (Lehrbuch der Elektrochemie, 5th Ed., p. 283) proposes the view that the slow process is one of hydration of the ions of the metal.—W. H. P.

Iron; Photoelectric behaviour of —— and the theory of passivity. H. S. Allen. Faraday Soc., Nov. 12, 1913. [Advance proof.]

Iron which is chemically active shows a relatively large photoelectric activity, *i.e.*, it loses a negative charge fairly rapidly when insulated and illuminated by ultraviolet light. Processes which render the iron passive greatly reduce this activity. These facts are in good agreement with the theory that the cause of passivity is to be found in the presence of a gaseous layer at the metallic surface. This theory like the oxide-film theory was originally put forward by Faraday.—W. H. P.

Anodic reactions; Mechanism of —— and the behaviour of iron and nickel anodes. E. P. Schoch. Faraday Soc., Nov. 12, 1913. [Advance proof.]

The author seeks to explain the phenomena of passivity by inquiring into the specific relation between the anion and the anode metal. With current densities below a certain limit the ions are discharged on the electrodes and react with velocities depending on the specific relation between the anion and metal. If the surface of the anode becomes covered with anions the production of oxygen ions begins and produces a permanent effect by formation of an oxide film or a layer of oxygen. The range of current densities in which the permanent effect is not produced is increased by all factors which promote reaction between metal and anion, *e.g.*, rise of temperature, stirring, etc. An increase in the hydrogen ion concentration prevents to some extent the formation of oxygen ions so that a higher P.D. is required in acid solutions to cause the formation of oxygen ions. Finally the different anions may be arranged in a series in which it is found that those which require only small current densities to produce a permanent effect on the anode surface, are the ones which would most easily give rise to oxygen ions, *e.g.*, hydroxyl, iodate, bromate, chlorate, etc. The author believes that the following experimental evidence decides in favour of his views against the hydrogen catalysis theory (see succeeding abstract). A chromium anode which has been made passive with reference to the formation of divalent ions, does not become active again to form trivalent ions but to form chromate ions. An iron or nickel anode which has become passive with reference to the formation of divalent ions does not become active again to form trivalent ions. When electrolysed in acetate or oxalate solution the electrode becomes active again at potentials considerably below those at which it ceased to be active before and at which it would be passive in other electrolytes. In all three cases the activity at the lower potential is due to a reaction which consumes oxygen and lays the metal surface bare (formation of chromate, oxidation of acetate or oxalate).—W. H. P.

Passivity. G. C. Schmidt and W. Rathert. Faraday Soc., Nov. 12, 1913. [Advance proof.]

Nickel and chromium remained passive when subjected to friction in an atmosphere of hydrogen under conditions in which *no* oxide film could remain. Iron under similar conditions was always active, but it is known always to contain appreciable quantities of hydrogen. If chromium is deposited electrolytically on an inactive sample of the metal prepared by the Goldschmidt process, the electrolytic chromium being active on account of its hydrogen content dissolves and under the influence of the evolved hydrogen the remaining metal also dissolves. An iron plate which is rendered just passive by exposing one side to a dilute solution of chromic acid becomes active at once when hydrogen is evolved on the other side of the plate owing to diffusion of the hydrogen, and continues active when the supply of hydrogen is interrupted. Similar results are obtained with chromium deposited on steel. The author considers that these results establish the validity of the hydrogen-catalysis theory of activity, according to which the passive metal is in a similar condition to that of water in the absence of air, which does not boil even when its vapour pressure is equal to that of the superincumbent atmosphere. Just as small amounts of air initiate the rapid evaporation of large quantities of liquid, so a small quantity of hydrogen can activate large quantities of iron, nickel, or chromium. —W. H. P.

Colouring metals; Investigations on processes for ——. E. Beutel. Z. angew. Chem., 1913, **26**, 700—702.

The colourations ("*Lüstersudfärbungen*") are produced when metals or alloys are immersed in hot solutions of complex thiosulphates, tartrates, etc., of certain metals, chiefly copper and lead, and are due to the deposition of thin films on the metal. In a solution of lead acetate and sodium thiosulphate brass becomes deep yellow, light violet, deep blue, light steel blue and eventually gray (after one minute's immersion) while lead sulphide separates from the solution. Platinum remains unchanged under the same conditions, but becomes coloured at once in contact with copper. If two sheets of platinum foil connected to a thermo-couple be immersed in the same bath, the cathode becomes coated with lead sulphide which at very low current density (0·001 amp. per sq. cm.) deposits as a coloured film. The process is thus electrochemical, copper going into solution in the case of brass. The deposit is devoid of structure and consists of pure lead sulphide; its thickness is estimated at 0·025—0·071 μ. Alkaline copper tartrate solution to which glucose has been added gives a film of cuprous oxide.—W. R. S.

Radioelements; Electrochemical behaviour of ——. F. Paneth and G. v. Hevesy. Monats. Chem., 1913, **34**, 1593—1603.

The chemical identity of certain radioelements with other elements, referred to by Soddy (this J., 1911, 84; see also this J., 1913, 424), extends also to their electrochemical behaviour. The decomposition potential of thorium C_1 and radium E is the same as that of bismuth, that of radium D and thorium B the same as that of lead, and that of radium A about the same as that of polonium. The electrolytic separation of thorium C_1 and radium E is hence retarded by addition of bismuth and that of thorium B by lead, and these facts may be utilised to obtain a more complete electrochemical separation of radioelements than has hitherto been possible.—A. S.

Polonium; Isolation of ——. F. Paneth and G. v. Hevesy. Monats. Chem., 1913, **34**, 1605—1608.

A hot saturated solution of radiolead nitrate is allowed to crystallise and the mother liquor separated, or a solution of radiolead nitrate may be enriched in polonium by dialysis (this J., 1913, 362). The neutral saturated solution is then diluted slightly, and electrolysed with the aid of platinum electrodes, after addition of a few mgrms. of a bismuth salt to hinder the separation of radium E (see preceding abstract). To obtain a deposit free from radium E, the cathode potential must not exceed $E_{Hg} = -0·08$ volt (corresponding to a current of 0·16 milliamp. per sq. cm.), but if polonium free from lead and not from radium E is all that is desired, a cathode potential of $E_{Hg} = -0·5$ volt (current=0·4 milliamp. per sq. cm.) may be used; or the solution may be treated with sufficient nitric acid to prevent cathodic separation of lead, and then electrolysed with a current of 0·1 ampère, the lead being deposited as peroxide on the anode and the polonium on the cathode. In the case of the neutral solution the polonium may be deposited, without the use of an external source of current, by immersing a sheet of copper in the solution: over 80 per cent. of the polonium is recovered. To remove the deposited polonium from the platinum or copper electrode, this is heated to about 1000° C. in a weak current of carbon dioxide or hydrogen in a quartz tube, and a piece of sheet platinum (or palladium) is hung in the cooler part of the tube (at 700°—900° C.); practically the whole of the polonium is condensed on the platinum; other metals (gold, copper, nickel) cannot be used in a similar manner.—A. S.

Minerals ; Utilisation of surface energies for the separation of ——. M. Moldenhauer. Kolloid-Zeits., 1913, **13**. 229—235.

The author reviews different types of flotation processes for the concentration of ores. In the processes in vogue at present, both an oil emulsion and a froth are produced in the mixture of ground ore and water (ore pulp), the froth being produced in three different ways : (1) the mixture is subjected to a vacuum. whereby the air dissolved in the water is liberated (Elmore vacuum process) ; (2) the mixture is rendered faintly acid and subjected to vigorous agitation at an increased temperature, whereby more air is entrained than can be dissolved (Minerals Separation Ltd. process) ; (3) the mixture is acidified and treated at an increased temperature with an easily decomposable carbonate (process of the Bergbau-A.-G. Friedrichssegen). Under favourable conditions all three processes will give a yield of up to 98 per cent. of the valuable constituents of the ore. A series of curves is given showing the influence on the formation of froth from a given ore pulp of different quantities of oil and acid respectively, the intensity of the agitation, the temperature, and the duration of agitation.—A. S.

Corrosion of metals by water. Stuart. *See* XIXb.

Action of antiformin [disinfectant] on metals and alloys. Zikes. *See* XIXb.

Patents.

Steel and steel alloys ; Process of treating [face-hardening] ——. W. H. Jones, Munhall, and A. F. Mitchell, Homestead, Pa. U.S. Pat. 1,076,768, Oct. 28, 1913.

Steel having a supercarburised face portion is treated so as to decarburise a portion of the supercarburised layer, part of the decarburised layer is then removed by machining, and the steel is finally hardened by water-quenching.—A. S.

Iron ; Manufacture of electrolytic ——. Soc. " Le Fer." Fr. Pat. 458,294, Aug. 2, 1912.

The access of air to the electrolyte of ferrous salts is regulated so as to bring about a partial oxidation of the latter, both electrodes being rotated and the temperature of the electrolyte kept constant.—B. N.

Ores ; Method and apparatus for treating —— more especially applicable for roasting spent or burned pyrites and the like. E. R. Sutcliffe, Leigh, Lancs. In part from Cuivres, Métaux et Produits Chimiques d'Hemixem Soc. Anon. Eng. Pat. 16,450, July 13, 1912.

Copper ores, especially silicious ores, are mixed with salt and heated in an inclined rotary furnace to 600° to 700° C., after which the charge passes to a second inclined rotary furnace, where it is exposed to this temperature for from 3 to 8 hours, whereby the copper is converted into soluble cupric chloride. The two furnaces may be in line, the second at a lower level, so that the charge passes from one to the other by gravitation. Gaseous fuel and air are supplied to the first furnace at its ore-discharge end, and part of the gases from the combustion chamber between the two furnaces may also pass through the lower furnace, although generally, the heat of the charge on entry, with the heat generated by the reaction, which is continued in the second furnace, is sufficient.—T. St.

Furnaces ; Ore roasting or drying ——. H. M. Ridge, London. Eng. Pat. 23,763, Oct. 17, 1912.

Three multiple-tier furnaces are described, in which ore fed on to the top hearth is worked along by rabbles attached to vertical shafts, passing from each hearth to the one below, and from left to right, and right to left on successive hearths. Each furnace has two or more of such vertical shafts, and by bringing into operation suitable additional feed and discharge openings, the portion of a furnace operated by any shaft can be put out of action, for the purpose of repairs, without stopping the working of the rest of the furnace.—T. St.

Engraving on metal cylinders in intaglio or in relief ; Chemical process for ——. M. Dumont and L. de Moor, Brussels. Eng. Pat. 21,526, Sept. 21, 1912.

An impression is produced upon the cylinder, in greasy ink (by pressure from a proof upon thin paper or transparent gelatin), and powdered with talc or colophony, the cylinder being then coated with a sensitised photographic emulsion which, after being "exposed," is "developed" by immersion in turpentine : after being heated to convert the hardened, remaining portion of the emulsion into acid-proof enamel, the cylinder is placed in an acid bath. In the case of a drawing with very fine lines, a re-transfer is prepared from a photographic negative or positive of an enlargement made in Indian ink. For half-tone work a re-transfer is made from a direct photograph in negative or positive net or screen ; or a phototype sheet with coarse grain is prepared from an ordinary negative photograph.—W. E. F. P

Metals ; Mixture for coating —— and uniting articles made of metal. A. Rosenberg, London. Eng. Pat. 23,300, Oct. 11, 1912.

A mixture for soft-soldering or for coating metallic surfaces, consists of a finely divided metal or alloy, a dry flux, and a vegetable or animal oil, grease, or fat. It may be enclosed in a thin-walled tube of the metal contained in the mixture, or of a material which on burning away will leave practically no residue. (See also Fr. Pat. 345,593 of 1904 ; this J., 1905, 32.)—T. St.

Metal compounds ; Process for treating natural or artificial —— prior to smelting. A. J. Boult, London. From C. Guillemain, Germany. Eng. Pat. 24,548, Oct. 26, 1912.

Antimoniates, arsenates, carbonates, chlorides, phosphates, vanadates, chromates, and sulphates of heavy metals are mixed with suitable fluxes or the like, and blown in converters, using finely divided fuel. The arsenic etc. are thereby volatilised, while the heavy metals become agglomerated and clinkered into a form suitable for further treatment. Suitable fluxes are residues from zinc reducing muffles, washing residues from the same, and carbides. As an example, a natural pure lead arsenate ore is treated with addition of 3 to 5 per cent. of its weight of ordinary unwashed residues from zinc distilling muffle furnaces, or with addition of finely distributed coke and sand developing about the same heat in the reaction. —T. St.

Molybdenum ; Manufacture of objects from ——. Chemische Fabrik von Heyden, Akt.-Ges., Radebeul, Germany. Eng. Pat. 25,976, Nov. 12, 1912. Under Int. Conv., June 19, 1912.

Molybdenum powder is mixed with magnesium oxide, or barium oxide, or with a compound which yields one of these oxides on heating, and the mixture is formed into rods, wires, or bands, by known methods. A suitable mixture consists of 100 parts of molybdenum and about 20 parts of anhydrous magnesium carbonate. A part of the magnesium oxide or barium oxide remains in the finished article, and effects an increase in ductility and tensile strength as compared with objects composed of pure molybdenum. (See also Eng. Pat. 1161 of 1911.)—T. St.

Copper smelting furnaces. W. G. Perkins, London. Eng. Pat. 27,869, Dec. 3, 1912.

The plant consists of a non-reversible, gas-fired, reverberatory furnace, a dust-collecting chamber and a regenerator ; the gases from the furnace pass through the dust-chamber at a reduced speed and then traverse the regenerator in an upward direction.—W. E. F. P.

Copper [and silver] from ore: Process of extracting ——. F. Laist, Anaconda, Mont. U.S. Pat. 1,076,833, Oct. 28, 1913.

THE sulphide ore, after an oxidising roast, is roasted with salt, then leached with dilute sulphuric acid in which some salt has been dissolved, and the resulting solution treated with hydrogen sulphide. After removing the precipitated sulphides, the major portion of the solution is used for leaching a fresh charge of roasted ore.—A. S.

Copper-aluminium alloy. E. D. Gleason, New York, Assignor to F. J. Roesler, Brooklyn, N.Y. U.S. Pat. 1,076,973, Oct. 28, 1913.

AN alloy of 90 parts of copper and 10 of "boron aluminium," prepared by adding aluminium to a fused mixture of calcium fluoride and vitrified boric acid, and then adding the mixture to molten copper.—A. S.

Lead-copper and lead-copper-tin compositions, and process of making same. E. D. Gleason, Assignor to Plastic Metal Co., New York. U.S. Pats. 1,077,698, 1,077,699, 1,077,700, and 1,077,701, Nov. 4, 1913.

THE compositions consist of (1) lead, lead sulphide, and 50 to 60 per cent. of copper; (2) lead, tin, lead sulphide, and from 50 to 60 per cent. of copper. The copper and lead sulphide are first melted together, and the lead, or lead and tin, then added, and the mixture fused. The function of the lead sulphide is to increase the miscibility of the alloying metals.—T. ST.

Magnetic [ore] separator. H. J. H. Nathorst, Malmberget, Sweden. Eng. Pat. 8485, April 10, 1913. Under Int. Conv., April 18, 1912.

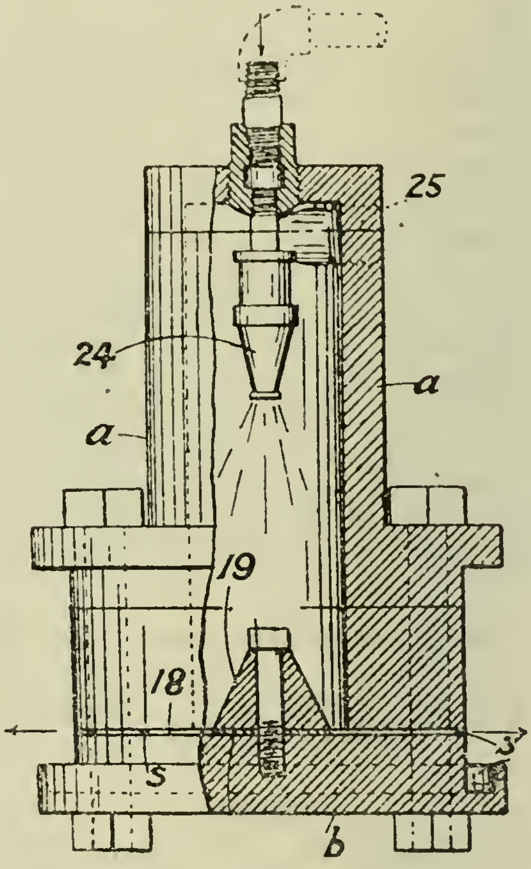
A CYLINDRICAL sheet iron drum, 3 to 6 mm. thick, and with a perfectly continuous surface, revolves about an adjustable fixed shaft. Magnets mounted on the shaft are energised by a direct and continuous current, the windings being arranged so that two or more poles are of alternating polarity, and in such manner that the poles alternate in the direction of rotation of the drum. The crushed ore is fed on to the top of the drum, and passes over the magnet poles, the magnetic and non-magnetic materials being collected on opposite sides of an adjustable separating board. (See also Eng. Pat. 8988 of 1890.)—T. ST.

Ore pulp; Apparatus for agitating or thickening ——. A. James, London. Eng. Pat. 8801, Apr. 14, 1913.

IN apparatus of the kind depending upon the action of rotating arms in a tank, the agitator or collector, which is carried on a suspended (balanced) bearing and driven from underneath, is mounted so that it may be raised and lowered by hand or drive from the main shaft.
—W. E. F. P.

Ores; Apparatus for sintering ——. J. E. Greenawalt, Denver, Colo., U.S.A. Eng. Pat. 10,249, May 1, 1913. Addition to Eng. Pat. 28,441, Dec. 10, 1912 (this J., 1913, 430).

THE ignition hood of the furnace previously described has been improved with the object of forming instantaneously a sheet of flame uniformly over the whole surface of the charge in the sintering pan. To the outside of the hood is fastened an enclosed tank containing fuel oil, the air space above which communicates with a compressed-air supply. The oil and air are supplied to two cylindrical burners fastened to the roof of the hood, and disposed symmetrically, with their axes at right angles to the surface of the charge. Each burner (see fig.) consists of an upper tubular part, *a*, a solid disc, *b*, and an intermediate sheet-metal disc, 18, containing radial slots, *s*, extending to the circumference from points short of the centre. To the centre of the disc is bolted an upright conical "spreader," 19, on to which the oil is discharged from a spray-nozzle, 24. Air is admitted to the burner through a tangential opening, 25, above the spray-nozzle. Between the tank and the burner the air passes through a reducing valve, so that there shall be a suitable excess pressure in the tank to allow of the oil being forced through the spray-nozzle. Air and atomised oil are thus forced through the slots in the sheet-metal disc in all directions in a horizontal plane. When the oil is ignited, a uniform sheet of flame results. By varying the size of the slots in different directions, the shape of the flame may be regulated.—T. ST.



Furnaces; Regenerative open hearth ——. T. B. Rogerson, Glasgow. Eng. Pat. 10,853, May 8, 1913.

To allow of rebuilding the block of a regenerative open hearth furnace, whilst the furnace is working, a "centre" (*e.g.*, a tube of metal or fire-clay) is slipped into the gas port below the block and the block is repaired with a plastic mixture of about 50 parts of broken silica brick, 20 parts of silver sand, and 30 parts of silica clay, introduced through the working door of the furnace and packed into position by suitable tools.—W. H. C.

Radiothorium; [Electrolytic] Preparation of ——. L. Meitner, Berlin, Assignor to O. Knöfler und Co., Berlin-Plötzensee, Germany. U.S. Pat. 1,076,141, Oct. 21, 1913.

SOLUTIONS containing radiothorium in large excess and very little or no thorium, are electrolysed, whereby the radiothorium is deposited at the cathode.—O. R.

Pig iron; Process for dephosphorising ——. A. F. Pasquier, Dijon, France. Eng. Pat. 25,251, Nov. 4, 1912. Under Int. Conv., Nov. 25, 1911.

SEE Ger. Pat. 252,504 of 1911; this J., 1913, 29.—T. F. B.

Iron and steel articles, Process for surface-hardening —— *using a thick or pasty hardening agent.* Gebr. Schubert. Fr. Pat. 459,175, June 12, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Eng. Pat. 13,805 of 1913; this J., 1913, 1016.—T. F. B.

Ore concentration; Apparatus for ——. W. Broadbridge, A. C. Howard, and Minerals Separation, Ltd., London. Eng. Pat. 25,490, Nov. 6, 1912.

SEE U.S. Pat. 1,064,209 of 1913 this J., 1913, 755.—T.F.B.

[Ore] pulp ; Apparatus for thickening and agitating ——. J. van Nostrand Dorr, Denver, Colo. U.S. Pat. 1,076,666, Oct. 28, 1913.

See Eng. Pat. 21,944 of 1912 ; this J., 1913, 663.—T. F. B.

Aluminium alloys and process of manufacture thereof. H. O. Ormiston, Rockdale, New South Wales. Eng. Pat. 6166, March 12, 1913. Under Int. Conv., Dec. 24, 1912.

See Fr. Pat. 455,617 of 1913 ; this J., 1913, 981.—T. F. B.

Aluminium ; Process for the treatment of the surfaces of articles of ——. A. Lang, Karlsruhe, Germany. U.S. Pat. 1,077,480, Nov. 4, 1913.

See Addition of Dec. 18, 1907, to Fr. Pat. 354,713 of 1905 ; this J., 1908, 690.—T. F. B.

Aluminium ; Solder for ——. C. Willmott, Smethwick. U.S. Pat. 1,078,114, Nov. 11, 1913.

See Eng. Pat. 19,214 of 1912 ; this J., 1913, 915.—T. F. B.

Ore ; Process for the agglomeration of —— *in rotary tubular furnaces.* F. L. Smidth & Co., Copenhagen. Eng. Pat. 7707, April 1, 1913. Under Int. Conv., May 23, 1912.

See Fr. Pat. 455,644 of 1913 ; this J., 1913, 949.—T. F. B.

[Ore] briquets ; Process of making ——. O. Kippe, Osnabrück, Germany. U.S. Pat. 1,078,544, Nov. 11, 1913.

See Fr. Pat. 457,245 of 1913 ; this J., 1913, 1018.—T. F. B.

Roasting furnaces. J. B. F. Herreshoff, New York. Eng. Pat. 6372, March 14, 1913. Under Int. Conv., April 12, 1912.

See U.S. Pat. 1,066,110 of 1913 ; this J., 1913, 794.—T.F.B.

Roasting sulphurous ores by a continuous process ; Mechanical system for ——. X. de Spirlet, Brussels. U.S. Pat. 1,077,010, Oct. 28, 1913.

See Addition of Jan. 22, 1913, to Fr. Pat. 415,338 of 1910 ; this J., 1913, 794.—T. F. B.

Copper ; Process and apparatus for producing —— *by electrolysis.* M. Perreur-Lloyd, Boulogne-sur-Seine, France. Eng. Pat. 6897, March 20, 1913. Under Int. Conv., March 22, 1912.

See Fr. Pat. 441,644 of 1912 ; this J., 1912, 932.—T. F. B.

Amphidizing [treating copper ores] ; Apparatus for ——. C. S. Bradley, New York, Assignor to Bradley Copper Process Co., Jersey City, N.J. U.S. Pat. 1,077,036, Oct. 28, 1913.

See Fr. Pat. 430,692 of 1911 ; this J., 1911, 1392.—T. F. B.

Zinc ; Process of and apparatus for use in manufacturing ——. C. V. Thierry, Paris. Eng. Pat. 7953, April 4, 1913. Under Int. Conv., July 19, 1912.

See Fr. Pat. 456,180 of 1913 ; this J., 1913, 949.—T. F. B.

Tungsten ; Working ——. C. T. Fuller, East Orange, N.J., Assignor to General Electric Co., New York. U.S. Pat. 1,077,696, Nov. 4, 1913.

See Eng. Pat. 9877 of 1912 ; this J., 1912, 1133.—T. F. B.

Tungsten ; Process of treating ——. C. T. Fuller, East Orange, N.J., Assignor to General Electric Co., New York. U.S. Pat. 1,077,827, Nov. 4, 1913.

See Eng. Pat. 15,586 of 1911 ; this J., 1912, 764.—T. F. B.

Metals, alloys, and steels ; Apparatus for treating molten ——. L. M. V. H. Baraduc-Muller, Paris. U.S. Pat. 1,077,925, Nov. 4, 1913.

See Addition of Jan. 13, 1911, to Fr. Pat. 434,865 of 1910 ; this J., 1912, 439.—T. F. B.

Foundry-sand ; Treatment or renovation of ——. A. Poulson, Farnworth, Widnes. U.S. Pat. 1,078,062. Nov. 11. 1913.

See Eng. Pat. 14,972 of 1912 ; this J., 1913, 369.—T. F. B.

Manganese from its ores ; Method of extracting ——. F. Heusler, Dillenburg, Germany. U.S. Pat. 1,078,199, Nov. 11, 1913.

See Ger. Pat. 250,035 of 1911 ; this J., 1912, 933.—T. F. B.

Ores ; Process of treating [silver-bearing] ——. E. Langguth, Neerpelt, Belgium. U.S. Pat. 1,078,360, Nov. 11, 1913.

See Ger. Pat. 240,768 of 1911 ; this J., 1911, 1457.—T.F.B.

Alloy. Rubel Bronze, Ltd. Fr. Pat. 459,212, June 13, 1913.

See U.S. Pat. 1,076,455 of 1913 ; this J., 1913, 1073. —T. F. B.

Method of nodulating materials. U.S. Pat. 1,076,705. *See* I.

Disintegration of silicates. [Extraction of nickel from garnierite.] Fr. Pat. 458,432. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Ozone ; The formation of —— *at various pressures.* H. von Wartenberg and L. Mair. Z. Elektrochem., 1913, **19**. 879—881.

Under otherwise similar conditions the concentration of ozone, and also the actual weight of ozone produced per watt-second by the silent electric discharge through oxygen at pressures varying from 0·25 to 5·0 atmospheres, has a very decided maximum at from 0·5 to 1 atmosphere. Outside the above limits the yield sinks to mere traces. —G. F. M.

Mechanism of anodic reactions, and the behaviour of iron and nickel anodes. Schoch. *See* X.

Patents.

[Iridium-plated tungsten] Electrode. R. H. Stevens, Salt Lake City, Utah, Assignor to United States Smelting, Refining & Mining Co., Portland, Me. U.S. Pat. 1,077,920, Nov. 4, 1913.

The tungsten electrode is plated with a non-oxidisable metal of the gold group, such as iridium.—B. N.

Tungsten conductors [for mercury vapour rectifiers]. Cie. Franc. pour l'Exploitation des Procédés Thomson-Houston. First Addition, dated April 4, 1913, to Fr. Pat. 379,393, June 29, 1907 (this J., 1907, 1232).

Tungsten, in the form of inverted cups, is used for the principal anodes in upper side tubes, and the cathode of mercury is in the middle limb of a lower triple tube, the outer limbs containing auxiliary anodes of mercury for starting the arc.—B. N.

Electrolytic cells. E. C. R. Marks, London. From Hooker Electrochemical Co., New York. Eng. Pat. 12,208, May 26, 1913.

See U.S. Pat. 1,075,660 of 1913 ; this J., 1913, 1075. —T. F. B.

Electrolytic apparatus. Hooker Electrochemical Co. Fr. Pat. 458,555, May 29, 1913.

See U.S. Pat. 1,075,660 of 1913 ; this J., 1913, 1075. —T. F. B.

Electrolytic diaphragm. H. A. Wagner, New York. U.S. Pat. 1,077,444, Nov. 4, 1913.

See Eng. Pat. 16,048 of 1913 ; this J., 1913, 1075.—T. F. B.

Refractory conductors; Production of ——. W. D. Coolidge Schenectady, N.Y., Assignor to General Electric Co.' New York. U.S. Pat. 1,077,674, Nov. 4, 1913.

See Eng. Pat. 282 of 1909; this J., 1910, 163.—T. F. B.

[Electrolytic] Preparation of radiothorium. U.S. Pat. 1,076,141. *See* VII.

Apparatus for the electrolysis of alkali salts, with the aid of a mercury cathode. Ger. Pat. 265,414. *See* VII.

XII.—FATS; OILS; WAXES.

Fats; Constituents of animal ——. Fat of Cervus elaphus (stag). J. Klimont and E. Meisl. Monats. Chem., 1913, **34**, 1489—1492.

The stag fat examined had the characters: sp. gr. at 50° C., 0·9066; acid value, 20·5; saponification value, 203·5; iodine value, 19·3; m.pt. (Pohl), 48·0° C.; solidif. pt., 47·5° C. By repeated crystallisation from acetone a substance, m. pt. 62·5°—63·5° C., was isolated in the form of needles and was identified as palmitodistearin (see Bömer and Limprich, this J., 1913, 434), which has been previously detected in beef tallow and mutton tallow (this J., 1903, 638, 1136).—A. S.

Vegetable fats; Detection of —— in animal fats. M. Klostermann. Z. Untersuch. Nahr. Genussm., 1913, **26**, 433—437.

The method described by Marcusson and Schilling (Chem. Zeit., 1913, 37, 1001) is not universally applicable, since digitonin precipitates only the free cholesterol and phytosterol and not their esters. Saponification is essential, and the following method is recommended:—100 grms. of the fat are saponified with alcoholic potassium hydroxide, the soap solution diluted with water, and the fatty acids liberated by hydrochloric acid, and extracted with 250 c.c. of ether. The ethereal solution is washed with water and shaken with 250 c.c. of petroleum spirit and about 25 grms. of sodium chloride, which is subsequently separated by filtration through cotton wool. The filtrate is heated and treated with a solution of 1 grm. of digitonin in 20 c.c. of 90 per cent. alcohol, and the crystalline precipitate separated after 15 minutes and washed with ether until free from fat. It is then dried with filter paper and acetylated with 20 to 30 c.c. of acetic anhydride. The excess of acetic anhydride is evaporated, the residue dissolved in 50 c.c. of absolute alcohol, and the solution treated drop by drop with water until crystals begin to separate. More water, up to 25 c.c. in all, is then added and the crystals filtered on cotton wool, washed with 70 per cent. alcohol, and dissolved in ether. The solution is evaporated to dryness, and the acetates are recrystallised from absolute alcohol and examined in the usual way.
—C. A. M.

Paraffin reaction; Shrewsbury's ——. P. A. Meerburg. Chem. Weekblad, 1913, **10**, 742—744. Chem. Zentr., 1913, **2**, 1778.

In testing fats for paraffin wax by Shrewsbury's method (this J., 1909, 902), the saponified mass should be added to the methyl alcohol as a whole and not drop by drop. To dissolve the soap the mixture must be warmed and then again cooled. Saponification should be effected in a metal vessel: if a Jena flask be used the glass is strongly attacked and the gelatinous soap solution is rendered turbid by separated silica, etc.—A. S.

"Mexican kapok" seed oil. H. Sprinkmeyer and A. Diedrichs. Z. Untersuch. Nahr. Genussm., 1913, **26**, 450—452.

A sample of "Mexican kapok" seed differed from the true kapok seed and apparently belonged to a species of *Bombax*. The Mexican seeds yielded 29·57 per cent. of oil and the kernels 49·66 per cent. The oil gave the following values:—Refraction at 40° C., 57·4; at 25° C., 65·9; acid value, 12·62; saponification value, 192·8; iodine value, 95·7; Reichert-Meissl value, 0·55; Hehner value, 95·60. *Fatty acids*:—M. pt., 31·2° C.; solidif. pt., 28·0° C.; refraction at 40° C., 46·0; iodine value, 92·0; neutralisation value, 199·8; and mean mol. weight, 286·3. The oil yielded no insoluble bromides, but gave a positive reaction in Halphen's cottonseed oil test. In colour it is superior to Java kapok oil (see also this J., 1913, 874, 917).
—C. A. M.

Olive oil; Denaturation of —— with sulphuric acid. Oil, Paint, and Drug Rep., Nov. 10, 1913. [T.R.]

The Collector of Customs at New York has been advised, as the result of a communication from Swan, Finch and Co., that under certain circumstances the denaturing of olive oil by the use of sulphuric acid will be permitted. It appears that the customs officials submitted this question to the Secretary of Agriculture, who reported that there was no objection to the use of sulphuric acid in denaturing olive oil if the acid used was in quantity of one part by volume of 66° B. acid to 99 parts of oil, if care be taken in mixing and the denaturing product be allowed to stand for 24 hours. Under the advice of the Agricultural Department, therefore, the customs officials have stated to the collector of customs that the use of sulphuric acid in denaturing olive oil will be permitted under the terms stated and in following the directions as to the denaturing operations.

Symphonia seeds from Madagascar; Composition of ——. A. Hébert. Bull. Soc. Chim., 1913, **13**, 1039—1041.

The seeds of two species of *Symphonia*, N.O. *Clusiaceae*, *S. laevis* and *S. louveli* which are used as sources of oil by the natives in Eastern Madagascar, yielded respectively 35·2 and 40·0 per cent. of fat of pasty consistence on extraction with petroleum benzine. The fat from the seeds of *S. laevis* had an iodine value of 66·7 and consisted of 40 per cent. of saturated and 60 per cent. of unsaturated acids (by lead-salt ether method): the fat from *S. louveli* gave similar figures. The unsaturated acids consisted chiefly of oleic acid. Analyses are also given of the residues after extraction of oil from the seeds; the residues are somewhat poor in nitrogen and carbohydrates and of such a fibrous texture that their use for feeding cattle would be undesirable.—R. G. P.

Turkey-red oil; Analysis of ——. W. Fahrion. Chem.-Zeit., 1913, **37**, 1372—1373.

The water-content of Turkey-red oil may be determined to within 1 per cent. by heating 3—5 grms. in a platinium crucible over a small flame until frothing ceases. There are oils on the market which though giving satisfactory results in practice, contain only very small quantities of combined sulphuric acid (*e.g.*, as little as 0·09 per cent. SO_3). In the case of oils of this kind, which owe their characteristic properties to the presence of polyricinoleic acids, the "total fat" should be determined by saponifying with alcoholic alkali, and decomposing the soap with acid. A higher result is obtained than when the oil is treated directly with acid for the separation of the fat, as in the latter case, the polyricinoleic acids are converted only to a small extent or not at all, into ricinoleic acid.—A. S.

Patents.

Oils and fats from oil-seeds and other vegetable raw materials containing oils and fats; Method of extracting ——. R. N. Riddle, Rahway, N.J. U.S. Pat. 1,076,997, Oct. 28, 1913.

The material is ground in the presence of a solvent, being alternately subjected to pressure and release of the same during the operation; the solution of the oil is then separated by pressure, and the solvent removed first by distillation and then the last traces by a current of an inert gas.—W. P. S.

Oil mixtures and the like ; Process of hydrogenating ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,078,136, Nov. 11, 1913.

In hydrogenating oils or fatty compounds containing acids or other contact poisons, it is proposed to dilute the material with a neutral oil before treating it with hydrogen in presence of a catalyst.—T. F. B.

Fatty acids and their glycerides ; Reduction of unsaturated ——. W. Fuchs. Fr. Pat. 458,445, May 14, 1913. Under Int. Conv., May 18, 1912.

The oil or fatty acid is heated to 90° to 150° C. and catalytically hydrogenated by means of hydrogen which has been more strongly heated (200° to 250° C.). The speed of the reduction is thus accelerated by about 10 per cent. and overheating of the oil is obviated. The hydrogen may be rendered still more active by treatment with chemically active rays.—C. A. M.

Oleine ; Process of obtaining desulphurised vegetable —— G. Félizat. Fr. Pat. 456,794, April 17, 1913. Under Int. Conv., April 22, 1912.

An oil suitable as a lubricant in spinning and weaving is prepared from oils that have been extracted by carbon bisulphide (*e.g.*, from olive marcs). The oil is freed from colloidal substances, treated with superheated steam to remove sulphur, saponified as completely as possible, and the liquid fatty acids (oleine) separated from the solid fatty acids by crystallisation and filtration or expression. —C. A. M.

Fats and oils ; Process of treating —— for the manufacture of fatty acids and glycerin. E. Twitchell. Fr. Pat. 456,956, April 22, 1913.

The fat is agitated with water in the presence of a relatively small proportion of a salt of a sulpho-aromatic fatty acid, and of a suitable quantity of an acid capable of combining with the metal of the salt, so that the sulpho-aromatic acid is liberated and effects the hydrolysis. The charge is heated and agitated until the fatty acids and glycerin separate, after which the metal of the salt is precipitated, and the products of the hydrolysis separated.—C. A. M.

Oils, fats, greases and waxes ; Production and utilisation of sulphonated products of certain ——. I. Levinstein, Manchester. Eng. Pats. 18,333, Aug. 9, and 18,714, Aug. 15, 1912.

A fat or wax containing a substantial proportion of palmitic acid is melted and sulphonated with sulphuric acid at about 40° to 45° C. The resulting sulpho acids may be mixed with mineral oils and waxes, resin oils, camphor or essential oils to form products soluble in or miscible with water. The neutral or alkaline salts of some of these sulpho acids, and notably the sodium salt of sulphonated palm oil, may also be used for similar purposes, and these sodium salts will also give with animal or vegetable fats (*e.g.*, tallow, japan wax, lanoline) mixtures which will dissolve in or mix with water.—C. A. M.

Oil mixtures for use as lubricants, for impregnating or coating substances, etc. ; Process for preparing ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 265,597, May 8, 1909. Addition to Ger. Pat. 263,278 (this J., 1913, 918).

In the process of the principal patent, the mineral oils may be replaced by fatty oils or fats of animal or vegetable origin. The mixtures of thickened tar oils and drying fatty oils may be further treated with a drier. The products from non-drying oils are more efficient lubricants than those prepared with mineral oils. The mixtures obtained when driers are used, can be employed as substitutes for varnishes.—T. F. B.

Soaps containing serums ; Process for preparing ——. H. Grauert. Ger. Pat. 265,538, Feb. 20, 1912.

Serums extracted from fresh or preserved animal blood or from defibrinated blood are added to soaps of all classes. —T. F. B.

Oils and fats ; Process for bleaching and thickening ——. W. P. Thompson, Liverpool. From F. Grüner, Esslingen on Neckar, Wurtemburg. Eng. Pat. 2260, Jan. 28, 1913.

See Fr. Pat. 453,664 of 1913 ; this J., 1913, 798.—T. F. B.

Detergents, detergent solutions, or emulsions ; Process for manufacturing ——. G. Petroff, Kuskowo, Russia. Eng. Pat. 19,759, Aug. 29, 1912.

See Fr. Pat. 452,054 of 1912 ; this J., 1913, 665.—T. F. B.

Oils, fats, waxes, and other fatty substances ; Manufacture and utilisation of sulphonated products of ——. I. Levinstein. Fr. Pat. 458,998, Feb. 28, 1913. Under Int. Conv., Aug. 9 and 15, 1912.

See Eng. Pats. 18,333 and 18,714 of 1912 ; preceding. —T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Paints for steel, subjected to alternate exposure to air and fresh water ; Some tests of ——. P. H. Walker and S. S. Voorhees. J. Ind. Eng. Chem., 1913, **5**, 899—905.

An investigation conducted under the joint direction of the Bureau of Chemistry and Bureau of Standards (U.S.A.). Fifteen paints prepared with the same linseed oil and drier (a solution of lead and manganese linoleates in oil of turpentine, containing 3·92 per cent. Pb and 0·79 per cent. Mn) were used and were made up in each case so as to show a viscosity of about 50 seconds by the Stormer viscosimeter. Plates of basic open-hearth steel, cleaned by a sand-blast and coated with the paints, were kept in tanks which were filled with water every afternoon at 4 o'clock and emptied each morning at 9 o'clock from Feb. 1, 1911 to Jan. 22, 1912 (except for short periods when the water was frozen) ; the plates were then left in the empty tanks from Jan. 22 to March 1, 1912. The condition of the plates was observed at intervals, and the results are given in a long table. The chief feature was the good results given by red lead and American vermilion (scarlet lead chromate), and it is suggested that in future tests one of these be used as a standard for coating one-half of a plate, the other half being coated with the paint to be tested.—A. S.

Patents.

White lead ; Manufacture of ——. E. H. Strange and H. E. Coley, London. Eng. Pat. 7139, March. 25, 1913.

Molten lead is forced by hydrostatic pressure through small perforations on to a cold travelling metallic surface, so as to solidify in fine threads which may be rapidly converted into white lead, as described in Eng. Pat. 6629 of 1907 (this J., 1908, 411).—C. A. M.

Paints ; Art of making ——. F. F. Bradley, Assignor to Bradley and Vrooman Co., Chicago, Ill. U.S. Pat. 1,077,239, Oct. 28, 1913.

Standardised paint stocks in a viscid condition are stored in separate containers, from which, after agitation to render the stock uniform, a predetermined quantity can be withdrawn and mixed with predetermined quantities of suitable paint liquids.—E. W. L.

Oil paints ; Process of manufacturing —— for pictures, etc. A. Cerne. Fr. Pat. 458,883, June 6, 1913.

Mixtures of ordinary pigments with oils, balsams, etc., are dried by means of heat, crushed, and ground.—C. A. M.

Plastic substances, impregnating solutions and the like ; Condensation products for making ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 24,255, Oct. 23, 1912.

The brittleness of the resins obtained by heating glycerin and other polyhydric alcohols with polybasic acids or anhydrides (see Eng. Pat. 23,776 of 1912; this J., 1913, 951) is minimised by combination with butyric acid. Two parts by weight of phthalic anhydride and one part of glycerin are heated first to 100° C. and then slowly to 185° C. at which temperature the mixture is maintained until distillation of water, acrolein, and other vapours ceases. Finally the temperature may be allowed to rise to 210° C. The first part of the reaction is complete when a sample drawn and cooled becomes hard and brittle without stickiness. 22 parts of the product are heated with 10 parts of butyric acid in glycerin, using a reflux condenser, for 8—24 hours until a sample drawn and cooled shows no sign of stickiness. This product is heated at 300° C. in an open vessel until distillation ceases and a mass is obtained which is brownish, soft and rubber-like and soluble in acetone. A solution in this solvent may be employed for impregnating fibrous or cellular matter. The fusible soluble resin may be rendered infusible and apparently insoluble by heating for 2—3 hours at 100°—120° C. Either normal or isobutyric acid may be used. —E. W. L.

Waterproof film and method of making it. G. Plüss. Fr. Pat. 456,925, Apr. 21, 1913. Under Int. Conv., May 15 and Oct. 24, 1912.

The pellicle forming on the surface of oil paints and varnishes is separated by suitable means (*e.g.*, wire gauze supports), and is dried and subjected to suitable treatment, such as dusting with bronze or other powder to prevent stickiness. Two such pellicles may be mounted on a fabric, which they will render waterproof.—C. A. M.

Fats, oils, resins, waxes, paraffin, mineral oil or its distillation products, fossil wax or mineral wax; Process for chlorinating ——. [*Production of artificial resins.*] C. F. Boehringer und Söhne. Fr. Pat. 459,261, Aug. 31, 1912.

See Ger. Pats. 256,856 and 258,156; this J., 1913, 499, 613. The introduction of chlorine is continued until no more is absorbed. The process may also be carried out in presence of a metallic catalyst, and the carbon tetrachloride may be replaced, wholly or partly, by other solvents, such as methyl alcohol, glycerin, acetone, chloroform, carbon bisulphide, benzene, or phenol.—T. F. B.

Paste for attaching linoleum and the like to floors. O. Kossack. Ger. Pat. 265,055, Aug. 20, 1912.

A solution of linoxyn in "alkaline spirit" is claimed. —T. F. B.

Gas purifying material; Process for the utilisation [as a pigment] of exhausted ——. C. J. H. Madsen, Copenhagen. Eng. Pat. 12,833, June 2, 1913. Under Int. Conv., June 7, 1912.

See Ger. Pat. 261,000 of 1912; this J., 1913, 834.—T. F. B.

Oil [for paints, etc.]; Process of preparing an ——. E. Richter, Plauen, Germany. U.S. Pat. 1,076,703, Oct. 28, 1913.

See Fr. Pat. 454,742 of 1913; this J., 1913, 876—T. F. B.

Mill for grinding paints or other liquid materials. T., J. R., and H. N. Torrance, and Torrance and Sons, Ltd. Fr. Pat. 460,000, June 24, 1913. Under Int. Conv., June 24, 1912.

See Eng. Pat. 14,733 of 1912; this J., 1913, 798.—T. F. B.

Coating and impregnating materials; Manufacture of ——. C. Roth, Frankfort on Maine, Germany. Eng. Pat. 2187, Jan. 27, 1913. Under Int. Conv., Feb. 8, 1912.

See Ger. Pat. 251,710 of 1912; this J., 1912, 1190.—T. F. B.

Solvents for resins and for nitrocellulose and solutions of these substances. Badische Anilin und Soda Fabrik. Fr. Pat. 459,006, May 5, 1913. Under Int. Conv., Sept. 11 and 27, 1912.

See Ger. Pat. 263,104 and Eng. Pats. 21,368 and 23,544 of 1912; this J., 1913, 918, 1021.—T. F. B.

Shellac and analogous lacs; Process for refining ——. H. Cassard. Fr. Pat. 459,458, June 19, 1913.

See U.S. Pat. 1,066,794 of 1913; this J., 1913, 835.—T. F. B.

Preparing oil mixtures for use as lubricants, for impregnating or coating substances, etc. Ger. Pat. 265,597. *See* XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Vulcanisation; Theory of ——. *V. Chemistry of rubber. VII.* D. Spence and J. Young. Kolloid-Zeits., 1913, 13, 265—271.

Further experimental evidence is given in support of the authors' view that vulcanisation is a chemical process (see this J., 1911, 816; 1912, 81, 785; 1913, 97). It is shown that there is no "critical temperature": vulcanisation takes place at all temperatures, and the acceleration due to rise of temperature is of the same order as in other chemical reactions. Comparative experiments with caoutchouc, balata, and gutta-percha showed that they all yield the same final product containing 32 per cent. of combined sulphur and exhibiting the same physical properties. The differences between raw caoutchouc, balata, and gutta-percha must therefore be of a physico-chemical nature, and in accord with this view is the fact that as balata and gutta-percha become vulcanised, they first acquire more and more the elastic properties of rubber; as vulcanisation progresses the properties of the products gradually become more alike until finally in all three cases a product having the characteristic properties of hard rubber is obtained.—A. S.

Patents.

Rubber, Processes and apparatus for extracting —— *from materials containing the same.* J. L. Palmer, London. Eng. Pat. 23,682, Oct. 16, 1912.

Landolphia bark concentrate or the like is rolled between and along two frictional surfaces rotating relatively to one another at a high speed, until the material is separated into masses of, in the main, rubber "worms," and into more or less barren particles of bark. The rotating members may be slightly concave discs, hemispheres, cones, or cylinders, mounted on resilient bearings. —E. W. L.

Caoutchouc, its homologues and analogues; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,959, July 21, 1912.

The autopolymerisation of butadiene or its homologues or analogues to caoutchouc substances, is considerably accelerated by colloidal metals.—T. F. B.

Caoutchouc substances obtained by polymerisation of butadiene and its homologues; Process for improving the ——. Badische Anilin und Soda Fabrik. Ger. Pat. 265,325, Aug. 3, 1912.

The physical properties, especially the strength, of butadiene-caoutchouc and its homologues, can be considerably improved by treatment with an organic peroxide or ozonide. —T. F. B.

[Elastic] composition. T. D. Kelly, Southend-on-Sea. Eng. Pat. 23,846, Oct. 18, 1912. (Cf. Eng. Pat. 8613 of 1911; this J., 1912, 595.)

Size or like gelatinous material (5 parts by volume) is mixed with fatty oils such as linseed or tungseed oil (3½ parts) or with mineral oil to which glycerin has been added, and the mixture is heated with metallic (lead, zinc or iron) oxides (½ part) and Portland or magnesium cement (2 parts) at a temperature not much above 212° F (100° C.) for 15 minutes. Colouring or filling material may also be added.—E. W. L.

Rubber, gutta-percha, balata, etc.; Process for extracting —— from the latex of rubber-bearing plants. H. Colloseus. Fr. Pat. 458,986, June 9, 1913. Under Int. Conv., June 11 and Sept. 13, 1912.

See Eng. Pat. 22,255 of 1912; this J., 1913, 298.—T. F. B.

Caoutchouc; Process for regenerating ——. E. Zappert. Fr. Pat. 459,693, June 26, 1913.

See Eng. Pats. 25,055 of 1912 and 4913 of 1913; this J., 1913, 984.—T. F. B.

Process for making isoprene. Fr. Pat. 459,988. *See* XX.

Process for preparing isoprene. Ger. Pat. 264,007. *See* XX.

Process for preparing isoprene. Ger. Pat. 264,923. *See* XX.

Producing erythrene and isoprene. Addition to Fr. Pat. 439,381. *See* XX.

Preparing isoprene or erythrene, or a mixture of these substances, from fusel oil. Ger. Pat. 264,902. *See* XX.

Process for preparing erythrene. Ger. Pat. 264,264. *See* XX.

Preparing butadiene and its homologues. Ger. Pat. 265,172. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Grease from harness leather scrap; Recovery of ——. P. M. Armstrong. J. Amer. Leather Chem. Assoc., 1913, 11, 459—468.

Grease recovered from leather scrap by means of solvents is not suitable for use on leather, as part of the solvent is always retained and is injurious to leather. The method of recovery described is free from this objection and has been used regularly on a practical scale. A covered tank, 5 feet in diameter and 4½ feet in depth, built of staves 2—3 inches thick, is half filled with water, which is heated to boiling by a brass steam coil mounted on a shelf a few inches above the floor of the tank. The coil is pierced at intervals of 3 or 4 inches with ⅛-inch holes directed towards the centre of the tank to facilitate agitation of the contents. The scrap is thrown in, a little at a time, until the whole mass is boiling, the necessary chemicals are added, steam turned off and the grease allowed to separate. When the grease is clear it may be run off by an overflow pipe or skimmed off with a dipper after setting, the grease is separated, remelted in a jacketed kettle and run into pans. Each kind of scrap requires slight variations in treatment. *Buffings* are treated in quantities of about 3 barrels at a time. When boiling, one or two gallons of hydrochloric acid are added and boiling continued till the buffings change from brown to light red and begin to disintegrate. 100 lb. should yield 25—30 lb. of grease. *Whitenings* are treated the same way but are not boiled so long and only ½ gallon of acid is used; the yield of grease should be 40—50 per cent. *Trimmings* are treated in the same way but when blackened a gallon of acid is added to the water to destroy the blacking. After boiling, another gallon is added and boiling continued till the colour of the foam changes from black to light brown. On account of the long boiling emulsification may take place, in which case, as much of the grease as possible is removed and the emulsion boiled again, repeating the process if necessary. *Black grease, i.e.*, grease which has been slicked out from the blackened leather may be recovered by the method. The blackening is a fine precipitate of mixed ferrous and ferric hæmatates. These compounds are destroyed by chromic anhydride, potassium permanganate, hydrogen peroxide and nitric acid. The tank is half filled with boiling water containing 2 lb. of caustic soda and a barrel of black grease added. When emulsification is complete, ½ lb. of commercial sodium or potassium permanganate is added and boiling continued 5 minutes. 1½ gallons of hydrochloric acid is then added and boiled vigorously. The grease is then removed by the dipper and settled in the jacket kettle to remove manganese dioxide. The precipitation of manganese dioxide may be avoided by using oxalic acid but the expense is greater. The grease thus recovered (yield 75—80 per cent.) is too soft to use alone but may be used in stuffing in place of tallow. *Table grease* is usually clear so no acid need be used and the water made only sufficiently hot to melt the grease, and with *floor scrapings* which is usually good grease containing dirt only, ½ gallon of hydrochloric acid is sufficient. Sulphuric acid should not be used as it is not removed by boiling and keeps the grease emulsified with the water.
—D. J. L.

Synthesis of depsides, lichen-substances and tannins. Fischer. *See* XX.

Patents.

Tanning hides and skins; Process for ——. Röhm und Haas. Ger. Pat. 265,855, March 6, 1913.

The products obtained by the action of normal sulphites and formaldehyde on phenols, are employed as tanning agents, either alone or in conjunction with known substances. Leathers obtained by this process can be coloured a variety of shades by treatment with different diazo compounds.—T. F. B.

Tanning agents: Process for preparing ——. Röhm und Haas. Ger. Pat. 265,915, Jan. 29, 1913.

Condensation products from phenols or their substitution products with formaldehyde or its equivalent, which are soluble in alkali, are treated with formaldehyde in presence of a normal sulphite, or solutions of the condensation products in alkali are treated with formaldehyde-bisulphite. The products can be concentrated by evaporation, and may also be neutralised. Light coloured tanning agents, suitable for use in making white leathers, are obtained.—T. F. B.

Leathers; Process for dressing and dyeing all kinds of ——. O. Trebitsch. Ger. Pat. 265,913, April 26, 1912.

After the tanning process, the leather is treated with a solution of a non-coagulable albuminoid compound of animal or vegetable origin, or with a decomposition product thereof Such albuminoid compounds may also be used for thickening the dyebath for leather. It is stated that this treatment prevents the hardening and cracking of the leather, and by fixing the tannin, renders the product more impervious.—T. F. B.

Tanning agent. P. F. Reinsch. Ger. Pat. 265,914, March 17, 1912.

A solution containing ferric oxychloride and magnesium chloride (prepared from magnesium carbonate and ferric chloride solution), which may also contain aluminium chloride, is said to be suitable for tanning all kinds of skins for preparing sole leather, upper leather, etc.—T.F.B.

Plastic masses from anhydrous glue, glycerin, and pulverulent filling materials; Process for hardening ——. I. Traube. Ger. Pat. 264,568, Feb. 25, 1913.

Mixtures of glue, glycerin, and powdered filling materials are moulded to the desired shape and treated with methyl alcohol, acetone, or other liquid which is soluble in water and has the power to precipitate the glue. The glycerin can be recovered from the solution by evaporation or by boiling.—T. F. B.

XVI.—SOILS; FERTILISERS.

Alkali soils; Influence of the salts common in —— upon the growth of the rice plant. K. Miyake. J. Biol. Chem., 1913, 16, 235—263.

In 1909, widely distributed tracts of alkali soil were discovered in the southern part of Formosa and it became of importance to ascertain the effect of the salts present on the growth of the rice plant. The author's experiments with solutions of pure salts showed that at very low concentrations the salts had a stimulating effect, but at higher concentrations they had a toxic action, on rice seedlings. The concentrations at which the stimulating effect was greatest were: $MgSO_4$, $N/500$; $MgCl_2$ and $CaCl_2$, $N/1000$—$N/5000$; NaCl, $N/50$—$N/100$; Na_2CO_3 and $NaHCO_3$, $N/100$—$N/500$. The salts acted injuriously when the concentrations were greater than $N/100$ for $MgSO_4$, $MgCl_2$, $CaCl_2$, NaCl, and Na_2CO_3, and $N/50$ for Na_2SO_4 and $NaHCO_3$. Experiments with $N/10$ solutions (at which concentration all the salts were toxic when used singly) showed that when two salts were present together in suitable proportions the toxic action of each was neutralised. To obtain this neutralising effect a greater addition of, for example, a sodium salt to a magnesium salt was needed than of a magnesium salt to a sodium salt, and in general, divalent cations ($Ca^{\cdot\cdot}$, $M^{\cdot\cdot}$) had a greater effect on univalent cations ($Na^{\cdot}$, $K^{\cdot}$) than univalent cations had on divalent cations. Calcium ions were more effective than magnesium ions; strontium ions were much less effective, and barium ions actually enhanced the injurious action of sodium and magnesium ions. The anions also play a part, but in a much lesser degree than the cations.—A. S.

Sodium chloride; Manurial experiments on the effect of —— in comparison with potassium chloride. P. Bolin. Meddelande No. 82 från Centralanstalten för jordbruksförsök, Stockholm, 1913. 1—16. Biedermann's Zentr., 1913, 42, 670—673.

Manurial experiments in Sweden with oats, grass, and root crops on peat soils of different kinds, have shown that in very many cases the improvement in yield produced by sodium chloride is as great as that produced by potassium chloride, when used in conjunction with Chile-saltpetre and superphosphate. The conclusion is that the salts act either by virtue of their chlorine, or else merely as salts supplying a "salt deficiency" in the soil. In either case the sodium chloride is the more economic application. In certain conditions, of course, the potassium salt has a specific action which the sodium chloride cannot exert, in which case it cannot be replaced by the cheaper salt.—W. H. P.

Fertilisers containing acid phosphate and calcium cyanamide; Decrease of available phosphoric acid in mixed ——. R. N. Brackett. J. Ind. Eng. Chem., 1913, 5, 933—935.

Laboratory experiments and experience on a factory scale both show that in mixed fertilisers containing 1 part of calcium cyanamide to 6·25 or 8·33 parts of acid phosphate (superphosphate), with or without "ammoniates" and potash salts, there is a gradual increase of the insoluble and decrease of the available phosphoric acid on standing —A. S.

Deterioration in the quality of sugar beets owing to the formation of nitrates in the soil. Headden. *See* XVII.

Patents.

Tobacco-scrap; Process of treating ——. C. F. Gloystein, Assignor to American Nicotine Co., Henderson, Ky. U.S. Pat. 1,078,427, Nov. 11, 1913.

Three parts by weight of a 1·5 to 2 per cent. soda solution are mixed with 2 parts of tobacco scrap "to a point not materially in excess of saturation," and the liquid is removed from the scrap by evaporation, the vapours containing nicotine being condensed. In this way it is said that the tobacco is obtained in its original condition so far as its fertiliser value is concerned.—T. F. B.

Dicalcium phosphate fertiliser; Process for producing a ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. Eng. Pat. 9342, April 21, 1913. Under Int. Conv., April 26, 1912.

See Fr. Pat. 456,786 of 1913; this J., 1913, 1079.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beets; Deterioration in the quality of ——, owing to the formation of nitrates in the soil. P. Headden. Blätter für Zuckerrübenbau, 1912, [24], 377. Biedermann's Zentr., 1913, 42, 674—676.

Since 1904 a fall has taken place in the sugar content of beets grown in Colorado, which has been generally attributed to the high percentage of soluble matter (1—2 per cent. of alkali sulphates and chlorides) in the soil, and to irrigation. The author, however, brings forward evidence to show that the principal cause is excessive nitrate assimilation, producing a lengthened vegetation period and a delay in ripening. The diminution in the sugar percentage is accompanied by a considerable increase in the yield of molasses, and a high content of nitrate nitrogen. The same changes can be produced by nitrate manuring, and much nitrate is always found in the soils which produce the low-quality beet.—W. H. P.

Fibre; Determination of —— in cane and bagasse. L. G. L. Steuerwald. Archief Suikerind. Nederl.-Indië, 1913, 21, 471—482.

The customary method of determining the fibre content of cane or bagasse, by extraction with alcohol, gives considerably lower results than those yielded by the formula:

$$\left.\begin{array}{c}\text{dry substance, per cent.}\\ \text{on the bagasse}\end{array}\right\} = \frac{\text{sugar, per cent. on bagasse} \times 100}{\text{quotient of purity of bagasse juice.}}$$

Experiments showed that the alcoholic extraction method is open to two sources of error: (1) a substance insoluble in water, and consisting principally of saccharetin (this J., 1912, 142) is dissolved from the fibre; (2) gummy and other bodies from the bagasse juice are precipitated on the fibre. Comparative determinations with exhausted Java bagasse showed that: (1) the alcoholic extraction method gives values considerably lower than the truth; (2) if to the value obtained by the alcoholic extraction method the percentage of saccharetin and allied bodies, which are soluble in alcohol and insoluble in water, be added, the result approximates closely to the truth, though a little lower than that calculated from the formula; (3) the cold aqueous digestion method (this J., 1911, 145), combined with pressing, gives too high results owing to the impossibility, it is stated, of obtaining a residue quite free from sugar, and it is, moreover, tedious. It is recommended that the fibre content should always be indirectly obtained by calculation from the formula, which according to the author gives more accurate results than any of the direct methods.—J. P. O.

Sugar solutions; Viscosity of ——. C. W. R. Powell. Chem. Soc. Proc., 1913, 29, 264—265.

The results of an investigation into the viscosities of aqueous solutions of sucrose, dextrose, and lævulose are given, dealing first with simple solutions containing only one of the sugars, and then with complex solutions containing mixtures of them. The effect of temperature on the viscosity of these solutions is found to be well expressed by Poiseuille's equation:

$$\eta t = \frac{\eta o}{1 + \alpha t + \beta t^2},$$

where ηo is the viscosity at 0°, ηt is the viscosity at t°, and α and β are constants. If the concentration of the solution is expressed as grams of solute per grams of solvent, the relation between viscosity and concentration is a logarithmic one, and may be represented by the equation $\eta x = A^x$, where x is the concentration and A a constant. It was found that for aqueous solutions of the three sugars mentioned, the two equations

$$\eta x = A^x,$$

$$\eta = \frac{m\eta a + n\eta b}{(m + n)},$$

may be used conjointly with a fair degree of accuracy to calculate the viscosity of a solution containing two or more of the sugars.

Molasses ; The final —— of Russian beet sugar factories. J. Mintz. Centr. Zuckerind., 1913, **22**, 184—185. (Compare also this J., 1912, 740 ; and 1913, 619.)

Analyses of 60 samples taken during the 1907-8 and 1908-9 campaigns from different Russian factories showed the following average values : Lowest apparent purity, 51·6 ; lowest true purity, 52·34 ; ratio of organic matter to ash, 2·0—2·5 ; nitrogen content, 1·6—3·6 per cent. of the dry substance. The composition of the ash varied within wide limits, but there was present less potash and soda and more lime than in German and Austro-Hungarian molasses, due apparently to the soil and the fertilisers used ; some samples contained only traces of soda. The highest ratio of organic matter to ash always coincided with the lowest purity, and inversely, which apparently confirms Schukow's view that of the organic and inorganic non-sugars of beet molasses the latter have the greater melassigenic effect The ratio of organic matter to ash depends upon the quality of the beet, its cultivation, and the conditions of working in the factory, but was practically constant for any factory during a certain period, even after the molasses had been treated with lime at a high temperature.—J. P. O.

Patents.

Sacchariferous vegetables ; Apparatus for leaching ——. M. Paschen, Köthen, Germany. U.S. Pat. 1,077,296, Nov. 4, 1913.

The apparatus comprises an inclined trough with an inlet for the slices at one end and one for the liquid at the other end, the respective outlets also being at opposite ends. The trough is divided by partitions into several chambers, with means for agitating and conveying, adapted to throw the slices over the several partitions. For the passage of the liquid from one chamber to the next, "overfalls" are provided comprising hollow partitions of inverted V-shape with inlets for the liquid at the upper end of one wall, and outlets in the lower end of the other wall.—J. F. B.

Sugar solutions ; Process for purifying and decolourising ——. F. Tiemann. Ger. Pat. 265,030, Aug. 27, 1912. Addition to Ger. Pat. 257,079.

Instead of using stannic oxalate alone, as in the chief patent (see Fr. Pat. 448,842 ; this J., 1913, 441), powdered animal charcoal is incorporated with an aqueous solution of the oxalate, and the mixture is added to the impure sugar solution. The stannic acid combines with the phosphate in the charcoal to form a compound analogous to phosphostannic acid which, in conjunction with the charcoal, forms a highly efficient decolourising agent. —T. F. B.

Juice from sugar cane and other plants containing sugar ; Process and apparatus for extracting ——. O. Mengelbier. Fr. Pat. 459,748, June 28, 1913. Under Int. Conv., Oct. 19, 1912.

See Ger. Pat. 261,999 of 1912 ; this J., 1913, 920.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Maltase of beer yeast ; Conditions of activity of the ——. I. L. Michaelis and P. Rona. Biochem. Zeits., 1913, **57**, 70—83.

The maltase present in aqueous extracts of dried bottom-fermentation yeast acquires its maximum activity in faintly acid solutions for which the values of p_H lie between 6·1 and 6·8. When these limits are passed in either sense, the activity of the enzyme falls off very rapidly and undergoes permanent enfeeblement or even destruction. If, for example, maltase is kept in a solution possessing the optimum reaction for invertase ($p_H = 4{\cdot}5$), it becomes permanently inactive. When an electric current is passed through solutions of maltase of optimum hydrogen ion concentration the enzyme migrates towards the anode. Maltase appears therefore to be extremely sensitive towards alkalinity or excessive acidity, and to be active and stable only in the form of anions. Unlike invertase it is adsorbed by kaolin to a considerable extent.—J. H. L.

Saccharomyces anamensis, the yeast of the new amylo-process. H. Will. Z. ges. Brauw., 1913, **36**, 576—577.

The "amylo-process" in distilleries takes its name from *Amylomyces Rouxii* which Calmette in 1892 isolated from "Chinese yeast" and applied as a fermenting agent for amylaceous materials. Other moulds, *e.g.*, *Rhizopus japonicus* and *R. Delemar*, have since been employed. Quite recently the "yeast anamite," isolated from a mixture of wild yeasts found on the sugar cane in Cochin China, has been applied to the fermentation of saccharified mashes, and this organism is particularly useful because it ferments at the same temperature at which the "amylo-mould" develops (35°—38° C.) and can therefore be employed together with the latter in mashes of the "amylo-process." This new yeast, to which the name *Saccharomyces anamensis Will et Heinrich* is given, resembles the wild yeasts in many respects. The cells are normally oval but some small ones are spherical. The dimensions range from 4μ by 4μ to $11{\cdot}2\mu$ by $9{\cdot}6\mu$, but very long cells occur in films and giant colonies. The spores, which number 1—4, are spherical and measure from $2{\cdot}4\mu$ to 4μ. The optimum temperature of sporulation is 33° C. (9 hours), the upper limit is 35° C. (12 hours) and the lower limit 12° C. (50 hours). The yeast ferments and assimilates dextrose, lævulose, galactose, sucrose, maltose and raffinose. Lactose is assimilated but only slightly fermented.—J. H. L.

Citric acid ; [Alleged] transformation of alcohol and of lactose into —— by moulds. C. Wehmer. Chem.-Zeit., 1913, **37**, 1393—1394.

The author's experiments do not confirm the statement of Mazé and Perrier (Comptes rend., 1904, **139**, 311) that *Citromyces* moulds produce citric acid from ethyl alcohol and from lactose. The organisms employed were *Citromyces* A and B (see this J., 1913, 156). The former did not develop well in liquids containing 5 per cent. of alcohol. Both assimilated lactose, but in no case was any citric acid produced.—J. H. L.

Alcohol production and consumption in France. Chem. Trade J., Nov. 29, 1913. [T.R.]

Statistics published by the French Ministry of Finance show that the total production of alcohol in 1912 was 87,440,420 gals., as compared with 63,797,165 gals. in 1911. In addition to this production, France received from foreign countries 4,913,571 gals. of pure alcohol and liqueurs. On the other hand, there was a total export trade of 8,321,370 gals. As regards the use made of the alcohol produced, 40,044,517 gals. took the form of beverages, a small quantity was used for the manufacture of perfumery, and 17,994,896 gallons were denatured. About 2,306,130 gals. were employed for mixing with wine, and 1,490,106 gals. were used in the manufacture of vinegar. Out of the quantity taxed for consumption, 21,905,701 gals. took the form of brandy, 5,776,457 gals. were used for absinthe, and 282,557 gals. were used for making perfumery. The remainder was employed in the manufacture of different liqueurs. Of the 17,994,896 gals. of denatured alcohol, 12,662,483 gals. were used for heating and lighting, while 4,113,504 gals. were employed for the manufacture of explosives.

Action of antiformin [disinfectant] on metals and alloys. Zikes. *See* XIXb.

Patents.

Malt cakes in mash filters ; Process for lixiviating ——. J. Schaeffer, Frankfurt on Maine, Germany. Eng. Pat. 9688, April 24, 1913.

The water used for lixiviating the cakes in the mash filters is repeatedly utilised for the penetration of one or more groups in one or more filters and at the end of a group a portion of the liquid enriched in extract is directly conveyed to the boiling pan, this portion being replaced by fresh water. Between the individual groups of filters, a pump or pressure-raising device is placed in order to avoid the necessity of employing a high initial pressure sufficient to force the liquid through all the groups. The forward chambers in which lixiviation is concluded may be cut out consecutively at the end of the lixiviation and the circulation confined to those chambers which are not completely lixiviated: freshly filled chambers may take the place of those cut out.—J. F. B.

Yeast with "roast aroma"; Process for obtaining dry ——. Versuchs- u. Lehranstalt f. Brauerei. Ger. Pat. 266,001, Jan. 11, 1913. Addition to Ger. Pat. 264,996 (this J., 1913, 1082).

A mixture of fresh yeast with a yeast extract is dried rapidly. The aroma of the product can be controlled by varying the amount of extract used: thus, one per cent. (calculated on the dry substance) gives a faint aromatic flavour to the product, whilst 10 per cent. produces a strong aroma.—T. F. B.

Yeast; Process of improving and preserving ——. Malz- u. Nährpräparateges. m. b. H., Munich, Germany. Eng. Pat. 26,005, Nov. 12, 1912. Under Int. Conv., Dec. 13, 1911.

See Fr. Pat. 450,988 of 1912; this J., 1913, 620.—T. F. B.

Yeast; Process of treating ——. E. Jacoby, Assignor to Diamalt Akt.-Ges., Munich, Germany. U.S. Pat. 1,078,288, Nov. 11, 1913.

See Fr. Pat. 450,988 of 1912; this J., 1913, 620.—T. F. B.

Fermenting vats. U. Deinhardt, Vieselbach, Germany. Eng. Pat. 10,595, May 5, 1913. Addition to Eng. Pat. 25,275, Nov. 4, 1912.

See Addition to Fr. Pat. 450,164 of 1912; this J., 1913, 1081.—T. F. B.

Glycerin from vinasses; Process for extracting ——. G. P. Guignard, Melun, Assignor to H. L. A. M. Watrigant, Lille, France. U.S. Pat. 1,078,580, Nov. 11, 1913.

See Fr. Pat. 445,895 of 1911; this J., 1912, 1196.—T.F.B.

XIXa.—FOODS.

Gliadin in flour and gluten; Determination of ——. G. A. Olson. J. Ind. Eng. Chem., 1913, **5**, 917—922.

It is customary to regard all the nitrogenous matter of flour which is soluble in dilute alcohol (50—70 per cent.) as gliadin. The author's experiments show that aqueous alcohol (preferably of 50—65 per cent. concentration) extracts two classes of nitrogenous compounds from flour and from gluten: On evaporating and diluting with water about 68 per cent. of the soluble nitrogenous compounds are coagulated and this portion corresponds to the gliadin as determined by the indirect method. The non-coagulable soluble nitrogenous compounds can be precipitated by phosphotungstic acid. For the determination of gliadin-nitrogen in flour, 4 grms. are digested with 200 c.c. of 50 per cent. (by vol.) alcohol, the mixture being shaken every 5 mins. during 2 hours, then allowed to stand overnight, and filtered till clear. The percentage of total soluble nitrogen is determined in 25 c.c. of the filtrate. Another 50 c.c. of the solution are concentrated slowly to 5 c.c., treated with 50 c.c. of water, concentrated at just below the boiling point to 10 c.c., treated with a further 50 c.c. of water and concentrated to 35 c.c. After cooling, the liquid is filtered till clear, and the nitrogen-content of the filtrate determined. This result when deducted from the total alcohol-soluble nitrogen gives the gliadin-nitrogen.—A. S.

Gelatin in sour cream; Detection of ——. A. Seidenberg. J. Ind. Eng. Chem., 1913, **5**, 927—928.

The method adopted provisionally by the U.S. Dept. of Agriculture (Bull. 107, rev., 121) for the detection of gelatin consists in shaking 10 c.c. of the cream with 10 c.c. of acid mercuric nitrate solution, adding 20 c.c. of water, again shaking, filtering after 5 mins., and adding an equal volume of picric acid solution, a precipitate being produced if gelatin be present. With sour cream, soluble decomposition products may produce a precipitate, but this is insoluble in hot water, whereas the gelatin precipitate is soluble. In such cases, the mixture is shaken vigorously, the liquid separated by siphoning and filtration, and the precipitate washed first with ammoniacal water until the washings are alkaline to litmus, and then with water. The washed precipitate is heated to boiling with 10—20 c.c. of water, and after filtering, the solution is cooled and treated with an equal volume of picric acid solution, the presence of gelatin being indicated by the formation of a precipitate. It is possible to detect 0·5 per cent. of gelatin in 20—25 c.c. of sour cream by this method.—A. S.

Patents.

Seasoning material and process of making the same. H. Fleck, Golden, Colo., U.S.A. Eng. Pat. 11,567, May 19, 1913. Under Int. Conv., May 18, 1912.

Vegetables, such as onions, celery, horse-radish, garlic, etc., are peeled, ground to a pulp, mixed with a volatile, non-miscible solvent, and centrifuged or pressed. The solvent is separated from the aqueous layer, mixed with the residual fibrous or pulpy matter, and after the addition of about 20 per cent. of its weight of salt, heated to 180° F. (82° C.) to remove the solvent, and then dried. In the case of onions, the outer skins may be extracted with water and the brown extract obtained on concentrating the solution added to the above-mentioned mixture.
—W. P. S.

Cocoa; Process of treating ——. H. B. Hunter, Norfolk, Va. U.S. Pat. 1,076,122, Oct. 21, 1913.

Cocoa is mixed with an "aqueous liquid" and heated first to a temperature sufficiently high to burst the starch cells and then in a closed vessel to from 100° to 125° C. until desired changes in the flavour are produced.—W.P.S.

Food fats of animal or vegetable origin; Process for the production of or for retaining the taste and aroma of natural butter in ——. L. and B. Kaufmann, Mannheim, Germany. Eng. Pat. 7296, March 27, 1913.

See Fr. Pat. 455,781 of 1913; this J., 1913, 957.—T. F. B.

Desiccating [meat and other foods]; Process of ——. C. Tellier, Paris. U.S. Pat. 1,076,923, Oct. 28, 1913.

See Eng. Pat. 16,206 of 1911; this J., 1912, 791.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Waters; Determination of the acidity or alkalinity of ——. J. Moir. J. Chem., Met. and Min. Soc., S. Africa, 191 14, 114—118.

A water can be shown to be either acid or alkaline and the degree of each to vary, according to the class of indicator used. A mine water containing sulphates of iron, aluminium and magnesium and about 65—70 parts of free sulphuric acid per 100,000, tested with nearly 30 indicators gave results varying from over 100 parts of acid with "tropaeolin O O" as indicator to *nil* with thymolphthalein. Another mine water containing ferric iron used about 17 c.c. of $N/5$ soda for 100 c.c. with thymolphthalein as indicator, 9·5 c.c. with methyl-red to the salmon shade, and 3 c.c. with methyl-orange to the intermediate shade, although the true acidity was about 115 parts of acid per 100,000. Johannesburg tap-water, containing bicarbonates and free carbonic acid, showed varying degrees of acidity to 12 indicators and varying degrees of alkalinity to 16 others. A standard neutral solution can be made by mixing freshly boiled $M/10$ solutions of disodium phosphate and monosodium phosphate in proportions of one of the former to 3 or 4 of the latter; the hydrogen ion concentration of the mixture is 10^{-7}, the same as in conductivity water. This solution will give the true neutral shade of any indicator. Another method, applicable to certain indicators, is to fill two parallel-walled glass cells with the indicator, and to add to one 1 c.c. of concentrated hydrochloric acid and to the other 1 c.c. of strong caustic soda. When these cells are placed behind each other, the colour observed on looking through both is the true neutral shade. The paper concludes with a table giving the approximate order of strength of 54 indicators.—J. H. J.

Antiformin [*disinfectant*]; *Action of* —— *on metals and alloys.* H. Zikes. Allgem. Z. Bierbrau. u. Malzfabr., 1913, **41**, 595—598.

Antiformin, a 10 per cent. solution of sodium and potassium hypochlorites rendered alkaline by addition of caustic alkali, strongly attacks iron, aluminium, nickel, cobalt and manganese when left in contact with these metals for several days. A 2 per cent. solution of antiformin produces visible signs of corrosion in iron within 3 days, and later gives rise to dendritic filaments of hydrated oxides (1—4 cm. long) much resembling in appearance certain vegetable forms. Zinc and certain alloys such as brass and German silver are attacked much less rapidly, whilst copper, tin, lead and bismuth are scarcely attacked even by 10 per cent. solutions in 10 days. In the disinfection of metal apparatus, especially those of iron or aluminium, with antiformin, it is advisable to shorten the duration of the treatment as much as possible.—J. H. L.

Chlorine [*in water*]; *Ortho-tolidine as a reagent for the colourimetric determination of small quantities of free* ——. J. W. Ellms and S. J. Hauser. J. Ind. Eng. Chem., 1913, **5**, 915—917.

An acetic acid solution of *o*-tolidine has been suggested by E. B. Phelps (Dittoe and Van Buskirk, Ohio State Board of Health, Bull. 3, No. 1, Jan., 1913) as a reagent for the detection of small quantities of free chlorine in water which has been disinfected by chlorine or hypochlorites. By using hydrochloric acid in place of acetic acid, the test may be used for quantitative purposes. 100 c.c. of the water are treated with 1 c.c. of a 0·1 per cent. solution of *o*-tolidine in 10 per cent. hydrochloric acid, and after 5 mins., the colour is compared with that of standards prepared in a similar manner with water which has been distilled with alkaline permanganate. (A larger quantity of the reagent must be used if the water contain more than 3 parts of free chlorine per million.) Permanent colour standards may be prepared by mixing together solutions of copper sulphate (1·5 grm. $CuSO_4,5H_2O$ and 1 c.c. H_2SO_4 per 100 c.c.) and of potassium bichromate (0·025 grm. $K_2Cr_2O_7$ and 0·1 c.c. H_2SO_4 per 100 c.c. for up to 0·1 part Cl per million, and 0·25 grm. $K_2Cr_2O_7$ and 1 c.c. H_2SO_4 per 100 c.c. for higher concentrations):—

Parts Cl per million.	Copper sulphate solution.	Potassium bichromate solution.	Parts Cl per million.	Copper sulphate solution.	Potassium bichromate solution.
	c.c.	c.c.		c.c	c.c.
0·01		0·8	0·60	2·00	5·1
0·02	—	2·1	0·70	2·00	5·8
0·03	—	3·2	0·80	2·00	6·3
0·04	—	4·3	0·90	2·00	6·7
0·05	0·4	5·5	1·00	2·00	7·2
0·06	0·8	6·6	2·00	2·00	12·0
0·07	1·2	7·5	3·00	2·00	21·0
0·08	1·5	8·7	4·00	2·00	30·0
0·09	1·7	9·0	5·00	2·00	39·0
0·10	1·8	10·0	6·00	2·00	46·0
0·20	1·9	2·0	7·00	2·00	56·0
0·30	1·9	3·0	8·00	2·00	63·0
0·40	2·0	3·8	9·00	2·00	70·0
0·50	2·0	4·5	10·00	2·00	75·0

—A. S.

Manganese; Colourimetric determination of small quantities of —— *in water.* L. Hartwig and H. Schellbach. Z. Untersuch. Nahr. Genussm., 1913, **26**, 439—442.

Fifty c.c. of the water (or more if less than 0·05 mgrm. of manganese is present) are evaporated with 0·5 c.c. of strong nitric acid (free from iron) to half the volume, and then cooled and treated with a slight excess of 1 per cent. silver nitrate solution above that required to precipitate all chlorides, and with 10 c.c. of 10 per cent. ammonium persulphate solution. The flask is heated over boiling water for 20 to 30 minutes until the silver chloride subsides, and the liquid is then boiled and cooled. The colour of the completely cold violet-red solution is then matched in Hehner cylinders with a solution of potassium permanganate (2·8769 grms. per litre = 1 grm. of Mn per litre) which has been diluted as follows:—10 c.c. are mixed with 90 c.c. of a solution of 40 grms. of ammonium persulphate, 12 c.c. of dilute nitric acid, and 12 c.c. of 1 per cent. silver nitrate solution in 2 litres, boiled and cooled. Of this dilute permanganate solution 10 c.c. are diluted to 100 c.c. (1 c.c. = 0·01 mgrm. of Mn). Prior to the introduction of the manganese solutions the Hehner cylinders are rinsed at least 3 times with the above mentioned solution of ammonium persulphate, nitric acid and silver nitrate.—C. A. M.

Determination of small quantities of lead, obtained by extraction, in cooking utensils covered with lead glaze. Meerburg. *See* VII.

Patents.

Water; Apparatus for sterilising —— [*by ultra-violet rays*]. M. von Recklinghausen, A. Helbronner, and V. Henri, Paris. Eng. Pat. 24,623, Oct. 28, 1912. Under Int. Conv., Oct. 30, 1911.

The lamp emitting the ultra-violet rays is suspended above a tank containing the water, and a helical quartz tube is mounted within the tank with its upper end just below the surface of the water and the lower end passing through the bottom of the tank. The upper layer of water is sterilised by the rays, passes into the helical tube, and is discharged therefrom through a valve at the lower end. When the apparatus has not been used for some time, this valve may be kept closed for a short time so that, when water is admitted, the tank is filled and the water overflows, carrying off floating impurities.—W. P. S.

Water filters. H. Herzbruch, Datteln, Germany. Eng. Pat. 12,163, May 24, 1913.

A filtering layer of uniform thickness, composed of granular material, such as sand, rests on a wood grid (to facilitate cleaning), which is carried by a series of contiguous, porous drain-pipes or hollow tiles, connected with ventilating shafts. The floor of the filtering bed is inclined towards the intake end, so that most of the muddy deposit is formed at the part where the water is deepest.—O. R.

Sewage; Treatment of ——. T. K. Irwin, London. Eng. Pat. 16,237, July 11, 1912.

In the treatment of sewage by the process described in Eng. Pat. 20,558 of 1909 (this J., 1910, 1078), the sludge is mixed with a fixed proportion of yeast, then heated to 80° F. (27° C.) and maintained at this temperature for 12—24 hours, whilst flowing through a series of troughs. Means are provided for removing the floating fermented material and conveying it to a drying apparatus. The liquid portion is treated with lime, alum, superphosphate, or the like, centrifuged, and the resulting effluent subjected to filtration or allowed to flow away directly, whilst the separated solids are conveyed to the drying apparatus. The latter is fitted internally with rapidly rotating blades which subdivide the solids in order to facilitate the drying.—W. P. S.

Pasteurising. F. Gettelman, Milwaukee, Wis. U.S. Pat. 1,077,270, Nov. 4, 1913.

The product is subjected to a series of water baths, the temperatures of which increase progressively, to effect sterilisation, and is heated by indirect radiation between the various baths. It is afterwards submitted to baths of progressively decreasing temperatures, and cooled between successive baths by an indirect cooling medium.—B. N.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona alkaloids; A new test for ——. G. N. Watson. Amer. J. Pharm., 1913, **85**, 502.

A freshly prepared saturated alcoholic solution of α-naphthol is treated with a little strong sulphuric acid (2 drops to 1 c.c.). When a few drops of this reagent are added to an aqueous solution of quinine sulphate a yellow precipitate is produced. If the reagent be added in excess a yellow solution results. The same reaction is produced with sulphates of quinidine, cinchonine, and cinchonidine, but no other white alkaloids give the yellow colour. The characteristic colour can be obtained with 1 c.c. of a 1 : 2000 solution of quinine sulphate.—F. Shdn.

Morphine in acid preparations of opium; Determination of ——. Débourdeaux. J. Pharm. Chim., 1913, **8**, 424—429. (See also this J., 1913, 988.)

An excess of milk of lime is added to 150 grms. of the acid laudanum of Sydenham, and the whole made up to 300 c.c. The mixture is filtered and the residue washed with 50 c.c. of water. The filter and residue are worked up with a further 150 c.c. of water, filtered, and the residue washed three times with water, using 50 c.c. each time. The liquid obtained is supersaturated with carbon dioxide, filtered if necessary, and the residue washed with a little carbonated water. The liquid and the precipitate are evaporated to 100 c.c. on the water bath. When cold, 50 c.c. of ether and 10 c.c. of $N/1$-ammonia solution are added, and the whole left in a cool place for 24 hours. The ether is then poured off and the insoluble matter filtered off, and washed 5 times with water saturated with ether and morphine, using 5 c.c. each time. The filtrate should be treated with 2·5 c.c. of $N/1$-ammonia solution to make sure that all the morphine has been precipitated. The filter and precipitate are dried at 100° C. and treated with 5 grms. of fresh finely powdered lime and 118 grms. of water. An aliquot portion is filtered and treated with 10 per cent. of its volume of 95 per cent. alcohol, 50 per cent. of ether and 2 per cent. of its weight of ammonium chloride. After standing in a cool place for 24 hours, the morphine is filtered off in a Gooch crucible, washed first with water saturated with ether and morphine, and afterwards with benzene, and dried at 100° C.—F. Shdn.

Caffeine in preparations of kola, particularly kola granules; Determination of ——. M. Francois. J. Pharm. Chim., 1913, **8**, 411—422, 451—458.

The mixture of calcined magnesia and extract of kola (including the fluid extract and the granules), as used in determining caffeine, becomes dry after 48 hours' exposure to the air, and after being finely powdered will yield the whole of its caffeine to chloroform. The residue left on evaporating the chloroform solution yields no ash but contains about 3 per cent. of impurities insoluble in hydrochloric acid. Continuous extraction of the dry magnesia mixture is to be preferred to shaking the mixture with chloroform and withdrawing two-thirds. The granules, 15 grms., are powdered and then triturated with 5 c.c. of water. After half an hour, the mixture is triturated with 10 grms. of magnesia. The whole is dried for 24 hours over sulphuric acid, finely powdered, and extracted continuously with chloroform for 4 hours, using 100 grms. of the solvent. The magnesia method does not give reliable results when applied to kola nuts.
—F. Shdn.

Nicotine; Determination of —— *as silicotungstate.* R. Spallino. Gaz. chim. ital., 1913, **43**, II., 482—486.

The gravimetric determination of nicotine as silicotungstate, the precipitate being ignited and the mixture of tungsten trioxide and silica weighed, gives accurate results when the factor 0·1139 is used for calculating the nicotine content. The method suggested by Chapin of drying the precipitate at 125° C., however, is not reliable: a constant weight is not attained even after 34 hours, and discordant results are obtained. (See also this J., 1909, 326; 1911, 1182.)—A. S.

Nicotine in presence of ammonia [e.g., in tobacco]; Determination of ——. R. Spallino. Gaz. chim. ital., 1913, **43**, II., 493—500.

The method depends on the fact that nicotine behaves towards picric acid as a di-acid base in aqueous solution and as a mono-acid base in alcoholic solution. From 1·5 to 3·5 grms. of tobacco are mixed with milk of magnesia and distilled with steam, the vapours being passed into 50—100 c.c. of an aqueous solution of picric acid. The distillate (600—700 c.c.) is diluted to 1 litre with alcohol, and divided into two equal portions which are evaporated to dryness separately. The residue from one portion is dissolved in alcohol and titrated with $N/2$ baryta in presence of lacmoid. The other residue is treated with water, the solution diluted to 100 c.c., filtered, 75 c.c. titrated with baryta, and the volume of baryta required for 100 c.c. calculated. The difference between the number of c.c. of $N/2$ baryta required for the alcoholic and aqueous solutions respectively, when multiplied by 0·0081 gives the weight of nicotine in grams.—A. S.

Tobacco of Italian manufacture; Presence of barium and arsenic in ——. R. Spallino. Gaz. chim. ital., 1913, **43**, II., 475—481.

In seven samples of snuff and three of smoking tobacco the barium content ranged from 0·019 to 0·036 per cent., calculated as barium sulphate and referred to the material dried at 100° C. In three samples of snuff and four of smoking tobacco, the arsenic content ranged from 0·08 to 1·02 mgrm. per 100 grms. of dry substance. In view of the rapidly growing use of arsenical insecticides in tobacco plantations, especially in the United States, it is recommended that a determination of arsenic should be a preliminary to the purchase of a consignment of tobacco.
—A. S.

Commercial chrysarobin; Note on the constituents of ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Proc., 1913, **29**, 285—286.

In a recent communication (this J., 1912, 253) the authors described the results of the examination of several samples of commercial chrysarobin. During the course of this research the following substances were isolated: Chrysophanol ("chrysophanic acid"), $C_{15}H_{10}O_4$; emodin monomethyl ether, $C_{16}H_{12}O_5$; chrysophanolanthranol, $C_{15}H_{12}O_3$; dehydroemodinanthranol monomethyl ether, $C_{16}H_{12}O_4$; ararobinol, $C_{23}H_{16}O_5$; and emodin, $C_{15}H_{10}O_5$. It was furthermore pointed out that commercial chrysarobin is subject to considerable variation in the relative proportions of its constituents, some samples being even entirely devoid of certain compounds which occur in others. In all the products examined, however, the first four of the above-mentioned compounds were invariably found to be present. O. Hesse (this J., 1913, 357), shortly afterwards, mentioned as constituents of commercial chrysarobin the following substances: "Chrysophanol" (chrysophanolanthranol); "emodinol" (emodinanthranol); the methyl ethers of both these substances; and a new substance, $C_{15}H_{12}O_4$, which is designated as chrysarobol. It was stated by Hesse, however, that of these five substances, only two, namely, "chrysophanol" (chrysophanolanthranol) and chrysarobol, had been ioslated directly in a pure state from commercial chrysarobin, whereas all the constituents described by the present authors were directly isolated in a state of purity. [But the authors draw attention to the fact that Hesse has employed the name chrysophanol for the anthranol of "chrysophanic acid," the former name having already been employed by the present authors, and previously by Tschirch (this J., 1911, 647; and Arch. Pharm., 1912, **250**, 27), as the designation for pure "chrysophanic acid." Moreover, since Hesse himself (Annalen, 1899, **309**, 32) and Jowett and Potter (Trans. Chem. Soc., 1902, **81**, 1577) have previously applied the name "chrysarobin" to chrysophanolanthranol, the employment of yet a third name for this substance only adds to the confusion already existing.] Chrysophanolanthranol has long been known to be a constituent of commercial chrysarobin, but chrysarobol has not been obtained by the present authors. This is doubtless due to the varying composition of the commercial product, since Hesse remarks that he only obtained this new substance from the chrysarobin occurring in commerce in the years 1905 and 1906. With regard to emodinanthranol (Hesse's "emodinol"), no doubt can be entertained that this was derived chiefly from the monomethyl ether of dehydroemodinanthranol which was isolated and described by the present authors, since the material examined by Hesse had been heated with hydriodic acid. [In a footnote to his paper, added after the completion of the work, Hesse states that he has never observed the occurrence of the monomethyl ether of dehydroemodinanthranol described by the present authors, but this is obviously due to his having worked almost entirely with material which had been demethylated by means of hydriodic or hydrochloric acid. In all the commercial samples of chrysarobin examined by the present authors it was present to the extent of from 13·4 to 41·1 per cent.]. Hesse himself shows that he could not obtain "chrysophanol methyl ether" and "emodinol methyl ether" in a state of purity, and the evidence he adduces does not seem to justify the conclusion that they are present. In the material examined by the present authors, the former compound certainly did not occur, but proof of the presence of small amounts of the latter was obtained. The statement made by Hesse that chrysophanolanthranol (Hesse's "chrysophanol") is insoluble in alkalis in the absence of air is incorrect This substance dissolves fairly readily in 10 per cent. aqueous potassium hydroxide, yielding a bright yellow solution, which, on the admission of air, develops the deep red colour due to the formation of chrysophanol.

Senna leaves ; The constituents of ——. F. Tutin. Chem. Soc. Proc., 1913, **29**, 278.

Three specimens of senna leaves have been submitted to examination, namely : (I) Tinnevelly senna leaves (*Cassia augustifolia*, Vahl) ; (II) senna leaves from Lima, Peru, which were found to be botanically identical with the Tinnevelly leaves ; and (III) Alexandrian senna leaves (*Cassia acutifolia*, Delile). The Tinnevelly leaves yielded, in addition to a small amount of essential oil, chlorophyll, and resinous products, the following definite substances : (i) Salicylic acid ; (ii) rhein ; (iii) kæmpferol ; (iv) aloe-emodin ; (v) *kaempferin*, $C_{20}H_{30}O_{16},6H_2O$ (m. pt. 185°—195°), a new glucoside of kaempferol ; (vi) a mixture of the glucosides of rhein and aloe-emodin ; (vii) the magnesium salt of an unidentified organic acid ; (viii) dextrose ; (ix) myricyl alcohol ; (x) a phytosterol ; (xi) a phytosterolin, $C_{33}H_{56}O_6$; (xii) palmitic and stearic acids. The Peruvian and Alexandrian senna leaves contained the abovementioned compounds, with the exception of the magnesium salt, and, in addition, *iso*rhamnetin. The latter also occured in the form of a glucoside. The statements of Tschirch and Hiepe (this J., 1900, 1139), that senna leaves contain "senna-*iso*emodin," "sennachrysophanic acid" (chrysophanol), a "substance, $C_{14}H_{10}O_5$," and "senna-rhamnetin," cannot be confirmed, it having been ascertained that the anthraquinone derivatives present consist solely of rhein and aloe-emodin, whilst the flavone product is either kaempferol, or a mixture of the latter with *iso*rhamnetin.

Rose geranium ; The cultivation of ——. E. Charabot and C. L. Gatin. J. d'Agriculture Tropicale, Oct. 1913. Perfum. and Essent. Oil Rec., 1913, **4**, 381—384.

The rose geranium is cultivated as a source of essential oil in the South of France, Algeria, and Réunion. The leaves yield an oil containing geraniol and rhodinol with a little *l*-linalol, menthone, and citral. The plant withstands dry weather very well, but is easily affected by a fall of the temperature to 2° or 3° C. Excess of moisture in the localities where it is planted is also detrimental. Fertilisers on the whole have a beneficial effect. The leaves are collected in Algeria during the spring, summer and autumn. The best yields are obtained from those collected after a period of dry weather. In Réunion, 1 kilo. of oil can be obtained from 1000—1800 kilos. of leaves, which corresponds to a yield of about 50—30 kilos. per hectare (44½—27 lb. per acre). The yield per hectare in Algeria is 20—30 kilos. (18—27 lb. per acre). The cost for cultivating, reaping, etc., varies from 550—500 francs per hectare (£8 17s. to £8 1s. per acre) in Réunion, to 497—435 francs (£8 to £7 per acre) in Algeria. The total output from these countries has shown a considerable falling off during the last few years.—F. Shdn.

Citronella oil ; Farnesol in Ceylon ——. F. Elze. Chem.-Zeit., 1913, **37**, 1422.

In the manufacture of geraniol from Ceylon citronella oil, small quantities of a fraction distilling between 150° and 165° C. at 5 mm. pressure are obtained, having the sp. gr. 0·938 at 15° C. and optical rotation (100 mm. tube), —3°. If this be saponified with alcoholic potash, distilled with steam, and the product fractionated in a vacuum, an oil is obtained from which the aliphatic sesquiterpene alcohol, farnesol (b. pt. 145°—146° C. at 5 mm., sp. gr. 0·895), can be isolated by means of its phthalic acid ester. Ceylon citronella oil contains 0·2—0·3 per cent. of farnesol, partly free and partly in the form of esters.—A. S.

Depsides, lichen-substances, and tannins ; Synthesis of ——. E. Fischer. Ber., 1913, **46**, 3253—3289.

A recapitulation of the author's work during the past five years on the use of carbomethoxy-derivatives of phenolcarboxylic acids for the synthesis of depsides, lichen-constituents and tannins. The carbomethoxy-derivatives of phenolcarboxylic acids in which the hydroxyl is in the ortho- or meta-position to the carboxyl group can be readily obtained by the action of methyl chlorocarbonate and alkali in cold aqueous solution. In other cases the carbomethoxy-derivatives can be obtained by effecting the reaction in an inert solvent, such as benzene, in presence of dimethylaniline (Hofmann, U.S. Pat. 639,714, Dec. 12, 1899). The carbomethoxy-groups can be subsequently removed partly or completely by treatment with varying quantities of aqueous alkalis or ammonia. Partly carbomethoxylated products may be methylated by means of diazomethane, and then on double saponification yield partly methylated phenolcarboxylic acids. The carbomethoxy-derivatives are converted into the corresponding chlorides by gently warming with phosphorus pentachloride or by shaking with phosphorus pentachloride in dry chloroform. These chlorides have proved specially serviceable for effecting syntheses of lichen-constituents and tannins or similar substances, which are ester-like derivatives of phenolcarboxylic acids, to which the general name, depsides (Gr. δέψειν = to tan), has been given. For example, di-*p*-hydroxybenzoic acid, $HO.C_6H_4.CO.O.C_6H_4.CO_2H$, is a didepside, di-*p*-hydroxybenzoyl-*p*-hydroxybenzoic acid, $HO.C_6H_4.CO.O.C_6H_4.CO.O.C_6H_4.CO_2H$ is a tridepside and so on. (See also this J., 1911, 1224 ; 1912, 503, 527, 1043 ; 1913, 500, 836, 905).—A. S.

Benzoic acid ; Modified Jonescu's reaction for ——. P. Fleury. J. Pharm. Chim., Nov. 16, 1913, 460.

Jonescu's reaction is based on the conversion of benzoic acid into salicylic acid by hydrogen peroxide. In this test it is shown that heat is liable to carry the reaction too far, and thus to cause failure. Whilst the reaction takes place in the cold, some hours are required for the purpose, but the addition of a trace of ferrous sulphate, which acts as a catalyser, ensures complete reaction in a fraction of a minute. The method recommended is as follows :—Ten c.c. of the solution to be tested (containing 1 to 5 mgms. of free benzoic acid) is treated with three drops of solution of ferric chloride (sp. gr. 1·260, containing about 26 per cent. of anhydrous salt) diluted 1 to 10, then with three drops of solution of hydrogen peroxide (12 vol.), also diluted 1 to 10, and finally with three drops of 3 per cent. solution of ferrous sulphate. The reagents are added in the order given, shaking after each addition. In about thirty seconds the reaction commences, and the violet colouration attains its maximum in five to ten minutes. The reaction is sensitive to 0·2 mgrm. of benzoic acid.

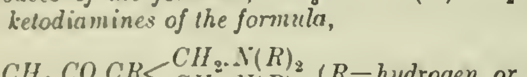
Solubilities in chlorinated aliphatic hydrocarbons. W. Herz and W. Rathmann. Z. Elektrochem., 1913, **19**, 887—888.

Attention is drawn to regularities in the solubility of iodine and certain organic acids in certain chlorinated aliphatic hydrocarbons. Tables are given showing that, of chemically related substances, such as chloroform and carbon tetrachloride, or tri- and tetra-chloroethylene, the less chlorinated has the greater solvent action. The solubility of homologous acids increases with increasing carbon content. A comparison of the solubilities of benzoic and salicylic acids and of phenylpropionic and cinnamic acids shows that the entry of a hydroxyl group or of a double bond greatly decreases the solubility in all the solvents.—G. F. M.

Detection of lead in bismuth subnitrate and carbonate. Guérin. *See* VII.

Patents.

Ketobases of the formula, $CH_3.CO.CH(R).CH_2.N(R)_2$, and of ketodiamines of the formula,



$$CH_3.CO.CR{<}\begin{matrix}CH_2.N(R)_2\\CH_2.N(R)_3\end{matrix}$$

(R=hydrogen or alkyl); Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,231, June 19, 1913. Under Int. Conv., June 20, 1912. Addition to Eng. Pat. 25,963 of 1912, dated Nov. 16, 1911 (see Ger. Pat. 254,714; this J., 1913, 380).

Acetone or one of its homologues is condensed with a homologue of dimethylamino-hydroxymethane or of tetramethyldiaminomethane. Thus a mixture of β-acetylpropyldiethylamine and ββ′-acetylmethyltrimethylenetetra-ethylenediamine (which can be separated by fractionation *in vacuo*) is obtained by condensing methylethylketone with diethylaminohydroxymethane or with tetra-ethyldiaminomethane.—T. F. B.

2-Phenylquinoline-4-carboxylic acid glycollic ester; Manufacture of esters of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 16,483, July 17, 1913.

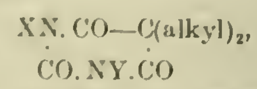
When a salt of 2-phenylquinoline-4-carboxylic acid is treated with an ester of a monohalogen acetic acid, the corresponding ester of the glycollic ester of 2-phenylquinoline-4-carboxylic acid, $C_6H_5.C_9H_5N.COOCH_2.COOR$, is obtained. The new compounds are insoluble in water, are almost tasteless, and may be used as remedies for gout, rheumatism, etc.—T. F. B.

2-Piperonylquinoline-4-carboxylic acid and its derivatives; Process for preparing esters of ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 459,180, June 12, 1913. Under Int. Conv., Jan. 13, 1913.

2-Piperonylquinoline-4-carboxylic acid and its derivatives are converted into esters by the usual processes, *e.g.*, by treatment with an alcohol in presence of sulphuric or hydrochloric acid, or by heating with an alkyl halide in presence of alkali. The ethyl ester of 2-piperonylquinoline-4-carboxylic acid has a m.pt. of 91° C., the methyl ester 135° C., and the phenyl ester 186°—188° C. —T. F. B.

N-Halogenalkyl-CC-dialkylbarbituric acids and preparation of the same. O. Wolfes, Darmstadt, Germany. U.S. Pat. 1,073,380, Sept. 16, 1913.

Compounds of the type,



$$\begin{matrix}XN.CO—C(alkyl)_2,\\ \vdots \qquad\quad \vdots\\ CO.NY.CO\end{matrix}$$

where X = halogenalkyl and Y hydrogen or halogenalkyl) are obtained by treating N-mono- or -dialkylene-CC-dialkylbarbituric acids with halogens or with hydrohalogen acids. They possess the known hypnotic action of the barbituric acids, together with a sedative action due to the halogen, this being especially marked in the case of the bromo-derivatives. For example, N-dibromopropyl-CC-diethylbarbituric acid is obtained by treating with one mol. of bromine the N-monoallyl-C.C-diethylbarbituric acid, prepared by condensing mono-allylurea with diethylmalonic ester. It is a colourless, crystalline substance of m.pt. 124° C. (corr. 126° C.).—T. F. B.

N-Halogenalkyl-C.C-dialkylbarbituric acids; Process for preparing ——. E. Merck. Ger. Pat. 265,726, Jan. 10, 1912.

See U.S. Pat. 1,074,030 of 1913; this J., 1913, 1030. Another method for preparing the products consists in treating N-alkyl-C.C-dialkylbarbituric acids with a halogen or a hydrogen halide.—T. F. B.

Alkylhomopiperonylamines and the process of making them. H. Decker, Hanover, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,966, Sept. 23, 1913.

N-Alkyl derivatives of homopiperonylamine are obtained by condensing homopiperonylamine with an aldehyde, treating the product with an alkyl halide, and decomposing the addition product in such a manner as first to remove the aldehyde residue and then to separate the base from its salt. Thus, the condensation product of homopiperonylamine and benzaldehyde is treated with methyl iodide, the product is decomposed with steam until the smell of benzaldehyde has disappeared, and the remaining solution is made alkaline and distilled with steam. Methylhomopiperonylamine is a colourless oil of b.pt. 156°—158° C. (24 m.m.), which forms crystalline salts with acids, *e.g.*, a hydrochloride of m.pt. 183°—185° C., a carbonate of m.pt. 72°—75° C., and a hydriodide of m.pt. 135°—136° C. —T. F. B.

Arsinic acids and process of making the same. L. Ach, Mannheim, and A. Rothmann, Heidelberg, Assignors to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 1,075,279, Oct. 7, 1913.

On treating *p*-dimethylaniline-arsinic acid with a mixture of nitric and sulphuric acids, a trinitro compound is formed, one of the nitro groups of which proves to be combined with the nitrogen of the amino-group, hence it is 3.5-dinitro-4-methylnitraminobenzene-1-arsinic acid. In place of dimethylaniline-arsinic acid, dimethylaniline-arsenious chloride may be used, or in general, any aromatic compound of arsenic containing the group, $-N(CH_3)R$, in in the *p*-position to the arsenic (R may represent hydrogen, methyl, or acyl). The nitration of the arsenic compound is effected by aid of heat, and the product is separated from the cooled solution by means of ice. The products can be converted by reduction into arsenic compounds having valuable therapeutic properties.—T. F. B.

Ointment containing colloidal compounds. Preparation containing colloidal compounds. C. Paal, Leipzig, and C. Amberger, Erlangen, Assignors to Kalle und Co. A.-G., Biebrich, Germany. U.S. Pats. 1,077,854 and 1,077,891, Nov. 4, 1913.

(1) A protecting colloid, such as wool fat, is incorporated with a solution of a divalent salt of a metal of the platinum group, and an alkali carbonate is added to produce the colloidal lower hydroxide of the metal; the soft mass is dissolved, a liquid is added in which the colloid is sparingly soluble or insoluble, and the precipitate containing the colloid is separated. (2) An alkali salt of a higher fatty acid, *e.g.*, oleic acid, is used in place of the alkali carbonate; in this case the products contain the platinum metal in the form of a colloidal soap.—T. F. B.

Monochlorhydrocarbons; Acetylation of ——. W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,077,988, Nov. 11, 1913.

Chloropentane and other monohalogen derivatives of hydrocarbons may be acetylated by treatment with an acetate (sodium acetate) and 70 to 99 per cent. acetic acid. —T. F. B.

Erythrene and isoprene; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 10, 1913, to Fr. Pat. 439,381, Jan. 25, 1912. Under Int. Conv., June 20, 1912.

The quaternary ammonium halogenides,

$$CH_3.CHX.CH_2.CH_2.NX(CH_3)_3, \text{ and}$$
$$CH_3.CHX.CH(CH_3)CH_2NX(CH_3)_3,$$

used in the principal patent (see Eng. Pat. 19,919 of 1911; this J., 1912, 701) may be replaced by similar compounds in which ethyl or homologous groups are combined with the nitrogen, instead of methyl groups.—T. F. B.

Isoprene and erythrene, or a mixture of these substances, from fusel oil; Process for preparing ——. O. Nauck. Ger. Pat. 264,902, May 15, 1912.

Isoprene and erythrene are obtained by passing the alcohols of fusel oil, or the hydrocarbons obtained by dehydrating these alcohols, over electrically heated metal wires or heated palladium sponge.—T. F. B.

Isoprene; Process for making ——. C. C. F. L. Gross. Fr. Pat. 459,988, June 13, 1913. Under Int. Conv., June 15 and July 6, 1912.

The vapours of turpentine oil are converted into isoprene by passing them over a catalyst consisting of a metallic oxide, such as cupric oxide. The catalyst may be prepared by mixing anhydrous cupric oxide with a saturated solution of cupric chloride or a chloride of another heavy metal, moulding the pasty mass to the desired shape, and drying; the mass is then packed into tubes or other suitable receptacles through which the turpentine vapours are passed. The catalytic effect of cupric oxide is apparent at 260° C., and is at a maximum at about 305° C., at which temperature a yield of about 35 per cent. of isoprene is obtained. Under the same conditions, except that metallic copper was used as catalyst, 500° C. was the optimum temperature and the maximum yield was 17·5 per cent.—T. F. B.

Isoprene; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 264,007, Sept. 30, 1910.

A good yield of isoprene is said to be obtained by treating trimethylethylene bromide with an organic base. When alcoholic potash is used instead of the base, α-dimethylallene and no isoprene is formed.—T. F. B.

Isoprene; Process for preparing ——. H. Staudinger. Ger. Pat. 264,923, Aug. 15, 1911. Addition to Ger. Pat. 257,640 (see this J., 1913, 507).

The mixture of terpene hydrocarbons obtained as by-product in the polymerisation of isoprene and its homologues to caoutchouc-like products, is vaporised and heated to a high temperature, *e.g.*, by means of electrically heated wires. The hydrocarbon mixture may be freed from unpolymerised isoprene, *e.g.*, by steam distillation, or it may be fractionated *in vacuo* before treating it by this method.—T. F. B.

Erythrene; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 264,264, July 21, 1912.

When primary or secondary butyl alcohol is heated to a high temperature, alone or in presence of a substance which facilitates decomposition, water and hydrogen are eliminated and erythrene is formed.—T. F. B.

Butadiene and its homologues; Process for preparing ——. C. Engler and H. Staudinger. Ger. Pat. 265,172, April 28, 1912.

The vapours of crude petroleum, petroleum distillates, or petroleum residuum are diluted with air or other inert gas, and heated to a high temperature.—T. F. B.

Pinacone from acetone; Process for preparing ——. Soc. pour la Production et la Vente des Articles en Caoutchouc "Bogatyr." Fr. Pat. 459,313, May 17, 1913.

Good yields of the pinacone alkyl oxides are obtained by treating acetone with amalgams of aluminium, sodium, zinc, or cadmium in presence of a salt of mercury or other salt which has a catalytic action, such as iron, zinc, or antimony salts. *Example.* A solution of 3·5 grms. of mercuric chloride in 350 grms. of acetone is slowly added to the amalgam obtained from 400 grms. of mercury and 27 grms. of aluminium. When the reaction is finished the pinacone alkyl oxide is decomposed by adding 100 grms. of water. The pinacone is separated from the aluminium hydroxide by means of acetone, and the solution is distilled. The yield is said to amount to 60—70 per cent.—T. F. B.

p-Nitrophenylcarbamyl chloride; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 459,885, June 12, 1913. Under Int. Conv., July 25 and Nov. 22, 1912.

p-Nitraniline can be converted into *p*-nitrophenylcarbamyl chloride by treatment with phosgene, preferably in presence of toluene or similar indifferent substance. It is advisable first to introduce the phosgene into the toluene, etc., and then to add the nitraniline. The reaction is stated to be more rapid in presence of nitro-benzene. The product melts at about 50° C., hydrogen chloride being evolved and the corresponding isocyanide formed.—T.F.B.

Curative agents (antitoxins) for smallpox, tuberculosis, foot-and-mouth disease, etc.; Process for preparing ——. W. Ponndorf. Ger. Pats. 265,207 and 265,208, May 9 and Aug. 20, 1911.

The skins of animals which have been inoculated with smallpox, tuberculosis, foot-and-mouth disease, or other toxins, is separated from infected portions, dried, powdered, and treated with a solvent. The resulting liquids constitute the antitoxins.—T. F. B.

Glycollylurethane; Process for preparing derivatives of ——. A. Voswinkel. Ger. Pat. 266,121, June 25, 1912. Addition to Ger. Pat. 247,270 (see this J., 1912, 796).

A salt of an organic acid is allowed to react with bromo- or chloro-acetylurethane in presence of a suitable solvent. Compounds such as acetylglycolurethane, bromo-isovalerylglycollylurethane, and salicylic acid-glycollylcarbamic acid methyl ester may be obtained by this method.—T.F.B.

Hexamethylenetetramine sulphosalicylate; Process for preparing ——. J. D. Riedel A.-G. Ger. Pats. 266,122 and 266,123, Oct. 3, 1912, and March 1, 1913. Additions to Ger. Pat. 240,612.

The secondary sulphosalicylate of hexamethylenetetramine is obtained either by treating the primary salt (prepared from equimolecular proportions of the components) with a second molecular proportion of hexamethylenetetramine, or by the action of two mols. of hexamethylenetetramine on one mol. of sulphosalicylic acid in absence of water, and preferably in absolute alcohol solution. It is more easily soluble in water than the primary salt, whilst its irritant properties are not so marked.—T. F. B.

Clupanodonic acid; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 266,350, Nov. 17, 1912.

The solid octobromides of the fatty acids of Japanese sardine oil are isolated and treated with zinc dust in a neutral solvent to remove the bromine. It is stated that a good yield of clupanodonic acid of iodine value 360, is easily obtained by this method (compare Tsujimoto; this J., 1906, 818).—T. F. B.

Condensation products of organic compounds [aldol, etc.]; Process for producing ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, U.S.A. Eng. Pat. 22,626, Oct. 4, 1912.

See Fr. Pat. 449,605 of 1912; this J., 1913, 507.—T. F. B.

Mercury compounds [of aryloxy-fatty acids]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4075, Feb. 17, 1913.

See Ger. Pat. 261,229 of 1912; this J., 1913, 841.—T. F. B.

4-Ketones of the quinoline series : Process for producing ——. A. Kaufmann, Geneva, Switzerland. Eng. Pat. 9315, April 21, 1913. Under Int. Conv., May 6, 1912.

See Fr. Pat. 456,254 of 1913 ; this J. 1913, 959.—T. F. B.

Diethyl sulphate ; Process for the manufacture of ——. L. Lilienfeld, Vienna. Eng. Pat. 13,882, June 16, 1913. Under Int. Conv., June 28, 1912.

See U.S.Pat. 1,074,633 of 1913 ; this J., 1913, 1030.—T.F.B.

Diethyl sulphate : Process for making ——. L. Lilienfeld. Fr. Pat. 459,282, June 16, 1913. Under Int. Conv., June 28, 1912.

See U.S.Pat 1,074,633 of 1913 ; this J., 1913, 1030.—T.F.B.

Hydrogenising organic compounds · Process of ——. H. Thron, Assignor to Verein. Chininfabriken Zimmer und Co., G. m. b. H., Frankfort, Germany. U.S. Pat. 1,077,442, Nov. 4, 1913.

See Eng. Pat. 10,204 of 1913 ; this J., 1913, 989.—T. F. B.

Hydrogenation of organic compounds ; Process for the ——. Verein. Chininfabriken Zimmer und Co. G.m.b.H. Fr. Pat. 458,963, May 7, 1913. Under Int. Conv., May 9, 1912.

See Eng. Pat. 10,204 of 1913 ; this J., 1913, 989.—T. F. B.

Acidylamino-oxyarsenobenzene ; Derivatives of —— and process of making same. P. Ehrlich and A. Bertheim, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,077,462, Nov. 4, 1913.

See Eng. Pat. 25,493 of 1912 ; this J., 1913, 550.—T. F. B.

3.3′-Diamino-4.4′-di[hydr]oxyarsenobenzene ; Preparation from alkali salts of the —— and process of making same. P. Ehrlich, Frankfort, and B. Reuter, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,078,135, Nov. 11, 1913.

See Fr. Pat. 445,325 of 1912 ; this J., 1912, 1200.—T. F. B.

Betaïne hydrochloride ; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 459,561, June 21, 1913. Under Int. Conv., Oct. 16, 1912.

See Eng. Pat. 15,161 of 1913 ; this J., 1913, 959.—T. F. B.

Betaïne or its salts , Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 459,587, June 23, 1913. Under Int. Conv., Oct. 24, 1912.

See Eng. Pat. 15,162 of 1913 ; this J., 1913, 990.—T. F. B.

Unsaturated hydrocarbons and intermediate compounds ; Process for making ——. F. E. Matthews and E. H. Strange. Fr. Pat. 459,871, June 4, 1913. Under Int. Conv., June 15, 1912.

See Eng. Pat. 13,923 of 1912 ; this J., 1913, 841.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Luminescence ; Colour photography of ——. J. M. Lohr. J. of Phys. Chem., 1913, **17**, 675—681.

Satisfactory photographs in colour have been obtained of the luminescence produced by exciting alkali halides and certain other salts by means of cathode rays, and also of luminous flames. Dufay plates were used for the work, but were found to be not highly sensitive to the faint cathodoluminescence from sodium iodide and chloride ; the yellow luminescence from cadmium sulphate was also difficult to reproduce.—T. F. B.

Photographic development ; Note on the role played by the carbonate in ——. J. H. Mathews and F. E. Barmeier. J. of Phys. Chem., 1913, **17**, 682—684.

A thick gelatin solution, containing a trace of phenolphthalein, was allowed to set in glass tubes, the ends of which were afterwards cut off. The tubes were immersed in solutions of sodium and potassium carbonates of different strengths, and the rise of the pink colour in the gelatin was noted and taken as a measure of the diffusion. It was found that the rate of diffusion increased with the concentration of the carbonate solution up to a certain limit (which was not determined), and then decreased. The solution having the greatest rate of diffusion was of the same concentration as that of the carbonate in a normal developing solution. The results are thought to indicate that one of the functions of carbonate in development is to open the pores of the gelatin.—T. F. B.

Patents.

Colour photography ; Manufacture of screens for ——. L. Dufay, Chantilly, France. Eng. Pat. 27,708, Dec. 2, 1912. Under Int. Conv., Dec. 2, 1911. Addition to Eng. Pat. 15,027 of 1912, dated June 30, 1911.

See Addition of Dec. 2, 1911, to Fr. Pat. 442,881 of 1911 ; this J., 1913, 451.—T. F. B.

Chemical process for engraving on metal cylinders in intaglio or in relief. Eng. Pat. 21,526. *See* X.

XXII.—EXPLOSIVES ; MATCHES.

Potassium chlorate ; The presence of potassium bromate in —— and the danger of spontaneous decomposition with mixtures containing such chlorates. A. Junk. Z. ges. Schiess- und Sprengstoffw., 1913, **8**, 412—414, 430—432.

Fireworks mixtures of the composition : potassium chlorate (39 parts), lead nitrate (39), sulphur free from acid (19·5) and antimony sulphide (2·5 parts), were prepared, using samples of chlorate containing, in one instance, as high as 0·6 per cent. of potassium bromate, and in the other instances only traces of this salt. Another series of mixtures was made in which the sulphur was mixed with an amount of sulphuric acid equivalent to 0·012 per cent. These mixtures were submitted to the following conditions of storage. (1) Sunlight, (2) room temperature of 20° to 25° C., and (3) in a water-oven at 85° C. In the case of the samples exposed to sunlight, those made with pure sulphur showed only a slight evolution of brown fumes, whilst with the samples containing acid sulphur, spontaneous decomposition took place in from 4 to 20 days, the sample containing the highest percentage of potassium bromate being the first to ignite. During storage at room temperature, the mixtures containing acid sulphur showed signs of strong brown fumes after one month. On adding a drop of water an explosion immediately took place. In the case of the samples containing sulphur free from acid, no signs of brown fumes were observed after the same period. On heating at 85° C., all the samples exploded between one and twenty hours, and those containing the acid sulphur were the first to decompose. The use of chlorate containing 0·6 per cent. of potassium bromate had no apparent influence on the stability of the explosives, but the author suggests that, as many samples of electrolytic potassium chlorate contain only 0·15 per cent. of bromate, this might be fixed as the limit. (See also Gartenmeister, this J., 1907, 223 ; Klopstock, this J., 1909, 89.)—G. W. McD.

Patents.

Acids containing dissolved organic substances ; Denitration of waste ——. H. G. C. Fairweather, London. From Sprengstoff A.-G.-Carbonit, Hamburg, Germany. Eng. Pat. 11,854, May 21, 1913.

In the denitration of waste acids by distillation, the gases from the still pass through a preliminary retort into a conduit, which is open at its lower end and dips into a vessel containing water or dilute nitric acid. The conduit is funnel-shaped and is provided with a discharge connection, which does not dip into the liquid in the vessel. The gases thus impinge on the surface of the water, whereby solid organic matter is deposited, a portion of the nitric gases are absorbed in the vessel, the greater part passing through the discharge outlet into one or more similar appliances, and finally to the condensing plant. The acid in the separating vessels becomes enriched and is discharged at a strength of 36° B. (sp. gr. 1·332) through an overflow.—O. R.

Explosives for use in blasting. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. Geo. Claude), Paris. Eng. Pat. 1928, Jan. 23. 1913. Under Int. Conv., Feb. 1, 1912.

See Fr. Pat. 450,750 of 1912; this J., 1913, 627.—T. F. B.

Explosive; Fulminating ——. R. Calvet. Fr. Pat. 459,014, May 24, 1913. Under Int. Conv., June 11, 1912.

See Eng. Pat. 9597 of 1913; this J., 1913, 960.—T. F. B.

Explosives. F. L. Nathan, W. Rintoul and F. Baker. Fr. Pats. 459,539, 459,540, 459,541, and 459,542, May 30, 1913. Under Int. Conv., May 30, 1912.

See Eng. Pats. 12,742, 12.743, 12,744, 12,745, and 12,746 of 1912; this J., 1913, 991.—T. F. B.

Match-splints; Art of treating ——. W. A. Fairburn, Short Hills, N.J., and F. V. D. Cruser and W. Green, Barberton, Ohio, Assignors to The Diamond Match Co., Chicago. Reissue No. 13,636, Oct. 28, 1913, of U.S. Pat. 1,044,154, Nov. 12, 1912.

See this J., 1912, 1203.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Potassium permanganate solution; Standardisation of —— *by sodium oxalate.* R. S. McBride. Bull. Bureau of Standards, 1913, **8**, 611—642.

As a result of experiments made under the direction of the U.S. Bureau of Standards to discover the best conditions for the use of sodium oxalate as a primary oxidimetric standard and as a working standard for regular laboratory use, the following method is recommended:—0·25—0·3 grm. of sodium oxalate is dissolved in 200—250 c.c. of hot water (80°—90° C.) in a 400 c.c. beaker, 10 c.c. of sulphuric acid (1 : 1) are added, and the solution is immediately titrated with *N*/10 permanganate, being meanwhile stirred vigorously and continuously with a small thermometer. The permanganate must not be added more rapidly than 10—15 c.c. per min., and the last 0·5—1 c.c. must be added in drops. The excess of permanganate necessary to produce the final colour must be ascertained by a control test. The solution should not be below 60° C. when the final point is reached. Duplicates should agree to 1 part in 2000 if weight burettes are used. The results are accurate to 0·1 per cent., probably to 0·05 per cent.—A. S.

Calcium and magnesium in the same solution; Titration of ——. P. J. Fox. J. Ind. Eng. Chem., 1913, **5**, 910—913.

The method consists essentially in precipitating first the calcium as oxalate and then, without filtering, the magnesium as magnesium ammonium arsenate, filtering, dissolving the washed precipitate in sulphuric acid, titrating the oxalate with permanganate, and then the magnesium ammonium arsenate with thiosulphate, after addition of potassium iodide, as described by Meade (this J., 1899, 1054) and by Frankforter and Cohen (J. Amer. Chem. Soc., 1907, **29**, 1464). In the titration of the arsenate irregularities are encountered owing to the slowness of the liberation of iodine, the escape of iodine before titration, the liberation of iodine by the action of light, and the returning colour at the end of the titration. To overcome these difficulties, thiosulphate is added immediately after the potassium iodide until a light straw colour is produced, then the solution is left in the dark for 5 or 6 minutes, and the titration is continued until no colour returns when the solution is kept for 1 minute in the dark. —A. S.

Realgar; A new method for preparing ——, *and a consequent source of error in the separation of arsenic and tin.* H. Caron and D. Raquet. Ann. Chim. Analyt., 1913, **18**, 432—434.

Sulphide precipitates are often treated directly with hydrochloric acid if found to be completely soluble in ammonium sulphide. Even in this case, however, the ammonium sulphide treatment should be adopted in order to ensure the precipitation of the tin as stannic sulphide; otherwise, in the presence of a stannous salt the following reaction occurs on subsequent boiling with hydrochloric acid: $As_2S_3+2HCl+SnCl_2=As_2S_2+H_2S+SnCl_4$. The resulting realgar being insoluble in ammonia would escape estimation in the succeeding treatment with that reagent. A similar reduction is effected by hypophosphites, and either method may be conveniently used for preparing realgar.—J. R.

Radioelements as indicators in analytical chemistry. [*Determination of the solubility of lead chromate and sulphide.*] F. Paneth and G. v. Hevesy. Monats. Chem., 1913, **34**, 1401—1407.

All attempts to separate radium D from lead have hitherto failed: if a definite quantity of radium D be added to a solution of a lead salt, the ratio RaD : Pb remains constant no matter in what way the solution is treated or how small the quantity of lead withdrawn from the solution. Since extremely minute quantities of radium D can be detected by means of its radioactivity, this fact may be utilised for the determination of small quantities of lead. About one-fifth of a curie of emanation was allowed to decompose in a closed flask over distilled water, and the resulting solution, containing about 10^{-6} grm. RaD, was added to a solution of 10 mgrms. of lead chloride. The lead was converted into chromate, the washed precipitate shaken with 100 c.c. of distilled water at 25° C. for more than 24 hours, a measured portion of the solution evaporated to dryness and from the radioactivity of the residue its content of lead was calculated. The results showed the solubility of lead chromate to be $1\cdot2.10^{-5}$ grm. per litre at 25° C. In a similar way the solubility of lead sulphide at 25° C. was found to be 3.10^{-4} grm. per litre in water and $1\cdot5.10^{-4}$ grm. per litre in water saturated with hydrogen sulphide. Thorium B may also be used in an analogous manner as an indicator of lead; thorium C or radium E as indicators of bismuth; uranium X, radioactinium, radiothorium or ionium of thorium, and mesothorium 2 of actinium.—A. S.

Molybdenum and tungsten; Sensitive reaction of ——*in presence of mercury.* E. Pozzi-Escot. Bull. Soc. Chim., 1913, **13**, 1042.

In a previous communication (this J., 1913, 553), for "tungsten" read "molybdenum" and inversely. The reaction is sensitive in the case of molybdenum but not in the case of tungsten.—L. E.

Kjeldahl's method of determining nitrogen; A simplification of ——. A. Hutin. Ann. Chim. Analyt., 1913, **18**, 426—428.

Superheated steam is passed into the usual distilling flask, which is provided with a 4-holed rubber stopper. The flask is charged by means of a dropping funnel and emptied by a siphon; so that the apparatus may be used continuously without disconnecting.—J. R.

Nitrogen; Comparison of the Kjeldahl-Gunning-Arnold method with the official Kjeldahl and official Gunning methods of determining ——. T. C. Trescot. J. Ind. Eng. Chem., 1913, **5**, 914—915. (See this J., 1912, 361.)

The Arnold modification (U.S. Dept. Agric., Bureau of Chem., Circ. 108, 1912, p. 15) differs from the official Kjeldahl method (U.S. Dept. Agric., Bureau of Chem., Circ. 107, Rev. p. 5), in that 10 grms. of crystallised potassium sulphate are added as in the Gunning method but potassium permanganate is omitted. Comparative determinations showed that the Arnold modification, with 1½ hours' oxidation, except in the case of cyanamide (which requires 2½ hours), gives more concordant and reliable results than the official methods (Kjeldahl and Gunning), in which oxidation for 3—4 hours is necessary. —A. S.

Investigations with the U.S. Bureau of Mines modification of the Abel-Pensky and Pensky-Martens flash-point testers. Allen and Crossfield. *See* IIA.

Detection of pitches in asphaltum. Halphen and Spiess. *See* IIA.

Titration of boric acid. Prideaux. *See* VII.

Determination of alumina in bauxite. Trautmann. *See* VII.

Detection of lead in bismuth subnitrate and carbonate. Guérin. *See* VII.

Determination of small quantities of lead, obtained by extraction, in cooking utensils covered with lead glaze. Meerburg. *See* VIII.

Rapid determination of manganese, vanadium, and titanium in pig-iron and steel. Wright. *See* X.

Detection of vegetable fats in animal fats. Klostermann. *See* XII.

Shrewsbury's paraffin reaction. Meerburg. *See* XII.

Analysis of Turkey-red oil. Fahrion. *See* XII.

Determination of fibre in cane and bagasse. Steuerwald. *See* XVII.

Determination of gliadin in flour and gluten. Olson. *See* XIXA.

Detection of gelatin in sour cream. Seidenberg. *See* XIXA.

Determination of the acidity or alkalinity of water. Moir. *See* XIXB.

Ortho-tolidine as a reagent for the colourimetric determination of small quantities of free chlorine [in water]. Ellms and Hauser. *See* XIXB.

Colourimetric determination of small quantities of manganese in water. Hartwig and Schellbach. *See* XIXB.

New test for cinchona alkaloids. Watson. *See* XX.

Determination of morphine in acid preparations of opium. Débourdeaux. *See* XX.

Determination of caffeine in preparations of kola, particularly kola granules. Francois. *See* XX.

Determination of nicotine as silicotungstate. Determination of nicotine in presence of ammonia. Spallino. *See* XX.

Modified Jonescu's reaction for benzoic acid. Fleury. *See* XX.

PATENTS.

Specific weight of gases and mixtures of gases ; Method of and apparatus for determining the ——. F. E. Wolf, Blankenese, Germany. Eng. Pat. 8796, April 14, 1913. Under Int. Conv., April 15, 1912.

SEE Fr. Pat. 456,295 of 1913 ; this J., 1913, 962.—T. F. B.

Gas-analyser ; Automatic ——. P. R. Boulton, Birmingham. U.S. Pat. 1,077,927, Nov. 4, 1913.

SEE Eng. Pat. 5601 of 1912 ; this J., 1913, 553.—T. F. B.

Apparatus for testing gas with miners' safety lamps. Eng. Pat. 27,264. *See* IIA.

XXIV.—MISCELLANEOUS ABSTRACTS.

Oxidation processes ; Mechanism of ——. H. Wieland Ber., 1913, **46**, 3327—3342.

THE author has shown previously (this J., 1912, 276, 331, 333, 1052) that many processes regarded as oxidations are in reality due to dehydrogenation, and this theory is now extended to the biological so-called oxidation processes. It is shown that dextrose can be converted into carbon dioxide at low temperatures by means of palladium black either alone or in presence of a quinonoid compound (or oxygen) capable of acting as a hydrogen-acceptor. The function of the oxygen or the quinonoid compound (quinone or methylene blue) is to combine with the hydrogen and thus prevent it saturating the palladium and rendering the latter inactive. In a similar manner, the so-called oxidations which can be effected by means of oxidases can also be effected with palladium black in presence of quinone or methylene blue, with exclusion of oxygen, and hence must be regarded as dehydrogenation processes. Experiments with *Bact. aceti* (Hansen) and with the enzyme prepared therefrom (this J., 1906, 999) showed that these can be used as catalysts instead of palladium black and are capable of effecting the conversion of alcohol into acetic acid in presence of methylene blue, with exclusion of oxygen. The reducing enzyme discovered by Schardinger in milk can be used to effect the conversion of salicylic aldehyde into salicylic acid in presence of methylene blue, that is, to act as an "oxydase," and this is in accord with the author's theory that the terms "reduction" and "oxidation" are merely two means of representing a single process, that of dehydrogenation.—A. S.

Almonds ; Presence of a new enzyme, salicinase, in ——. G. Bertrand and A. Compton. Comptes rend., 1913, **157**, 797—799.

EXPERIMENTS under comparable conditions showed that the temperature and reaction of medium most favourable to the action of an enzyme preparation from almonds on salicin are different from those most favourable to its action on other hydrolytes, *e.g.*, amygdalin and cellose. These results, together with those of Sigmund (this J., 1909, 258) and Armstrong (this J., 1912, 958) lead the authors to conclude that another enzyme, *salicinase*, different from those already identified, is present in almonds.—A. S.

The metric carat. Circular No. 43, U.S. Bureau of Standards. Min. and Eng. World, Nov. 15, 1913. [T.R.]

SINCE July 1, 1913, the Bureau of Standards has been recognising the metric carat of 200 mgrms. as the unit of weight for diamond and other precious stones, and will use this unit for purposes of certification of all carat weights submitted to the Bureau for test. On the same date the U.S. Treasury Department also began the use of this unit in the customs service for the levying of import duties on precious stones. This unit was also put into commercial use in the United States on that date by practically all the dealers in gems and precious stones through the efforts of a committee representing all the principal firms handling gems.

Books Received.

PRACTICAL SCIENCE FOR ENGINEERING STUDENTS. By H. STANLEY, B.Sc. Lecturer in the Merchant Venturer's Technical College, Bristol. Methuen and Co., Ltd., 36, Essex Street, London, W.C. 1913. Price 3s.

VOLUME (7⅜ by 5 ins.), containing 160 pages of subject matter, numbered index to experiments (described with illustrations), and alphabetical index of subjects. The subject matter is classified as follows :—I. Measurements, etc. II. Heat. III. Mechanics. IV. Magnetism, and electricity. V. Determinations of density, capillarity, viscosity, candle power, etc. VI. Materials. VII. Tables of densities, melting points. Properties of saturated steam. Mathematical tables, etc.

INDUSTRIAL ORGANIC ANALYSIS. FOR THE USE OF TECHNICAL AND ANALYTICAL CHEMISTS AND STUDENTS. By. P. S. ARUP, B.Sc., with a Foreword by J. C. IRVINE, D.Sc., Ph.D. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 7s. 6d. net.

VOLUME (7½ by 5½ ins.), containing 318 pages of subject matter with 14 illustrations and one table of References; also an alphabetical index of subjects. The subject matter is classified as follows:—I. Coal and coke. II. Coal-tar and its distillation products. III. The fatty oils and fats. IV. Soap. V. Petroleum and its distillation products. Lubricating oils. VI. Milk and butter. VII. Starch, etc. Flour. Barley and malt. VIII. Preservatives and artificial colouring matters in foods.

A TEXT BOOK OF QUANTITIVE CHEMICAL ANALYSIS. By A. C. CUMMING, D.Sc. and S. A. KAY, D.Sc. Gurney and Jackson, London. Oliver and Boyd, Tweeddale Court, Edinburgh. 1913. Price 7s. 6d. net.

VOLUME (9 by 6 ins.), containing 374 pages of subject matter, 96 illustrations, an Appendix, with list of common reagents, tables of Densities, concentrations, etc., and logarithims, and an alphabetical index of subjects. The text is classified as follows:—I. General principles and methods. II. Volumetric analysis. III. Gravimetric analysis. IV. Colourimetric methods. V. Systematic quantitative analysis. VI. The analysis of simple ores and alloys. VII. Gas analysis. VIII. Water analysis. IX. Quantitative analysis of organic substances. X. Determination of molecular weights.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Blanchet*, A.: Nouveau manuel complet des applications du froid industriel, contenant la description des machines frigorifiques, 74 fig., in-18. L. Mulo. Paris. 1913. 4 fr.

Kältekongress Washington-Chicago 15—24. 9. 1913: Festschrift f. den 3. internationalen. Den Teilnehmern des Kongresses gewidmet vom österreich. Verein f. Kälteindustrie Wien. Ueber Auftrag des Komitees red. v. Prof. Alois Schwarz. (VIII, 163 S. m. Abbildgn. u. 1 Taf.) 31×24 cm. Berlin. Verlag f. Fachliteratur. 1913. M. 10.

Kälteindustrie, Bilder aus der deutschen: Hrsg. vom deutschen Kälte-Verein als Stiftg. zum 3. intern. Kälte-Kongress in Chicago 1913. (V, 100 S. m. 126 Abbildgn.) 35,5×27,5 cm. München, R. Oldenbourg. 1913. M. 6.

Ostertag, Prof. P.: Berechnung der Kältemaschinen auf Grund der Entropie-Diagramme. (VII, 77 S. m. 30 Fig. u. 4 Taf.) gr. 8°. Berlin. J. Springer. 1913. M. 4.

Technik der tiefen Temperaturen: Dem 3. intern. Kälte-Kongress in Chicago 1913 vorgelegt v. der Gesellschaft f. Lindes Eismaschinen, Abteilg. f. Gasverflüssigg., München. (V, 63 S. m. 34 Abbildgn. im Text u. auf 1 Taf.) gr. 8°. München. R. Oldenbourg. 1913. Cloth M. 3.

Ripper, W. M.: Heat Engines. Being a new edition of "Steam." Cr. 8vo., pp. 362. Longmans. London. 1913. 3s. 6d.

Roberts, E. W.: The Gas Engine Handbook. 7th edition. Cr. 8vo., leather. C. Lockwood. London. 1913. Net 9s.

IIA. *Neumann*, Dr. K.: Die Vorgänge im Gasgenerator auf Grund des 2. Hauptsatzes der Thermodynamik. (55 S. m. 53 Abbildgn.) Lex 8°. Berlin. J. Springer. 1913. M. 2.

V. *Ducousso*, G.: L'industrie de la soie en Syrie. ill. In-16. A. Challamel. Paris. 1913. 4 fr.

Adressbuch der Papier-Industrie Deutschlands u. der Schweiz, enth. die Adressen der Papier-, Pappen- u. Papierstoff-Fabriken, der Buntpapier-, Glacé-, Metallpapier-, Chromopapier-, Chromokarton-, Kartonpapier- u. Pergamentpapier-Fabriken, der Papier- u. Pappen-Grosshandlgn., Papieragenten etc. nebst e. ausführl. Bezugsquellen-Verzeichnis der Erzeugnisse. Jahrg. 1913. (XXXII, 392 u. 114 S.) Lex 8°. Berlin. A. Birkner. Cloth M. 6.

Piest, Dr. C., E. *Stich*, Dr. W. *Vieweg:* Das Zelluloid. Beschreibung seiner Herstellg., Verarbeitg. u. seiner Ersatzstoffe. (XI, 205 S. m. 78 Abbildgn.) Hrsg. v. L. M. Wohlgemuth. gr. 8°. Halle, W. Knapp. 1913. M. 9.35.

VI. *Steuckart*, C.: Der Zeugdruck. Sein Wesen, seine Geschichte u. seine Ausübg. Gemeinverständlich dargestellt. (63 S.) Lex 8°. Leipzig. B. F. Voigt. 1914. Cloth M. 4.

VII. *Auerbach*, F., u. H. *Pick*, Drs.: Umsetzungen schwerlöslicher Bleisalze m. wässerigen Lösungen kohlensaurer Alkalien. (III, 84 S. m. Fig.) Lex 8°. Berlin. J. Springer. 1913. M. 4.40.

Keghel, M. de: Les perles fines—Les nacres et leurs imitations, in-16. B. Tignol. Paris. 1913. 1 fr. 50.

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VIII. *Bleivergiftungen* in hüttenmännischen u. gewerblichen Betrieben. Ursachen u. Bekämpfg. Hrsg. vom k. k. arbeitsstatist. Amt im Handelsministerium. VIII. Tl. Bericht üb. die Erhebgn. in der keram., Glas- u. Emailindustrie. (VIII, 136 S. m. 25 Fig. u. 9 Taf.) 32×24,5 cm. Wien. A. Hölder. 1913. M. 3.40.

X. *Borchers*, R.: Fortschritte der Edelmetallaugerei während der letzten Jahrzehnte. (III, 155 S. m. 136 Abbildgn. im Text u. auf 1 Taf.) gr. 8°. Halle. W. Knapp. 1913. Cloth M. 8.55.

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XIV. *Lock*, R. H.: Rubber and Rubber Planting. Cr. 8vo. pp. 260. Camb. Univ. Press. London. 1913. Net 5s.

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XV. *Chaplet*, A.: Les mixtures épilatoires. 2 fig. in-8°. H. Desforges. Paris. 1913. 1 fr. 50

XVI. *Aluminiums* im Pflanzenreich. (26 S. m 6 Fig.) gr. 8°. Wien. A. Hölder. 1913. 78 Pf.

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XVII. *Samec*, M., u. F. v. *Hoefft*: Studien üb. Pflanzenkolloide. III. Entaschungs- u. Lösungsvorgänge bei Stärke. (S. 141—200 m. Fig.) gr. 8°. Dresden. Th. Steinkopff. 1913. M. 2.50.

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XIXA. *Besselich*, N.: Die Bonbon-Fabrikation. Illustriertes Lehrbuch f. die Fabrikation aller Arten Karamell-Bonbons u. Dragées, sowie f. die Kandiszuckerfabrikation im Klein- u. Grossbetrieb. 2., neubearb, u. erweit. Aufl. Unter Mitwirkg. hervorrag. Fachleute hrsg. (288 S. m. 73 Fig.) gr. 8°. Trier, N. Besselich. 1913. Cloth M. 4.50.

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XIXB. *Prescott*, S. C., and E. E. A. *Winslow*: Elements of Water Bacteriology, with special reference to Sanitary Water Analysis. 3rd edition. Cr. 8vo. Chapman & Hall. London. 1913. Net 7s. 6d.

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XX. *Gattefossé*: Technique de la fabrication des parfums naturels et artificiels, fig., in-4°. H. Desforges, Paris. 1913. 2 fr.

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XXI. *Andresen*, Dr. M.: Das latente Lichtbild, seine Entstehung u. Entwicklung. (VIII, 61 S. m. 4 Abbildgn.) 8°. 1913. Halle, W. Knapp. M. 2.40.

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Grasshoff, J. u. F. *Loescher*: Die Retusche v. Photographien nebst ausführlicher Anleitung zum Kolorieren m. Aquarell- u. Oelfarben. 11. ergänzte u. verb. Aufl. Mit 14 Fig. auf Taf. u. im Text. (111 S.) 1913. Photographische Bibliothek. Berlin, Union, Zweigniederlassg. 8°. Cloth M. 3.

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XXIII. *Beckurts*, Prof. H.: Die Methoden der Massanalyse. Unter Mitwirkg. v. Dr. O. Lüning. Zugleich 8. völlig umgearb. Aufl. v. Fr. Mohr's Lehrbuch der chemisch-analyt. Titriermethode. (XXI. u. S. 843—1112 m. 22 Abbildgn.) gr. 8°. Braunschweig, F. Vieweg & Sohn. 1913. Cloth M. 33.60.

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Maillard, L. G.: Genèse des matières protéiques et des matières humiques. Action de la glycérine et des sucres sur les acides *α*-aminés, in-8°. Masson et Cie., Paris. 1913. 12 fr.

Vanino, Prof. L.: Handbuch der präparativen Chemie. Ein Hilfsbuch f. das Arbeiten im chem. Laboratorium. Unter Mitwirkg. verschiedener Fachgenossen hrsg. (In 2 Bdn.) 1. Bd.: Anorganischer Teil. (XX, 670 S. m. 82 Abbildgn.) Lex 8°. Stuttgart, F. Enke. 1913. Cloth M. 20.

Werner, Prof. A.: Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. 3. durchgesch. 3. verm. Aufl. (XX, 419 S.) 8°. Braunschweig, F. Vieweg & Sohn. 1913. Cloth M. 12.

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22nd December, 1913.

THE PRESIDENT.

Sir Wm. Crookes, O.M., the President of this Society, has been elected President of the Royal Society. It has been an invariable practice that the President of the Royal Society should hold no similar office in other learned Societies, and in accordance with this well recognised rule Sir Wm. Crookes has reluctantly felt compelled to resign the Presidency of the Society of Chemical Industry. At the meeting of the Council on the 22nd inst. the resignation of Sir Wm. Crookes was accepted with much regret, and Dr. Rudolph Messel, F.R.S., was elected President in his place.

Birmingham Section.

Meeting held at Birmingham University on Thursday, October 30th, 1913.

MR. H. T. PINNOCK IN THE CHAIR.

THE REACTION OF METALS AND ALLOYS WITH NITRIC ACID.

BY J. H. STANSBIE, B.SC.(LOND.), F.I.C.

The investigation of Dr. Veley* on the effect of rotating a copper ball in dilute nitric acid suggested the experiments described below. No claim is made for originality, but the method and apparatus should prove useful for both pure metals and alloys. The apparatus consists of a glass tube turned up at the bottom and drawn off at the top into which a thick platinum wire is fused. This is fixed in the rotor of an electrolytic apparatus, and takes the place of the rotating cathode. The piece of metal to be experimented with is in the form of a short tube made to fit the outside of the glass tube, and to rest on the turned up edge at the bottom. The nitric acid solution is contained in a beaker. For malleable metals and alloys the tube was formed from the rolled sheet, but for brittle ones it was cast in a sand mould. The tubes were thoroughly prepared so that clean surfaces should be presented to the acid solution. Two experiments were made under exactly the same conditions, except that in one the tube was rotated and in the other at rest. 50 c.c. of the acid solution (1·108) were used for each experiment, unless otherwise stated.

Copper tube. This was prepared from electrolytic copper rolled into sheet.

(1)	Rotated for 1 hour, weight of copper dissolved,	0·0017	grm.
	Rest ,, 1 ,, ,, ,, ,,	0·0323	,,
(2)	Rotated for 2 hours ,, ,, ,,	0·0047	,,
	Rest ,, 2 ,, ,, ,, ,,	0.1790	,,

The copper tube was then rotated for 1 hour in a solution already containing 0·575 grm. of dissolved copper, when 1·129 grms. of metal dissolved from the tube. This solution was then boiled down to one half and made up to 50 c.c. with fresh acid. On rotating the tube for 1 hour in this solution only an additional 0·0045 grm. of copper passed into solution. When the tube was left at rest for 1 hour in the last solution without boiling a further 2·202 grms. of copper dissolved into it. From this it is clear that the increased action is due to the accumulation of nitrite in the solution, and that the nitrate is ineffective. Boiling the solution decomposes the nitrite, and leaves the metal all in the form of nitrate.

Silver. A series of experiments were then made with a silver tube. The results are given below.

(1)	Rotated for 1 hour metal dissolved	0·0008	grm.
	Rest ,, 1 ,, ,, ...	0·1935	,,
(2)	Rotated for 2 hours ,, ...	0·0012	,,
	Rest ,, 2 ,, ,, ...	0·8233	,,
(3)	,, ,, 2 ,, ,, ...	1·1812	,,
(4)	,, ,, 2 ,, ,, ...	2·7811	,,
(5)	Rotated ,, 2 ,, ,, ...	0·0695	,,
(6)	Rest ,, 2 ,, ,, ...	6·9734	,,

Experiments 1 and 2 were conducted in exactly the same way as those with the copper tube. In experiment 3 the tube was removed, weighed, and put back again into the same solution. This was repeated in experiment 4, and the results show that a marked increase in the rate of dissolution takes place in the presence of the products of the reaction. The solution from 4 was then boiled down to one-third its volume and made up to 50 c.c. with fresh acid, and the tube rotated in it for 2 hours with the result given in 5, which shows that there was still some nitrite undecomposed. On returning the tube to the solution the very marked increase in the rate given in 6 was obtained. The solution was then boiled down to one-fourth its volume and allowed to cool, when it crystallised into a solid mass. This was dissolved in water, the solution added to excess of sodium hydroxide, and made up to 500 c.c. 50 c.c. of the clear solution gave practically no indication of nitrous acid. This shows that with sufficient boiling the silver nitrite is completely decomposed.

Mercury. In the experiments with mercury the metal was contained in a glass capsule resting on the bottom of a tap funnel which contained the nitric acid solution. The funnel was arranged under the rotor so that the glass tube could act as a stirrer and keep the solution above the surface of the metal in constant motion.

In the first experiments 50 c.c. of the 1·108 acid were used, and very little action was observed either with rotation or at rest. The reaction between mercury and the acid is evidently much less vigorous than with either copper or silver. In the next experiment 50 c.c. of 1·2 acid were used. The appearance of bubbles of gas on the surface of the metal as the rotor was working made it evident that dissolution was taking place. The rotation was stopped at the end of an hour, and the solution run into excess of sodium hydroxide. The nitrous acid in the clear solution was determined. The following are the results obtained :—

Rotated for 1 hour, weight of mercury dissolved,	0.5450	grm.
Weight of nitrous acid in the solution	0·0260	,,
Rest for 1 hour, weight of mercury dissolved	5·1484	,,
Weight of nitrous acid in solution	0·5820	,,

It is therefore clear that the dissolution of the mercury is dependent upon the presence of nitrous acid in the solution, and the accumulation of the nitrite in the neighbourhood of the dissolving metal.

Bismuth. A cast tube was used in the experiments with this metal, and was immersed in 50 c.c. of nitric acid of sp. gr. 1·149, at room temperature. The results are given below.

(1)	Rotated for 1 hour, weight of bismuth dissolved	0·0325	grm.
(2)	Rest ,, 1 ,, ,, ,, ,,	1·6203	,,
	Weight of nitrous acid found in the solution	0·4073	,,
(3)	Rotated for 2 hours, weight of bismuth dissolved	0·0455	,,
(4)	Rest ,, 2 ,, ,, ,, ,,	3·5555	,,
	Weight of nitrous acid found in the solution	0·1776	,,
(5)	Rotated for 1 hour, weight of bismuth dissolved	0·1754	,,

The last solution, which already contained 1·4 grms. of bismuth, was well boiled to decompose the nitrite, and made up to 50 c.c. with fresh acid before being used.

These experiments make it clear that it is the accumulation of nitrite in the neighbourhood of the dissolving metal which accelerates the action. So that it falls into line with copper, silver and mercury under similar conditions. It is noticed, however, that a black deposit which increases with the time of exposure, collects on the surface of the tube. This consists most probably of a lower oxide of the metal which is insoluble in nitric acid.

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* Proc. Roy. Soc., **46**, pp. 216—222.

Copper-zinc alloys. Six alloys were made, two of which were cast in strips, cold rolled, and bent into the form of short tubes; the others were cast in sand moulds of the required form. Two tubes of each alloy were prepared, as it was necessary to use separate tubes for the rotation and rest experiments in order to detect changes in the composition of the dissolved portions under the different conditions. Tubes of the same alloy were immersed in equal volumes of the acid solution at the same time, and the one started rotating while the other remained at rest. When the allotted time had elapsed the tubes were removed, washed, dried and weighed, and the copper in solution was determined by electrolysis. The results are given in the table below.

Reference to cols. *c*, *d*, *c′* makes it clear that alloys containing more than 48 per cent. of copper dissolve as a whole, for the dissolved portion is of practically the same composition as the original alloy. With less than 48 per cent. of copper the presence of the zinc becomes evident, for it either dissolves faster in proportion than the copper, or precipitates that metal from the solution. The latter assumption is probably the correct one, for in cols. *a*, *a′* it is seen that less copper is apparently dissolved when the alloy is at rest than when it is rotating. This seems to be due to the salts formed remaining longer in contact with the metallic surface and thus giving the zinc more chance of precipitating the copper from them. This is also borne out by the appearance of the tubes when they come from the solution. The "rest" tube shows the thicker deposit of copper.

In order to test the statement that some zinc alloys are able to deposit copper from solution, experiments were made with a neutral solution of cupric nitrate. This was prepared by heating excess of copper with dilute nitric acid until the basic nitrate began to separate, which was filtered off, and the clear solution made up to a measured volume. 50 c.c. of this solution gave on electrolysis $Cu = 0{\cdot}6048$ grms.

Tubes of the six alloys dealt with above were rotated separately for two hours in 50 c.c. of this solution, which was then electrolysed to determine the copper left in solution in each case, with the following results:—

1.	Weight of copper left in solution	0·6052 grm.
2.	,, ,, ,, ,, ...	0·5935 ,,
3.	,, ,, ,, ,, ...	0·5856 ,,
4.	,, ,, ,, ,, ...	0·5667 ,,
5.	,, ,, ,, ,, ...	0·0073 ,,
6.	,, ,, ,, ,, ...	0·0008 ,,

Evidently, then, down to 80 per cent. of copper the neutral nitrate has no corrosive action upon the alloys within the limits of the experiments; below that and down to 48 per cent. the action begins and increases slowly. With a higher percentage of zinc the action is much more rapid, and the alloys act much the same as zinc itself. It is clear then that in solutions in which the zinc is in greater proportion than in the dissolving alloy some of it must be regarded as having passed into solution by the displacement of copper from its salts, and that the red loosely adherent surface of the partially dissolved alloy is not alone due to the picking out of the zinc from the surface by the acid solution.

Alloy.	Duration of experiment in hours.	Sp. gr. of acid.	Rotation.			Percentage of copper in the alloys.	Rest.		
			Copper in solution.	Alloy dissolved.	Percentage of copper in the solutions.		Percentage of copper in the solution.	Alloy dissolved.	Copper in solution.
No.			a	b	c	d	c′	b′	a′
1	2	1·108	0·0505	0·0648	77·93	79·05	79·39	2·3526	1·8685
2	2	1·108	0·1321	0·1865	70·84	69·82	70·13	2·3222	1·6280
3	2	1·108	0·4325	0·7777	55·62	57·16	56·10	0·8885	0·4495
4	1½	1·055	0·9163	1·9892	46·06	47·11	45·8	1·4553	0·6663
5	1	1·055	0·5465	3·7790	14·5	31·95	5·15	3·6213	0·1865
6	½	1·018	0	1·4951	0	17·16	2·3	1·4543	0·0395

On comparing cols. *b*, *b′* it is seen that the first alloy acts practically the same as pure copper, for its dissolution depends upon the presence of nitrite in the solution. This dependence, however, decreases as the content of zinc increases, and disappears entirely with about 50 per cent. of the metal present.

The fall in the rate of dissolution of alloys Nos. 3 and 4 shown in col. *b′* is probably due to their being in the cast state, whereas Nos. 1 and 2 had been rolled.

In the case of No. 4 it is evident that the zinc is beginning to act independently, for when at "rest" some copper is precipitated, and when in rotation the rate is increased by the distribution of the products through the solution.

No. 5 is the most remarkable alloy in the series. It has practically the composition of the compound, $CuZn_2$, and is quite distinct from the others, both in appearance and properties. It is so friable that it will almost crumble between the thumb and finger, but though it dissolves much more rapidly than the other alloys it is able to precipitate copper from solution; zinc is thus able to separate itself from its combination with copper.

It is evident that at first the single solid solution of which the alloys rich in copper consist acts towards the acid solution like a single metal having the properties of copper; but the alloys rich in zinc have a more complex composition, consisting as they do of at least two solid solutions, and give reactions resembling those of zinc itself.

The quantity of nitrous acid formed in the solution diminishes as the content of zinc increases. This is in agreement with the results given in the last paper (this J., 1913, 317).

London Section.

Meeting held at Burlington House on Monday, December 1st, 1913.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE ACTION OF ANTISEPTICS IN INCREASING THE GROWTH OF CROPS IN SOIL.

EDWARD JOHN RUSSELL, D.SC., AND WALTER BUDDIN, B.A.

The action of antiseptics on the soil.

Much of the work recorded in this paper arose out of a mistake committed by a youthful laboratory attendant. The absorption of oxygen by various chemical substances was under investigation by the writer at the time he changed over from pure chemistry to agricultural chemistry; before disbanding the apparatus some observations were made on soils and it was found that fertile soils absorbed oxygen more rapidly than non-fertile soils of the same character. A connection was thus traced between the rate of absorption of oxygen and the productiveness of the soil. Since the oxygen absorption was very considerably reduced in sterilised soils it was concluded that the process is largely due to the activity of micro-organisms, and the connection between oxygen absorption and fertility was attributed to the large part played by micro-organisms in the production of plant food.

When these experiments were practically finished a final confirmatory series was undertaken. By a mistake which caused some little annoyance at the time the sterilisation was only carried out at 100° C. and not at 130° C. as was necessary for completeness. An experiment was, however, made with this incompletely sterilised soil. A remarkable result was obtained; it was found that this soil absorbed oxygen much *more* rapidly than untreated soil. Other methods of partial sterilisation (*e.g.*, treatment with volatile antiseptics) gave similar results. Owing to the close connection known to exist between oxygen absorption and productiveness it was anticipated that such partially sterilised soils would be more productive than untreated soils; pot experiments showed that this deduction was well founded.

At this stage it was found that this conclusion was not really novel; the fact had already been discovered accidentally by a vine grower in Alsace who treated the soil of his vineyard with carbon disulphide to kill phylloxera and obtained a marked increase in crop. This observation was communicated to one of the German Experiment Stations and formed the subject of much research, the most notable result of which was the discovery by Hiltner and Störmer that the numbers of bacteria on partially sterilised soils rise much higher than on untreated soils.

This was the position of the problem when the work was taken to Rothamsted. Here Dr. H. B. Hutchinson joined in the investigation, and after several years' work the following propositions were definitely established:—

1. Partial sterilisation causes first a fall and then a large rise in the numbers of bacteria in the soil.

2. Simultaneously there is a considerable increase in the rate of production of ammonia from the complex nitrogenous compounds of the soil.

3. The increased productiveness of partially sterilised soil is due, at any rate in part, to this increased productiveness of ammonia.

4. The increase in bacterial numbers is the result of improvement in the soil as a medium for bacterial growth and not an improvement in the bacterial flora. Indeed, when the original bacterial flora is introduced into partially sterilised soil the numbers rise even higher than when the new flora is left to itself.

5. The improvement in the soil is permanent.

6. But if some of the untreated soil is introduced into partially sterilised soil the bacterial numbers after an initial rise begin to fall, and the fall is out of all proportion to the amount of added soil.

These and other experiments show that ordinary soil contains a factor which keeps down the bacterial population and prevents it from attaining maximum numbers. The factor is not bacterial; it appears, however, to be living, and to consist in organisms larger than bacteria, more readily killed, and more slow in multiplication under soil conditions. Search for organisms fulfilling this description was made, and revealed the presence of numerous protozoa, the existence of which had hardly been suspected before.

When this detrimental factor is put out of action by gentle heat or by antiseptics the bacterial numbers increase, more plant food is formed, and the productiveness of the soil is raised.

Our new conception, therefore, is that the soil organisms may be divided roughly into two groups in their relation to the processes of food production; a useful group and a detrimental group. The latter are, speaking generally, more readily killed than the former. Conditions that are harmful to active life in the soil tend, therefore, to reduce their numbers and lead to an increased activity of the useful bacteria. On the other hand, conditions favourable to active life tend to keep up the detrimental organisms and therefore to reduce the useful bacterial activity. We have thus been able to render intelligible a number of obscure and paradoxical effects that have hitherto caused considerable perplexity. It has already been observed by practical men in various countries that certain soil conditions harmful to the growth of organisms were ultimately beneficial to productiveness; such are long continued and severe frost, long drought (especially if associated with hot weather), sufficient heat, treatment with appropriate dressings of lime, gas lime, carbon disulphide, etc.

Further it has been observed that conditions which are undoubtedly favourable to life, such as the combination of warmth, moisture and organic manures found in glasshouses, lead to reduced productiveness after a time. This phenomenon is spoken of as "sickness" by the practical man.

It is difficult to account for this result on the old view that the useful plant-food making bacteria are the only active micro-organisms in the soil. On the other hand, our new view that detrimental organisms are also present readily explains the observed facts.

The "sickness" that affects the soils of glasshouses run at a high pitch (such as cucumber houses) and less slowly those run at a lower pitch (such as tomato houses) has been investigated in some detail owing to its great technical importance. It was traced to two causes: an accumulation of various pests, and an abnormal development, especially in cucumber houses, of the factor detrimental to bacteria. The properties of this factor show that it is identical in character with that present in normal soil, and strongly indicate its biological nature. No evidence of a soluble toxin could be obtained.

Some remarkably interesting protozoa and allied organisms have been picked out from these sick soils.

The "sickness" of sewage farm soils also appears to be conditioned in part by the copious development of organisms destructive to bacteria. Another factor also comes into play; a falling off in the rate of percolation due to physical causes.

Thus the large organisms of the soil destructive to bacteria are seen to play an important part in productiveness. Little was known of these organisms at the time our experiments began, but fortunately Messrs. T. Goodey and K. Lewin in our Laboratory, and Mr. C. Martin in his own Laboratory at Abergavenny took up the zoological survey of the soil and have already obtained some notable results. This work is being carried on purely from the zoological standpoint in the first instance, with the view of discovering the life histories of the various organisms picked out; when these have been studied in detail it will be possible to speak more definitely about the part played in the soil by each particular form.

The practical application of all this work has been kept well in view. Methods are being worked out for applying partial sterilisation methods on the large scale so as to increase the productiveness of the soil. But instead of setting up a large number of field plots to discover some cheap and convenient process, the simpler alternative is adopted of inducing horticulturists who go in for intensive culture to adopt some of the methods known to work.

The tomato and cucumber growers have responded well to this invitation, and during the past three seasons a number of experiments have been carried out in our Laboratory and Pot Culture House to solve some of the problems arising out of the application of partial sterilisation to their particular work. The arrangement has been advantageous in many ways. Certain very interesting lines of investigation have been opened up that promise to throw much light on our general fertility problems and that we should probably not have found otherwise. The growers also have expressed their interest in the very practical way of organising an Experiment Station to be started in the Lea Valley district and devoted exclusively to the investigation of problems connected with the glasshouse industry. Finally, the method of partial sterilisation has now passed out of the laboratory into the hands of the practical man, and each season it becomes cheaper and applicable to a wider range of growers; we are also learning what are the difficulties attendant on the use of the method in practice.

The differences exhibited by the various antiseptics.

The effects described in the preceding paragraphs are general and are produced by practically all the antiseptics that have so far been tested. But very considerable differences are revealed by a closer study of the action of individual substances. The various antiseptics are then seen to fall into two sharp classes; those that volatilise completely without leaving any residue in the soil, and those that cannot be completely removed, but persist for a longer or shorter time. The former present the simplest case and will therefore be studied first.

Perhaps the best instance of an easily volatile chemically inert antiseptic is toluene. When soil is treated with small quantities of this substance either in liquid or in vapour form there is a marked change in the micro-organic population of the soil and apparently also some slight but obscure chemical change shown by the liberation of a very small amount (about 0·004 per cent.) of ammonia. The most striking change is in the numbers of bacteria per gram of soil; counts made either by the gelatine or the agar plate method reveal first a considerable fall, and then, a few days after the toluene is removed, a marked rise to a level much higher than was attained in the original untreated soil; and the numbers remain round about this new level so long as no untreated soil gets in. The new flora is not quite of the same type as the old; the nitrifying organisms and perhaps others are suppressed, but examination of the plates shows less change in type than might have been expected. Simultaneously there is a marked increase in the rate of production of ammonia excepting only when the soil is already heavily charged with nitrates, a case which we need not discuss as it is not of normal occurence in our conditions.[*] The ammonia remains in the soil as such, and does not undergo the usual transformation into nitrates, because the nitrifying organisms as well as the amœbæ and ciliated protozoa are all killed.

The following typical figures illustrate the action of toluene :—

Toluene.

Grams of toluene added per kilo. of dry soil.	Bacteria present. Millions per gram. of soil.			Ammonia and nitrate present, parts per million of dry soil.		Effect on Protozoa.
	At start.	After 34 days.	After 51 days.	At start.	After 30 days.	
grms. 0	22	16	18	24	43	C A M
M/200=0·46	16	22·5	18·5	26·5	50	C M
M/100=0·92	8·5	76	92	28·5	56	M
M/50 =1·84	7	87	94	29	63	(M)
M/10 =9·2	8	95	87	29·5	65	None present
M/5 =18·4	8	77	90	29·5	66	,,
M =92	7	90	86	30	66	,,

Note. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbæ.
M ,, ,, ,, Flagellated protozoa.

The results are also expressed in the curves of Fig. 1.

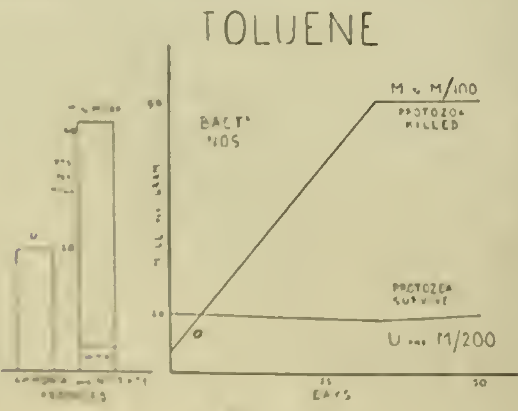

Fig. 1.

It will be observed that the partial sterilising effect is hardly produced when M/200 grams of toluene are used per kilo of soil, but shows distinctly when M/100 grams are used. This amount is equal to 0·09 per cent. or 2 lbs. per ton of the soil. Larger quantities behave precisely like the smaller ones.

Benzene behaves almost exactly like toluene, but is a little less potent, the effective dose lying between M/100 and M/50 grams per kilo of soil.

The saturated ring compound is less potent; cyclohexane does not act till M/50 grams per kilo of soil are added and even then it is not as effective as benzene. The open chain compound, hexane, is even less effective, and partial sterilisation begins only after the addition of M/10 grams per kilo, *i.e.*, 0·7 per cent. by weight of the soil.

The alcohols are not nearly so active as might be supposed: methyl and ethyl alcohol only acting at the full M dose, *i.e.*, 32 grams and 46 grams respectively per kilo of soil. Ether is more potent, and acts when rather more than M/10=7·4 grams are applied per kilo of soil. Chloroform is even more effective, M/50=2·3 grams per kilo being sufficient to produce partial sterilisation. Carbon disulphide is the most potent and is at least as effective as toluene.

The following is the order of effectiveness of the easily volatile antiseptics on our soils :—

	Effective dose grams per kilo.	Per cent. by weight of soil.	lbs. of antiseptic per ton of soil.
Toluene, carbon-disulphide	M/100	0·09	2
Benzene	below M/50	below 0·16	below 3·4
Cyclohexane ..	M/50	0·17	3·7
Chloroform ..	M/50	0·23	5
Ether	M/10	0·74	16·3
Hexane	M/10	0·86	18·9
Methyl & ethyl alcohols	M	3·2 & 4·6	70·4 & 101

Excepting for these differences in degree there are no marked differences in the kind of action of these substances and the results given for toluene are typical of the whole class.

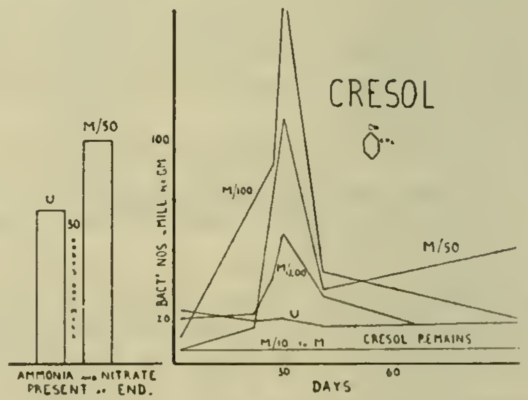

Fig. 2.

The non-volatile antiseptics present a more complex case because they persist in the soil and modify the development of the bacterial flora. A typical instance is furnished by cresol. The initial effect is the same as that produced by the volatile antiseptics: the bacterial numbers fall, the protozoa are killed, and there is as before a slight liberation of ammonia. But the later effects are very different in several ways: the bacterial numbers run up to an extraordinary extent reaching in one experiment the unusual value of 106 millions per gram. The flora is not so mixed as was the case with volatile antiseptics, but is very simple and the colonies all look exactly alike and might indeed be cultures of one group only of organisms. The high numbers do not persist but rapidly fall and approach the level obtaining in the untreated soil. Since cresol is present for much of the time it follows that the bacteria developing in these experiments can tolerate it, indeed the extraordinary high numbers suggest that they actually feed upon it. Thus they resemble the organisms already described by Fowler, Arderr, and Lockett.[*]

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[*] This is dealt with fully by Russell and Hutchinson in the Journal of Agric. Science, 1913, 5, 191 *et seq.*

[*] Proc. Roy. Soc., 83B, 149.

Simultaneously there is an increase in the amount of ammonia formed in the soil, but nothing corresponding to the increase in bacterial numbers. It appears, therefore that the organisms multiplying in presence of small quantities of cresol do not possess marked powers of decomposing the proteins and other nitrogen compounds in the soil to form ammonia. The results are given in the following table :—

Cresol.

Grams of cresol added per kilo. of dry soil.	Bacteria present. Millions per gram of soil.			Ammonia and nitrate present, parts per million of dry soil.		Effect on Protozoa.
	At start.	After 30 days.	After 100 days.	At start.	After 100 days.	
grms. 0	23·5	19	17	30	33	C A M
M/200=0·54	19	56	36	29·5	40	C A M
M/100=1·08	11	164	22	27	41	A M
M/50 =2·16	6	106	52	29·5	48·5	M
M/10 =10·8	6	4	9	25	29·5	None present
M/5 =21·6	4	3	4	26·5	27	,,
M =108·0	3	2	4	25	29	,,

Not·. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbæ.
M ,, ,, ,, Flagellated protozoa.

The results are also expressed in the curves of Fig. 2.

Phenol resembles cresol in its action, but the rise in bacterial numbers is more marked—no less than 548 millions were recorded in one experiment—and there is an even smaller production of ammonia than in the case of cresol. This observation furnishes still further evidence that the organisms tolerating (or perhaps feeding on) phenol are not active ammonia producers in the soil. The results obtained are as follows :—

Phenol.

Grams of phenol added per kilo of dry soil.	Bacteria present. Millions per gram of soil			Ammonia and nitrate present, parts per million of dry soil.		Effect on protozoa.
	At start.	After 16 days.	After 74 days.	At start.	After 70 days.	
grms. 0	23	27	15	28	30	C A M
M/200= 0·47	17	101	19	26	33	C A M
M/100= 0·94	12	548	29	29	34	(CA)M
M/50 = 1·88	7·5	14	44	25	27	M
M/10 = 9·4	6	7	6	27	26	None present
M/5 =18·8	5	3	3	22	23	,,
M =94	5	2	1	22	21	,,

Note. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbae.
M ,, ,, ,, Flagellated protozoa.

Both phenol and cresol are active at about the M/100 dose. Hydroquinone—a very potent poison—behaves somewhat like phenol. The initial depression of bacterial numbers is greater and sets in even with the M/200 application (=0·05 per cent.). Certain bacteria tolerate it and apparently feed on it, for the numbers rise to a high level when small doses are added and after a time come down again. The colonies on the plates are practically all alike, suggesting that only one group of organisms survies: there is nothing like the variety seen in the untreated or toluene-treated soils. Quinone behaves in similar manner but is less potent. The production of ammonia is only small.

Hydroquinone.

Grams of hydroquinone added per kilo of dry soil.	Bacteria present. Millions per gram of soil.			Ammonia and nitrate present, parts per million of dry soil.		Effect on protozoa.
	At start.	After 24 days.	After 70 days.	At start.	After 70 days.	
grms. 0	20	16	15	29	35	C A M
M/200= 0.55	4	55	30	26	44	C A M
M/100= 1·1	1	20	24	24	35	A M
M/50 = 2·2	1	61	45	22	30	M
M/10 = 11·0	0·1	0·1	1	22	24	None present
M/5 = 22·0	0·1	0·1	0·2	22	20	,,
M =110	0·1	0·1	0·1	22	20	,,

Note. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbae.
M ,, ,, ,, Flagellatd protozoa.

Quinone.

Grams of quinone added per kilo of dry soil.	Bacteria present. Millions per gram of soil.			Ammonia and nitrate present, parts per million of dry soil.		Effect on protozoa.
	At start.	After 20 days.	After 70 days.	At start.	After 70 days.	
grms. 0	24	17	16	37	42	C A M
M/200= 0·54	7	56	36	32·5	40	C A M
M/100= 1·08	5	140	33	32	32·5	M
M/50 = 2·16	2·5	60	41	30	32	M
M/10 =10·8	2·5	0·1	159	19	27	None present
M/5 =21·6	1	0·1	4	19	19	,,

Note. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbae.
M ,, ,, ,, Flagellated protozoa.

All the non-volatile antiseptics in higher doses bring about a depression in the amount of nitrate revealed by analysis, the cause of which is not yet determined.

Formaldehyde is normal in its initial behaviour; the bacterial numbers are depressed and protozoa killed at the M/100 dose but it is not clear that the nitrifying organisms are killed. Subsequently a very unusual result is obtained for which we cannot yet account: there is a marked rise in the amount of ammonia produced, but no increase in the bacterial numbers above what occur in the untreated soil. The cause of this phenomenon is under investigation. The results are :—

Formaldehyde.

Grams of formaldehyde added per kilo of dry soil.	Bacteria present. Millions per gram of soil.			Ammonia and* nitrate present, parts per million of dry soil.		Effect on protozoa.
	At start.	After 35 days.	After 80 days.	At start.	After 40 days.	
grms. 0	17	27	12	27	57	C A M
M/200=15	13	28	8	33	71	(C A)M
M/100= 0·3	5	24	18	26	64	M
M/50 = 0·6	5	17	9	18	60	(M)
M/10 = 3·0	0·1	0·1	7	10	21	None present
M/5 = 6·0	0·1	0·1	0·1	18	17	,,
M/1 =30·0	0·1	0·1	0·1	21	28	,,

Note. C indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbae
M ,, ,, ,, Flagellated protozoa.

The results are also expressed in the curves of Fig. 3.

Pyridine is the nearest approach on our list to a nitrogenous antiseptic: unfortunately it is extremely mild and only begins to act after the addition of more than M/10 grams per kilo, or 0·8 per cent. of the soil. Smaller doses furnish a magnificent diet for certain bacteria; gelatine plate cultures showed the presence in one instance of 3500 millions per gram, the highest we have ever come across. It is interesting to note also that the pyridine is decomposed by the bacteria, for the soil treated with M/10 dose which contains phenomenally high numbers and also contains an extraordinary large amount of ammonia and nitrate, while that treated with the M/5 dose, where the bacteria did not multiply, contains only the normal amount.

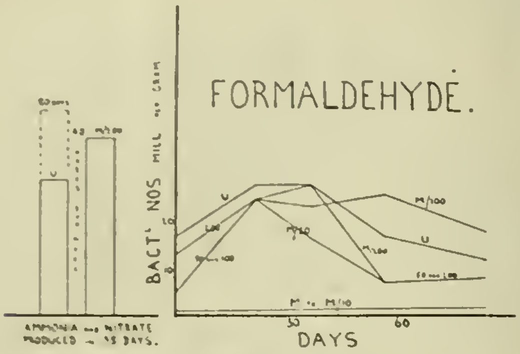

FIG. 3.

Pyridine.

Grams of pyridine added per kilo of dry soil.	Bacteria present. Millions per gram of soil.			Ammonia and nitrate present, parts per million of dry soil.		Effect on protozoa.
	At start.	After 30 days.	After 80 days.	At start.	After 80 days.	
grms.						
0	29	26	13	33	40	C A M
M/200 = 0·39	25	78	19	29	79	C A M
M/100 = 0·79	30	173	28	32	120	C A M
M/50 = 1·58	32	942	35	32	200	C A M
M/10 = 7·9	22	16	3500	29	430	(C A)M
M/5 = 15·8	12	8	7	38	46	(M)
M/1 = 79·0	7	5	3	42	34	None present

Note. C Indicates the presence of Ciliated protozoa.
A ,, ,, ,, Amœbae.
M ,, ,, ,, Flagellated protozoa.

The effect produced on the plant by the antiseptic treatment of the soil.

We have seen in the preceding paragraphs that the treatment of the soil with antiseptics leads to an increased production of ammonia and nitrate after the antiseptic is removed. This additional ammonia and nitrate is of course valuable plant food and an increased crop growth might reasonably be anticipated on soils treated in this way. But the soil is very complex and at least four other effects have been observed besides those already described. (1) A small liberation of ammonia and possibly of other substances also; (2) a more or less drastic action on the numerous insect pests and disease producing fungi resident in the soil; (3) a disturbance in the bacterial flora, which is liable to become more marked the longer the antiseptic remains in the soil, this indirectly affects the decompositions going on in the soil; (4) any of the antiseptic persisting in the soil may have a direct action on the plant. Thus a soil which has been treated with antiseptics differs from a similar soil that has not been treated in the following ways so far as the plant is concerned:—

(1) It contains more plant food.

(2) It contains fewer disease organisms and pests.

(3) It may contain various substances not usually present in soil.

(4) Some of the antiseptic may persist.

The first two tend to increase the amount of plant growth; the third may or may not, while the fourth is likely to be harmful to the plant.

The simplest case is, as we should expect, presented by the inert volatile antiseptics like toluene acting on soils relatively free from insect and fungoid pests and not over rich in nitrates. Here the chief factor is the increased amount of plant food; and the results obtained are shown in the following typical crop yields, the crops in untreated soils being taken as 100 in each case:—

	Buckwheat.	Mustard	Rye.	Wheat.	Barley.
Untreated soil ..	100	100	100	100	100
Soil treated with					
Chloroform ..	138	124	135		
Carbon disulphide	128	118	141		
Toluene	116	111	119	134	139

If the untreated soil is already sufficiently well supplied with nitrates and ammonia there is nothing gained by adding more: the plant can only utilise a certain quantity and will not grow beyond the limit set by its habit, by the water supply, the temperature, etc. Partial sterilisation of the soil leads to increased growth only when the limiting factor is the supply of nitrate and ammonia. In the following cases the soils were all equally well manured with ammonium sulphate: partial sterilisation is seen to have been wholly ineffective:—

Tomato Plants.

	Average weight of fruit per plant in grams.	Relative weights.
Untreated soil	967	100
Soil treated with:		
0·1 per cent. Formaldehyde	1010	104
0·05 per cent. ,,	946	98
0·2 per cent. Phenol ..	909	94
0·1 per cent. ,, ..	963	100

In the case of the soils treated with formaldehyde and phenol, however, the crop of fruit was somewhat earlier than on the untreated soil.

A more complex case arises when disease organisms and insect pests occur to any notable extent in the soil. So long as these remain unaffected little may be gained by increasing the amount of nitrogenous plant food; the effect of the soil treatment on plant growth is therefore the resultant of two separate effects, one on the disease organism or pest and the other on the production of plant food.

Unfortunately, there is no simple way of studying the action of various antiseptics on disease organisms: the only method is to grow plants and see whether or not they are attacked. Even then the experiment is liable to break down, for the conditions of temperature or moisture content obtaining during growth may be unsuitable for the development of the organism.

A third complication may arise; the antiseptic remaining behind in the soil, or some decomposition product resulting from its action, often causes a considerable retardation in the early stages of growth and at a later period appears in certain cases to cause a remarkable development of fibrous root which reacts on the general growth of the plant. This is now under investigation at Rothamsted; it is seen to a marked extent in steamed soils.

For our present purpose it is unnecessary to discuss these various effects in detail: their resultant action on the plant is seen in the following table which sets out the yields of tomatoes grown on a nursery soil well stocked with disease germs :—

Soil treatment.	Mortality, *i.e.*, percentage of plants that died after being potted up.	Fruit picked per surviving plant up to			
		July 17	Aug. 9	Sep t. 16	End of Season.
		grms.	grms.	grms.	grms.
Untreated	66	121	514	1,011	1,113*
Heated	None	521	1,119	1,335	1,488
Formaldehyde† ..	None	376	804	1,123	1,339
Pyridine†	16	288	751	1,194	1,352
Higher bases, Collidene, etc. ..	33	267	917	1,296	1,445
Benzene	33	120	526	1,131	1,354
Calcium Sulphide..	33	147	486	1,036	1,338
Carbolic acid ..	None	158	499	975	1,096
Cresylic acid ..	None	152	426	1,078	1,181
Heavy solvent naphtha ..	33	137	594	1,131	1,318
Light solvent naphtha ..	50	146	515	1,118	1,411
Petrol	None	159	604	1,114	1,320
Toluol (crude) ..	16	150	631	978	1,090
Toluol (refined) ..	16	198	568	1,018	1,299
Naphthalene ..	16	104	513	1,201	1,343
Naphthalene residue "C"	16	87	417	1,025	1,255
Nitrobenzene ..	16	83	418	1,102	1,208

* There were very considerable losses of plants on the untreated soil of which no account is taken in this column, which deals only with the surviving plants. The losses on the partially sterilised soils were much smaller. If instead of giving the yield per surviving plant we set out the yield per 100 plants potted up, the untreated soil comes out very badly indeed.

† One part per thousand of soil, *i.e.* 2 lb. of antiseptic watered on to a ton of soil: 2½ times this quantity was used for all the other antiseptics. We had reason to suppose, however, that these amounts were too large.

The general results of a number of experiments made at Rothamsted enable us roughly to arrange in the following order a number of antiseptics for use in soils containing disease organisms.

Class 1. Most effective. Formaldehyde, pyridine.

Class 2. Cresol, phenol, calcium sulphide, carbon disulphide, toluene, benzene, petrol.

Class 3. Least effective. Higher homologues of benzene (*e.g.*, heavy solvent naphtha), naphthalene and certain of its derivatives.

The order within the classes is roughly the order of merit indicated by a number of experiments extending over three seasons, but considerable deviation occurs in individual trials.

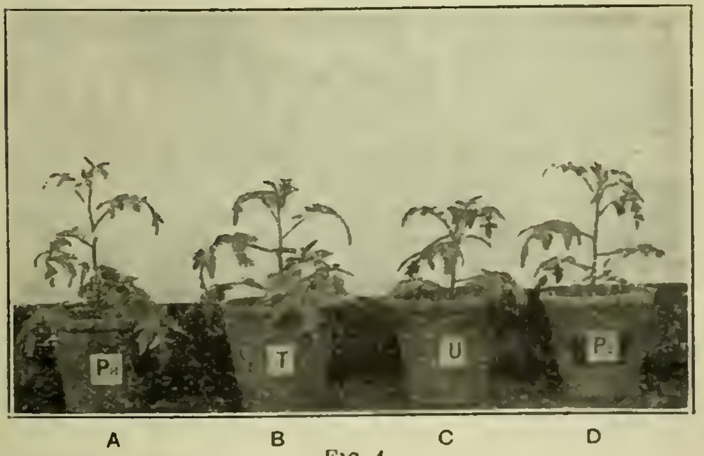

FIG. 4.

Tomato plants in A untreated soil, and in soil treated with B toluene, C phenol, D petrol.

None of these antiseptics is as good as steam, either in increasing the amount of ammonia in the soil, in killing insect and fungoid pests, or in inducing a good fibrous root development. In all trials, therefore, a steamed soil is included to set the standard of excellence previously unattained by antiseptics.

It will be observed that this order of merit just given is not quite the same as that indicated by the laboratory trials, but the discrepancy is more apparent than real. Disease organisms and possible root changes did not come into play in the laboratory experiments while they do here. But there is a further and probably more important difference still. In the laboratory experiments careful precautions were taken to prevent reinfection, and the bacterial flora surviving the antiseptic received no additions from outside, and so that a species once exterminated never re-appeared. In these vegetation experiments, however, such rigid exclusion was impracticable, and there were many opportunities for the reintroduction of bacteria killed by the antiseptic. Hence a soil treated, *e.g.*, with phenol would not necessarily maintain in the plant house as simple a flora as is kept up in the laboratory experiments. Experiments are now in hand to ascertan the effect of this reintroduction of new forms.

The use of antiseptics in horticultural and agricultural practice.

From the foregoing remarks it is evident that antiseptics may be used in practice in the following cases :—

1. Where the crop yield is limited by the supply of nitrogenous plant food and where therefore an increased production of ammonia in the soil is desirable.

2. Where disease organisms and other detrimental forms are present, and the micro-organic population of the soil has lost much of its effectiveness in producing ammonia from the nitrogen compounds of the soil. Such soils are known as "sick" soils and are fairly prevalent in practice and in certain types of high farming and market gardening. To some extent also sewage sick soils come into this category.

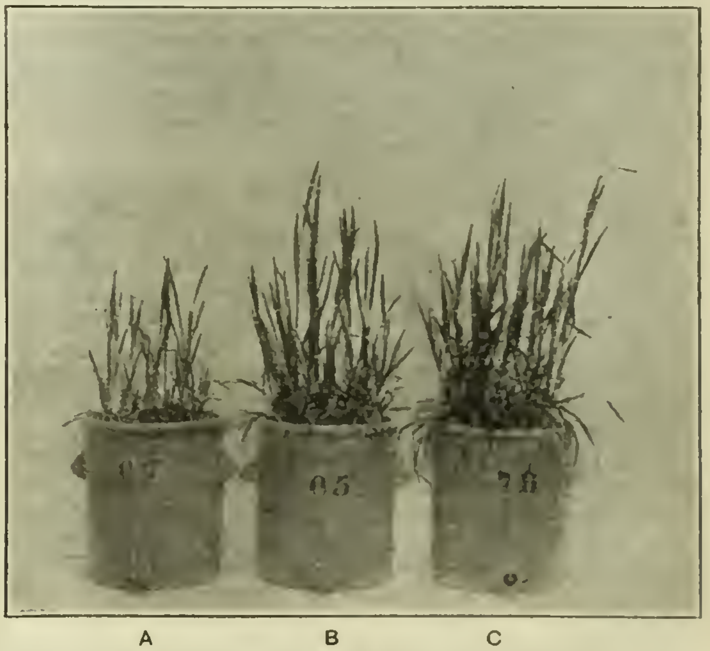

FIG. 5.

Wheat grown in A untreated soil, B soil treated with toluene, C heated soil.

The first case is the simplest in principle, but the most difficult in practice from the circumstance that it is already provided for by the various nitrogenous manures on the market. Until the antiseptic treatment can be made to cost less than a dressing of a nitrogenous manure it will have no chance against these competitors.

The second case is more difficult in principle, but easier in practice because it is not provided for, and there is a clear field here for the application of antiseptics in practice. Hitherto the sick soil has either been thrown out from the nursery, or in the milder cases occurring in the field, has been sown with other and often less valuable crops which will not act as hosts to the disease organisms and left to recover. Growers under glass are now treating sick soils with steam, which, as has already been stated, is more effective than any antiseptic yet found, and can be used at a cost of about 1s. per ton of soil. The antiseptic treatment must therefore cost less than this. In our experiments M/100 to M/50 grams per kilo of soil was frequently an effective dose when the mixing was perfect; this works out for our two first classes of antiseptics at 1—3 lbs. per ton. In practice the admixture is not perfect because soil has a remarkable power of absorbing certain dissolved substances from their solutions, and the mere washing through of a water solution of an antiseptic affords no guarantee that the antiseptic has penetrated below the surface; indeed a simple experiment frequently shows that much of it has not. All substances are not equally affected and trials have to be made in each individual case. Vapours are free from this objection, but they suffer from another: if they are insoluble in water they fail to penetrate the soil particles. For this reason toluene is disappointingly ineffective in practice and comes below carbon disulphide, to which in laboratory experiments it was equal.

It is further necessary that the substance should disappear from the soil after its work is done. Substances of relatively low boiling point simply evaporate; others, such as calcium sulphide, bleaching powder, etc., decompose and leave behind only calcium carbonate, itself a valuable substance for increasing soil fertility. Others again, such as phenol and cresol are apparently oxidised by bacteria.

Nothing but actual trial enables one to ascertain the best antiseptics for use in practice. Fortunately the action of the Lea Valley growers in starting an experiment station for the investigation of these and cognate matters enables experiments to be carried out which would otherwise prove rather difficult; in justification of their action it must be repeated that partial sterilisation either by heat or antiseptics is the only method known for dealing with the important economic problems associated with "sick" soils and soils containing many disease organisms. The experience thus gained will show the cheapest and most effective methods in practice, and it will then be possible to take the further step and see what chance partial sterilisation will have either in competing with nitrogenous fertilisers, or in supplementing their action.

In the meantime chemists who can turn out antiseptics at a low price—say 3d. per lb. or less—may well bear in mind the possibility of developments in this direction. It is, of course, wholly unnecessary that the substance should be pure, but it must be capable of standardisation and of being turned out uniform in composition. Several of our experiments have shown that fluctuations in composition of a commercial product have led to considerable variation in the action on the plant. This sort of thing would annoy a grower, who would be naturally displeased if the particular sample he got did not come up to expectation, and who might put in a claim for compensation if any damage were done to his crop. Solid substances have an advantage in that they can be handled readily, but liquids also serve, provided they are soluble or miscible with water, or can be made so by addition of suitable substances.

The following experimental methods have proved useful in our laboratories and may be adopted by the works chemist in sorting out possible antiseptics for practical purposes:—Some rejected glass house "sick" soil—the worse its character the better for the experiment—is divided into three lots, one is left untreated while the other two are treated respectively with 0·1 and 0·25 per cent. of the antiseptic, care being taken that the admixture is as far as possible perfect. Five experiments are then carried out:—

1. Chemical analyses are made at periodical intervals extending over a month, to ascertain the rate at which ammonia and nitrates accumulate in the treated and untreated soils.

2. At the same time bacteriological counts are made by the gelatine plate method to ascertain the rate of development of bacteria.

3. Some of each lot of soil is inoculated into test tubes containing a one per cent. hay infusion, and after six days' incubation at 25° C. drops of the infusion are examined under the low power of the microscope for protozoa. If these organisms are killed by the treatment it commonly happens that other harmful organisms are killed also.

4. Seeds are sown in the soils and the young plants are carefully watched to observe the development of "damping-off," root knots, or other diseases.

5. Plants are grown right through to fruiting and the produce weighed.

The results of all the series are usually concordant, but it is not safe to dispense with any of the five, and we should view with suspicion any results so obtained. It is essential to the proper carrying out of the experiments that the treated and untreated soils should be stored under similar conditions of moisture, temperature and aeration, and this can most conveniently be accomplished by allowing the excess of antiseptic to evaporate as far as it will, then making up the soils to uniform moistness, and finally putting up 800 gr. lots in clean litre bottles and plugging with sterilised cotton wool.

The absolute effectiveness of an antiseptic having been ascertained in comparison with one or two of the antiseptics in the list just given, the next step is to determine the ease of distribution in the soil.

This is done by putting a layer of soil 3 inches thick on to a Buchner funnel and pouring through it a dilute solution of the antiseptic. The concentration of the filtrate must then be compared with that of the original solution. Some degree of absorption is inevitable and unobjectionable because the soil does get mixed up to a certain extent in practice. But too great a degree of absorption is likely to be detrimental.

The present cost of an antiseptic is not necessarily a bar to its use in practice. Long before Lawes started the manufacture of superphosphate it was known from laboratory experiments that addition of calcium phosphate to the soil increased plant growth. In the year 1842 this substance appears in a popular price list* at 3d. per oz., a wholly impossible price for practical agricultural purposes. Yet 1843 saw the manufacture of superphosphate at a price well within the means of the farmer, and a few years later this fertiliser was coming into widespread use. If effective antiseptics are found fulfilling the requirements of the grower there is every reason to anticipate a satisfactory demand for them.

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* Edward Palmer's Catalogue for 1842.

New England Section.

Meeting held at Boston, on Friday, March 21st, 1913.

MR. C. L. GAGNEBIN IN THE CHAIR.

THE SERPEK PROCESS FOR NITROGEN FIXATION.

BY SAMUEL A. TUCKER.

Processes of nitrogen fixation at present divide themselves into two classes—high tension arc fixation, and chemical absorption. With the former we have a long line of brilliant researches, from the early experiments of Cavendish to those of Lord Rayleigh, McDougall and Howles, Moscicki, Guye, Bradley and Lovejoy, Haber, Nernst, etc., and down to the commercial processes of Birkeland and Eyde, Pauling, and Schönherr.

The earliest work in connection with absorption methods seems to have been done by Jacobs in this country and by Frank in Europe, and they both found that by treating barium carbide with nitrogen at a lower temperature than that necessary for its formation in the electric furnace barium cyanide was formed; as a matter of fact the product consisted of a mixture of cyanide and cyanamide. The method used gave neither a uniform product nor a satisfactory yield, because the carbide was not all at the proper temperature, nor was this temperature known, and further the material was not in such a porous state of division that proper absorption could take place.

The substitution of calcium carbide in the Erlwein process[1] was an improvement as regards cheap raw material, but much the same method was used as for barium and it could not rank as a commercial success. It remained for Frank and Caro[2] to evolve a practical process of absorbing the nitrogen by calcium carbide to form calcium cyanamide as the chief nitrogenous constituent of the product. The calcium carbide has to be ground to a fine powder and then treated at the proper temperature in an atmosphere of pure nitrogen. The chief expenditure of power in this process is, of course, for the manufacture and grinding of the carbide, as the actual absorption of the nitrogen evolves heat and takes but little more energy than is necessary to raise the mass to the reaction temperature. The cyanamide must also be ground, and the absorption process is somewhat slow. The nitrogen must be exceedingly pure and dry with an oxygen content not over a few tenths per cent. In Europe it is prepared by the fractional distillation of liquid air, and in this country air is passed over hot copper. In any case some copper treatment must be carried on, as Linde nitrogen contains far too much oxygen.

This brief review of the Frank process would indicate that it is somewhat complicated, but in spite of this it appears to be successful, as it is now established on a large scale which is constantly extending. One reason for this is to be found in the comparatively low power cost as compared with the high-tension arc system of fixation. Based on the power necessary to make calcium carbide and converting this to form cyanamide, it works out in favour of the Frank process in about the ratio of 3½ to 1.

This method of fixation has been studied further by Bredig,[3] Foerster and Jacoby,[4] etc., with addition agents, and in our own laboratory on lithium[5] and strontium[6] carbides as absorbers of nitrogen.

We now come to the Serpek process, which appears to be very promising. This method consists in heating bauxite and carbon in an atmosphere of nitrogen at a temperature of about 1800° C. in a specially designed electric furnace. Serpek first used aluminium carbide[7] for the absorption, in much the same way that calcium carbide was used by Frank, but the carbide requires a high temperature for its formation and would be expensive. He also found that alumina and carbon could be heated directly in nitrogen to form the nitride,[8] but later discovered that the temperature of the reaction was all important,[9] 1850° C. being taken as a maximum. Catalytic or addition agents, such as hydrogen chloride and sulphur dioxide, were found advantageous; the impurities occurring in bauxite seem also to facilitate the reaction. Indeed, with pure alumina and carbon a much higher temperature is required than when bauxite is used. The product formed is largely aluminium nitride, AlN, which can be decomposed by caustic soda to form ammonia and sodium aluminate:—

$$AlN+3NaOH=NH_3+Na_3AlO_3.$$

In conjunction with Henry L. Read[10] the author has investigated the Serpek process so far as the reaction is concerned and has verified the chief points of importance as to nitrogen content of the product, the temperature relations, and the necessity of using bauxite. The use of catalyst mentioned by Serpek failed to give any advantage. We have only the information furnished by Serpek's patent[11] and by the recent article of J. W. Richards.[12]

From this we learn some mechanical features of the process, which consist in the use of two rotating inclined cylinders one of which is provided with a detachable electric furnace of the resistance type. Bauxite is passed through the upper cylinder and there meets the hot gases from the reaction which are heated both by the electric furnace and also by combustion with air admitted by suitable ports. Before entering the electric furnace the bauxite is mixed by means of a side hopper with the requisite quantity of carbon and thus passes to the electric furnace. The temperature here is in the neighbourhood of 1800° C. and the charge in its passage meets the nitrogen from a producer placed at the lower end of the apparatus. The charge is thus subjected to the action of the nitrogen, in a very advantageous way for its absorption, and after this stage of the process it passes on to a closed receptacle at the bottom.

The mechanical features appear to be well worked out. The continuous nature of the working is a very decided advantage. The use of producer gas as a source of nitrogen is unquestionably good, because the heat evolved is utilised to some extent in the process itself. But there is the further advantage in the Serpek design so far as heat conservation is concerned, which is seldom found in electric furnace operations, and that is the utilisation of the hot gases to preheat the charge and to calcine the raw material. The electric furnace itself might present some complications, but seems to consist of a tubular section with resisters of carbon and with the refractory parts consisting chiefly of aluminium nitride.

The product obtained consists of a gray powder the exact nitride content of which we do not know. In the experiments that we made at Columbia, some of the selected portions contained about 30 per cent. of fixed nitrogen, though it cannot be definitely stated that the commercial product would have this nitrogen content. Under suitable conditions of crystallisation the product seems to consist of nearly pure nitride in which there are apparently two different compounds, the blue and brown crystals, the former having something of the appearance of carborundum, the latter brown needle-like crystals. Prof. Luquer, who has kindly examined these crystals, believes them to be the same. Both are strongly double refracting and have the same structure, but have different properties.

The ease with which aluminium or its carbide takes up nitrogen is well shown by the simple experiment of heating a mixture of aluminium powder and charcoal to the reaction temperature in a crucible, when a mixture of aluminium nitride, carbide, and oxide is obtained; from such a mixture it is easy to show the decomposition of the nitride into ammonia by the addition of alkali and also to distinguish the crystals of the nitride under the microscope. Weston and Ellis[13] have studied this reaction and have obtained up to 40 per cent. of the nitride in this way.

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[1] See Eng. Pat. 16,298 of 1902; this J., 1903, 554.

[2] See this J., 1908, 1096.

[3] See Fr. Pat. 382,188 of 1907; this J., 1908, 225.

[4] Foerster & Jacoby, Zeit. Electrochem., 1907, **13**, 101 (this J., 1907, 423).

[5] Tucker & Moody, Jour. Am. Chem. Soc. 33, 1478.

[6] Tucker & Wang, Trans. 8th Congress App. Chem., Xa, 121.

[7] Fr. Pat. 367,124; this J., 1906, 1096.

[8] *loc. cit.*

[9] Eng. Pat. 7507 of 1909; this J., 1910, 277.

[10] Trans. Am. Electrochem. Soc., 22 (this J., 1912, 1124).

[11] Eng. Pat. 13,086 of 1910; this J., 1911, 421.

[12] Met. and Chem. Eng., 1913, 11, 137.

Aluminium nitride as prepared by Serpek is of value not only from its combined nitrogen but also from the valuable by-product of alumina arising from its decomposition. This should be available for the manufacture of aluminium. Without this advantage the process as one for the fixation of nitrogen would be of doubtful value; the alumina would have to be used over again as raw material after evolving the ammonia, and apart from the complications, alumina in the pure state requires a much higher temperature for nitrogen fixation than bauxite. So much so is this the case that if this were done it is very doubtful if the process could be carried on successfully.

In a recent paper[14] I have attempted to show how much this production of alumina is concerned with the aluminium industry. If the Serpek process were to be worked on a scale commensurate with the Frank cyanamide process, the production of alumina would actually exceed the present demands of the aluminium industry in raw material to the extent of some 34,000 tons annually. However, there seems little doubt that the Serpek alumina would find a ready market. It is quite impossible to compare the cost of producing fixed nitrogen by the Frank and Serpek processes, because we know very little as to the costs of making cyanamide by the former, and still less as to the cost of the Serpek product. Perhaps the best way of comparing the processes is to contrast the chief points of each, as follows:—

Frank Process.

Favourable.	*Unfavourable.*
Low power costs for nitrogen fixed.	Process discontinuous.
Material can be used directly as fertiliser.	Heat losses at carbide manufacture stage.
	Expensive nitrogen.
	Two rather complicated grinding operations.
	Low nitrogen content in the product.

Serpek Process.

Favourable.	*Unfavourable.*
Continuous process.	Expensive raw material.
High nitrogen content in product.	Chemical treatment before nitrogen is available as fertiliser.
Heat conserved.	
Valuable by-product.	

From this it would seem that there were decided advantages attached to the Serpek process, but it remains to be seen just how it will work in practice. It is now being tried in France on a large experimental scale.

New York Section.

Meeting held at Chemists' Building on Friday, November 21st, 1913.

MR. O. W. THOMPSON IN THE CHAIR.

THE RELATION OF COMPOSITION OF ASH IN COAL TO ITS FUSION TEMPERATURE.

BY OSCAR W. PALMENBERG, B.S.

One of the most troublesome features in the combustion of coal is that due to the production of clinker, which influences the rate of combustion and the cost of maintenance, especially where automatic stokers are in use. A coal may clinker so readily as to be unfit for use, irrespective of its fuel value. When coal is burned under a boiler for the production of steam, it is especially important to know whether the ash will clinker and at what temperature.

Several methods have been suggested to determine whether a coal has an ash which will fuse at a low temperature, and many persons have held that an analysis of the ash or the amount of iron in the ash, or of sulphur in the coal will give the explanation.

To show that there is no relation between the clinkering quality of a coal and the sulphur or iron content, the writer has made this investigation, and the analyses of the ash together with the fusing temperature determinations on a wide range of coals will readily show that no conclusion can be obtained from a chemical analysis.

The ash of coal is composed mainly of silica, iron oxide, aluminium oxide, calcium oxide, magnesium oxide, sodium oxide, potassium oxide, carbonates and sulphates. Since all coals, but particularly soft coals, consist of a mixture of pure coal substance and pyrites, bone, slate, fire-clay, etc., these elements will be present in a variable proportion depending upon the nature of the coal vein and the method and care by which the coal is extracted from the ground. In making an analysis, therefore, of a coal sample representing a mixture of all these materials, a definite percentage of the component parts of the ash may be obtained, but this analysis does not tell us how much pyrites, bone, slate, fire-clay, etc., is present. It is, therefore, apparently impossible to judge from this analysis whether the ash will have a high or low fusing temperature. It is true that the pyrites will fuse at a lower temperature than the slate, but since both may contain iron, the analysis does not indicate a method of arriving at a conclusion to show the fusibility of the ash due to the iron content. The problem offered is very similar to that of trying to determine a formula by which the calorific value of a coal may be estimated. This has been attempted by using the percentage of ash and volatile matter or of ash and fixed carbon, but since these constituents are so variable in their composition, depending upon their sources, it is impossible to arrive at a reliable method. For that reason a calorimetric determination must be made.

The following analyses and fusing temperature determinations were made on coals mined in Pennsylvania and samples were obtained either from the mine or place of consumption:—

Fusing temperature of the ash in coal arranged according to the iron content.

No.	Fe_2O_3 %	S %	Ash. %	Fus. T. °C.
1	4·81	0·51	5·15	2700
2	6·28	1·01	9·15	2600
3	7·29	0·90	6·41	2600
4	7·88	0·74	5·57	2600
5	7·94	1·52	15·61	2750
6	11·28	1·04	8·53	2745
7	13·84	1,80	13·51	2300
8	14·14	1·46	7·88	2615
9	15·15	1·07	6·38	2560
10	15·21	1·42	7·98	2400
11	15·38	1·57	..	2156
12	16·00	1·63	9·90	2309
13	17·43	..	7·98	2516
14	17·95	2·11	11·04	2309
15	19·19	1·79	7·90	2138
16	19·54	2·41	11·33	2380
17	22·26	2·06	9·70	2400
18	22·26	1·90	7·23	2372
19	22·38	2·56	..	2210
20	22·57	2·00	9·03	2336
21	23·17	1·16	9·52	2535
22	23·30	2·40	8·10	2156
23	24·40	2·23	10·90	2190
24	26·50	2·13	6·86	2192
25	27·22	3·13	13·54	2138
26	28·39	1·96	6·65	2084
27	28·81	2·32	7·55	2318
28	30·67	2·17	7·90	2246
29	33·27	2·86	9·33	2520
30	35·13	2·13	6·25	2300
31	36·12	3·04	8·40	2264
32	36·17	2·60	7·50	2500
33	38·75	3·97	10·60	2180
34	39·51	2·97	8·22	2210
35	39·88	2·41	8·96	2372
36	40·93	2·68	9·08	2415
37	44·00	4·12	..	2246
38	44·39	3·51	9·34	2318

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[13] Weston and Ellis, Trans. Faraday Soc., 4, 60, 1908.

[14] Tucker, The relation of alumina to the fixation of nitrogen, Jour. Ind. and Eng. Chem., 5, 191 (1913).

Analyses showing the composition of the ash of bituminous and semi-bituminous coal.

No.	Fus. temp.	Fe_2O_3	Sulphur.	SiO_2	Al_2O_3	CaO	MgO	K_2O,SO_3 Na_2O,CO_2	Ash.
	°C.								
1	2700	4·81	0·51	51·93	36·82	3·84	1·00	1·60	5·15
2	2615	14·14	1·46	44·74	36·91	2·18	0·41	4·85	7·88
3	2600	6·28	1·01	48·83	42·62	1·64	0·30	3·90	9·15
4	2600	7·29	0·90	54·18	34·53	3·01	0·47	0·52	6·41
5	2400	22·26	2·06	40·61	32·94	1·77	0·51	1·91	9·70
6	2372	39·88	2·41	30·07	25·31	2·63	0·39	1·71	8·96
7	2309	17·95	2·11	47·94	28·47	4·17	0·51	0·96	11·04
8	2300	13·84	1·80	46·40	35·30	3·58	0·31	0·57	13·51
9	2300	35·13	2·13	30·90	31·14	2·00	0·52	0·31	6·25
10	2246	30·67	2·17	35·48	30·73	2·10	0·44	0·28	7·90
11	2180	38·75	3·97	29·37	29·52	1·57	0·37	0·44	10·60

These analyses seem to show that there is no relation between the percentages of the various constituents of the ash and the fusing temperature. Therefore a chemical analysis is of no value to arrive at a conclusion regarding the clinkering quality of a coal. It may be noted that although coals having an ash with a very low iron content seem to give the highest fusing ash, no definite fusing temperature fits a definite percentage, and when the iron content goes beyond 10 per cent. the fusion temperature cannot be judged at all. That the sulphur content of the coal has no bearing whatsoever upon the fusibility of the ash is also apparent.

The writer intends to continue this investigation on coals from other sources than Pennsylvania with the object of determining whether there may not be some having practically no iron and showing a low fusing ash.

Since the sulphur occurs in coal combined either with iron, lime, or the hydrocarbons, there naturally exist innumerable combinations, and for this reason the sulphur content cannot be used as an index to clinkering. Only in those cases in which the sulphur is in combination with the iron, in the form of pyrites, would it be possible to judge the clinkering property, if the iron content of the ash had any bearing upon the fusion temperature.

The fusion temperature determination of the ash of coal will in the future displace the sulphur determination in coals used for steaming purposes, and will readily show the fallacy of buying and selling coal on an analysis basis where specifications are used containing sulphur tables penalising beyond a certain guaranteed amount of sulphur. It has been quite a common practice to place 1·50 per cent sulphur as a limit and penalising as much as 4 cents per ton for every 0·25 per cent. above 1·50 per cent. The injustice of this practice is very evident, as it often happens that coals with a high sulphur content are extremely high in heat value and do not clinker readily at all. Since the sulphur has no appreciable effect upon the metallic parts of the furnace it need therefore not be considered in the selection of a coal for steaming purposes.

To arrive at the value of a coal for steaming purposes it is therefore just as essential to make the fusion test of the ash as it is to make the calorimetric determination. If these determinations are made there is a ready explanation why two coals of apparently like proximate analyses give entirely different evaporation when fired under like conditions.

Discussion.

Mr. J. B. F. Herreshoff said that the practical results of coal users seemed at variance with the conclusions of Mr. Palmenberg. In the experiments of his own company, it had been found that when the ash contained less than 8 per cent. of iron, the amount of clinkering was tolerable, but that when the amount of iron was as high as 15 per cent. of the ash, the clinkering was so marked that they could not use the coal, while with 30 per cent. of iron in the ash, the ash was so fusible that it would drip through the grate bars. Coal with not more than 10 per cent. of ash, and of which ash 8 to 8½ per cent. might be iron, was found to be satisfactory. With coal high in fixed carbon there was more clinkering than in the case of coals low in fixed carbon on account of the higher temperature to which the ash was subjected during combustion in the former case. The great difficulty that his company had experienced with coal analyses was that of sampling.

Mr. Fuerst asked if from these analyses, calculations had been made upon the probable fusibility of the ash in the manner understood by metallurgists in the calculation of blast furnace slags.

Mr. G. W. Thompson asked if in the tests to determine the fusing point of the ash, the coal had been completely burned before making the melting test, or if some carbon had been left associated with it, and upon Mr. Palmenberg's reply that the ash was tested after complete burning so that the ash was thoroughly oxidised and free from any contamination with carbon, he suggested that the discrepancies between Mr. Palmenberg's results and those found by Mr. Herreshoff in actual practice might be accounted for by supposing that in the laboratory tests of Mr. Palmenberg the iron in the ash was in the ferric condition while in actual practice the iron would be in the ferrous condition at the time it was subjected to the heat which produced clinkering, ferrous iron being a fluxing ingredient though ferric iron might not be.

Mr. F. S. Hyde asked what the effect of lime in the ash might be; in his experience a clay containing 5 per cent. of lime would be much more fusible than the same clay without it.

In answer to Mr. Herreshoff, Mr. Palmenberg said that he had found many coals running higher than 15 per cent. that would not clinker readily, and those showing the higher fusion test would give splendid results under actual firing conditions. The clinkering of a coal in a furnace depended upon the rate of combustion, and if the nature of the coal was such that it generated a higher temperature than the fusion temperature of the ash, then clinker would be formed if the ash were in sufficient quantity and exposed to the hot fire-bed. He presumed that the coals that Mr. Herreshoff referred to were burned under conditions that the rate of combustion would give a very high furnace temperature.

In answer to Mr. Hyde's question, lime in appreciable quantity would no doubt influence the fusion temperature as it would flux with the silica. The coals investigated had all been low in lime and, therefore, no conclusion could be obtained in regard to its influence. The analyses bore out the fact that the fusion temperature was not influenced by the small amount of lime present, and should the lime reduce the fusion temperature, the effect might be offset by the presence of a larger amount of alumina which had the property of making the ash infusible.

Scottish Section.

Meeting held at Glasgow on Tuesday, November 25th, 1913.

DR. THOMAS EWAN IN THE CHAIR.

A NEW FORM OF EXTRACTION APPARATUS AND REFLUX CONDENSER.

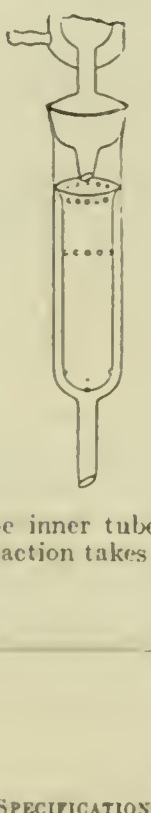
BY PROBODHA CHUNDRA CHATTOPADHYAY, M.A.

(A) *Extraction Apparatus.*

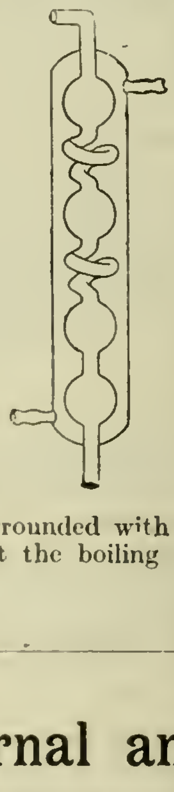
After working with various forms of extraction apparatus, the writer has tried to rectify some of their inconveniences by designing an apparatus in which the extraction is carried out on a different principle from that which is to be found in extractors of the Soxhlet type.

As shown in the figure, the extractor consists of an outer glass jacket and an inner glass tube (thimble) of smaller diameter. The latter is provided with a series of holes at the top and with some near the middle. There is also a very small hole at the bottom of the thimble to allow the liquid to drain away completely when the extraction is finished. The neck of the extractor may be ground so that a reflux condenser can be fitted to it. The most important feature of the apparatus is the absence of any syphon tube, which is the most fragile part of a Soxhlet.

In using the apparatus the substance to be extracted is placed in the glass thimble direct or in a fat-free paper thimble which is then placed inside the extractor. The subsequent process is the same as in an ordinary Soxhlet extraction apparatus. The vapour of the extracting liquid rises through the annular space and passes into the thimble through the upper holes (and also through the other holes during the first period) and is condensed in the reflux condenser. The condensed liquid drops on the substance to be extracted in the thimble and afterwards falls into the boiling flask (passing through the holes in the middle of the thimble).



EXTRACTION APPARATUS.



REFLUX CONDENSER.

As the inner tube is always surrounded with vapour, the extraction takes place nearly at the boiling point of the extracting liquid and therefore can be finished more quickly than with ordinary extractors. Further, on account of the higher temperature, the extraction is more efficient.

When the extraction is finished and the apparatus is cooling, the last drop of extracting liquid drains away through the small hole provided at the bottom of the glass thimble, which is impossible with any other form of extractor especially with those having syphon arrangements.

(B) *Reflux Condenser.*

As the extraction takes place at a comparatively high temperature, a more efficient condenser is necessary for the perfect condensation of the vapour. This is secured by the reflux condenser illustrated above.

Of the ordinary reflux condensers, those having bulbs in the inner tube or spiral shaped inner tubes are comparatively more efficient. But, in spite of bulbs, there exists a central draught and thus some vapour is lost in one form, especially in tropical climates; whilst in the other, though there is no central draught, the spiral is quickly filled with the condensed liquid if the ebullition be somewhat rapid, and the condensation is not perfect, since the vapour cannot condense and fall rapidly at the same time, the bore of the spiral tube being too narrow to allow the vapour and the condensed liquid to pass in opposite directions at the same time. Though double surface condensers have a comparatively larger condensing surface, and are most suitable for ordinary distillation purposes, they are not so efficient as reflux condensers, one reason being that central draught is not prevented.

In the apparatus under notice, four bulbs and two spirals are arranged in the inner tube, as shown in the figure. The vapour first enters the two bulbs, where the greater part is condensed. The remaining vapour passes through the first spiral and is cooled, and in the next bulb there is further condensation. If any vapour remains, this condenses in its passage to the fourth bulb through the second spiral. There cannot be any central draught. This combination appears to produce an ideal reflux condenser.

Note.—These pieces of apparatus are manufactured for me by Herr F. A. Kuehnlenz, of Frauenwald (Thüringia) and can be obtained from him and from Messrs. A. Gallenkamp & Co., Ltd., of London.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Fire-alarm; New automatic ——. F. A. J. Fitzgerald. J. Franklin Inst., 1913, **176**, 575—582.

ITS action depends on the fact that the electrical resistance of "*thermitite*," a preparation of silver sulphide, is remarkably sensitive to temperature. Thermoscopes containing strips of the "thermitite" are inserted like electric lamps, in a circuit. If one of these becomes slightly heated, sufficient current passes to trip a relay and permanently close the circuit, which causes an alarm to sound on a gong. An important feature is that a slight rise in the air-temperature causes quicker heating of the thermoscope, so that the effect is self-intensifying.

—W. H. P.

PATENTS.

Drying machines; Rotary ——. T. J. Maycock, London. Eng. Pat. 25,484, Nov. 6, 1912.

AN apparatus for drying rags and the like. It consists of a horizontal perforated drum, rotated within an outer casing, through which a current of hot air is passed. The drum is provided inside with V-shaped lifters, attached with the apex next to the periphery. The hot air is forced into the drum at each end by fans driven in opposite directions, so that opposing currents enter the drum and set up a whirling motion therein. The vapour-laden air escapes through an aperture in the middle of the lower part of the outer casing.

—W. H. C.

Drying and cooling of granular materials. J. A. Topf und Soehne, Erfurt, Germany. Eng. Pat. 29,835, Dec. 27, 1912. Under Int. Conv., June 4, 1912.

The material is fed at a constant rate into the upper end of a tower and is maintained at a constant depth by means of inclined baffles, placed in the lower part of the column at an inclination corresponding with the angle of repose of the material. The material is dried or cooled by either heated or cooled air forced or drawn downwards through it by a blower or fan.—W. H. C.

Drying rooms. E. Rosenburg, London. Eng. Pat. 12,070, May 23, 1913.

At each end of the room is a partition dividing off a narrow compartment open at the top and bottom. In each of these compartments, near the bottom, is a heating coil. The air, heated by the coils, rises and is deflected, by curved baffles at the top, towards a cooling coil at the top of the room, in the middle. The air then flows downwards over the material to be dried, again upwards, over the heating coils, and so on. Moisture is deposited on the cooling coil, and the condensed water flows down to a gutter beneath.—W. H. C.

Drying apparatus ; Vacuum ——. O. S. Sleeper, Assignor to Buffalo Foundry and Machine Co., Buffalo, N.Y. U.S. Pat. 1,073,872, Sept. 23, 1913.

A horizontal steam-heated drum rotates on hollow trunnions in the upper part of a vacuum chamber. Extending lengthwise below the drum is a tube having a slot in its upper surface, with a curved distributing plate, concentric with the drum in front, and a dam or baffle behind. Liquid is supplied to the tube by a pump and is distributed in the form of a thin film to the periphery of the drum, the excess flowing over the edge of the distributing plate and from the bottom of the vacuum chamber into a reservoir beneath, whence it is returned to the pump. The dried material is removed from the drum by a scraper. The reservoir beneath the vacuum chamber is provided with an agitator. The tube through which the liquid is supplied can be turned round to facilitate access to the slot for cleaning purposes. Inside the heating drum is a scoop, disposed obliquely, which collects the condensed water and directs it to the outlet pipe.—A. S.

Dryer ; Steam ——. E. Tailhade. Fr. Pat. 459,822, July 1, 1913.

A series of superposed jacketed horizontal troughs or drums provided with agitators and conveyors are heated by exhaust steam which is first superheated and then passed through the jackets. The waste gases from the superheater may be passed over the materials in the dryer to regulate the temperature.—W. H. C.

Washing gases or vapours ; Method of and apparatus for ——. A. H. Lymn, London. Eng. Pat. 744, Jan. 9, 1913. Addition to Eng. Pat. 11,452 of 1912 (this J., 1912, 1167).

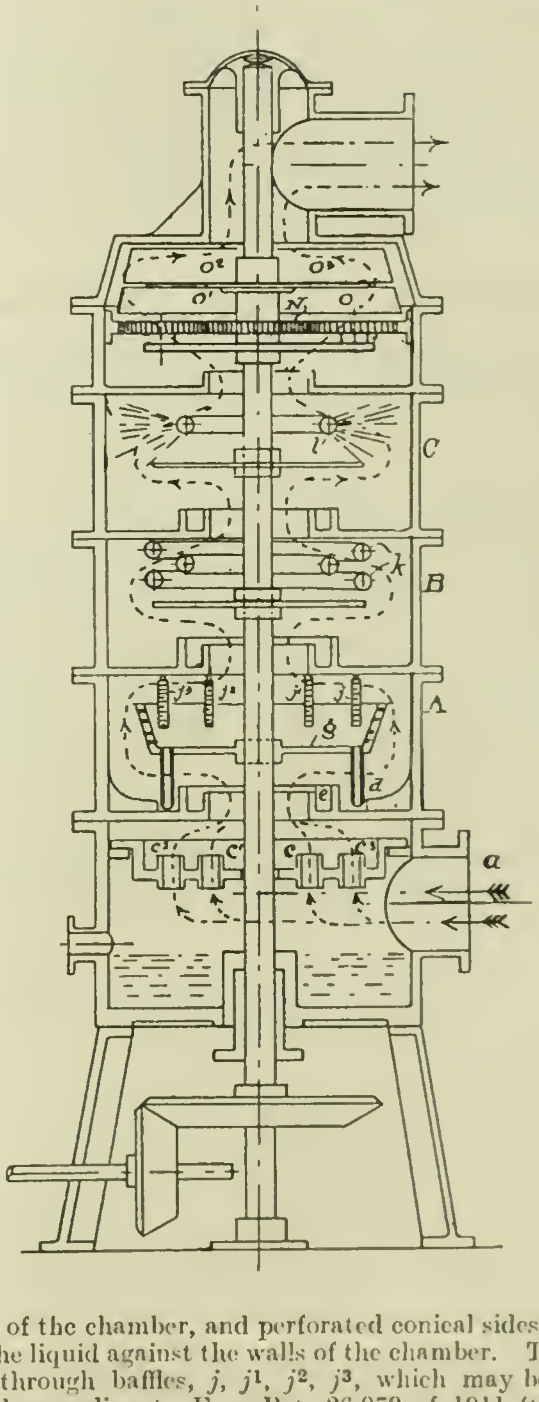
The central distributing devices for the washing liquid described in the principal patent are made non-rotatable, and of lesser diameter than the smaller diameter of the collecting devices surrounding them, which are formed as inverted truncated cones. The momentum of the gas or vapour ascending through the apparatus is utilised to break up or distribute the descending films of liquid.—H. H.

Washing and physical mechanical and chemical purification of gases and vapours ; Process and apparatus for the ——. H. Riché. Fr. Pat. 459,025, June 9, 1913.

The gas is passed downwards through a tower divided by horizontal partitions into superposed communicating compartments. To ensure an intimate contact between the gas and the purifying liquid, which is also passed down the tower, the openings in the partitions are filled with vertical bundles of pointed cylindrical or prismatic rods placed point downwards with the points resting on the partition below. The gas and the liquid pass through the apertures between the points of the rods and bubble up through the layer of liquid on each partition.—W. H. C.

Washing gases ; Apparatus for —— *applicable also for distilling purposes.* A. J. Liversedge, Croydon, and W. B. Davidson, Gravelly Hill, Warwick. Eng. Pat. 25,593, Nov. 7, 1912.

The gas enters at a, and passes through tuyères, c, c^1, c^2, c^3, into a chamber, A, in which a pan, g, rotates, having depending scoops, d, to pick up washing liquid from the bottom of the chamber, and perforated conical sides which spray the liquid against the walls of the chamber. The gas passes through baffles, j, j^1, j^2, j^3, which may be constructed according to Eng. Pat. 26,979 of 1911 (this J., 1912, 1071), and enters a chamber, B, containing heating or cooling pipes, k. It then flows into a chamber, C, containing a spraying coil, l, for introducing steam or liquor, and finally passes through a fan, o, o^1, o^2, o^3, such as is described in Eng. Pat. 29,178 of 1904, where the entrained liquid is separated. The openings at the centres of the diaphragms separating the different chambers are provided with double lips, e, to steady the liquid, so that it descends as a thin film over the entire surface of the inner lip. When used for distilling, the liquid is introduced at the top of the apparatus and is heated by means of coils or by the introduction of steam. The atomising of the liquid facilitates the evolution of the volatile ingredients. —H. H.



Air and industrial gases; Method of removing dust from ——. E. Liebrecht. Ger. Pat. 265,584, Nov. 29, 1912.

A mass of crystalline soluble material, arranged so that it retains its shape, is used as a filter for the gases, and is kept moist on the surface by the introduction of steam or mist. The particles of dust are retained by the material, and a fresh clean surface of the latter is continually exposed by the gradual solution of the outer layer.—A. S.

Suspended particles; Electrical separation of —— from electrically non-conducting fluids, especially gases. E. Möller. Ger. Pat. 265,964, Sept. 1, 1912.

Electrical discharges are produced from a series of thin wires passing centrally through tubes which serve as electrodes upon which the particles are deposited. The gas is divided by the series of tubes into a number of separate streams, each of which is subjected to high-tension electrical discharges. The ends of the tubes are widened or rounded off and the wires are kept taut by weights suspended from their lower ends. The portions of the wires near the ends of the tubes may be thickened or enclosed in sheaths.—A. S.

Mixing and atomising gases and liquids; Ejector for ——. A. H. Rasche. Ger. Pat. 265,585, June 27, 1912.

The mixing tube of the ejector is provided with enlarged portions and in each of these is an annular baffle plate disposed transversely across the middle.—A. S.

Centrifugal apparatus for cleansing liquids [from dirt, etc.]. R. A. Sloan and J. E. L. Barnes, Liverpool. Eng. Pat. 25,817, Nov. 11, 1912.

To facilitate the separation of very finely divided solids from liquids, for example, in the cleansing of benzine, naphtha, etc., after it has been used for dry cleaning, a centrifugal drum separator is provided with a number of baffles at the periphery so that the liquid is subjected to centrifugal action for a considerable period as it passes from the bottom of the drum round the baffles to the upper lip where it is discharged. The baffles may be at right angles to the cylindrical walls of the drum but are preferably parallel thereto, thus forming additional depositing surfaces for the solid. The drum is surrounded by a gas-tight casing, which has a compartment below the drum for the collection of the dirty flushing liquid periodically discharged from central holes at the bottom when the drum is stopped.—H. H.

Extracts, Process and device for the preparation of ——. K. Gebhardt, geb. Zurkalowski, Berlin. Eng. Pat. 2013, Jan. 24, 1913.

A receptacle having a perforated bottom and containing the material to be extracted (coffee powder, tea, fruit, malted grain, etc.) is disposed above a layer of water within an outer vessel. The water is heated and when the steam evolved has sufficiently softened the material, cold water is allowed to fall on to the latter from a reservoir in the upper part of the vessel. The extract flows down through the perforations and then rises in a pipe from which it is again delivered on to the material in the receptacle.—A. S.

Separating substances of different specific gravity [e.g., coal and coke from furnace residues]; Method of and apparatus for ——. A. Gründler, Berlin. Eng. Pat. 15,945, July 10, 1913. Under Int. Conv., Oct. 29, 1912.

The materials are separated by means of an aqueous suspension of aluminium silicates (clay, loam, marl, etc.), having a density intermediate between the densities of the materials to be separated. The liquid is introduced at the bottom of the separating chamber, and the removal of the lighter particles with the overflow liquid at the top is facilitated by slowly rotating screw blades working just beneath the surface of the liquid. The ingredient carried away by the liquid may be precipitated by the addition of water, and the silicates recovered. The process is specially suitable for the separation of coal and coke from furnace residues.—H. H.

Filter and hydraulic presses; Combined ——. G. W. Johnson, London. From Chemische Fabrik Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 18,842 of 1913, date of appl., Aug. 7, 1912.

In hydraulic filter-presses of the kind in which hydraulic press cylinders are introduced between adjacent plates of the press, the press pistons are provided with passages opening behind the filter-plates, and leading into longitudinal grooves in the cylinder walls, through which the filtrate escapes.—H. H.

Press for the extraction of juices, liquids, oils, etc. J. C. Fiddyment. Fr. Pat. 459,710, June 26, 1913.

To avoid the loss of efficiency in screw presses, due to the material being carried round at such a rate that the press is not completely filled, or to the slipping back of the material towards the inlet, a second screw tapered in the reverse direction to the main screw is arranged parallel to it. The blades of this auxiliary screw project into the spaces between those of the main screw.—W. H. C.

Condenser for fractional condensation or distillation. E. Böhm. Ger. Pat. 265,577, April 7, 1912.

The vapours are passed through a coil each convolution of which has a globular enlargement or bulb with an outlet for the condensed liquid at its lowest point. Immediately behind the outlet is a baffle which prevents the vapour from taking the shortest path across the bulb.—A. S.

Reaction-spaces; Method of filling large ——. H. Vollberg. Ger. Pat. 265,724, Feb. 5, 1913.

The spaces are packed with superposed layers of short firebrick cylinders, spaced apart, and filled with pieces of coke or wood charcoal or with compressed blocks of wood charcoal. When compressed blocks are used, an annular space is left between the block and the wall of the cylinder for the passage of the gases.—A. S.

[Furnace] gases; Filtration of ——. A. Stolte, Hannover, Germany. Eng. Pat. 26,077, Nov. 13, 1912.

See Fr. Pat. 450,957 of 1912; this J., 1913, 590.—T. F. B.

Furnaces; Gas-fired ——. P. A. J. Cousin, Loos-lez-Lille, France. Eng. Pat. 476, Jan. 7, 1913. Under Int. Conv., Jan. 9, 1912.

See Fr. Pat. 438,873 of 1912; this J., 1912, 626.—T. F. B.

Kiln; Continuous ——. F. D. Shaw, Chicago, Assignor to Shaw Kiln Co., Atlanta, Ga. U.S. Pat. 1,079,443, Nov. 25, 1913.

See Eng. Pat. 17,066 of 1911; this J., 1912, 876.—T. F. B.

Distilling methods and apparatus. E. A. R. Chenard, Cognac, France. Eng. Pat. 10,783, May 7, 1913. Under Int. Conv., May 7, 1912.

See Fr. Pat. 443,499 of 1912; this J., 1912, 971.—T. F. B.

Drying plant. G. Falchi, Marseilles, France. U.S. Pat 1,079,547, Nov. 25, 1913.

See Fr. Pat. 449,806 of 1912; this J., 1913, 504.—T. F. B.

Drying apparatus. F. F. W. Stieler, Berlin. U.S. Pat. 1,079,673, Nov. 25, 1913.

See Fr. Pat. 454,468 of 1913; this J., 1913, 858.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

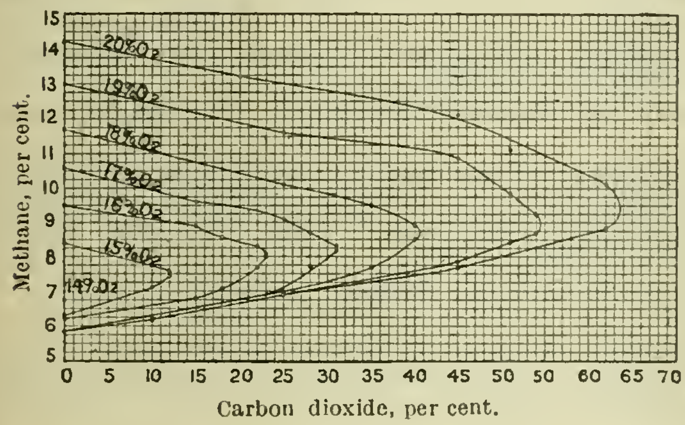
Explosions in Mines Committee; Fifth report of ——. [Cd. 7132.] 25 pages.

The effect of incombustible dust on the inflammability of coal dust was investigated, using Altofts shale, fuller's earth, flue dust, and sand. A flame of burning gas unaccompanied by any concussion or violent disturbance of the air would not cause coal dust to propagate flame for more than a limited distance when the coal dust was at rest. When the flame was accompanied by shock, as in the case of a blown-out shot, a dust cloud was raised and propagation of the explosion could then take place. A mixture of equal parts of coal dust and incombustible dust was not exploded by a blown-out shot, but might be by explosion of pure coal dust. Incombustible dust was only effective when it could be easily blown into a cloud with the coal dust, otherwise the flame was able to lick up the particles of coal dust from the mixture and thus propagate ignition. Zones of incombustible dust would probably not be so effective in preventing explosion as mixtures with the coal dust. The Committee consider that the safety of dusty mines would be largely increased by using not less than 50 per cent. of incombustible dust mixed with coal dust. Accumulations of coal dust on high ledges and timbers should as far as possible be replaced by incombustible dust.—G. W. McD.

Gaseous mixtures; Influence of inert gases on inflammable ——. J. K. Clement. Bureau of Mines, U.S.A. Techn. paper. 43, 1913, 24 pages.

The author determined the upper and lower percentages of methane, and of a natural gas containing CH_4 83, C_2H_6 16, and N_2 1 per cent., which would explode, in mixtures containing from 14 to 20 per cent. of oxygen, the rest of the mixture being nitrogen and carbon dioxide. The effect, in each mixture, of substituting carbon dioxide for nitrogen was to narrow, from both ends, the explosive zone. Thus with 20 per cent. of oxygen, when carbon dioxide was absent, all mixtures containing CH_4 5·8 to 14·2 per cent. (and hence N 74·2 to 65·8 per cent.) would explode; but when 62 per cent. CO_2 was present, the explosive range was only between 8·8 and 10·1 per cent. CH_4. The results were plotted in curves, of which that given, is an example. With the aid of this curve, analysis of any gas containing only methane, nitrogen, carbon dioxide, and oxygen within the above limits, would show whether or not the gas would explode on contact with a flame. The effect of carbon dioxide was attributed to its high specific heat, which rendered it more difficult to raise the gas to the necessary temperature for reaction.—J. T. D.

Limits ot explosibility in methane, oxygen, carbon dioxide, and nitrogen.



Pit-gas and air; Comparative inflammability of mixtures of ——, ignited by momentary electric arcs. W. M. Thornton. Trans. N. Eng. Inst. Min. and Mech. Eng., 1913, 64, 32—44.

The author determined the least currents at different voltages, both continuous and alternating, which would ignite mixtures of pit-gas (one sample containing CH_4 87 and N_2 12 per cent., the other 93 and 6 respectively) and air, containing 9·5 per cent. of the gas, and the least igniting currents at constant voltage, when the percentage of gas in the mixture varied. In all cases the current needed, diminished as the voltage was raised, and the current at constant voltage was at a minimum with about 6·5 to 8·5 per cent. of gas in the mixture, and rose rapidly on either side of this, but most rapidly when the percentage of gas was lowered. With alternating currents, other things being alike, the least igniting current increased with the frequency of the alternations. In all cases, too, the currents required to ignite these mixtures were greater than those needed to ignite corresponding mixtures of methane and air.—J. T. D.

Patents.

Peat and other organic bodies; Treatment of ——, to facilitate the removal of water therefrom. H. Keeble, Merton Park, Surrey, and E. M. Keeble, Stoke Ferry, Norfolk. Eng. Pat. 25,385, Nov. 5, 1912.

The peat is agitated with an aqueous solution of bleaching powder, the mixture (containing preferably 93—95 per cent. of water) being heated to a temperature of 30°—40° C.; the proportion of bleaching powder employed corresponds to about 2 lb. per ton of dry peat.—W. E. F. P.

Fuel [briquettes]; Manufacture of agglomerated ——. L. Martel. First Addition, dated June 4, 1913, to Fr. Pat. 456,061, Mar. 27, 1913 (this J., 1913, 936).

The process described in the principal patent is applied in making briquettes by means of tar and dry pitch from all kinds of fuel and also from the asphaltic calcareous material mentioned in Fr. Pat. 448,604 (this J., 1913, 412). A suitable proportion of tar is 0·3 per cent. of the total weight.—A. T. L.

Carbonaceous fuel, stable under varying atmospheric conditions and resisting deformation, and in which the sulphur is rendered innocuous; Manufacture of ——. E. Pollacsek. Ger. Pat. 266,401, Jan. 30, 1913. Addition to Ger. Pat. 264,783.

The powdered coal, after being mixed with milk of lime and a binding agent, is immediately, without drying, mixed with the richer fuel prepared as described in the chief patent (see Fr. Pat. 442,556; this J., 1912, 913), then dried and briquetted.—A. S.

Briquetting fuels, such as coal and coke, with dry paper "flock." F. Reinold. Ger. Pat. 266,457, June 2, 1912.

The moisture content of the material to be briquetted is so adjusted, before the addition of the paper "flock," that the mixture is in a suitable condition for briquetting without further addition of water.—A. S.

Chamber oven, in which the direction of the heating-gases may be varied. Stettiner Chamotte-Fabrik Act.-Ges. vorm. Didier. Fr. Pat. 459,101, June 11, 1913. Under Int. Conv., Nov. 18, 1912.

A gas-fired, multiple-chamber oven of the regenerative type (employed *e.g.* for the manufacture of illuminating gas) in which the grouping of the chambers and regenerators, and the arrangement of the heating channels and flues, are such that any group of chambers may be put out of action without interfering with the efficient operation of the remainder.—W. E. F. P.

Combustible gaseous mixtures; Process of and apparatus for producing ——. A. Rosenberg, London. Eng. Pat. 25,165, Nov. 2, 1912.

An intimate mixture of liquid fuel with a limited quantity of air or/and oxygen under pressure is continuously introduced into the lower end of a vertical, cylindrical chamber by means of an atomising nozzle acting as an injector or ejector, the conditions being such that partial-combustion (initiated within the cold chamber by means of a sparking plug) is maintained entirely by the continuous introduction of the mixture, the unconsumed portion of the liquid fuel being vaporised by the heat generated. The chamber is provided internally with baffles and with a wire-gauze partition for preventing the escape of flame through the outlet pipe. Auxiliary supplies of air or oxygen may be admitted by means of separate inlets.—W. E. F. P.

Gas-producer. W. O. Amsler, Pittsburgh, Pa. U.S. Pat. 1,077,578, Nov. 4, 1913.

The producer has a rotatable body and a fixed top upon which a fuel hopper and a combined poker and fuel-feeding device are supported. As the body of the producer rotates, the poker is forced through the fuel in a circular path. Fresh fuel is introduced through the poker, which is hollow and has a discharge opening a short distance above its lower end.—W. H. C.

Combustion apparatus and gas producer. G. H. Niles, St. Louis, Mo. U.S. Pat. 1,078,160, Nov. 11, 1913.

The producer comprises a vertical shaft with a charging opening at the top and two gas outlets leading respectively from the middle part above the combustion zone and from the top of the producer to a mixing chamber, the lower gas outlet being inclined upwards. The fuel rests upon a grate and air is led to the ash-pit by a flue in the brickwork behind the combustion zone. An air flue is formed in the brickwork behind the upper part or distillation zone of the producer, and air from this flue together with producer gas from the combustion zone and distillation gases from the upper part of the producer, are led to the lower end of the mixing chamber.—A. T. L.

Gas; Process of producing ——. J. J. and F. C. Nix, Alhambra, Cal., Assignors to J. A. Merrill, Los Angeles, Cal. U.S. Pat. 1,078,304, Nov. 11, 1913.

A liquid hydrocarbon is atomised by spraying with steam, and jets of air under pressure and steam are directed at an acute angle into the jet of atomised hydrocarbon. The mixture is caused to burn under a pressure above atmospheric, and the gaseous products are mixed with further jets of steam and air to produce a further combustion, the resulting gases passing to the outlet of the producer.— A. T. L.

Coal-gases; Art of treating [purifying] ——. C. G. Tufts, Syracuse, N.Y., Assignor to Semet-Solvay Co., Solvay, N.Y. U.S. Pat. 1,078,014, Nov. 11, 1913.

Crude coal gas is washed with excess of water at 60° to 70° C., so as to remove part of the tar and all the fixed ammonium salts without removing free ammonia and naphthalene. The gas is then separated from tar and the free ammonia removed as sulphate at the same temperature, and finally the gas is washed with a cold liquid, in which naphthalene is insoluble or sparingly soluble, so as to cool the gas and obtain the naphthalene in a crystalline condition.—A. T. L.

Blast-furnace and similar gases; Apparatus for purifying and cooling ——. E. Hofmann. Fr. Pat. 459,737, June 27, 1913. Under Int. Conv., Dec. 6, 1912.

The gases are passed first through vertical scrubbers and then through rotary purifiers above the latter, the water employed in the system flowing by gravity through the rotary and vertical apparatus in succession and thence to settling tanks.—W. E. F. P.

Fuel for explosion engines of all kinds. J. de Cosmo and H. Quinaux. Fr. Pat. 459,857, April 10, 1913. Under Int. Conv., March 20, 1913.

A cheap fuel which can be used in the ordinary petrol carburettors is made by mixing together crude naphthalene, nitronaphthalene, refined mineral oil and creosote oil. —A. T. L.

Fire extinguishing fluid. J. W. Aylsworth, East Orange, N.J., Assignor to F. L. Dyer, Montclair, N.J. U.S. Pat. 1,078,030, Nov. 11, 1913.

For extinguishing gasolene (petrol) fires use is made of a mixture of chlorine derivatives of hydrocarbons, which are miscible with gasolene and yield flame-extinguishing vapours and of which one boils at a lower and the other at a higher temperature than gasolene. A mixture of dichloromethane and carbon tetrachloride, with or without "a perchlorinated organic radical" having a boiling point much higher than that of carbon tetrachloride may be used.—A. T. L.

Chewing-gum [with an asphaltum base]. J. M. Trimble, Assignor to W. K. Burton, Memphis, Tenn. U.S. Pat. 1,078,564, Nov. 11, 1913.

Normally unpalatable asphaltum is boiled in a deodourising infusion containing a flavouring extract, and may then be combined with other ingredients.—E. W. L.

Carbonaceous fuel of permanent shape; Process for the production of weatherproof —— and for rendering innocuous the sulphur contained in the coal. E. Pollacsek, Florence, Italy. U.S. Pat. 1,079,142, Nov. 18, 1913.

See Fr. Pat. 442,556 of 1912; this J., 1912, 913.—T. F. B.

Fuel for internal combustion engines. L. Stahn, Osnabrück, Germany. Eng. Pat. 27,111, Nov. 25, 1912.

See Fr. Pat. 451,301 of 1912; this J., 1913, 590.—T. F. B.

Retort furnaces. A. Gohmann, Stettin, Germany. Eng. Pat. 13,518, June 11, 1913. Under Int. Conv., Nov. 18, 1912.

See Fr. Pat. 459,101 of 1913; preceding.—T. F. B.

Chamber-oven. A. Gohmann, Assignor to Stettiner Chamotte-Fabrik A.-G vorm. Didier, Stettin, Germany. U.S. Pat. 1,079,003, Nov. 18, 1913.

See Ger. Pat. 254,664 of 1912; this J., 1913, 353.—T.F.B.

Gasification of fragmentary, gritty, or powdery fuels; Process and apparatus for the ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 3673, Feb. 12, 1913. Under Int. Conv., Feb. 22, 1912.

See Fr. Pat. 454,656 of 1913; this J., 1913, 860.—T. F. B.

Blast furnace and similar gases; Apparatus for cooling and purifying ——. E. Hofmann, Duisburg, Germany. Eng. Pat. 15,726, July 8, 1913. Under Int. Conv., Dec. 6, 1912.

See Fr. Pat. 459,737 of 1913; preceding.—T. F. B.

Separating substances of different specific gravities [e.g. coal and coke from furnace residues]. Eng. Pat. 15,945. *See* I.

Preparing primary monochloro-compounds of the higher hydrocarbons of mineral oils, lignite tar oils, etc. Ger. Pat. 267,204. *See* XX.

Gas-analysing apparatus. U.S. Pat. 1,077,342. *See* XXIII.

Quantitative analysis of a mixture of known gases. Fr. Pat. 458,916. *See* XXIII.

Thermo-electric calorimetric bomb. Addition to Fr. Pat. 436,330. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Peat; Wet carbonisation of ——. T. Rigby, Dumfries, and Wetcarbonising Ltd., London. Eng. Pat. 24,639, Oct. 28, 1912.

Peat which has been subjected to the wet carbonising process (see Eng. Pats. 6041 of 1910 and 17,610 and 19,330 of 1911, and Fr. Pat. 455,896 of 1913; this J., 1911, 883; 1912, 1171; 1913, 77, 937), gives up its water in a filter-press much more readily at a high than at a low temperature. According to the present patent, hot peat pulp coming from the wet-carboniser is passed through a heat interchanger where it gives up part of its heat to the entering pulp, and is itself cooled to the required temperature (about 70°—80° C.) for satisfactory filtration. The pulp is then filtered and the hot filtrate is passed through a second heat interchanger to preheat cold peat pulp on its way to the first heat interchanger.—W. H. C.

Retort [for wood distillation, etc.] C. B. and M. Darrin, Bellingham, Wash. U.S. Pat. 1,074,104, Sept. 30, 1913.

Successive car-loads of wood or other carbonaceous material are passed through the length of the retort, which comprises five sections connected by expansion joints and separated by gates. In the first section live steam is admitted so as thoroughly to heat the new charge. In the second section, superheated steam is admitted to distil the water, sap and volatile oils, the volatile and the condensed products being collected. This section and the next are heated by flues leading from fire-boxes at either side of the fourth section. In the third and fourth sections, which are at a higher temperature than the second, the material yields further quantities of volatile products which are fractionally condensed, and in the last section, the charcoal is cooled by introducing steam.—A. T. L.

Animal charcoal; Manufacture of an improved ——. Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappij, Amsterdam. Eng. Pat. 3436, Feb. 10, 1913. Under Int. Conv., Jan. 18, 1913.

The charcoal is prepared by boiling washed, comminuted fish with water until a syrupy mass is obtained on standing, drying the mass, carbonising the resulting powder and washing the residue with water or dilute hydrochloric acid. —W. E. F. P.

Charcoal for decolourising; Process and apparatus for making —— from all kinds of charcoal or materials containing charcoal. A. Scholz, H. Koch, and B. Henatsch. Fr. Pat. 459,828, July 1, 1913.

The materials, such as vegetable charcoal, wood and peat charcoal, animal black, coke, residues from mineral oil, etc., are first submitted to dry distillation, and are then heated to bright redness in the absence of air, for example in a current of steam or carbon dioxide. In order to reduce the loss caused by the interaction of these gases with the charcoal, a series of vertical retorts are connected together and the gas is passed through them all in a closed circuit. The retorts are provided with rotating stirrers formed by a vertical helix and vertical perforated tubes through which the inert gas is admitted. The bottom of the retort is closed by a conical plug which can be lowered for discharging the charcoal.—A. T. L.

III.—TAR AND TAR PRODUCTS.

Patents.

Anthraquinone-β-sulphonic acid chlorides; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 266,521, July 20, 1912.

An alkali salt of an anthraquinone-β-sulphonic acid or substitution product thereof is heated with chlorosulphonic acid. The sulphochloride is obtained in good yield. The same treatment of the α-sulphonic acids does not produce sulphochloride.—T. F. B.

Bromo-aminoanthraquinones; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 266,563, Oct. 8, 1911. Addition to Ger. Pat. 263,395 (see this J., 1913, 1004).

To prepare bromo-aminoanthraquinones in which the bromine occupies the same position as in the bromo-aminoanthraquinonesulphonic acids used as starting point for the reaction, sulphuric acid is used of greater dilution than that specified in Ger. Pat. 265.727 (this J., 1913, 1100), and no mercury or mercury salt is added. The mixture is heated only for so long and to such a temperature as may be necessary just to eliminate the sulpho-group.—T. F. B.

Anthraquinone-N-1·1′-oxazines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 266,945 and 266,946, Feb. 8 and June 5, 1912.

(1.) A mixture of a 1-halogen-anthraquinone with a free 2-position and a 2-halogen-1-aminoanthraquinone is heated in nitrobenzene solution, together with a substance which unites with acid and in presence of a catalyst. The products consist of hitherto unknown anthraquinone-N-1·1′-oxazines, and not 2-halogen-1·1′-dianthrimides as might have been expected. (2.) A mixture of 1-nitro-2-hydroxyanthraquinone and a 1-halogen-anthraquinone is heated in presence of metallic copper and nitrobenzene. The products are identical with those obtained according to the preceding patent.—T. F. B.

1-Aminoanthraquinone-2-carboxylic acids and their derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 267,211, Nov. 24, 1912. Addition to Ger. Pat. 247,411 (see this J., 1912, 764).

The esters of aromatic alcohols with anthraquinone-2-carboxylic acids in which the 1-position is occupied by a negative substituent, are converted into 1-aminoanthraquinone-2-carboxylic acids and their derivatives by condensation with ammonia or a primary or secondary amino-compound. (See also Ger. Pat. 256,344; this J., 1912, 1174.)—T. F. B.

2-Aminoanthraquinones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,212, June 5, 1912.

The yield of 2-aminoanthraquinone from anthraquinone-2-sulphonic acid and ammonia may be increased considerably if the sulphurous acid formed during the reaction is converted into the sparingly soluble barium salt, and thus prevented from acting further on the anthraquinone molecule.—T. F. B.

Preparing primary monochloro-compounds of the higher hydrocarbons of mineral oils, lignite tar oils, etc. Ger. Pat. 267,204. *See* XX.

IV.—COLOURING MATTERS AND DYES.

Patents.

Azo dyes. E. Fussenegger, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,076,756, Oct. 28, 1913.

p-Nitraniline or a derivative thereof containing a methyl or an alkyloxy group in the *o*-position to the amino group, is diazotised and combined with 2·8-aminonaphthol-3·6-disulphonic acid, and the nitro-group of the resulting product is reduced. The compounds thus obtained are treated with phosgene to produce the dyestuffs claimed. They dye cotton brilliant red shades fast to light.—T. F. B.

Sulphur [sulphide] dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22.414, Oct. 4, 1913. Under Int. Conv., Oct. 5, 1912.

See Fr. Pat. 453.026 of 1913; this J., 1913, 746.—T. F. B

Monoazo dyestuff; Black mordant ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,078,925, Nov. 18, 1913.

See Eng. Pat. 2956 of 1912; this J., 1912, 1073.—T. F. B.

Azo dyes: Blue ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,078,926, Nov. 18, 1913.

See Eng. Pat. 8767 of 1913; this J., 1913, 905.—T. F. B.

Azo dyestuffs ; Brown ——. K. Schirmacher and H. Elvert, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Hochst on Maine, Germany. U.S. Pat. 1,076,321, Oct. 21, 1913.

See Addition of Dec. 9, 1912, to Fr. Pat. 441,044 of 1912 ; this J., 1913, 650.—T. F. B.

Disazo dyes and processes of making same. G. Kalischer, Mainkur, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 1,079,415, Nov. 25, 1913.

See Eng. Pat. 14,125 of 1912 ; this J., 1913, 745.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Kapok fibre. C. G. Schwalbe and R. Troeltzsch. Tropenpflanzer, 1913, **17**, 655—660.

The results of a chemical examination of kapok fibre are given. When extracted first with ether and then with alcohol, it yielded 0·75—0·93 and 1·54—1·78 per cent. respectively, or very little more than cotton yields under similar circumstances : and the difficulty of wetting kapok is due therefore not to a high content of fat and wax, but rather to the large quantity of enclosed air and the water-resistant cuticle. Erban found that kapok could be bleached with 10 per cent. of its weight of potassium permanganate, a loss of weight of 20—25 per cent. resulting. Attempts to find a cheaper method of bleaching failed. Unbleached kapok when pulped in a beating engine, with addition of soap solution of or Turkey-red oil, gave a pulp which might be used, in admixture with other pulps, for blotting paper and for roofing boards. For these purposes old material that had been used for stuffing cushions or the like, would be suitable, or, if raw kapok were used, the costly treatment necessary for the removal of fragments of seed husks might be dispensed with.—A. S.

Vulcanised fibre ; Manufacture of a product resembling ——. F. Ahrens. Papierfabrikant, 1913, **11**, 1414—1417.

Boiled cotton or linen rags are beaten in presence of sodium carbonate to a long-fibred half-stuff. The pulp is drained and washed in centrifugal machines, in which also the short-beaten fibre-fragments are eliminated. The stuff is mixed with a dilute solution of zinc chloride and formed into boards of spongy texture. Single boards are laid flat in stoneware trays, covered with a concentrated solution of zinc chloride and allowed to remain protected from the air for some hours. The excess of liquid is drained off and the surface of the sheet is strewn with a layer of finely powdered, fused zinc chloride, several mm. thick. When the powder has dissolved the action can be accelerated by slight and uniform heating in an electrically heated oven, in which the temperature at all points can be carefully controlled. At first the temperature must not exceed 40° C., but after an hour it may be raised to 60°—70° C. The board becomes vitreous and smooth. The tray is removed, the board allowed to cool and absorb moisture from the air, and the lye poured off and replaced by water. The sheet gradually hardens and is allowed to drain on a glass plate. Washing is continued in a tank of water in which the sheet is suspended on lead-covered wire netting, and is completed in running water. The sheet is dried slowly at 60°—100° C., if necessary with the help of a vacuum. It is finally pressed flat and constitutes a product which is pale yellow in colour, fairly transparent at a thickness of 1 cm. and possesses all the properties of the best vulcanised fibre. The zinc chloride is recovered to the extent of 90 per cent. and the fine particles of fibre from the centrifugal machines are collected in filter-presses and used as a filling for vulcanite goods.—J. F. B.

Cellulose ; König's new process for manufacture of ——. A. Frohberg. Wochenbl. Papierfab., 1913, **44**, 4432—4434.

Owing to the action of the sulphuric acid in König's process (this J., 1913, 939), the production of sugar would amount to 10—17 per cent. of the wood, or even more, whereas in the sulphite process it is never more than 7 per cent. Consequently the yield of cellulose by the new process would be lower and in quality it would partake of the nature of hydrocellulose. The consumption of steam in the digestion would be four times as great as in the digestion by the sulphite process. The total time occupied in the digestion and the cycle of attendant operations would be 27 hours, as against 14—20 hours by the sulphite process. Taking the costs of materials and steam per ton of unbleached cellulose, König's process would require an expenditure of £12, including costs of evaporation and recovery, from which must be deducted £3 17s. for the value of useful by-products (resin, tannin and fodder-material) recovered, whilst the similar costs of the sulphite process, without recovery, would work out at £5 10s. per ton.—J. F. B.

Viscose ; Commercial manufacture of ——. Pulp and Paper Mag. Chem. Trade J., Dec. 13, 1913. [T.R.]

Chemical pulp used for making viscose must be as pure as possible, have a small percentage of ash, and contain but few constituents soluble in soda lye (wood-gums). Over-bleached pulp is injurious owing to its content of oxy-cellulose, and, on the other hand, pulp bleached too little cannot be employed. The boards are first cut into suitable pieces and slightly dried, and then weighed out in wire baskets and suspended in large iron tanks filled with soda lye, the duration of the treatment varying from 20 minutes to 6 hours, according to the nature of the pulp. Excess of soda lye is removed by hydraulic pressure or, preferably, by a centrifuge, after which the pulp must be rather more than three times its original weight. It then passes through kneading machines, which furnish a crumbly loose mass, which is left for some time, precautions being taken that certain temperature limits are not exceeded, that the board may remain moist, and the percentage of sodium carbonate may not rise too high. For the conversion of the alkali cellulose into the xanthate, a simple rotating drum is used, in which the material is thoroughly mixed with 30 per cent. to 33 per cent. of carbon bisulphide. The process is stopped when the product has a light-yellow colour and a certain rise of temperature has been reached, and before the initially loose mass becomes lumpy. The finished xanthate is dissolved in condensation water or distilled water containing some soda lye, a large admixture of which diminishes the viscosity. The principal precipitation agents are sodium bisulphate, ammonium sulphate mixed with glucose, and thiosulphate.

Report of the Departmental Committee on celluloid. [Cd. 7158.] Price 3d. [T.R.]

The Committee considers that the necessity has not arisen for making regulations with regard to the storage of celluloid in shops, nor do they think it necessary that manufacturers should be required to mark all packages containing articles into the composition of which celluloid enters. They recommend, however, that occupiers of wholesale shops and warehouses in which more than 5 cwt. of celluloid are stored should be required to register the premises with the local authorities, who should be responsible for enforcing certain regulations which the committee propose. Dealing with the regulations relating to public cinematograph exhibitions, the Committee remarks that under the present law it is difficult to obtain relief even for a film which is not composed of celluloid owing to the difficulties connected with the interpretation of the word "inflammable." Some films brought to the notice of the Committee did not contain nitro-cellulose, and were not easily ignited, and in such cases regulations might properly be relaxed.

Dr. Dobbie's report on the composition and properties of celluloid and celluloid substitutes is summarised as follows :—

Different specimens of celluloid exhibit considerable differences in their stability to heat, but all celluloid decomposes at a comparatively low temperature. Ignition or decomposition may result from exposure to temperatures which are not specially dangerous in the case of ordinary combustible materials, and which may sometimes be attained in storage and use. Film celluloid ignites more readily than ordinary celluloid. The sudden decomposition of celluloid is accompanied by the evolution of a considerable amount of heat and the emission of large volumes of poisonous and inflammable gases which readily ignite, and may, when mixed with air, give rise to an explosion. Celluloid burns much more rapidly than ordinary combustible material, and continues to burn in the absence of air. The best means of extinguishing burning celluloid is the application of water. There appears to be no definite relation between chemical composition and stability to heat, but celluloid containing mineral pigment is more stable, generally speaking, than transparent celluloid. A considerable proportion of the cheap celluloid articles sold in London and the provinces is of low stability to heat. The same observation applies to a number of specimens of sheet celluloid from a continental comb-producing district. Celluloid of good quality does not seriously deteriorate when kept from 20 to 35 years, nor when stored for some months even at a tropical temperature.

Patents.

Non-conducting material and process of making same ——. T. B. Parkison, Muncie, Ind., Assignor to Union Fibre Co., Winona, Minn. U.S. Pat. 1,078,307, Nov. 11, 1913.

Mineral wool is coated, during its manufacture, with a hydrocarbon oil by exposing it to the smoke of burning petroleum. The treated wool is combined with a fibre stronger than itself, *e.g.*, flax fibre, a binder, *e.g.*, paper pulp, and a waterproofing liquid.—J. F. B.

"*Artificial wool*"; *Process of manufacture of* ——. C. Villedieu, F. Lebert and A. Coumbary. Fr. Pat. 459,406, Sept. 4, 1912.

Vegetable fibres, *e.g.*, jute or preferably Senegal hemp ("dhâ"), are steeped in a cold solution of caustic soda containing from 10 to 28 per cent. NaOH, to which are also added 2—5 per cent. of sodium peroxide and 1 per cent. of "soluble oil." The modified fibre is then acidified, washed, dried and carded for the production of textiles, either alone or in conjunction with wool.—J. F. B.

Celluloid, etc., for receiving prints, drawings, etc.; Preparation of sheets of ——. F. R. Miller and The Millergraph Co., Brooklyn, N.Y., U.S.A. Eng. Pat. 25,256, Nov. 4, 1912.

Sheets of celluloid or other plastic material are first roughened by a moulding process producing dots, stipples, lines or a combination of these. The coarsely roughened surface is then re-roughened with a finer grain by abrasion, for instance by means of a sand-blast.—J. F. B.

Cellulose articles, particularly threads and films from viscose; Manufacture of ——. F. Steimmig. Fr. Pat. 458,979, June 9, 1913. Under Int. Conv., Feb. 15, 1913.

The viscose is coagulated in solutions of neutral metallic salts, *e.g.* sodium chloride, sodium sulphate, magnesium chloride or calcium chloride, to which is added a certain proportion of an ammonium salt. A concentrated solution of common salt containing 10 per cent. of ammonium sulphate is suitable. Reducing substances, oxidising agents or organic compounds such as glycerin, may also be added.—J. F. B.

Plastic and elastic compositions, threads, films, coatings, etc. [*cellulose ethers*]; *Process of manufacture of* ——. L. Lilienfeld. Fr. Pat. 459,972, March 11, 1913. Under Int. Conv., March 16, 1912.

Alkyl ethers of cellulose or its derivatives (see this J., 1913, 420) are employed, either alone or in conjunction with other substances, for the manufacture of plastic compositions, etc. Various types of these ethers exist, some soluble in water and some soluble in organic media, and appropriate mixtures are made according to the solubility of the components.—J. F. B.

Sulphite towers; Process of recovering escaping acid gases from ——. J. A. de Cew, Montreal, Canada. U.S. Pat. 1,077,243, Oct. 28, 1913.

The escaping gases from the manufacture of sulphite liquor are passed successively through chambers containing moistened limestone and moistened calcined magnesite, preferably in lump form.—F. Sodn.

Sulphite pulp spent lyes; Process for purifying and concentrating ——. L. Brunet. Fr. Pat. 459,069, Aug. 24, 1912.

The lyes are sprayed into the top of a tower up which a current of heated air is passed. The sulphurous acid compounds are thus oxidised and the lye is concentrated by evaporation, issuing at the bottom of the tower as a thick liquid containing calcium sulphate in suspension.
—J. F. B.

Waste printed paper; Process for removing ink from ——. C. Kurtz-Haehnle. Fr. Pat. 459,300, June 17, 1913.

The paper is steeped in an alkaline liquid, lightly pressed, disintegrated with the addition of water by agitation or centrifugal action, avoiding all pressure, and then passed through a trough, similar to a sand-table, but provided with skimming-laths at the top in addition to the usual settling-laths at the bottom. The liberated printing ink which rises to the top is skimmed off and the purified pulp is further washed, if necessary, by spraying with water on an endless sieve with circular motion.—J. F. B.

Viscose; Manufacture of threads, films, ribbons, strips and the like from ——. Chem. Fabr. von Heyden Akt.-Ges., Radebeul, Saxony. Eng. Pat. 26,472, Nov. 18, 1912. Under Int. Conv., July 8, 1912.

See Fr. Pat. 446,449 of 1912; this J., 1913, 133.—T. F. B.

Viscose; Process for the precipitation of —— *for the purpose of obtaining threads of artificial silk, films, and other objects of regenerated cellulose.* L. Leduc, Couture St. Germain, and H. M. Jacquemin, Maransart, Belgium. Eng. Pat. 3169, Feb. 6, 1913.

See Fr. Pat. 454,061 of 1913; this J., 1913, 865.—T. F. B.

Cellulose [*ester*] *composition.* G. Koller, Forest Gate. U.S. Pat. 1,079,773, Nov. 25, 1913.

See Eng. Pat. 4744 of 1911; this J., 1912, 328.—T. F. B.

Producing a fertiliser from sulphite-cellulose waste lyes. Ger. Pat. 265,689. *See* XVI.

Obtaining fermentable glucose and ethyl alcohol from sawdust, peat, and similar cellulosic materials. Fr. Pat. 459,593. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Hypochlorite solutions; The bleaching action of ——. S. H. Higgins. Chem. Soc. Proc., 1913, 29, 302—303.

Bleaching powder solution to which an excess of boric acid has been added has very energetic bleaching properties, because the boric acid merely liberates hypochlorous acid from the hypochlorite, whereas an excess of hydrochloric acid produces free chlorine and a solution of very weak bleaching properties. If, however, calcium carbonate be added to the latter solution, hypochlorous acid is regenerated, and the bleaching properties are restored. The addition of hydroxides to hypochlorite solutions opposes the hydrolysis of the hypochlorite, and retards the bleaching action, whereas the addition of small quantities of acids, assists the hydrolysis and stimulates the bleaching action; the effect on the bleaching properties of the solution is due to the active mass of the free hypochlorous acid present, being in the one case reduced and in the other augmented.

Even in the presence of a large excess of hydroxides the solutions have a small bleaching effect, which is probably due to a small amount of hypochlorous acid being still present in solution in spite of the opposition of the hydroxide to the hydrolysis of the metallic hypochlorite. All the experiments point to the conclusion that hypochlorite solutions owe their bleaching properties entirely to the free hypochlorous acid present in solution. Sometimes there is a secondary reaction between the hypochlorous acid and any neutral chloride present, producing nascent chlorine of energetic bleaching properties (this J., 1912, 486), but the main action is one of direct oxidation by the hypochlorous acid. During the bleaching action, chlorides are produced by the reduction of the hypochlorites, but the stimulating effect of chlorides thus produced on the bleaching action is negligible.

PATENTS

Textile fibres of animal origin ; Process of degreasing and scouring ——. P. Vindrier. Fr. Pat. 459,516, Sept. 6, 1912.

THE fibres are treated in a bath containing alkali sulphides, principally sodium sulphide, the free alkali of which is neutralised by soap, sodium carbonate, oleic acid, glucose or other suitable substance. A bath for the treatment of schappe silk is composed of sodium sulphide, 300—400 grms., soap, 4—5 kilos., sodium carbonate, 4—5 kilos., water, 800—1000 litres. The treatment is preferably carried out in a perforated drum, the interior of which is studded with spikes which lift the material out of the solution. The drum revolves in a closed casing and its direction of rotation is reversed at intervals.—J. F. B.

Shades [developed] on the fibre ; Production of ——. J. Y. Johnson, London. From Badische Anilin u. Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 6796, March 19, 1913.

FAST shades which can be discharged are produced by padding the fibre with the condensation product of acetone with 1.8-naphthalenediamine-4-sulphonic acid and developing with an unsulphonated diazo-compound. (Compare Eng. Pat. 12.819 of 1900 ; this J., 1901, 708.) —J. B.

Dyeing machine. J. Hussong, Camden, N.J. U.S. Pat. 1,079,247, Nov. 18, 1913.

A DYE-VAT is divided by a vertical partition, which does not extend to the top and bottom of the vat, into a dyeing chamber and a circulating chamber. Circulation is effected by a horizontal shaft with reversible drive carrying two circulating wheels which are fitted into openings in a partition dividing the circulating chamber into an upper and a lower section.—J. B.

Dyeing with vat colouring matters. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,456, Oct. 14, 1912.

SEE Fr. Pat. 457,154 of 1913 ; this J., 1913, 1007.—T. F. B.

Dyeing vegetable fibres. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 4541, Feb. 22, 1913.

SEE Fr. Pat. 455,803 of 1913 ; this J., 1913, 940.—T. F. B.

Dyeing machine. J. Liddle, Glasgow. From The Psarski Dyeing Machine Co., Cleveland, U.S.A. Eng. Pat. 8916, April 5, 1913.

SEE Addition of April 5, 1913, to Fr. Pat. 436,936 of 1911 ; this J., 1913, 1064.—T. F. B.

Centrifugal apparatus for cleansing liquids. Eng. Pat. 25,817. See I.

Process of ornamenting leather by dyeing. Fr. Pat. 459,970. See XV.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Alkali haloids ; Solubilities of —— in methyl, ethyl, propyl, and iso-amyl alcohols. W. E. S. Turner and C. C. Bissett. Chem. Soc. Trans., 1913, 103, 1904—1910.

THE authors' results, together with those of some previous workers for solubility in water, are shown in the following table, the figures representing grams of the anhydrous salt dissolved by 100 grms. of the solvent at 25° C. :—

Substance.	Solvents.				
	Water.	Methyl alcohol.	Ethyl alcohol.	Propyl alcohol.	Iso-amyl alcohol.
LiCl	83·37	42·36	25·83	16·22	9·03
LiI.	168·5	343·4	250·8	47·52	112·5
NaCl	36·05	1·31	0·065	0·012	0·002
NaI	184·5	90·35	46·02	28·22	16·30
KCl	39·90	0·53	0·022	0·004	0·0008
KBr	67·75	2·17	0·142	0·035	0·003
KI..........	148·3	18·04	2·16	0·43	0·098
RbCl	94·35	1·41	0·078	0·015	0·0025

In four cases the solid phase at 25° C. is not the anhydrous salt but $LiCl,H_2O$, $LiI,3H_2O$, $NaI,3H_2O$ and $LiI,4C_3H_7OH$ respectively. The solubility curve for lithium chloride in ethyl alcohol from 0° to 60° C. is given. At temperatures up to 17·4° C. the solid phase consists of $LiCl,4C_2H_5OH$; at higher temperatures of the anhydrous salt.—A. S.

Potash works effluents. II. P. Rohland. Chem.-Zeit., 1913, 37, 1448. (See also this J., 1912, 1029.)

THE replacement of magnesium in potash works effluents by calcium can be accomplished by treating the effluent with a lime silicate such as cement. Natural silicates act more slowly. The process is advantageous in that the lime is more valuable than the magnesia for agricultural purposes, and the water is more easily softened when it does not contain magnesium chloride. Another method of treatment is to add soda ash and mix the precipitated magnesium carbonate with brown coal. The product is sold as " Humus magnesia " for manurial purposes, but its value is doubtful. The various methods of using the magnesium chloride for industrial purposes, *e.g.* for building material (" tekton "), artificial wood, the spraying of dusty roads, or the preparation of magnesium have not found great application. It is probable however that, suitably diluted, the effluent is not so harmful to the fishery industry as other industrial effluents.—W. H. P.

Periodate in presence of iodate and iodide ; Determination of ——. E. Müller and G. Wegelin. Z. anal. Chem., 1913, 52, 755—759.

THE method is similar in principle to that of Müller and Jacob (this J., 1913, 866), but borax and boric acid are employed in the place of bicarbonate ; in the presence of much caustic alkali the process is thus rendered more expeditious. An aliquot part of the solution is treated with dilute sulphuric acid and potassium iodide, then with borax solution (until no longer acid to Congo paper), and the liberated iodine is titrated with N/10 arsenious acid. This gives the total iodate and periodate oxygen. A second portion is mixed with borax and boric acid (sufficient to prevent the reddening of phenolphthalein), potassium iodide is added, and the solution titrated with arsenious acid ; one-fourth of the periodate oxygen is thus indicated. Or, the determination may be made on a single portion of the solution by treating with 20 c.c. of saturated borax solution containing about 0·5 grm. of boric acid, adding 2 grms. of potassium iodide, and titrating with $N/10$ arsenious acid ; then adding dilute sulphuric acid (until acid to Congo paper), neutralising again with borax, and once more titrating with arsenious acid ; if a and b c.c. of $N/10$ arsenious acid be used in the respective titrations, 4a c.c. corresponds to the periodate and (b—3a) c.c. to the iodate oxygen.—F. SODN.

Radium-barium salts; "Fractional adsorption" and "fractional deadsorption" of —— by colloidal hydrated manganese dioxide. E. Ebler and W. Bender. Z. anorg. Chem., 1913, **84**. 77—91.

The use of manganese dioxide as absorbent for radium-barium salts (see this J., 1911, 1280, 1380; 1912, 874; 1913, 656) has numerous advantages. Fractionation and consequent increase of the radium content of the fractions take place during adsorption even in presence of 0·05 *N* hydrochloric acid. Not more than one hour's shaking is necessary. If the dioxide is dissolved in hot hydrochloric acid and gaseous hydrogen chloride passed into the solution, there are two further "enriching processes," first the solution of the adsorption compound which can be done fractionally and second the precipitation of the radium barium chloride with hydrogen chloride, in which the radium is much more completely precipitated than the barium. It is also possible to "deadsorb "electrolytically and in this case also fractionation takes place, in fact the radium barium chloride solution might be made the anolyte in a cell containing a layer of freshly precipitated dioxide between the anolyte and the catholyte. On passing current through such a cell fractionation would take place in the course of the electrolysis. The authors' experiments were carried out with precipitates obtained from permanganate with manganese chloride or with methyl alcohol. The principal advantage of manganese dioxide over silicic acid is the ease with which the deadsorption is carried out and the fact that it can be done fractionally.—W. H. P.

Zirconium hypophosphite, a photosensitive salt. O. Hauser and H. Herzfeld. Z. anorg. Chem., 1913, **84**, 92—94.

The hypophosphite is obtained by adding hypophosphorous acid to zirconium nitrate. The amorphous precipitate at first formed redissolves in excess of the acid. On adding much alcohol a colourless crystalline precipitate separates, which when dried over calcium chloride, has the composition, $Zr(H_2PO_2)_4$. In direct sunlight the hypophosphite becomes deep violet. Microscopic examination of the coloured crystals shows no evidence of decomposition.—W. H. P.

Refractory oxides; Melting points of some ——. C. W. Kanolt. J. Franklin Inst., 1913, **176**, 587—588. (See also this J., 1912, 817.)

The oxides were melted in a graphite resistance furnace, using a Morse optical pyrometer for measuring the temperature. Smoke was avoided by use of a high vacuum or by a gentle current of an inert gas (hydrogen). Magnesia and alumina were melted in graphite crucibles, alumina, lime, and chromic oxide in a tungsten vessel. Lime was also made into tubes which were supported by the upper end in the cooler part of the furnace. The results were as follows :—

Oxide.	M.pt., °C.	Number of determinations.	Average deviation.
Magnesia	2800	6	13°
Lime	2572	5	3°
Alumina	2050	8	4°
Chromic oxide ..	1990	5	6°

—W. H. P.

Cyanamide; The polymerisation of ——. G. F. Morrell and P. Burgen. Chem. Soc. Proc., 1913, **29**, 300—301.

In the case of pure cyanamide, about 10 per cent. polymerised in 6 months. In aqueous solution, even at elevated temperatures, the reaction proceeded but slowly, many hours' heating at 100° C. being required to complete it. In solution in absolute alcohol the reaction-velocity was further reduced. The influence of acids and bases, such as sulphuric acid, ammonia, and sodium hydroxide, was in the direction of a marked acceleration of the change, very small quantities reducing the period of half-change in aqueous solution at 100° C. from about twelve hours to as many minutes. The author further stated that the method found most satisfactory for isolating cyanamide from its sodium salt was to neutralise a well-cooled concentrated aqueous solution of the latter with oxalic acid. The precipitated sodium oxalate was filtered off, and the filtrate evaporated almost to dryness in a vacuum. From this residue the cyanamide was extracted with ether, in which other substances present were insoluble. It was finally purified by recrystallisation from the same solvent.

Reaction for boric acid or methyl alcohol. Pieszczek. *See* XXIII.

Patents.

Lead chamber for the manufacture of sulphuric acid. T. Kalinowsky. Ger. Pat. 265,640, Aug. 25, 1912.

The chamber is contracted at one part, and in the contracted portion, a lattice-work partition or the like is inserted, over which water, dilute acid, or nitrous vitriol is caused to trickle. The inclined walls and roof connecting the contracted part with the other parts of the chamber are so shaped that no "dead" corners or spaces are formed.—A. S.

Sulphuric acid; Process for the concentration of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 459,092, June 11, 1913. Under Int. Conv., Oct. 26, 1912.

Sulphuric acid circulates from a heater through a tower, in which it meets a current of heated air or other gases, and back to the heater again. Using a series of such combinations of heaters and towers, it may be preferable to pass the liquor from the first tower to the second heater, and so on, the concentration being progressively increased to a desired limit in each apparatus.—O. R.

Ammonia from gaseous mixtures containing it; Process for extracting ——. Badische Anilin und Soda Fabrik. Fr. Pat. 458,951, June 7, 1913. Under Int. Conv., Aug. 6, 1912.

Compressed gases containing ammonia (as obtained, for instance, in the synthetic production of ammonia) are passed, in the same direction as an absorbing liquid through a system of tubes which may be arranged in series and supplied respectively with solutions of ammonia of progressively diminishing concentration.—F. Sodn.

Ammonia; Absorption of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 25,260, Nov. 4, 1912, and 9654, April 24, 1913.

See Fr. Pat. 458,951 of 1913; preceding. The absorption is effected under a pressure exceeding 10 atmos.; the process may be carried out in a series of tubes or other vessels in such a way that the gases and absorbents move in opposite directions as regards the series as a whole, but in each unit of the series they move in the same direction. —T. F. B.

Alumina and ammonia; Simultaneous preparation of pure —— by the treatment ot aluminium nitride or mixtures containing this nitride. W. Zänker. Fr. Pat. 459,093, June 11, 1913. Under Int. Cov., June 12, 1912.

Aluminium nitride or a mixture containing it is boiled, successively or simultaneously, and preferably under pressure, with an alkaline-earth oxide and a concentrated solution of alkali carbonate, so as to obtain free ammonia and a solution of alkali aluminate from which pure alumina may be precipitated.—F. Sodn.

Sodium hydrosulphite, Manufacture of —— based on the expansion of liquefied sulphurous acid. L. Descamps. Fr. Pat. 459,144, Aug. 27, 1912.

A mixture of water and zinc dust is treated with the calculated quantity of liquefied sulphur dioxide, so that expansion takes place within the mixture, and the product is run into the calculated amount of a concentrated solution of sodium hydroxide; a strong solution of very pure sodium hydrosulphite is obtained, in approximately theoretical yield, together with a precipitate of slightly hydrated zinc oxide, in a condition very favourable for filtration. A little sodium carbonate or other suitable precipitant may be added to ensure complete elimination of the zinc.—F. Sodn.

Barium sulphate; Concentration of ——. E. Bohon. Fr. Pat. 459,265, Aug. 31, 1912.

Crude barium sulphate is treated with dilute sulphuric acid, whereby soluble impurities (iron oxide, alumina, and magnesium carbonate) are removed and barium carbonate is converted into sulphate. Moreover, in the separation of the specifically heavier barium sulphate from the lighter silica, etc., sulphuric acid is claimed to be more economical than hydrochloric acid and to give a superior product.—F. Sodn.

Zinc sulphite, sulphide, oxide, and a mixture of the first two products; Process and apparatus for the manufacture of ——. P. Ferrere. Fr. Pat. 459,371, Sept. 3, 1912.

Zinc sulphate or chloride solution is decomposed by calcium oxychloride, $3CaO,CaCl_2$, in the presence of an excess of sulphurous acid, and, after filtering off calcium sulphate and expelling sulphur dioxide, the precipitated zinc sulphite is converted into oxide by calcination or is decomposed, wholly or partially, by hydrogen sulphide, so as to give zinc sulphide or a mixture of this and sulphite yielding, on ignition, an intimate mixture of sulphide and oxide for use as a pigment. Apparatus of a continuous type is described, in which the reactions are effected partly in columns and partly in vessels fitted with stirrers, the residual sulphur dioxide and calcium chloride solution being constantly returned into the system.—F. Sodn.

Iron in solution; Process for the oxidation and separation of ——. Bayerische A.-G. für Chemische und Landwirtschaftlich-Chemische Fabrikate, H. Hackl, and H. Bunzel. Fr. Pat. 459,576, June 23, 1913. Under Int. Conv., June 25, 1912.

In the oxidation of ferrous solutions by means of oxygen, air, or ozonised air, a small quantity of a cuprous compound is added to act as an oxygen-carrier. For the treatment of potable or industrial waters, the addition of a basic copper carbonate is recommended, followed by filtration through a layer of calcium carbonate.—O. R.

Iron; Precipitation of —— *from solutions containing iron and zinc.* A. Ramén. Ger. Pat. 266,349, July 31, 1912.

Air is blown into the hot solution, and an alkaline-earth carbonate is added gradually and progressively as the iron is oxidised, so that the iron may be precipitated without notable precipitation of zinc.—A. S.

Manganates, Preparation of —— *from aqueous alkalis, manganese oxygen compounds and oxygen, gases containing oxygen, or substances capable of yielding oxygen, by heating under pressure.* F. Bergius and O. Sackur. Ger. Pat. 266,347, June 1, 1912.

The process is carried out in closed vessels under such conditions that the evaporation of water is prevented.
—A. S.

Hydrogen, Manufacture of —— *and apparatus therefor.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 2096, Jan. 25, 1913.

A ferruginous mass is treated alternately with steam and a purified reducing gas, both of which are pre-heated in regenerators situated outside the reaction furnace, so as practically to avoid transference of heat by conduction from these to the furnace. The reducing gas leaving the reaction furnace is burnt with oxygen or air in the regenerators, and the process may be made continuous by employing two or more regenerators with a central furnace, and passing steam and gas through the system, first in one and then in the opposite direction.
—F. Sodn.

Hydrogen and oxygen by the electrolysis of water; Apparatus for the industrial production of ——. L'Oxhydrique Française. Fr. Pat. 459,967, Sept. 21, 1912.

The diaphragm of each element is composed of asbestos fabric, which is nipped between two wooden frames fastened together by means of wooden screws; the frames are suitably bored so as to provide conduits for the evolved gases and the electrolyte. The electrodes are composed of light sheet iron, grooved or corrugated, so as to possess as much active surface as possible, and bored in places corresponding to the perforations of the diaphragm frames. The electrodes may be nickelled on their anode sides, and their edges are turned over for attachment to the wood frames. The apparatus comprises a series of such elements, mounted between flanges, and fitted with compressing, regulating, and safety devices, the whole being perfectly gas-tight and little subject to loss of heat by radiation.—O. R.

Sulphur from pyrites; Process for the extraction of ——. W. A. Hall. Fr. Pat. 458,028, July 26, 1912.

A modification of the process described in Fr. Pat. 455,905 of 1912 (this J., 1913, 943), sulphur being extracted as vapour, in a single operation, by employing only sufficient steam to prevent loss of sulphur as sulphur dioxide and carbon oxysulphide. The pyrites, which may be mixed with a small proportion of lime to prevent fusion, is agitated, and a slightly increased pressure preferably maintained within the furnace.—F. Sodn.

Radioactive emanations; Process and apparatus for the separation of rare gases containing —— *from natural gases.* Aerators, Ltd. Fr. Pat. 459,081, June 10, 1913.

Gases (from natural springs or the like) are compressed until the carbon dioxide is liquefied, the liquid carbon dioxide and rare gases are allowed to expand in a chamber terminating in a series of porous tubes, in which solid carbon dioxide is retained, and the residual gases, containing only traces of carbon dioxide, are finally passed through a series of U-tubes containing potassium carbonate or hydroxide.—O. R.

Concentrating acid such as nitric acid by means of a drying agent; Process of ——. E. Collett, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,079,541, Nov. 25, 1913.

See Fr. Pat. 450,448 of 1912; this J., 1913, 600.—T. F. B.

Gases containing sulphur dioxide; Purification of ——. R. Messel, London, Assignor to General Chemical Co., New York. U.S. Pat. 1,078,937, Nov. 18, 1913.

See Fr. Pat. 414,387 of 1910; this J., 1910, 1203.—T. F. B.

Ammonia and other compounds containing nitrogen and hydrogen; Process for synthetically preparing ——. F. Hlavati, Vienna. U.S. Pat. 1,079,705, Nov. 25, 1913.

See Fr. Pat. 453,207 of 1913; this J., 1913, 791.—T. F. B.

Hydrogen; Process for the production of ——. H. Lane, Birmingham. Assignor to Internationale Wasserstoff Akt.-Ges., Frankfort-on-Maine, Germany. U.S. Pat. 1,078,686, Nov. 18, 1913.

See Fr. Pat. 405,200 of 1909; this J., 1910, 212.—T. F. B.

Sulphur from hydrogen sulphide and sulphur dioxide; Process of obtaining ——. W. Feld, Linz, Germany. U.S. Pat. 1,079,291, Nov. 18, 1913.

See Fr. Pat. 432,590 of 1911; this J., 1912, 128.—T. F. B.

Nitrous oxide; Process for the production of ——. C. Torley and O. Matter. Fr. Pat. 459,385, May 21, 1913.

See Eng. Pat. 11,828 of 1913; this J., 1913, 867.—O. R.

Recovering escaping acid gases from sulphite towers. U.S. Pat. 1,077,243. *See* V.

Quantitative analysis of a mixture of known gases. Fr. Pat. 458,916. *See* XXIII.

VIII.—GLASS; CERAMICS.

Patents.

Vitreous materials; Manufacture of envelopes of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,300, Aug. 8, 1912.

An envelope of vitreous material consisting of a quartz section and a low-expansion sodium magnesium borosilicate glass section; the two sections are separated by vitreous compositions, integrally united and containing progressively increasing quantities of silica merging into quartz, thus having progressively increasing coefficients of expansion.—O. R.

Glass; Process for cleaning ——. A. Papenfuss. Ger. Pat. 265,648, Aug. 9, 1912.

The surface of the glass is treated with a mixture of 4 parts of 32 per cent. hydrofluoric acid and 1 part each of 4—5 per cent. sulphurous acid, 32 per cent. antimony chloride solution, and 32 per cent. zinc chloride solution and 3 parts by weight of 32 per cent. hydrochloric acid, and after a few minutes is washed with water.—A. S.

Ceramic and other like ware; Apparatus for dipping —— into liquid glaze or colour. S. H. Ellis, Hanley, and T. Holt, Warrington. Eng. Pat. 5090, Feb. 28, 1913.

Improvements in the machine claimed in Eng. Pat. 5673 of 1900 (see this J., 1901, 476). The gear dipping into the liquid is coated with a metal sheath in order to prevent glaze getting into and clogging the machinery. The cages for holding the ware are provided with vertical uprights having inward projections which are movable from the axial centre of the cage to suit the various sizes of ware to be dipped. One of the adjustable uprights is hinged to allow of the cages being charged and discharged. A sifting box with suitable machinery is attached to the glaze tub in order to keep the mass well mixed. —H. H. S.

Ceramic and other surfaces; Metallising ——. Q. Marino, London. U.S. Pat. 1,077,357, Nov. 4, 1913.

A solution of iron fluoride is applied to the surface and deposition of metallic iron effected by a finely divided metal capable of reducing iron from its salts.—H. H. S.

Enamels; Process for the manufacture of opaque ——. L. Weiss. Fr. Pat. 459,999, June 23, 1913. Under Int. Conv., Sept. 30, 1912.

Five per cent. of easily decomposable fluorides, such as the fluorides or double fluorides of tin, titanium, or zirconium, is added to the enamel mixture, and the latter is then heated in the presence of water or alkali hydroxides. —O. R.

Enamels; Process of manufacturing opaque or clouded ——. L. Weiss, Barmen, Germany. Eng. Pat. 14,632, June 24, 1913. Under Int. Conv., Sept. 30, 1912.

See Fr. Pat. 459,999 of 1913; preceding.—T. F. B.

IX.—BUILDING MATERIALS.

Canadian asbestos. J. Roy. Soc. Arts, 1913, 62, 36.

The province of Quebec contains the principal asbestos-producing areas of Canada. The present workable deposits lie scattered through the great serpentine range which strikes through the townships of Broughton, Thetford, and Coleraine. The total length of this belt is 23 miles, with a width varying from 100 feet in the extreme easterly part to 6000 feet in the Mock Lake area. The principal deposits occur at Thetford, Black Lake, Danville, and East Broughton, the first two being the most important. The mineral occurs in a series of narrow and irregular veins, occasionally, though rarely, attaining a width of six inches. Large mills are now in operation in which the rock is broken and crushed and the fiberised asbestos is taken up from screens by suction fans, and blown into collectors or settling chambers. The annual production is at present over 100,000 tons, valued at upwards of 3,000,000 dollars (£625,000). It includes a wide variety of grades, from the long-fibred crude asbestos, valued at 300 dollars (£62 10s.) a ton, down to the shortest mill fibre, valued at only 2 or 3 dollars (8s. 4d.—12s. 6d.) a ton, and "asbestic sand," used for wall-plaster, and valued at from 75 cents to a dollar and a half (3s. 1½d.—6s. 3d.) a ton. (See also this J., 1912, 1181.)

Patents.

Bricks, blocks, slabs and other articles, and apparatus therefor; Manufacture of ——. J. F. Burn, Ystradgynlais, Wales, A. C. Burn, Kingston-on-Thames, and G. C. Carter, London. Eng. Pat. 6044, March 11, 1913.

In the manufacture of articles by the sand-lime process each of the operations of lime slaking, mixing, and steam hardening is carried out in presence of carbon dioxide. The apparatus comprises a carbon dioxide generator through which steam from a boiler can be passed, and which is connected with a pump, a perforated tubular "distributor," through which steam and carbon dioxide have access to the lime which is to be slaked, a pug-mill, and a converter, which communicates with the boiler and the carbon dioxide generator by means of two independent pipes. Instead of allowing the steam which is left in the converter to condense, it is forced out by injecting carbon dioxide, a portion of the latter being absorbed by the bricks, whereby they are thoroughly hardened.—O. R.

Heat-insulating compound. L. Schön, Vienna. Eng. Pat. 14,058, June 18, 1913. Under Int. Conv., June 18, 1912.

Magnesium carbonate, 80 parts, silk impregnated with ammonium carbonate, 10 parts, asbestos fibre or glass wool, 10 parts, and glue powder, 1½ parts, are made into a paste with water, the glue is hardened by means of formalin, and the resulting compound is coated with a waterproof varnish. Resin, rubber, or the like may be used instead of glue, and a fabric impregnated with stearine, kerosene, or the like, should be interposed between the composition and the article to be insulated.—O. R.

Fireproofing wood. W. A. Hall, New York, Assignor to W. A. Hall Lumber and Fibre Co. U.S. Pat. 1,076,762, Oct. 28, 1913.

Claim is made for a solution containing about 12 parts of potassium chloride, 22 of magnesium sulphate, 17 of magnesium chloride, and 27 of sodium chloride, with or without 10 parts of ammonium phosphate.—F. Sodn.

Plaster of Paris; Treatment of ——. H. T. Beans, New York. U.S. Pat. 1,076,863, Oct. 28, 1913.

The surface of moulded plaster of Paris is rendered hard and waterproof by treatment with a solution of sodium tungstate or "its substantial equivalent." The solution may be repeatedly applied and the surface of calcium tungstate burnished after each application.—F. Sodn.

Concrete-waterproofing composition. C. Ellis, Montclair, N.J., Assignor to New Jersey Testing Laboratories. U.S. Pat. 1,077,689, Nov. 4, 1913.

The composition consists of an acid sludge treated with an equivalent quantity or with an excess of lime and admixed with pulverulent material.—H. H. S.

Moulding compound. E. D. Gleason, New York, Assignor to New-Metals and Process Co., Long Island City, N.Y. U.S. Pat. 1,077,958, Nov. 4, 1913.

A composition capable of resisting the action of heat at 1500° F. (816° C.) is produced by mixing 11 vols. of dry inert pulverulent material (*e.g.*, powdered soapstone) with 1 vol. of dry powdered hydraulic cement, and then adding to the mixture a solution consisting of 2 vols. of water and 1 vol. of saturated sodium silicate.—H. H. S.

Artificial stone or like composition. J. S. Kruse, London U.S. Pat. 1,078,100, Nov. 11, 1913.

A mixture of 15 parts by weight of magnesia of sp. gr. 1·7, 6 of magnesium chloride and 1 of shellac or other resin. The chloride may be in aqueous, and the shellac in alcoholic, solution. An alternative mixture consists of 20 parts by weight of hydrated magnesium oxychloride and 1 part of magnesium resinate.—H. H. S.

Cement kilns; Process of and apparatus for producing draught in —— and separating dust from the waste gases of such kilns. R. C. Carpenter, Ithaca, and T. J. Fleming, Los Angeles, Cal. U.S. Pat. 1,078,254, Nov. 11, 1913.

Suction-draught is employed to draw the dust-laden waste gases into a spacious dust chamber, wherein the gases are cooled and the greater part of the dust deposited. The remaining dust is removed from the cooled gases by washing.—H. H. S.

Refractory material. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,078,525, Nov. 11, 1913.

A refractory furnace lining is composed of a surface layer of dense silicon carbide of high mechanical strength and low thermal resistivity, united to, and insulated by, an inner layer of porous silicon carbide of high thermal resistivity.—H. H. S.

Hydraulic lime, cement, and Portland cement from the residues of the incineration or distillation of domestic refuse and sludge; Process for the manufacture of ——. J. Elsner. Fr. Pat. 458,551, May 29, 1913.

Lime, clay, silicates, blast-furnace slag, and certain salts, such as the chlorides of alkali or alkaline-earth metals, are added to the residues in question and the mixture is heated to 600°—1050° C., preferably in the presence of air and steam, with the production of valuable cementitious products.—O. R.

Roman cement: Process of manufacture of ——. M. J. Davidsen. Fr. Pat. 459,517, Sept. 6, 1912.

Roman cement is moistened with water, crushed, and heated to 100°—200° C.—O. R.

Silica-lime brick and its process of manufacture. E. Leblanc. Fr. Pat. 459,623, June 24, 1913.

Infusorial earth is dried, mixed with 15—20 per cent. of calcium hydroxide in the form of milk of lime, moulded, and hardened by hot air or steam at atmospheric pressure, or in an autoclave by steam at 4—5 atmospheres for 2—4 hours or by steam at 10 atmospheres for 1—2 hours. If the siliceous material contain organic matter and limestone, it is previously calcined, allowance being made for the lime-content of the calcined product, when adding the milk of lime.—O. R.

Stone, Artificial —— and process of making same. A. Fra[illegible], Berlin. U.S. Pat. 1,078,845, Nov. 18, 1913.

See Fr. Pat. 427,546 of 1911; this J., 1911, 1118.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron-carbon alloys, Hypereutectic ——. H. Hanemann. Z. anorg. Chem., 1913, **84**, 1—23. (See also Ruff, this J., 1912, 233; Wittorf, 1912, 388.)

The saturation melting point curve is regarded as almost continuous from 1180° C. (4 per cent. C) to 1900° C. (6·5 per cent. C), as the points of inflexion of Ruff and Wittorf were not definitely established. Carbon supersaturation in the melt favours very rapid crystallisation of graphite which is the stable form of carbon in iron-carbon alloys from 1200°—1900° C. The so-called primary cementite could only be obtained at atmospheric pressure by very rapid quenching. The influence of pressure was important because the dissociation of cementite is accompanied by an increase of volume. The only carbide whose formation was definitely established was Fe_3C, and this was mainly "secondary" and not "primary" cementite.—W. H. P.

Solubility of carbon in iron, Influence of silicon on the ——. G. Charpy and A. Cornu. Comptes rend., 1913, **157**, 901—904.

Silicon reduced the solubility of carbon in iron to nearly zero at 900° C. when it was above 4 per cent. and at 1000° C. when above 7 per cent.—W. H. P.

Iron; The porosity of ——. W. H. Perkins. Chem. Soc. Proc., 1913, **29**, 302.

An attempt to verify the conclusion of Friend that iron is slightly porous (this J., 1912, 190) showed that only very small quantities of the alkalis, and therefore presumably of other salts, are retained after prolonged washing. In the case of ammonia, it may attain 0·0000001 gram per sq. cm. after about 15 to 20 minutes' washing.

Platinum ores; Analysis of ——. M. Wunder and V. Thüringer. Z. anal. Chem., 1913, **52**, 740—752.

The method is a modification of that of Deville and Debray (Ann. Chim. Phys., 1859, [3], **56**, 439). The ore (3 grms.), from which grains of gold may have been separated mechanically, is decomposed by *aqua regia*, the residue of sand, osmiridium, etc., weighed and fused with borax and metallic silver, the silver button treated with nitric acid, and the insoluble osmiridium weighed. The acid solution of the ore, after expulsion of nitric acid, is treated with chlorine, evaporated at a low temperature, the residue treated with water, the solution saturated cold with ammonium chloride, the precipitated double ammonium salts of platinum and iridium ignited, and the metals weighed. The mixed platinum and iridium are treated with *aqua regia*, the solution again saturated with ammonium chloride, and the ignited precipitate redissolved, in order to separate platinum from any iridium still present. The ammonium chloride filtrate is precipitated, boiling, with dimethylglyoxime (this J., 1913, 960), and, after ignition, the gold obtained is dissolved in *aqua regia*, any platinum precipitated from the solution with ammonium chloride, and the gold, after removal of ammonium chloride, precipitated with ammonium oxalate and weighed as metal. Palladium is determined in the filtrate, nearly neutralised by ammonia, by adding dimethylglyoxime (*loc. cit.*), and the filtrate from this reduced by zinc and hydrochloric acid. The reduced metals are treated with dilute nitric acid (1 : 1), the insoluble portion fused with potassium bisulphate, and the melt of rhodium sulphate dissolved in strong hydrochloric acid, small quantities of iridium and platinum remaining insoluble. Rhodium is precipitated from the solution by reduction with zinc. The nitric acid filtrate, after repeated evaporation with hydrochloric acid, is used for the determination of copper by thiocyanate, and the filtrate from this is treated for the recovery of small quantities of rhodium by reduction. Iron is determined in the filtrate from the first zinc treatment by oxidising, precipitating as basic acetate, dissolving in hydrochloric acid, reprecipitating as basic acetate, and finally weighing as oxide.—F. Sodn.

Nickel-gold-silver alloys; Ternary ——. P. De Cesaris. Gaz. chim. ital., 1913, **43**, II., 609—620.

The author's results for binary Ni-Au alloys differ somewhat from those of Levin (Z. anorg. Chem., 1905, **45**, 238): the saturated solid solutions contain Ni 8 and 80 per cent. respectively, and the eutectic about 20 per cent. Ni (solidif. pt. 955° C.). Ninety-five ternary alloys were examined and the results plotted in a triangular diagram in the form of isotherms from 1450° to 1200° C. at intervals of 25° and from 1200° to 950° C at intervals of 50°. The limited miscibility of nickel and silver in the liquid state persists in the ternary alloys up to a content of 50—55 per cent. Au. The constituent which separates first from the ternary alloys is either a solid solution of nickel and gold, rich in nickel and probably containing a little silver, or a ternary solid solution of gold, silver, and nickel. The two surfaces of primary crystallisation meet along a curve extending from the Ni-Ag eutectic (close to the m.pt. of silver, 961° C.) to the Ni-Au eutectic (955° C.). Eight photomicrographs are given.—A. S.

Bismuth-cadmium-zinc alloys ; Constitution of ——. C. H. Mathewson and W. M. Scott. Int. Zeits. Metallog., 1913, **5**, 1—60.

About 100 ternary mixtures were studied by the method of cooling curves, the object being primarily to determine the conditions of miscibility between the liquid phases at the temperature of primary crystallisation. The experimental results are given in tables and in a series of curve-diagrams, including a triangular diagram of isothermal crystallisation. Bismuth and cadmium and zinc and cadmium respectively are miscible in all proportions in the liquid state, but in the case of Bi-Zn alloys containing Bi 0·65—63·2 per cent. (atomic), two immiscible liquid layers separate at the temperature of primary crystallisation. When cadmium is added to Bi-Zn alloys the temperature of primary crystallisation falls and the two layers gradually approach one another in composition until at 326° C. the two layers unite to form a homogeneous liquid of the composition: Bi 7, Cd 47, Zn 46 per cent. (atomic). At lower temperatures zinc, cadmium, or bismuth separates first from a homogeneous liquid, followed successively by a binary eutectic, and, at 143° C., by a ternary eutectic of the composition: Bi 44·3, Cd 54·1, Zn 1·6 per cent. (atomic). —A. S.

Metals and their oxides ; A method of disintegrating —— into a colloidal state. M. Kimura. Mem. Coll. Sci. and Eng., Kyoto Imp. Univ., 1913, **5**, 211—213.

Wires or rods of Pt, Ag, Cu, Al, Zn, Sn, Bi, Pb and Ni were heated to incandescence or to the melting point and then quickly plunged into distilled water. Ultramicroscopic examination showed that the water after the experiments contained colloidal particles, and electrical migration tests indicated that the particles consisted partly of the metal and partly of the oxide or hydroxide. —A. S.

Metals covered with a thin layer of water or alcohols and subjected to the action of ultra-violet rays ; Corrosion of ——. M. Kimura. Mem. Coll. Sci. and Eng., Imp. Univ., Kyoto, 1913, **5**, 253—260.

Following Svedberg's observation (Beiblätter z. d. Ann. Phys., 1910, **34**, 1070) that metals are disintegrated at the surface and yield colloidal particles when covered with water or alcohols and exposed to ultra-violet rays, the author describes experiments, chiefly with silver, copper, and an alloy of Cd 90, Sb 10 per cent., showing that in a vacuum no corrosion takes place, in air there is very slight corrosion, in oxygen somewhat more, and in water strong corrosion, under the influence of the rays. The mechanism of the action is discussed and photomicrographs of the corroded surfaces of the metals are given. —A. S.

Patents.

Iron ores ; Process for roasting carbonated ——. J. Sovignet, Paris. Eng. Pat. 145, Jan. 2, 1913.

During the roasting, preferably in a rotary tubular furnace, the temperature is slowly raised to the point at which the iron carbonate is decomposed, but not sufficiently high for the decomposition of calcium carbonate or the formation of iron silicates or black oxide of iron. The roasted ore is then brought into intimate contact with a quantity of hot air, just sufficient to oxidise the iron completely to ferric oxide.—T. St.

Iron ; Method of treating ——. J. Kirby, Pittsburgh, Pa. U.S. Pat. 1,079,129, Nov. 18, 1913.

The tensile strength of iron is claimed to be increased by the addition of vanadium oxide and a reducing agent such as aluminium.—W. R. S.

[*Iron ; Decarburising and purifying* ——.] *Metals ; Chemical processes specially applicable to the treatment of* ——. J. E. Bucher. Fr. Pat. 459,853, March 6, 1913.

The metal (*e.g.*, iron) is heated in an atmosphere composed of nitrogen and sodium vapour with the object of converting the contained carbon, etc., into cyanide and other compounds of sodium which are subsequently eliminated by treatment with water.—W. E. F. P.

Iron for the manufacture of Thomas steel and similar pig irons containing manganese ; Production of ——. H. Naegell. Ger. Pat. 265,843, Oct. 29, 1912.

Instead of adding manganese ore to the blast-furnace charge, molten ferromanganese is added to the pig iron in the ladle or mixer.—A. S.

Metals [*Magnesium*]*; Electrolytic production of* ——. R. W. Wallace and E. Wassmer, London. Eng. Pat. 18,449, Aug. 10, 1912.

A mixture of fused magnesium chloride and sulphide is electrolysed in a closed vessel through which a current of nitrogen or other inert gas is passed; magnesium and sulphur chloride are claimed to be formed.—W. R. S.

Furnace ; [*Portable electric*] *smelting* ——. T. H. Holroyd, Southfields, Surrey. Eng. Pat. 21,560 of 1912, date of appl., March 20, 1913.

A cylindrical shell lined with refractory material, has a removable cover at one end and at the other end is tapered to form a pouring lip, which is provided with a cut-off valve. The shell consists of upper and lower portions fastened together at flanged surfaces, and the lining is shaped into right- and left-handed helical ribs which serve to mix the charge. The furnace is mounted to revolve axially, on ball bearings, in a suitable tilting cradle, the revolving and tilting gear being driven by an electric motor. An insulated collector ring, provided with a contact maker, receives the current for heating the charge, as the furnace revolves. The whole is mounted on a carriage on rails, motion being imparted to driving wheels by a second motor. Along each side of the top of the cradle are platforms for inspection and repair purposes, and a third platform, arranged to remain horizontal, is situated at the taper end, near a feeding device for the addition of materials to the charge.—T. St.

Furnace ; Electric —— [*for smelting zinc ores*]. Comp. pour le Traitement des Métaux et des Minerais par l'Electricité, Puteaux, France. Eng. Pat. 12,444, May 28, 1913. Under Int. Conv., Jan. 10, 1913.

An electric resistance furnace for smelting zinc ores in horizontal retorts, is built of very refractory bricks, and to ensure even distribuion of heat the muffles are contained in hollowed blocks composed of a mixture of carbonaceous and silicious materials, and resting on a mass of granulated carbon, which forms the main resistance, and the shape of which is maintained by the pressure exerted upon it. The blocks are in parallel with, but have a resistance about ten times as great as, the main resistance. Only a small amount of heat, therefore, is generated in them directly, and they are mainly heated by thermal conduction. The current is led to the main resistance by columns of granulated carbon of high conductivity, resting on metal plates (usually of steel), which are connected with the leading-in conductors. Excessive heating of the plates is thus avoided, whereby their life is considerably increased.—T. St.

Furnace ; Electric —— *with mixed heating.* C. A. Keller. Fr. Pat. 459,631, Sept. 10, 1912.

The furnace, for metallurgical work, may be heated by means of forced combustion with heavy oils and air, and also by electric current. The first mode is employed for the purpose of economy, and the second for the termination of operations in which the high temperature and inert atmosphere attained with electric heating are advantageous.—B. N.

Cleaning, electro-plating and finishing surfaces. G. P. M Lee and W. A. Brame, London. Eng. Pats. 26,255, Nov. 15, 1912, and 26,504, Nov. 18, 1912.

(1) The articles are suspended from a movable carrier which can be successively lowered into cleaning, plating, washing and drying vats. (2) The operations are carried out in an air-tight chamber the closure of which is formed by the surface to be treated. The latter is connected with the cathode, and a flow of electrolyte is maintained inside the chamber which contains the anode.—W. R. S.

Ore separator ; Centrifugal ——. A. Habermann, Alston, Cumberland. Eng. Pat. 7647, April 1, 1913.

Sand and slime are fed on to the inner surface of an open-ended drum, which is rotated on external bearings in a horizontal plane. The material becomes classified according to the specific gravities of its components, and these are withdrawn, with the assistance of streams of water, by separate channels.—T. St.

[*Copper.*] *Metals ; Apparatus for extracting* ——, *from ores.* H. S. MacKay, Assignor to MacKay Copper Process Co., Riverside, Cal. U.S. Pat. 1,074,274, Sept. 30, 1913.

The apparatus consists of an electrolysing device for preparing or regenerating the solvent (*e.g.*, a solution of iron chlorides obtained by the employment of iron anodes in the electrolysis of a solution of sodium chloride) ; means for leaching the ore with the latter and also for precipitating the dissolved metal (copper) electrolytically from the resulting solution. The apparatus comprises three chambers. The first is divided into anode and cathode compartments (similar compartments being connected by means of pipes at their upper parts), the second receives the mixed solution from the anode compartments (with which solution the ore is subsequently treated), and the third that from the cathode compartments ; the second and third chambers are provided with filters. The precipitating vat is divided into two communicating chambers, in the larger one of which a number of electrode plates are suspended, so that they can be intermittently raised and dropped (by the action of cams) for the purpose of shaking off the deposited spongy metal. The ore solution is delivered at the top of the larger chamber and discharged through a filter at the bottom of the smaller one ; the bottom of the larger chamber is of inverted conical shape and provided at the apex with a separate outlet for the precipitated spongy metal.—W. E. F. P.

Lead ; Apparatus for refining ——. J. F. Beattie, Hammond, Ind. U.S. Pat. 1,078,408, Nov. 11, 1913.

Two "kettles" are suspended by a single cable between two stationary "crystallisers" ; the arrangement being such that when one kettle is raised into transferring position relative to the first crystalliser, the other is lowered into receiving position with regard to the second crystalliser. —W. E. F. P.

Clad metals ; Process of producing ——. B. E. Eldred, Bronxville, N.Y. U.S. Pat. 1,078,906, Nov. 18, 1913.

Steel is coated with a softer metal, such as brass, then placed cold within a heated and expanded shell of a high-melting metal, such as copper, and heated so as to expand the core and produce a union.—W. R. S.

Tungsten and molybdenum ; Process for the production of malleable metals of high melting point, especially ——. J. Canello. First Addition, dated June 11, 1913, to Fr Pat. 444,878, June 12, 1912 (this J., 1912, 1133).

The final heating of the metal—at a temperature of 2500° C. and in an inert or reducing atmosphere free from carbon—is effected electrically in a closed, water-jacketed chamber adapted for use with a radiation pyrometer ; the metal rod or bar is supported vertically, the upper end being clamped to one electrode and the lower end immersed in mercury contained in a water-jacketed vessel which forms the extremity of the other electrode. Small quantities (1—2 per cent.) of nickel may be added to metallic tungsten to increase its malleability.—W. E. F. P.

Zinc ; Process for obtaining —— *by distillation.* H. Speeketer. Ger. Pat. 265,327, March 7, 1912. Addition to Ger. Pat. 245,681.

A rotary furnace is used for carrying out the process described in the chief patent (this J., 1912, 543), and a source of heat is used which can be easily cut off, *e.g.*, a coal dust flame, gas flame or the like. The furnace may be connected with a gas producer, the gas from which is used to raise the temperature of the heat-accumulating material in the furnace. The air supply of the producer is then cut off, the charge of zinc ore, etc., is introduced into the furnace, and reducing gases from the same or another furnace, after being freed from zinc dust and zinc oxide, are forced through the producer and then through the furnace to carry away the volatilised zinc. The reducing gases may also be used for heating the heat-accumulating material.—A. S.

Nickel alloy of high chemical resistance and which can be worked mechanically. W. and R. Borchers. Ger. Pat. 265,328, Feb. 11, 1913. Addition to Ger. Pat. 255,919 (this J., 1913, 295).

The alloy contains per cent. more than 25 (*e.g.*, about 30) Cr, 0·25—1·5 Ag, and 0·5—5 Mo, the remainder being nickel.—A. S.

Nickel-cobalt alloy of high chemical resistance and which can be worked mechanically. W. and R. Borchers. Ger. Pat. 265,076, Feb. 11, 1913. Addition to Ger. Pat. 256,361 (this J., 1913, 431).

The content of silver or copper in the alloy described in the chief patent is reduced to not less than 0·25 per cent. and a quantity of molybdenum equal to 0·5—5 per cent. of the alloy is added.—A. S.

Aluminium alloy ; Hard ——. W. de l'Or, geb. Peyjean. Ger. Pat. 265,924, Dec. 19, 1911.

An alloy of Al 84 Pb about 11, and "glass," about 5 per cent.—A. S.

Metals , Process for protecting —— *from local corrosion by the action of electrolytes.* A. Lienhop. Ger. Pat. 265,359, Jan. 23, 1913.

The metal, after it has been worked into the desired shape, whereby the condition of the surface is altered, is given a new surface by means of solvents or electrolytically, but the new surface must not consist of an electrolytic deposit of a more electro-positive or other foreign metal or metallic oxide. In the case of metal which has already been exposed to the action of electrolytes, the corrosive liquid and the products of corrosion are removed, and a new surface is then produced on the metal.—A. S.

Agglomeration of ores ; Rotary kiln for the ——. Gewerkschaft Justine Schottenbach. Ger. Pat. 265,589, Dec. 20, 1912.

The inner surface of the lining of the sintering zone of the kiln is provided with longitudinal wedge-shaped ribs. The charge tends to adhere to the lining of the kiln and the deposit so produced would in time prevent satisfactory working. If the firing be stopped, the deposit soon shrinks and draws away from the lining, and can then be easily detached when the lining is provided with ribs as claimed.—A. S.

Gramophone needles ; Method of hardening —— *in a mercury bath.* O. Diensthuber. Ger. Pat. 265,643, Feb. 1, 1913.

The needles, heated to incandescence, are plunged into a bath of mercury through a covering layer of potassium cyanide, then again heated to incandescence, and cooled by a blast of cold air.—A. S.

Tunnel oven for annealing or cementation. G. Richter. Ger. Pat. 265,761, Feb. 26, 1913.

The oven has a furnace on each side and flues for leading the combustion gases or air for cooling transversely through successive zones of the oven. The wagons carrying the articles through the oven have each a longitudinal median partition: the heating gases or air for cooling pass partly over the partitions and partly through openings in the lower parts of the same.—A. S.

Vanadium, molybdenum, tungsten or other metals which, in their highest stage of oxidation, are soluble in alkalis or alkali carbonates; Treatment of ores containing ——. A. H. Perret. Ger. Pat. 265,769, Feb. 19, 1913. Addition to Ger. Pat. 264,373.

In carrying out the process described in the chief patent (see Fr. Pat. 412,641 and addition thereto; this J., 1910, 1016; 1912, 237), the solution obtained by lixiviating the reaction product with water is treated with aluminium salts to precipitate the silicon.—A. S.

Metals, metallic oxides and sulphides; Process for obtaining —— *by heating a mixture of ore or the like with a reducing agent in a rotary furnace.* H. Speeketer. Ger. Pat. 266,221, March 29, 1912.

The process is worked discontinuously so that the temperature can be raised gradually and reduction effected in stages, in order to recover separately the different metals (lead, zinc, iron). A reducing atmosphere is maintained in the furnace, or, if an oxidising flame be used, the charge is disposed as a relatively thick layer. The blast is introduced alternately from end to end of the furnace to ensure uniform heating. Two furnaces (or one long furnace divided by a partition) are used, in one of which the charge is preheated by the waste gases from the other.—A. S.

Hearth for reverberatory and similar furnaces; Process for the production of a —— *protected against the destructive chemical and mechanical action of fused substances containing metallic oxides.* P. Schmidt und Desgraz Ges. m. b. H. Ger. Pat. 266,422, Feb. 7, 1913.

The furnace is first charged with a layer of molten pig-iron or cast iron, and slags containing iron or manganese are then melted above the layer of molten iron, whereby the latter is converted superficially into iron sulphide. Hearths of refractory material constructed in the usual way may be repaired in an analogous manner.—A. S.

Armour-plates and other steel articles; Manufacture of ——. J. L. Benthall, Chesterfield, Assignor to Vickers, Ltd., Westminster. U.S. Pat. 1,079,323, Nov. 25, 1913.

See Eng. Pat. 19,458 of 1911; this J., 1912, 820.—T. F. B.

Metals; Extraction of ——. G. L. Fogler, Pittsburgh, U.S.A. Eng. Pat. 18,508, Aug. 12, 1912.

See Fr. Pat. 447,218 of 1912; this J., 1913, 238.—T. F. B.

Zinc retorts; [Removing gases and vapours from] vertical ——. A. Roitzheim, Duisburg-Ruhrort, Germany. Eng. Pat. 9314, April 21, 1913. Under Int. Conv., April 23, 1912.

See Fr. Pat. 456,636 of 1913; this J., 1913, 1018.—T. F. B.

Sulphide ores; Process for the treatment and separation of complex ——. T. R. Forland, Broken Hill, New South Wales. U.S. Pat. 1,078,779, Nov. 18, 1913.

See Fr. Pat. 456,063 of 1913; this J., 1913, 949.—T. F. B.

Ore concentration. G. A. Chapman and S. Tucker, Assignors to Minerals Separation, Ltd., London. U.S. Pat. 1,079,107, Nov. 18, 1913.

See Eng. Pats. 28,929 of 1911 and 12,171 of 1912; this J., 1913, 146.—T. F. B.

Magnesium; [Electrolytic] process for the preparation of metallic ——. R. W. Wallace and E. Wassmer, London. U.S. Pat. 1,079,079, Nov. 18, 1913.

See Eng. Pat. 18,449 of 1912; preceding.—T. F. B.

Apparatus for purifying and cooling blast-furnace and similar gases. Fr. Pat. 459,737. *See* IIa.

Quantitative analysis of a mixture of known gases. Fr. Pat. 458,916. *See* XXIII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Batteries; Primary electric ——. A. P. Manchester, Providence, and H. M. Spooner, Cranston, Rhode Island, U.S.A. Eng. Pat. 2693, Feb. 1, 1913.

The negative electrode is composed of a mixture of cupric and cuprous oxides, free from iron, immersed in a gelatinous alkaline electrolyte, and the positive and negative terminal connections extend respectively through the bottom and top of the vessel.—B. N.

Cell; Galvanic ——. M. L. Kaplan, Brooklyn, N.Y. U.S. Pat. 1,078,788, Nov. 18, 1913.

Manganese carbonate is oxidised by a dilute aqueous solution of a permanganate, thus forming "dihydrated" manganese peroxide as a fine dense greyish-blue powder, which is used as a depolarising agent in a cell of the Leclanché type.—B. N.

Electrolytic apparatus with liquid anode. Schott und Gen., Verrerie D'Iéna. Third Addition, dated May 9, 1913, to Fr. Pat. 404,332, June 23, 1909 (this J., 1910, 222 and 960). Under Int. Conv., June 10, 1912.

The mercury anode and the measuring vessel are not separated by a grid, or other arrangement, as is usual, the surface of the anode, in contact with the electrolyte, being sufficiently reduced in area to prevent the splashing of mercury through vibrations of the apparatus.—B. N.

Furnace; Electric ——. A. E. Greene, Chicago, Ill. U.S. Pat. 1,078,619, Nov. 18, 1913.

The furnace is of the transformer type the primary and secondary coils, both acting as resistors, being embedded in the bottom wall and parallel to the interior surface of the chamber, so that the heat generated in the resistors is conducted to the charge in the furnace. A metallic core encircles the primary winding, and consists of a central vertical portion concentric with the primary winding, and plate-like upper and lower portions which form the secondary and at the same time constitute a magnetic circuit.—B. N.

Furnaces, Regulating the consumption of energy in electric —— *for diminishing the importance of variations of power and of tension which they produce.* Soc. Electro-Chimique de Brignoud. Fr. Pat. 459,369, June 18, 1913.

For maintaining a constant supply to an installation of furnaces, from an ordinary power or lighting system, a liquid rheostat is employed as an "absorber," with electrodes formed from a funnel and a central rod in the lower part of the funnel, water being delivered around this rod to prevent the formation of arcs. The "absorber" takes up, at any moment, the energy not utilised by the furnaces. Transformers with two secondary windings may be employed, one winding feeding the furnace and the other, at a convenient tension, the "absorber." Various methods of mounting the furnaces and "absorbers" are described, in the cases where one, two or three furnaces are fed from a triphase or polyphase system.—B. N.

Furnace; Electric —— *with electrodes passing through charging receptacles.* A. Helfenstein, Vienna. Eng. Pat. 2577, Jan. 31, 1913. Under Int. Conv., Feb. 4, 1912.

See Fr. Pat. 454,195 of 1913; this J., 1913, 873.—T. F. B.

Furnace; Enclosed electric —— with upper charging chutes. Helfenstein Elektro-Ofen-Ges. m. b.H., Vienna. Eng. Pat. 9590, April 23, 1913. Under Int. Conv., April 27, 1912.

See Fr. Pat. 456,926 of 1913: this J., 1913, 1076.—T. F. B.

Electrical heating resistances, particularly applicable to electrical furnaces; Method of construction of ——. Soc. Générale des Nitrures, Paris. Eng. Pat. 12,837, June 2, 1913. Under Int. Conv., July 26, 1912.

See Fr. Pat. 458,031 of 1912; this J., 1913, 1019.—T. F. B.

Retort-furnace; Electric ——. J. Bally, Grenoble, France. U.S. Pat. 1,079,588, Nov. 25, 1913.

See Fr. Pat. 432,153 of 1911; this J., 1912, 32.—T. F. B.

Ozonators. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 4575, Feb. 22, 1913.

See U.S. Pat. 1,064,065 of 1913; this J., 1913, 758.—T.F.B.

Magnetite electrodes; Manufacture of ——. W. Seeger, Nuremberg, Germany. U.S. Pat. 1,079,269, Nov. 18, 1913.

See Ger. Pat. 235,307 of 1910; this J., 1911, 1021.—T.F.B.

Gaseous chemical reactions by the aid of the electric arc; Effecting ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 459,746, June 28, 1913. Under Int. Conv., Oct. 5, 1912.

See Ger. Pat. 265,413; this J., 1913, 1068.—B. N.

Electrical separation of suspended particles from electrically non-conducting fluids, especially gases. Ger. Pat. 265,964. *See* I.

Apparatus for the industrial production of hydrogen and oxygen by the electrolysis of water. Fr. Pat. 459,967. *See* VII.

Electrical process for the ageing of wines, beers, and spirits [and rectification of perfumes]. Fr. Pat. 459,141. *See* XVIII.

Apparatus for detecting and estimating certain substances [oxidising and reducing agents] by virtue of their polarising or depolarising action on an electric couple. Eng. Pat. 1776. *See* XXIII.

XII.—FATS; OILS; WAXES.

Hydroxyfatty acids in fats; Determination of —— by means of organo-magnesium compounds. T. Zerewitinoff. Z. anal. Chem., 1913, 52, 729—737.

A known weight (0·1—0·2 grm.) of the carefully dried fatty acids is dissolved in pyridine, and treated with a solution of magnesium methyl iodide in amyl ether, as previously described for the determination of active hydrogen (this J., 1911, 1233), the resulting methane being measured. The percentage of total hydroxyl (alcoholic and carboxylic) $=\frac{0{\cdot}000719.V.100}{16{\cdot}S} \quad 0{\cdot}0764\frac{V}{S}$, where V is the volume of methane in c.c., at 0° C. and 760 mm., and S the weight of substance in grms. The acid hydroxyl number is then determined by titrating 1 grm. of the acids, dissolved in a mixture of alcohol and ether (1 : 4), with $N/10$ alcoholic potassium hydroxide, using phenolphthalein as indicator. The percentage of acid hydroxyl $=30{\cdot}357T.n/a$, where T is the weight of potassium hydroxide in 1 c.c. of the standard solution, n the number of c.c. of alkali used, and a the weight of fatty acids. By subtracting this result from the percentage of total hydroxyl, the "alcohol hydroxyl number" is obtained.—F. Sodn.

Spirit for soap manufacture; Denaturation of —— in Australia. Board of Trade J., Dec. 11, 1913. [T.R.]

A Customs Order (No. 1,687), dated 18th October, 1913, issued by the Australian Department of Trade and Customs, states that spirit denatured by the addition of not less than 5 per cent. of purified methyl alcohol may be delivered for use in the manufacture of transparent toilet soap: the denatured spirit to be kept on the manufacturers' premises under Customs seal, and added to the soap stock, as required, under the supervision of an Officer. The purified methyl alcohol must conform to the following standard:—(1) It should be colourless and perfectly clear. (2) Sp. gr. at 60° F. not more than 0·800. (3) It should be miscible with distilled water in any proportion. (4) Not more than ½ c.c. of acetone oils should separate when tested in the prescribed manner. (5) When distilled, at least 95 per cent. by volume should have passed over at a temperature of 68° C.

Patents.

Oil mixtures suitable for lubricating, impregnating, or coating purposes; Process for preparing ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 265,599, May 8, 1909. Addition to Ger. Pat. 263,278 (see this J., 1913, 918).

Fats and waxes of mineral origin may be used in place of the mineral oils (see also this J., 1913, 1077, 1119).—T. F. B.

Oils and fats; Extraction apparatus for materials containing ——. W. Wurl. Ger. Pat. 266,131, Dec. 28, 1911.

The apparatus consists of a horizontal cylinder in the lower part of which are two longitudinal perforated plates, inclined inwards from opposite sides of the wall of the cylinder so as to form a trough, in which is disposed a screw conveyor for discharging the spent material after extraction.—A. S.

Fats, oils, and fish-oils; Apparatus for converting —— into like bodies of higher melting-points. M. Wilbuschewitsch, Nischninovgorod, Russia. U.S. Pat. 1,079,278, Nov. 18, 1913.

See Fr. Pat. 426,343 of 1910; this J., 1911, 966.—T. F. B.

Oils and fats; Process for bleaching and thickening ——. O. Schcrieble, Esslingen, Germany. U.S. Pat. 1,079,727, Nov. 25, 1913.

See Fr. Pat. 453,664 of 1913; this J., 1913, 798.—T. F. B.

Fats and fatty oils; Process for hydrolysing —— into glycerin and fatty acids. G. Petroff, Novo Gireevo, Russia. U.S. Pat. 1,079,437, Nov. 25, 1913.

See Fr. Pat. 437,336 of 1911; this J., 1912, 545.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

Oil paints; Apparatus for mixing and straining ——, and for like purposes. K. Rapp and M. Räpe, Mannheim, Germany. Eng. Pat. 14,391, June 21, 1913.

To prevent contact of the paint with the wall of the receptacle, the shaft and gearing of a paint mixing and straining apparatus are rigidly attached by means of brackets to a liner which is introduced into the receptacle. The liner is clamped down on to a removable sieve resting on a ledge in the bottom of the apparatus. The vertical shaft carries brushes, the pressure of which on the sieve is controlled by an adjustable spring.—E. W. L.

Printing ink. M. Wolff, London. Eng. Pat. 30,037, Dec. 31, 1912.

Wet peat, or other partially carbonised vegetable fibrous material, is pressed and added to a mixture of 10 lb of sodium silicate of 100° T. (sp. gr. 1·5) dissolved in 50 galls. of boiling water, into which 3 to 6 per cent. by weight of "vegetable black" has been stirred. The mixture is boiled for 30 to 60 minutes. The liquid portion is separated, and the pulp-like residue is strained and then mixed with suitable oils, *e.g.*, linseed and resin oils, and ground. Crude petroleum or petroleum distillation residues alone or mixed with hydrocarbons of sp. gr. less than 0·78 may be used instead of the resin and like oils. —E. W. L.

Roofing materials; Weather-proof coating substances for covering and ——. G. Halle, Vienna. Eng. Pat. 14,063, June 18, 1913.

A MIXTURE of 50 kilos. of montan wax (or residues from the manufacture of montan wax), 100 kilos. of stearine pitch (or the asphaltum-like residues of the petroleum, tar and fat industries), and 100 kilos. of a suitable mineral colouring matter such as lithopone, iron oxide, or ochre, is kept at a melting temperature for from half-an-hour to 2 hours, air being preferably blown through meanwhile. The mixture can either be applied as a coating, or suitable materials may be impregnated therewith.—E. W. L.

Resinous products; Manufacture of ——. J. J. Buser. Fr. Pat. 458,904, June 6, 1913. Under Int. Conv., June 14, 1912.

RESINOUS substances are produced by acting on phenol and its homologues with sulphur chloride and treating the reaction product with formaldehyde or its polymers. The nature of the product may be varied by varying the temperature and pressure and by the addition of solvent oils, glycerin, and camphor.—G. W. McD.

Oil paintings, frescoes, water colours, chromolithographs, pictures, photographs, distemper colours, etc.; Cleaning and restoring ——. A.-G. für Anilin-Fabrikation. Fr. Pat. 459,922, July 2, 1913. Under Int. Conv., March 1 and May 15, 1913.

THE surface of the picture, etc., is treated with alcohols or esters sparingly soluble in water and not easily volatile, and which do not harden or coagulate at ordinary temperatures.—G. W. McD.

Oil paintings; Process for cleaning or restoring ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 17,523, July 30, 1913. Under Int. Conv., March 1, 1913.

SEE Fr. Pat. 459,922 of 1913; preceding.—T. F. B.

Linoleum, lincrusta, or like material. A. C. Schwarting, Assignor to Reis- und Handels-Akt.-Ges., Bremen, Germany. U.S. Pat. 1,079,728, Nov. 25, 1913.

SEE Eng. Pat. 26,959 of 1911; this J., 1912, 240.—T. F. B.

Manufacture of zinc sulphite, sulphide, oxide, and a mixture of the first two products. Fr. Pat. 459,371. *See* VII.

Preparing oil mixtures suitable for lubricating, impregnating, or coating purposes. Ger. Pat. 265,599. *See* XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Oxidation of ——. G. Hübener. Gummi-Zeit., 1913, 28, 237—239.

THE author does not accept Kirchhof's view (this J., 1913, 799) that the course of oxidation (by air) of vulcanised rubber confirms the thiozone vulcanisation theory of Erdmann (this J., 1908, 934). He shows that when all Kirchhof's values for combined sulphur in the various stages are added together and calculated upon the original substance, they are actually in excess of the total sulphur in the mixings. Experiments made by the author on vulcanised hard rubber mixings lead him to the conclusion that very little of the "free" sulphur after vulcanisation can be extracted by acetone, and that the ratio of easily oxidisable to firmly fixed sulphur is more nearly 2 : 1 than 1 : 2. A considerable difference was found between the values for acetone-soluble sulphur obtained respectively with a finely-filed sample and a sample prepared with a coarser rasp.—E. W. L.

Rubber; Standardisation of ——. Times, Dec. 10, 1913. [T.R.]

THE Standardisation Committee of the Rubber Growers' Association proposes to establish a central testing station where vulcanising and physical tests will be carried out under standard conditions. It is also proposed to erect an experimental factory, the objects of which would be mainly to advise regarding the best type of plantation rubber to be used for specific purposes and best methods of using; to advise regarding mixings, processes, etc., in respect of which manufacturers may ask for assistance; experimental work, with a view to determining new uses for plantation rubber; to provide the organisation for bringing before the trade the results of work done, new methods and uses, etc. The formation of a limited liability company to carry on the work is recommended.

PATENTS.

Rubber; Apparatus for coagulating and curing ——. F. A. Byrne, Birmingham. Eng. Pat. 23,219, Oct. 11, 1912.

SMOKE or coagulating vapours are delivered through a pipe or pipes, under pressure, directly on to latex fed on to the outer surface of a rotating drum.—H. E. P.

India rubber; Coagulation and curing of ——. F. A. Byrne, Birmingham. Eng. Pats. 24,854, Oct. 30, 1912, and 18,060 and 18,062 of 1913, date of Appl., Oct. 30, 1912.

(1) THE vapours or gases produced by the destructive distillation of wood, etc., employed, according to Eng. Pat. 27,664 of 1911 (this J., 1913, 98), for coagulating and curing rubber, may be replaced or supplemented by vapours of aldehydes. If the vapours have a softening or deleterious effect on rubber, a coagulant such as pyroligneous acid must be added to the aldehyde. The vapours may be passed into the latex, or into chambers in which sheets of the coagulated rubber are placed. The following aldehydes may be used: formaldehyde, paraformaldehyde, acetaldehyde, acrolein, etc. (2) Instead of aldehydes phenols such as carbolic acid, cresol, thymol, creosol, and naphthol may be employed. (3) Sulphur dioxide may be employed in the same manner as aldehydes and phenols. —E. W. L.

Rubber; Extracting —— *from plants.* S. Goldreich, London. Eng. Pat. 23,681, Oct. 16, 1912.

THE pieces of wood and bark are treated with boiling or hot liquid (*e.g.* water, and creosote as preservative) before removal of bark, preferably by a power-hammer. The wood and bark are then treated separately for the extraction of rubber.—H. E. P.

Pontianak compound and method of preparing same. G. Staunton, Assignor to W. S. Potwin, Chicago. Ill. U.S. Pat. 1,078,070, Nov. 11, 1913.

CRUDE pontianak is dissolved in a suitable oil, lime and sulphur are added, and the mixture is heated to bring about vulcanisation, then cooled in order to solidify the product.—E. W. L.

Rubber; Art of devulcanising ——. D. A. Cutler, Mount Vernon, New York. U.S. Pat. 1,078,086, Nov. 11, 1913.

VULCANISED rubber goods are devulcanised by subjecting them to the action of a bath containing zinc chloride and pine oil of sp. gr. 0·88—0·90 or 0·93—0·95.—E. W. L.

Waste rubber; Process of reclaiming ——. G. Reynaud. Fr. Pat. 459,447, Sept. 5, 1912.

WASTE vulcanised rubber is soaked in a solvent, such as turpentine or mineral oil, until it has taken up about half its own weight of solvent. It is then passed repeatedly, together with a small quantity of new or reclaimed rubber, between differentially geared rollers—which may be heated—until the desired degree of homogeneity and plasticity is imparted to the mass.—E. W. L.

Vulcanised rubber ; Process of desulphurising ——. G. Reynaud. Fr. Pat. 459,886, Sept. 18, 1912.

Vulcanised rubber, ground or not, is impregnated with a solvent, and heated in a closed vessel, or in the air, with a solution of an alkaline salt. The heating may be effected by passing the mass between steam-heated rollers. The alkaline sulphide formed is eliminated by washing with hot or cold water, and the product dried.—E. W. L.

Caoutchouc-like substances ; Process of producing ——. C. Coutelle, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,073,845, Sept. 23, 1913.

Hydrocarbons of the butadiene series (isoprene) are polymerised by alkali metals or alkali-forming metals, *e.g.* sodium, which have been superficially oxidised *e.g.* by air. Larger yields are stated to be obtained than with the bright metals.—H. E. P.

Caoutchouc ; Process for the production of substances resembling ——. Badische Anilin und Soda Fabrik. Fr. Pat. 459,005, May 5, 1913. Under Int. Conv., Sept. 3, Nov. 6 and Dec. 9, 1912, and Jan. 22, 1913 ; and First Addition thereto, dated June 7, 1913. Under Int. Conv., May 16, 1913.

(1) The polymerisation of butadiene and its homologues by means of metallic sodium can be accelerated by carrying out the operation in an atmosphere of carbon dioxide. Certain differences in the course of the change are noted ; instead of thickening gradually, with reduction in volume, the liquid is transformed without any preliminary increase in viscosity, into a black, worm-like mass, considerably swollen. Mixtures and alloys of sodium with other metals may be employed. The black mass obtained may be used to polymerise further quantities of butadiene hydrocarbons. A number of examples of applications of the process are given. (2) In order further to accelerate the polymerisation, the mixture of hydrocarbon and metal is agitated with fragments of a solid, non-metallic substance. For instance, 100 kilos. of isoprene and 5 kilos. of sodium are placed in a ball-mill in an atmosphere of carbon dioxide, a quantity of porcelain balls is added, and the mill is kept running at ordinary or a slightly elevated temperature until a dry mass is formed. This product may be employed for the polymerisation of further quantities of isoprene, or it may be freed from metallic sodium by washing with water, and dried, after removing the porcelain balls.—E. W. L.

Caoutchouc and analogous substances ; Manufacture of ——. F. E. Matthews. Fr. Pat. 459,134, June 3, 1913. Under Int. Conv., July 2, 1912.

Instead of mixing caoutchouc with polymerised styrolene, as described in Eng. Pat. 16,278 of 1911 (this J., 1912, 694), the caoutchouc is mixed with or dissolved in styrolene, and the mixture or solution subjected to a polymerising process. For example, a mixture of 100 parts of Para rubber and 50 parts of styrolene may be allowed to polymerise spontaneously, or polymerisation may be accelerated by the addition of sodium (Eng. Pat. 24,790 of 1910 ; this J., 1911, 1378), or by heating to 100°—200° C., or by the action of light (Stobbe, Annalen, 371, 259—287). After mixing with 6 parts by weight of sulphur the product may be vulcanised by heating for 1½ hours at a temperature corresponding to a steam pressure of 3 kilos. per sq. cm. (42½ lb. per sq. in.).—E. W. L.

Caoutchouc ; Process for the manufacture of —— *starting with synthetic isoprene.* C. K. F. L. Gross. Fr. Pat. 459,987, June 13, 1913. Under Int. Conv., June 15 and 20, 1912.

Isoprene is polymerised by heating with trioxymethylene, finally in a closed vessel, under pressure. Both substances may be in the liquid form, or they may be allowed to interact in the form of vapour.—E. W. L.

Rubber ; Process for the regeneration of waste ——. G. Reynaud, Paris. Eng. Pat. 20,558, Sept. 9, 1912.

See Fr. Pat. 459,447 of 1912 ; preceding.—T. F. B.

Rubber ; Process for regenerating vulcanised ——. C. P. Bary, Assignor to H. P. C. G. Debauge, Paris. U.S. Pat. 1,079,464, Nov. 25, 1913.

See Addition of May 17, 1911, to Fr. Pat. 413,809 of 1910 ; this J., 1911, 1323.—T. F. B.

Caoutchouc ; Manufacture of compounds resembling or related to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 26,550, Nov. 19, 1912, and 977, Jan. 13, 1913.

See Fr. Pat. 459 005 of 1913 ; preceding.—T. F. B.

Caoutchouc-like substances from butadiene and its homologues ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7945, April 4, 1913. Under Int. Conv., July 22, 1912.

See U.S. Pat. 1,073,845 of 1913 ; preceding.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Patents.

Leather ; Process of making —— *flexible.* G. Basler, Lynn, Mass., U.S.A. Eng. Pat. 7109, March 25, 1913. Under Int. Conv., March 28, 1912.

Leather soles are made flexible by applying a moistening liquid and immediately bending the sole across its entire width, first in one direction and then in the other, around a curve of short radius relatively to the thickness of the leather, in order to open the pores. The liquid may be applied to the grain side only. As moistening liquid, water alone may be used or solutions containing alkaline or soapy substances and other cleaning, penetrating, opening, softening, bleaching and preserving agents. A machine for bending the leather is described.—D. J. L.

Leather ; Process of ornamenting —— *by dyeing.* M. Boyeux. Fr. Pat. 459,970, Sept. 20, 1912.

A mixture of oil of turpentine, 250, yellow wax, 80, fish oil, 50, and paraffin, 10 grms., is used as a resist in leather dyeing.—W. P. S.

Leather-cream ; Manufacture of carnauba wax ——. C. Mähler and L. Seth, Cöln, Germany. Eng. Pat. 933, Jan. 13, 1913.

Eight kilos. of carnauba wax are melted with 8 kilos. of train oil. 8 kilos. of water are boiled with 24 kilos. of train oil and a colouring matter with continual stirring. The two mixtures are then poured together and mixed with 8 kilos. of glycerin and stirred till cold.—D. J. L.

[Thermoplastic] Composition of matter and process of making the same. B. B. Goldsmith, New York. U.S. Pat. 1,076,417, Oct. 21, 1913.

An albuminoid (" gelatoid ") is treated with β-naphthol and an indurating agent (formaldehyde). The mass is heated and pressed and may be rolled before the action of the indurating agent is complete.—H. E. P.

Glue ; Vegetable ——. *Process for making glue.* F. G. Perkins, South Bend, Ind., Assignor to Perkins Glue Co. U.S. Pats. 1,078,691 and 1,078,692, Nov. 18, 1913.

See First and Second Additions to Fr. Pat. 436,297 of 1911 ; this J., 1913, 791.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Swamp rice soils ; The gases of ——. Their composition and relationship to the crop. W. H. Harrison and P. A. Subramania Aiyer. Mem. Dept. Agric. in India, 1913, **3**, 65—106.

When green manure ferments in a swamp rice soil a large proportion of methane is produced, a smaller amount of nitrogen and some carbon dioxide and hydrogen. The introduction of a crop modifies the course of fermentation, the proportion of methane in the soil gas being greatly reduced and that of nitrogen increased, while the evolution of hydrogen is practically inhibited. The soil conditions are anaërobic immediately after admitting water to the fields, and they remain so as long as irrigation proceeds. Nitrification is therefore impossible, and nitrates are quickly denitrified, so that the crop must obtain its nitrogen from ammonia and other anaërobic decomposition products of the green manure. Some of the substances produced in this decomposition are toxic to the crop, and must be removed in the drainage water or destroyed by prolonged decomposition before the seedlings are introduced, otherwise the crop will suffer. The surface of a swamp rice soil is covered with a film of algæ, etc., which evolves large quantities of oxygen, and this oxygen is the chief agent in aerating the roots of the crop. In undrained soil, where the aerated solution does not enter the soil, the roots become congested near the surface, and can only feed in a limited amount of soil. If the draining is too rapid the formation of the surface film and consequently of oxygen is retarded. The best rate of drainage is a relatively slow one. Atmospheric oxygen is not so effective at the roots as the oxygen dissolved in the drainage water. The use of green manures is valuable in this connection, since it promotes greater activity of the surface film.—W. H. P.

Humus ; Chemistry of ——. S. L. Jodidi. J. Franklin Inst., 1913, **176**, 565—573.

In view of the greatly varying constitution of carbohydrates and proteins, and of the readiness with which some of the simpler carbohydrates and amino-acids (lysine, tryptophane and tyrosine) form melanoid products, humus must be regarded as a substance consisting of a great many different products and not as a mixture of a few simple acidic compounds. The easily soluble decomposition products are washed out while the less soluble ones accumulate. The less resistant products undergo further change more rapidly, while the more resistant remain. Fresh humus will contain more of the primary decomposition products, and old humus more of the secondary decomposition products. The author enumerates some of the more important compounds which have been found in soil, and gives an outline of the complicated functions of humus in nature.—W. H. P.

Denitrification ; The mechanism of ——. W. Hulme. Chem. Soc. Proc., 1913, **29**, 307—308.

A series of experiments, conducted with a view to investigate the mechanism of denitrification, showed that this reduction might be divided into two parts: namely, the bacterial reduction, and the enzymatic reduction. The fermentation of similar media, one with and the other without potassium nitrate, under anaërobic conditions, showed the gas evolution to consist of nitrogen (98 per cent.) and carbon dioxide from the nitrate-containing medium, and of hydrogen (70 per cent.) and carbon dioxide from the nitrate-free medium. A medium containing only a very small percentage of nitrate evolved nitrogen and carbon dioxide as long as nitrate and nitrite were present in the solution, but hydrogen and carbon dioxide appeared as soon as these had disappeared ; thus the chemical agent by which the organism reduces the nitrate is nascent hydrogen. The media were tested for enzyme action by precipitation with alcohol, drying, dissolving in water, and Chamberland-filtration, measured quantities of this solution being added to small quantities of a sterilised 1 per cent. solution of potassium nitrate, and the nitrite produced measured. The results showed a considerable reduction with the " product " obtained from the nitrate-containing flasks, whilst that obtained from the nitrate-free flasks was devoid of this reducing power. These results were confirmed by a second series of experiments, in which the fermentation took place aerobically. The enzyme solutions in all cases were not affected by boiling. The mechanism of denitrification may be, therefore, represented as follows :—

(1) $C \ldots + H_2O + \text{organism} = CO_2 + H_2 + \ldots\ldots$

or $CH_2 \ldots + O_2 + \text{organism} = CO_2 + H_2 + \ldots\ldots$

where C represents the carbon of the nutrient substance.

(2) $KNO_3 + E = KNO_2 + EO$

(Enzyme).

$EO + 2H = E + H_2O$

$2KNO_2 + 5H + 2CO_2 = 2KHCO_3 + 4H_2O + N_2$.

thus accounting for the large percentage of nitrogen in the gases evolved from the nitrogen-containing flasks.

Radioactive emanations ; Influence of —— on the growth of plants. J. Stoklasa and V. Zdobnicky. Comptes rend., 1913, **157**, 1082—1084.

Three sets of tests were carried out, viz., (1) cultures in Knopp's nutritive solution (1 grm. $Ca(NO_3)_2$, 0·3 grm. KH_2PO_4, 0·25 grm. KCl and 0·25 grm. $MgSO_4$ per litre) prepared with natural radioactive water or with water rendered active by means of radium emanation: the radioactivity amounted to 70 Mach units per 700 c.c. and was renewed every 4 days ; (2) small pot tests, the soil being watered with radioactive water ; (3) in large vessels of 85 litres capacity exposed to radioactive air. In all cases an increased crop was obtained provided the radioactivity was not excessive. In the small pot tests, for instance, using 5—7 kilos. of soil, and watering at intervals of four days, the effect was unfavourable when the radioactivity was greater than 300 Mach units, but with an activity of 40—60 units a considerably increased crop was obtained. Besides the increased yield, the formation of flowers and of seeds was accelerated. Among the plants used in the trials were lentils, peas, wheat, poppies, lupins, sugar beets, etc.—A. S.

Patents.

Soil ; Process of sweetening and fertilising the ——. L. Cheeseman, Glenburn, Pa., Assignor to Witherbee, Sherman and Co., Port Henry, N.Y. U.S. Pat. 1,076,818, Oct. 28, 1913.

The soil is treated with barium hydroxide or a mixture of this and barium sulphydrate, or with a composition containing barium sulphide or barium sulphide and lime. —F. Sodn.

Vinasse ; Utilisation of —— as a fertiliser. Melasseschlempe G.m.b.H. Fr. Pat. 459,872, June 5, 1913.

Vinasse (150 parts) is heated with phosphoric acid, phosphates or superphosphates (298 parts) to a temperature of 128° C., and the acids liberated are condensed. —G. W. McD.

Organic fertilisers ; Manufacture of ——. E. C. Pluszeski. Fr. Pat. 459,903, June 25, 1913.

To prevent loss of nitrogenous matter by solution, alum is added to slaughter-house refuse during the process of fat extraction.—G. W. McD.

Fertiliser from sulphite-cellulose waste lyes ; Process for producing a ——. A. Stutzer. Ger. Pat. 265,689, Dec. 16, 1911.

Sulphite-cellulose waste lyes, to which fertilisers may be added, are absorbed by peat moss litter, and the mixture is heated to about 120° C. in a suitable drying apparatus, *e.g.*, of the rotary drum type, provided with an acid-resisting lining. It is stated that the dried mass can be reduced to a powder.—T. F. B.

Preparing mixtures suitable for exterminating plant pests. Ger. Pat. 265,656. *See* XIXB.

Process for destroying parasites of plants and animals. Ger. Pat. 266,809. *See* XIXB.

XVII.—SUGARS ; STARCHES ; GUMS.

PATENTS.

Syrups ; Product for the refining of ——, which effects their simultaneous decolourisation, defecation and clarification. P. Lagrange. Fr. Pat. 459,213, Aug. 29, 1912.

THE product contains 40 per cent. of powdered charcoal, 50 per cent. of monocalcium phosphate, and 10 per cent. of alumina, but the alumina may be omitted or replaced by albumin. It is made by mixing tricalcium phosphate (1000 kilos.) with hydrochloric acid (1000 litres of 22 per cent. acid diluted with 500 litres of water) and aluminium sulphate or chloride (150—200 kilos.), stirring in powdered charcoal and adding a slight excess of alkali. After filtration and washing, the product is pressed, dried and powdered.—J. H. L.

Beet sugar ; Process and apparatus for the filtration of raw beet juices, diffusion liquors and other liquids produced in the manufacture of ——. M. de Wierusz-Kowalski. Fr. Pat. 459,418, June 18, 1913.

FILTRATION is effected without the aid of artificial pressure, and deposition of the suspended matter on the filtering medium is prevented. The filtering units are each formed of a sack of suitable material stretched over an extensible frame, and having a small outlet tube at the bottom. The cells are immersed in the liquid and are held in position by guides ; any one cell can be removed without interrupting the working of the others. When a cell is in position, its small outlet tube fits into another tube fixed to the casing of the battery, and thus enables the filtered liquid to be drawn off ; when these two tubes are drawn asunder (*e.g.*, when a cell is lifted out of the battery) each is closed automatically by valves so that ingress of unfiltered liquid is prevented. The deposition of suspended matters on the filtering medium is prevented either by continuous agitation of the liquid, or by scrapers or brushes to which an automatic periodic motion may be imparted. The liquid to be filtered may be kept in motion in a direction perpendicular to the surface of the cells, so that the precipitate tends to be deposited on one side of the cells only.—J. H. L.

Centrifugal drum, especially for separating starch from starch suspensions. S. Aston, Maschinenfabrik und Eisengiesserei. Ger. Pat. 265,154, March 2, 1912.

THE drum is in the form of two concentric truncated cones with a screw fixed to the inner cone and rotating in the annular space at a different speed to the outer cone. The starch suspension is introduced into the interior of the inner perforated cone and moist starch is forced by the centrifugal force to the inner wall of the outer cone, from which it is removed and carried downwards by the screw. The starch is discharged through an annular opening between the lower edge of the outer cone and a plate fastened to and rotating with the inner cone, and a steel scraper extends into this opening to prevent it becoming blocked.—A. S.

Sugars ; Process of producing fermentable ——. F. E. Gallagher, Troy, N.Y., and H. S. Mork, Allston, Mass., U.S.A. Eng. Pat. 400, Jan. 6, 1913. Under Int. Conv., June 6, 1912.

SEE U.S. Pat. 1,033,064 of 1912 ; this J., 1912, 833.—T.F.B.

Obtaining fermentable glucose and ethyl alcohol from sawdust, peat, or similar cellulosic materials. Fr. Pat. 459,593. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Worts ; Influence of the brewing water, the degree of modification of the malt, and the method of mashing, on the nitrogen content of —— and particularly on their content of assimilable nitrogen. W. Windisch, H. Asemann and K. Hoffmann. Woch. Brau., 1913, **30**, 565—567, 573—575, 585—587, 592—594.

THE amount of assimilable nitrogen was determined by submitting the wort to 5 or 6 successive fermentations, each started by adding to the wort (previously freed from alcohol and treated with sugar) a trace of yeast ; the total nitrogen in the successive yeast crops was determined. Carbonates of the alkaline earths, especially magnesium carbonate, when present in brewing waters tend to check the solution of nitrogenous matters and the formation of assimilable nitrogen in the mash ; magnesium and calcium sulphates have the reverse effect. Long grown malts (8 days) produce worts containing rather more nitrogen than those prepared from short grown malts (5 days) but the proportion of this nitrogen assimilable by yeast is almost the same in both cases. Variations in the method of mashing produce no striking differences in the proportion of assimilable to total nitrogen in worts. Brewery worts almost invariably contain much more assimilable nitrogen than is necessary for the yeast, so that a considerable excess is found in finished beers: the degree of this excess does not appear to stand in any simple relation to the stability of beers.—J. H. L.

PATENTS.

Malt and the like ; Apparatus connected with grinding and mashing ——. A. H. Morgan, Tamworth, Staffs. Eng. Pat. 25,108, Nov. 2, 1912.

AN inclined spout, revolving in the upper part of the grist case, delivers the grist from the malt mill either directly round the walls of the case or on to a cone of slightly smaller diameter than that of the case, so that a pit is formed in the centre of the case. The husks and coarse grits work towards the centre and are discharged into the mash tun before the fine grits and flour, any risk of a set mash being thus avoided.—L. E.

Diastase ; Manufacture of ——. S. Fränkel, Vienna. Eng. Pat. 18,427, Aug. 13, 1913. Under Int. Conv., Aug. 17, 1912.

A DIASTASE solution, *e.g.*, a cold extract of malt, is fermented directly (*i.e.*, without being first sterilised by filtration), in presence of calcium carbonate, with pressed yeast containing lactic bacteria, to remove carbohydrates and nitrogenous compounds. The fermented solution is filtered, and the filtrate, which must contain no reducing sugar, is concentrated *in vacuo* until calcium lactate begins to crystallise. The solution is then left until crystallisation is complete, and filtered. Both the residual crystals, which are pressed until fairly dry, and the syrupy filtrate contain diastase ; the filtrate may be further purified by the usual methods.—L. E.

Fermentation ; Process of acidifying musts, etc., in conjunction with the use of ammonium compounds prior to alcoholic ——. A. Pollak. Fr. Pat. 459,548, June 13, 1913. Under Int. Conv., Aug. 8, 1912.

WORT or other fermentable liquid is treated with acidifying (*e.g.*, lactic) bacteria, and when the maximum acidity is attained, one-half or three-fourths of the acid is neutralised with ammonia or an unstable compound thereof, such as ammonium carbonate or hexamethylenetetramine ; or part of the acidified wort may be completely neutralised and then added to the remainder. Acidification is then allowed to continue until a maximum acidity is again attained, the cycle of operations being continued until no more acid can be formed. The product, which may contain as much as 8 per cent. of lactic acid, and a considerable proportion of ammonium compounds, serves for the preparation of yeast or alcohol.—L. E.

Sawdust, peat or similar cellulosic materials; Process for obtaining fermentable glucose and ethyl alcohol from ——. A. de Posnansky and L. Spassky. Fr. Pat. 459,593, Sept. 9, 1912.

The material is freed from resins and tannins by one or more extractions with water, which may contain sodium carbonate or lime, at 140° C. It is next heated for 2 hours at 140° C. with a dilute solution of calcium bisulphite, to dissolve the lignin, which may be subsequently recovered from the liquid by acidification with hydrochloric acid. The material freed from lignin is heated at 140° C. with a dilute solution containing hydrochloric, sulphurous and hydrofluoric acids, until saccharification is complete (about 3 hours). The solution containing the sugar is distilled under reduced pressure to remove the volatile acids, and after it has reached a density of 20°—30° B. (sp. gr. 1·162—1·263) a jet of steam or carbon dioxide is passed through it at 60°—70° C. The residual acids are neutralised by chalk (or if their amount is very large the sugar is extracted with strong alcohol and the extract distilled) and the syrup is treated with a little tartaric acid, sterilised by heating, and fermented. (Cp. Fr. Pat. 451,268; this J., 1913, 620.)—J. H. L.

[*Fermentation*] *Starchy materials; New process of saccharifying ——, manufacturing alcohol, wines from grains, etc., characterised by the employment of a new organism capable of yielding the same results in a septic medium and in presence of bacteria, as are obtained with the mucors now utilised industrially under aseptic conditions.* Soc. Franc. des Distilleries de l'Indo-Chine. Fr. Pats. 459,634, Sept. 10, and 459,815, Sept. 16, 1912.

(1) Claim is made for the use of a new organism, *Mucor Boulard No. 5*, which has as strong a saccharifying power as the mucors now employed industrially, and has the advantage that it can effect saccharification in strongly infected and acid media. (2) The wort is treated at 45° C. with a culture of *Mucor Boulard No. 5*, yeast being added when the sugar-content of the liquid amounts to say 80 grms. per litre. The process may be carried out either aseptically or in open vats. The activity of the mucor and the yield of alcohol are not diminished unless the wort becomes very strongly infected and acquires a high acidity, *e.g.*, equivalent to 9·8 grms. of sulphuric acid per litre, and even in such a case, the loss of alcohol is very small.—L. E.

Wines, beers and spirits; Electrical process for the ageing of —— [and rectification of perfumes]. C. Henry. Fr. Pat. 459,141, Aug. 27, 1912.

The process may be applied to the ageing of wines, beers and spirits, the rectification of perfumes and the purification and sterilisation of various products particularly wines and beers. The liquid is subjected to the greatest possible difference of potential, but the current passing should be very feeble, so as to avoid electrolysis as far as possible. The electrodes are of silver or platinum and each is enclosed in a receptacle which communicates with the main body of liquid through a glass bulb and tube; impurities from the liquid are deposited around the electrodes and may be easily removed by emptying the glass bulbs. In the treatment of costly liquids such as essential oils, the electrodes, enclosed in some absorbent material (wool or filter paper), are immersed directly in the liquid and the absorbent material is cleaned or changed at the end of the operation.—J. H. L.

Beverages of low alcohol-content, and rich in carbon dioxide; Manufacture of ——. M. Busma. Fr. Pat. 459,961, July 3, 1913.

A liquid containing fermentable sugars is treated with (1) nectariferous flowers which contain aromatic substances and yeasts of low fermenting power, (2) seeds or fruits either in their natural state, or ground (*e.g.*, ground poppy seeds), which contain nutritive substances and yeasts of low fermenting power but containing no aromatic substances, and (3) ground linseed cake which contains considerable quantities of nutritive and mucilaginous substances. The relative proportions of these three classes of constituents may vary in different cases and either of classes (2) and (3) may be omitted.—J. H. L.

Alcohol; Rectification of —— in apparatus for discontinuous working. C. Schilling. Fr. Pat. 459,947, July 3, 1913.

Five fractions are separated, *viz.*. first and second head fractions, middle fraction (not further treated) and first and second tail fractions. The distillates of second quality (second head fraction and first tail fraction) are not mixed with the next charge of crude spirit in the still, but are introduced into the column at a suitable stage of the distillation; similarly distillates of third quality (first head fraction and second tail fraction) are introduced into the column during the distillation of the next charge of crude spirit instead of being rectified separately. The advantages claimed for the process are more efficient dephlegmation in the column, considerable saving of steam, time and alcohol, and suppression of filtration through charcoal.—J. H. L.

Wines and distillery vinasses; Treatment of ——. L. Rivière. First Addition, dated Aug. 27, 1912, to Fr. Pat. 447,138, Oct. 18, 1911 (this J., 1913, 247).

The fats present in the wine or vinasse are saponified by lime. The calcium soap, after separation from the liquid, is converted into soluble soaps or free fatty acids. The filtrate from the calcium soap is concentrated under reduced pressure, mixed with alcohol and filtered from protein matters. The cakes of the latter are treated in the filter-press with compressed air, carbon dioxide or other gas, and afterwards dried for fodder. Alcohol is removed from the filtrate by distillation under reduced pressure, the residue is mixed with fine sand, kieselguhr or similar material, and the glycerol extracted, *e.g.*, with acetone. The residue may be used as fodder. *Errata.*—In the original patent, for (*pentoses*) read (*pentosans*) and for *acide chlorique . . . chlorate*, read *acide perchlorique . . . perchlorate.*—J. H. L.

Mashes and other fermentation substrates; Process of preparing —— for subsequent fermentation. A. Pollak, Allach, Germany. Eng. Pat. 13,193, June 6, 1913. Under Int. Conv., Aug. 8, 1912.

See Fr. Pat. 459,548 of 1913; preceding.—T. F. B.

Malt, seeds, and the like; Apparatus for treating ——. L. Topf, Erfurt, Germany. U.S. Pat. 1,079,153, Nov. 18, 1913.

See Eng. Pat. 17,206 of 1909; this J., 1910, 972.—T. F. B.

De-alcoholising wine, beer, and the like; Process and apparatus for continuously ——. G. Ciapetti, Rome. Eng. Pat. 22,988, Oct. 8, 1912.

See Fr. Pat. 443,573 of 1912; this J., 1912, 1004.—T. F. B.

Beverages free from alcohol or containing very little alcohol; Production of ——. M. Busma, Berlin. Eng. Pat. 15,613, July 7, 1913.

See Fr. Pat. 459,961 of 1913; preceding.—T. F. B.

Utilisation of vinasse as a fertiliser. Fr. Pat. 459,872. *See* XVI.

Zymase and reductase; The mutual relations of ——. Lwow. Ber. der deutsch. botanischen Ges. **31**, 141—147. Through Brewers' Journal, 1913, Dec. 15, 696. (See also this J., 1913, 955.)

Earlier researches having shown that, as the result of oxidation by atmospheric oxygen, the pigments formed from chromogens have a highly restricting effect on alcoholic fermentation, the author experimented with Methylene Blue, for the purpose of testing the accuracy of the chemical explanation previously advanced. From the results it appears that 1 grm.-mol. of Methylene Blue extracts 1 grm.-mol. of hydrogen from the fermenting liquid, and thereby renders inactive 1 grm.-mol. of glucose, which is thus preserved from further decomposition into alcohol and carbon dioxide. The hydrogen, temporarily combined by the reductase, is essential to the normal course of fermentation, being required both by alcohol and carbon dioxide. It is probable that the separation of carbon dioxide proceeds synchronously, correctively, and in the same phase with that of another, still unknown, body. An exact parallelism exists between the reducing and fermenting energy of yeast, and it is doubtful whether reductase exists as an independent enzyme in yeast; it may be that the reducing properties belong to a single but complex fermentation agent, viz., zymase.

XIXa.—FOODS.

The gases of swamp rice soils. Their composition and relationship to the crop. Harrison and Subramania Aiyer. *See* XVI.

Patents.

Fodder from peat; Production of ——. F. Sahlfeld, Hanover, Germany. Eng. Pat. 9352, April 21, 1913.

A closed vessel is divided by a perforated plate into upper and lower sections for the peat and for water respectively; both sections are provided with steam pipes. The vessel is heated to 121° C. and compressed air is then admitted to raise the pressure to 5 or 6 atmospheres. During the digestion the water is continually pumped from the lower part of the vessel and discharged over the peat. After 4 hours the solution of sugars and mucilage produced is drawn off, concentrated under reduced pressure, and mixed with bran, malt, or exhausted peat fibre to form a fodder.—W. P. S.

Concentrating apparatus for the manufacture of preserved [liquid] food. Cecchin and Quaquarini. Fr. Pat. 459,026, June 9, 1913.

A hollow rotating shaft, through which steam is circulated, passes down the centre of a vertical cylinder, which is connected at the top with an exhaust pump. The liquid to be concentrated is introduced through a coil at the upper part of the cylinder, falls on to perforated plates attached to the shaft, and thence on to a hollow helix also attached to the shaft and supplied with steam from the same. Below the helix are two hollow plates provided with scrapers. The lower part of the cylinder is surrounded by a steam-jacket, and a small helix and scrapers fitted to the shaft at this part cause the concentrated material to pass through a valved chamber into a second cylinder provided with a steam-heated rotating shaft carrying a helix; the material is discharged from the second cylinder into suitable receptacles.—W. P. S.

Cocoa powder; Process of manufacturing a readily soluble ——. J. Bergmuller. Fr. Pat. 459,675, June 25, 1913.

Cocoa mass is ground to a paste and submitted to centrifugal action for several hours at about 65° C.; the fat is thus separated from the mass and caused to adhere to the surface of the particles, whilst the moisture is evaporated. The mass is then pressed in the usual way.
—W. P. S.

Oil cakes, flours, grains, fruits, or leguminous seeds; Deodorisation of —— *for use as foods either alone or mixed with fats and oils.* C. J. Nicoud. Fr. Pat. 459,838, July 2, 1912.

The powdered material is introduced, together with a quantity of water and alcohol, into a closed vessel from which the vapours may be exhausted; the vessel may be heated to accelerate the evaporation of the liquids. The material may also be treated under a low pressure with small quantities of carbon dioxide and nitrogen. The deodorised material may be mixed subsequently with neutral edible fats or oils.—W. P. S.

Sterilising milk and other liquids; Process for ——. O. Lobeck, Leipsic, Germany. Eng. Pat. 18,834, Aug. 16, 1912.

See Fr. Pat. 447,458 of 1912; this J., 1913, 249.—T. F. B.

Condensation or concentration of milk and other liquid; Process for the ——. E. W. Kuhn, London. Eng. Pat. 20,536, Sept. 9, 1912.

See Fr. Pat. 448,160 of 1912; this J., 1913, 445.—T. F. B.

Drying milk and similar food; Machinery for ——. J. O. A. Amundsen, Stavanger, Norway. U.S. Pat. 1,078,603, Nov. 18, 1913.

See Fr. Pat. 443,057 of 1912; this J., 1912, 1005.—T.F.B.

Preparation of extracts. Eng. Pat. 2013. *See* I.

XIXb.—WATER PURIFICATION; SANITATION.

Guaiacum resin as a reagent for the detection of minute traces of copper. W. R. G. Atkins. Chem. Soc. Proc., 1913, 29, 303.

In order to ascertain how far traces of metals might vitiate tests for oxydases by guaiacum resin, a series of experiments was carried out to determine the limits of sensitiveness of the reaction towards certain salts, when it was found that very minute amounts of copper salts or of potassium permanganate may be detected by means of the reaction. Accordingly it is suggested as a reaction useful in water analysis. Below are recorded the limits of sensitiveness of the reaction, expressed in grams per c.c. Copper as sulphate, 2×10^{-9} to 2×10^{-8}. Potassium permanganate, 4×10^{-8}. Potassium bichromate, 1×10^{-7}. Iron, as ferrous sulphate, 1×10^{-6}, as ferric sulphate, 1×10^{-6}. Lead as acetate, 6×10^{-6}. Nitric acid, 2×10^{-5}. Manganese as sulphate, 8×10^{-4}. In each case a few drops of hydrogen peroxide were added, as well as a very dilute solution of the reagent. Traces of chlorides were also present, and play an important part.

Potash works effluents. Rohland. *See* VII.

Patents.

Water: Apparatus for preparing solutions for use in purifying or softening —— *or other purposes.* F. A. Anderson, Newcastle-on-Tyne. Eng. Pat. 5465, March 4, 1913.

A cylindrical tank, closed at the bottom, is provided inside with three open cylinders nested one within the other. The solids to be dissolved are placed in a basket at the top of the innermost cylinder, which is in such a position that when the apparatus is filled, the solids just dip into the water. Water is then allowed to flow in between the innermost cylinder and the next outer one.
—F. Shdn.

[Water] Filters. J. Blondiau, Braine-le-Comte, Belgium. Eng. Pat. 16,050, July 11, 1913. Under Int. Conv., July 17, 1912.

The water passes first through a layer of coarse submerged sand, then, in admixture with air, through a lower filter of unsubmerged finer sand, where the impurities are oxidised, next through a lower filter of submerged fine sand, and finally through hollow filter-bricks into a reservoir below. The water after passing through the oxidising zone of the filter, does not come into contact with unfiltered air until it is withdrawn from the reservoir.—W. H. C.

Water purification; Method of ——. W. T. Alliger and J. W. Gamble, Philadelphia, Pa., and G. H. Gibson, Montclair, N.J., Assignors to J. S. L. Wharton, W. S. Hallowell, and J. C. Jones, as Firm of Harrison Safety Boiler Works, Philadelphia, Pa. U.S. Pat. 1,078,655, Nov. 18, 1913.

The water is heated and agitated by means of steam to decompose bicarbonates and expel the liberated carbon dioxide, then treated with a reagent which will react with the non-carbonate impurities, and the heating continued.—W. P. S.

Effluents; Oxidising filter for the biological purification of ——. Deutsche Filterkompagnie, Ges.m.b.H. Ger. Pat. 265,828, March 5, 1912.

The filter consists of a number of perforated hollow elements filled, to a greater or smaller extent, with filtering material. The filter-elements are constructed of a reactive material such as volcanic rock and a binding medium, and the filtering material consists of pieces of volcanic rock. The filter-elements communicate with one another by means of openings in the side and bottom walls.—A. S.

Disinfecting and therapeutic preparations; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4571, Feb. 22, 1913.

Bolus alba is impregnated with a sparingly soluble or insoluble compound of a metal such as silver, copper, mercury, zinc, lead, or bismuth. The products are said to show a strong disinfecting action and to be non-irritant, retaining the properties of *bolus* as regards its drying action on wounds, etc.—T. F. B.

Plant pests; Process for preparing mixtures suitable for exterminating ——. A. Lang. Ger. Pat. 265,656, Aug. 19, 1911.

Powdered aluminium, magnesium, calcium, or similar metal is intimately mixed with the equivalent quantity of sulphur, and the product is mixed with carbon and an oxide or nitrate, or similar combustible mixture, pressed into solid masses by aid of a combustible binding agent, such as collodion, and ignited. The residue evolves hydrogen sulphide on treatment with water.—T. F. B.

Parasites of plants and animals; Process for destroying ——. C. Beyer. Ger. Pat. 266,809, Jan. 24, 1913.

Solutions of valeric acid or its compounds may be used as parasiticides; they may be sprayed on plants or used as dips for animals. Suitable strengths are from 0·5 to 2 per cent. aqueous solutions.—T. F. B.

Water; Process for rendering sterilised —— tasteless and odourless. R. Grüter, Charlottenburg, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,078,918, Nov. 18, 1913.

See Ger. Pat. 260,653 of 1912; this J., 1913, 840.—T.F.B.

Oxidation and separation of iron in solution. Fr. Pat. 459,576. *See* VII.

Manufacture of hydraulic lime, cement, and Portland cement from the residues of the incineration or distillation of domestic refuse and sludge. Fr. Pat. 458,551. *See* IX.

Apparatus for detecting and estimating certain substances [oxidising and reducing agents] by virtue of their polarising or depolarising action on an electric couple. Eng. Pat. 1776. *See* XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Linaloe oil [and shiu oil]. Schimmel's Rept., Oct., 1913.

In view ot the fact that shiu oil may be used as an adulterant of linaloe oil, the detection and determination of camphor (which is a constituent of shiu oil but is absent from Mexican and Cayenne linaloe oils) is of importance. The presence of one per cent. of camphor can be detected in linaloe oil by the semicarbazide method: 25 grms. of steam-distilled oil are diluted with a mixture of 1 grm. of semicarbazide hydrochloride and 1 grm. of sodium acetate in 25 c.c. of 90 per cent. alcohol; after standing for 24 hours, 1 grm. of sodium bicarbonate is added, the mixture is distilled with steam, and the residue is evaporated slightly on a water-bath; on cooling, the semicarbazone separates. It is dissolved in a little alcohol, and the alcohol is evaporated; if camphor is present, its odour is clearly perceptible when the residue is treated with sulphuric acid. The camphor content of adulterated linaloe oil may be estimated rapidly and accurately as follows:—Ten grms. of the oil is dropped slowly into a cooled solution of 50 grms. of potassium permanganate in 300 c.c. of water. When the reaction is complete, *i.e.*, at the end of about two hours, 200 c.c. of water is added and the camphor, which is not attacked, is distilled by means of steam: after adding salt to the distillates, they are extracted several times with ether and the extracts evaporated. This method renders possible the determination or detection of 1 per cent. of camphor or 10 per cent. of shiu oil in linaloe oil. The principal sources of linaloe oil are Mexico and French Guiana. It is customary to estimate roughly the oil content of the wood by the colour, which is yellower the more oil is present. For the distillation of the oil, 90 to 100 kilos. of wood shavings and 100 kilos. of hot water are distilled under about 3 atmos. pressure, the process occupying about 1½ hours. The crude oil is freed from mechanical impurities by decantation and filtration, and is then distilled with steam or in a vacuum. The annual exports of oil from French Guiana have increased from 347 kilos. in 1889 to 22,147 kilos. in 1910, whilst the export of wood has risen from 145,305 kilos. in 1891 to 1,262,000 kilos. in 1910.—T. F. B.

Chloroform and alcohol; Miscibility of ——. K. Enz. Pharm.-Zeit., 1913, **58**, 528. Chem. Zentr., 1913, **2**, 1789.

When aqueous alcohol is added to chloroform the mixture is turbid at first. To obtain a clear mixture with 10 parts of chloroform the following proportions of alcohol of different concentrations are required: sp. gr. 0·834, 3 parts; 0·830, 2·2; 0·820, 0·93; 0·818, 0·87; 0·814, 0·43; and sp. gr. 0·812, 0·32 part.—A. S.

Acetone; Action of calcium on ——. P. N. Raikow. Chem.-Zeit., 1913, **37**, 1455.

Anhydrous acetone is decomposed by metallic calcium at the ordinary temperature, mesityl oxide being the principal product. The reaction requires some days for completion.—T. F. B.

Reaction for boric acid or methyl alcohol. Pieszczek. *See* XXIII.

Patents.

Medicinal preparation in tablet form. H. Sefton-Jones, London. From J. A. Wülfing, Berlin. Eng. Pat. 392, Jan. 6, 1913.

Tablets are prepared from calcium carbonate, or carbonate, oxide, or peroxide of magnesium, or a mixture of these substances, with the addition of a binding and flavouring medium.—F. Shdn.

Esters of polyhalogen-substituted alcohols with therapeutically active acids; Process for the manufacture of ——. R. Wolffenstein, Berlin. Eng. Pat. 5811, March 8, 1913.

See U.S. Pat. 1,072,289 of 1913; this J., 1913, 959. Other polyhalogen alcohols may be converted into esters by heating them with salicylic, cresotinic, isovaleric, or other similar acids or their chlorides.—T. F. B.

Remedy for infectious diseases, Process for the production of a ——. D. J. van Stockum, Amsterdam. Eng. Pat. 5957, March 10, 1913. Under Int. Conv., March 28, 1912.

The spleen of cattle, pigs, or other suitable animals is mixed with toluene water and subjected to the action of X-rays or ultra-violet rays. It is then filtered and the filtrate fractionally precipitated by adding saturated ammonium sulphate solution until the mixture contains at least 60 per cent. of this solution. The first fractions of the precipitates are removed and the last fraction is collected and dissolved in water or salt solution. This treatment is said to result in the generation or rendering active of a ferment which is a remedy for infectious diseases. —T. F. B.

Hexa-amino-arsenobenzene; Manufacture of ——. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 8041, April 5, 1913. Under Int. Conv., Oct. 14, 1912. Addition to Eng. Pat. 7488 of 1913, dated April 1, 1912.

4-AMINO-3.5-DINITROBENZENE-1-ARSINIC acid is reduced in alkaline solution by means of sodium hydrosulphite; when the yellow precipitate has separated completely it is filtered off and warmed gently with dilute acid, whereupon it dissolves gradually with evolution of sulphur dioxide. The solution is filtered and the hexa-amino-arsenobenzene is precipitated from the filtrate by addition of dilute caustic soda solution.—T. F. B.

Mercury compounds and processes of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,079,693, Nov. 25, 1913.

A MERCURY salt is combined with umbelliferone or other derivative of hydroxycoumarone, to form substances in which the mercury is combined directly with a carbon atom of the coumarone nucleus.—T. F. B.

Alkyl-lactic esters; Process for preparing ——. W. Neuberger. Ger. Pat. 266,120, Jan. 3, 1913.

SMALL yields of esters of alkyl-lactic acids are obtained from a lactic ester, an alkyl halide, and silver oxide unless the alcoholic residue of the ester is the same as that of the alkylating agent, or unless an excess of the alkylating agent and silver oxide is used. The use of a dehydrating agent (*e.g.*, anhydrous sodium sulphate or copper sulphate) is found to lead to almost quantitative yields of the pure product, even though only the calculated quantity of the alkyl halide and silver oxide be used.—T. F. B.

Thiourea; Process for preparing ——. C. F. von Girsewald. Ger. Pat. 266,404, Aug. 13, 1912.

THIOUREA free from dicyanodiamide may be obtained by decomposing a heavy metal salt of cyanamide by means of hydrogen sulphide.—T. F. B.

Urea; Process for preparing ——. H. Immendorff and H. Kappen. Ger. Pat. 267,207, Nov. 3, 1911.

THE conversion of cyanamide into urea is readily effected by heating it under pressure, in aqueous solutions, with a small quantity of an acid, *e.g.*, sulphuric acid. The acid is found in the product in the form of its ammonium salt. —T. F. B.

Ketones; Process for methylating ——. J. D. Riedel A.-G. Ger. Pat. 266,405, May 18, 1912.

HYDROXYMETHYLENE derivatives of ketones or their derivatives (chlorides, amides, esters, etc.) are easily converted into the corresponding α-methyl derivatives by treatment with hydrogen in presence of a catalyst.—T.F.B.

Alkylated ketones; Process for preparing ——. K. Blendermann. Ger. Pat. 266,520, April 25, 1912.

THE alkali compounds of the condensation products from oxalic esters and ketones are alkylated, and the oxalic residue is eliminated from the products.—T. F. B.

Ethylene; Process for purifying —— for catalytic reactions, especially for preparing ethane. Elektrochemische Werke G. m. b. H. Ger. Pat. 266,519, Oct. 16, 1912.

THE impurities and contact poisons in ethylene prepared from alcohol are removed by submitting the gas to strong compression, whereupon the by-products are condensed. —T. F. B.

m-Chlorobenzoic acid; Process for preparing ——. W. Gluod. Ger. Pat. 266,577, June 5, 1912.

m-CHLOROBENZOIC acid is stated to be the principal product when benzoic acid is treated with a mixture of hydrochloric and nitric acids, care being taken that the reaction is stopped at the right time.—T. F. B.

Monochloro compounds of the higher hydrocarbons of mineral oils, lignite tar oils, etc.; Process for preparing primary ——. H. Strauss. Ger. Pat. 267,204, April 24, 1912.

THE higher hydrocarbons of crude petroleum, etc., are converted into monochloro derivatives by treating their vapours with chlorine under diminished pressure. The products are useful for conversion into alcohols and then into higher fatty acids.—T. F. B.

2-Piperonylquinoline-4-carboxylic acid and its derivatives; Manufacture of esters of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 14,128, June 18, 1913. Under Int. Conv., Jan. 13, 1913.

SEE Fr. Pat. 459,180 of 1913; this J., 1913, 1128.—T. F. B.

Nitroso derivatives of phenylglycine-ortho-carboxylic acid; Process for the manufacture of ——. J. Houben, Berlin, Assignor to J. D. Riedel A.-G., Berlin-Britz, Germany. U.S. Pat. 1,079,246, Nov. 18, 1913.

SEE Eng. Pat. 14,341 of 1912; this J., 1912, 914.—T. F. B.

Pinacones; Process of producing ——. A. Jonas and E. Tschunkur, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,079,916, Nov. 25, 1913.

SEE Addition of Feb. 16, 1912, to Fr. Pat. 434,553 of 1911; this J., 1912, 843.—T. F. B.

Electrical process for the ageing of wines, beers, and spirits [and rectification of perfumes]. Fr. Pat. 459,141. *See* XVIII.

Manufacture of disinfecting and therapeutic preparations. Eng. Pat. 4571. *See* XIXB.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Films or screens for colour photography and cinematography; Preparation of ——. R. G. Bradshaw and J. C. Lyell, London. Eng. Pat. 6894, March 20, 1913.

THE surface of the film or screen support is coated on opposite sides with different colours, which are then removed by suitable mechanical means from the desired parts; for example, by coating with red on one side and green on the other, and by erasing certain parts of each in fine lines, points, etc., a coloured screen giving either red and green, or red, green, and violet, may be obtained. —T. F. B.

Tablets readily soluble in water, especially for photographic purposes; Preparation of ——. Chem. Fabr. von Heyden. Ger. Pat. 266,237, July 25, 1912.

POTASSIUM salts, particularly the sulphite and carbonate, are made into tablets, without addition of an organic developer. The tablets are said to dissolve very rapidly, generally in less than one minute.—T. F. B.

Toning photographic silver pictures; Process of ——. R. Fischer, Steglitz, Germany. U.S. Pat. 1,079,756, Nov. 25, 1913.

SEE Fr. Pat. 454,792 of 1913 this J., 1913, 885.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Accident which occurred in No. 47, a mixing or kneading house, at the explosives works of Messrs. Kynoch, Ltd., Umbogintwini, Durban, Natal, on Aug. 21, 1913; Report on an ——. Major A. B. Denne, Chief Inspector of Explosives, Union of South Africa. [U.G. 49—'13.]

One European and one native were killed by the explosion. The explosive in course of manufacture consisted of nitroglycerin (82·4 per cent.), nitrocotton (5·6), sodium nitrate (8), and potassium nitrate (4 per cent.). There were 1000 lb. of explosive in the building, and, of this, probably 750 lb. were in the porch, and 250 lb. in a McRoberts' kneading machine. At the site of the kneading machine a crater 15ft. in diameter and 3ft. deep, was formed, whilst at the site of the porch the crater was 22 ft. in diameter and 6 ft. 6 in. deep. The first explosion probably occurred in the porch from a blow on a thin film of the explosive caused either by dropping a full box, or setting a box down roughly after emptying it, or by a blow on the edge of the pan whilst emptying a box, or by the sudden breaking of a pulley and the broken portion striking the explosive.—G. W. McD.

Fifth report of Explosions in Mines Committee. See IIa.

Patents.

High explosives. W. S. Pierce, Frankfort, Ind., U.S.A. Eng. Pat. 22,240, Sept. 30, 1912.

A mixture of chlorinated nitrated coal tar (18 parts), chlorinated nitronaphthalene (6), soluble nitrocellulose (1), and potassium chlorate (80 parts).—G. W. McD.

Explosives; Manufacture of primary ——. R. Calvet, Barcelona, Spain. Eng. Pat. 13,501, June 11, 1913.

Cupric or cuprous sulphocyanide (thiocyanate) or the double salt (1 part), is mixed with potassium chlorate or perchlorate (1·5—2 parts) to form a detonating composition.—G. W. McD.

Detonators or high explosives and propellants. C. Claessen. Fr. Pat. 459,979, May 29, 1913.

The detonator is so composed that mercury fulminate, or a mixture of mercury fulminate and potassium chlorate, detonates lead azide (0·2 grm.), which in turn detonates nitro-compounds such as trinitrotoluene and tetranitromethylaniline.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Asbestos as a filtering medium. Coplans and Gibbs Lloyd. Brit. Med. J., Nov. 22, 1913, 1375. Chem. and Drug., 1913, **83**, 812.

It was found that when solutions of diastase, pepsin, milk-curdling enzyme, typrsin, peptone, curare, strychnine, suprarenin and adrenalin were filtered through asbestos the dissolved substance was removed from solution. The time required for the absorption varied. Other filtering materials, such as fuller's earth and kaolin, had a similar effect, though in a less degree.—J. H. J.

Palladium; Determination of —— with α-nitroso-β-naphthol and separation of the same from copper and iron. M. Wunder and V. Thüringer. Z. anal. Chem., 1913, **52**, 737—739.

Palladium is quantitatively precipitated by α-nitroso-β-naphthol on boiling and may be determined in the presence of (ferric) iron and copper as follows:—The chloride solution (containing not more than 0·05 grm. of palladium) is diluted to about 150 c.c., 20 c.c. of concentrated hydrochloric acid and 20 c.c. of acetic acid are added, the mixture heated to boiling, and a hot saturated solution of nitroso-β-naphthol in 50 per cent. acetic acid gradually introduced, as long as a red colouration (giving place to a red voluminous precipitate) is produced. The mixture is filtered hot, and the precipitate washed with hot 5 per cent. hydrochloric acid, followed by hot water, dried, ignited, and reduced in hydrogen. Copper is determined in the filtrate by precipitation as thiocyanate and iron in the filtrate from the copper by oxidation with nitric acid and addition of ammonia, the precipitate being dissolved in hydrochloric acid and precipitation repeated. The method is accurate but offers no advantages over separation with dimethylglyoxime (this J., 1913, 111); in the latter method, the filtrate, after separating copper, may be boiled with a large excess of nitric acid and the iron precipitated directly with ammonia.—F. Sodn.

Boric acid or for methyl alcohol; Reaction for ——. E. Pieszczek. Pharm.-Zeit., 1913, **58**, 850—851. Chem. Zentr., 1913, **2**, 1941.

If methyl alcohol be used instead of ethyl alcohol, the green flame colouration in presence of borates can be obtained even without addition of sulphuric acid. The test can be used for distinguishing the two alcohols and for detecting as little as 5—10 per cent. of methyl alcohol in ethyl alcohol. It is advantageous to allow 1—2 mins. for the interaction of the alcohol and the boric acid before igniting the alcohol vapour.—A. S.

Determination of periodate in presence of iodate and iodide. Müller and Wegelin. See VII.

Analysis of platinum ores. Wunder and Thüringer. See X.

Determination of hydroxy fatty acids in fats by means of organo-magnesium compounds. Zerewitinoff. See XII.

Guaiacum resin as a reagent for the detection of oxidases and of minute traces of copper. Atkins. See XIXb.

Linaloe oil [and shiu oil]. See XX.

Patents.

Detecting and estimating certain substances [oxidising and reducing agents]; Apparatus for —— by virtue of their polarising or depolarising action on an electric couple. E. K. Rideal and U. R. Evans, London. Eng. Pat. 1776, Jan. 22, 1913.

A copper tube has a side tube near either end, for inlet and outlet of the liquid to be tested. The ends of the copper tube are closed with vulcanite stoppers, through which a platinum rod passes. The platinum rod and the copper tube are connected with a voltameter. When, for example, the liquid contains oxidising agents (chlorine, ozone or permanganate in water or effluents) a current flows between the electrodes, and can be measured by the voltameter. (See also this J., 1913, 881.)—G. W. McD.

Gas-analysing apparatus. J. W. Hays, Chicago, Ill. U.S. Pat. 1,077,342, Nov. 4, 1913.

A measuring burette, with levelling tube and bottle, is connected by capillary tubes and stopcocks with several absorption vessels. The latter are each connected with a displacement vessel. The displacement vessels are all connected together, one only of the series having an opening to the atmosphere.—W. H. C.

Gases; Quantitative analysis of a mixture of known ——. Siemens und Halske Akt.-Ges. Fr. Pat. 458,916, June 7, 1913. Under Int. Conv., June 7, 1912.

The gas is kept in rotary motion, for example by a centrifugal fan, and the difference in the pressures at two different distances from the axis is measured. For different gases, the pressures at a given distance from the axis are in proportion to the molecular weights or to the average molecular weight of a mixture of gases. In order to compare the molecular weights of two gases, the gases are delivered from two similar fans to the atmosphere, and manometers of the flexible diaphragm type are connected with corresponding points of each fan. The two diaphragms act through springs on opposite arms of a bell-crank lever which carries a pointer to indicate the ratio of the molecular weights, or the molecular weight of one gas if that of the other is known. The apparatus may also be adapted to indicate the ratio of the two observed pressure differences electrically. It may be used for controlling manufacturing processes yielding gaseous products, by causing the movements of the manometer to control the regulating devices of the process. Examples mentioned include the manufacture of lighting gas, the control of blast-furnaces and the production of nitric oxide in the electric arc.—A. T. L.

Thermo-electric calorimetric bomb. C. Féry. First Addition, dated May 20, 1913, to Fr. Pat. 436,330, Nov. 13, 1911 (this J., 1912, 461).

The steel bomb is provided with a removable nickel cup-shaped lining which is not attacked by the nitric acid formed during the combustion. This lining is weighed before and after a determination in order to ascertain the weight of water formed in the combustion. The lining has a flange at the upper end which is gripped between a flange of the steel bomb and its cover. The cover has lugs which pass between lugs on the bomb; it is turned so as to bring the lugs bayonet-fashion beneath the lugs of the bomb, and is then fixed securely by screws which pass through these lugs. To increase the conductivity the steel bomb is provided with a copper sheath, which forms one element of the thermocouple. The bomb is supported in the brass casing, which forms the other element, by means of a single constantan disc.—A. T. L.

Books Received.

Corrected Sikes's Tables for Ascertaining the Strength of Spirits, with Directions for using his Glass Hydrometer. Corrected under the supervision of Major C. H. Bedford, D.Sc., M.D., I.M.S., Director of the Central Excise Laboratory for India. Government Printing Office, Calcutta. Price 8 annas.

This volume, presented to the Society by Mr. A. F. Joseph, of Colombo, contains 135 pages, 9¾ by 6⅜ ins. The tables cover a range of temperature from 40° to 100° F., at intervals of 1° F. (See this J., 1913, 857.)

Mining and Treatment of Feldspar and Kaolin in the Southern Appalachian Region. By A. S. Watts. Bulletin 53, U.S. Bureau of Mines. Government Printing Office, Washington.

Volume of 170 pages, 9⅛ by 5¾ ins., with index, and containing 3 maps and 25 illustrations in the text.

The Titaniferous Iron Ores in the United States. Their Composition and Economic Value. By J. T. Singewald, jun. Bulletin 64. U.S. Bureau of Mines. Government Printing Office, Washington.

Contains 145 pages of text, 9⅛ by 5¾ ins., with 19 figures and plates.

Die Atome. Von Jean Perrin. Mit Autorisation des Verfassers Deutsch herausgegeben, von Dr. A. Lottermoser. Theodor Steinkopff's Verlag. Dresden und Leipzig. 1914. Price M. 5. M. 6 (bound).

Volume (8⅞ by 6¼ ins.) containing 191 pages of subject matter with thirteen illustrations, and alphabetical indexes of authors and subjects. The subject matter is classified as follows:—I. The atomic theory and chemical science. II. Molecular movement. III. The Brownian movement. Emulsions. IV. The laws of the Brownian movement. V. Fluctuations and Smoluchowski's Theory. VI. Light and the Quantum, and the extension of the Quantum theory. VII. Atomic structure of Electricity. VIII. Building up and destruction of the atoms.

Analyses of Coals in the United States. By N. W. Lord. Bulletin 22. U.S. Bureau of Mines. Government Printing Office, Washington.

This bulletin is bound in two parts, Part 1 contains 321 pages, 9⅛ by 5¾ ins., and deals with the methods of analysis and examination used; it is chiefly devoted to tabulated analyses of samples collected between July 1, 1904, and June 30, 1910. Part 2 consists of 878 pages, and contains a detailed description of the samples of which analyses appear in Part 1; a bibliography and index conclude the work. Some of the early chapters in Part I are by J. A. Holmes, F. M. Stanton, A. C. Fieldner, and S. Sanford.

The Progress of Scientific Chemistry in our own times, with Biographical Notices. By Sir William A. Tilden, F.R.S. Second Edition. Longmans, Green & Co., 39, Paternoster Row, London. New York, Bombay, and Calcutta. 1913. Price 7s. 6d. net.

Volume (7⅞ by 5½ ins.) containing 360 pages of subject matter, and alphabetical indexes of names and subjects. The subject matter is classified and headed as follows:—I. Matter and energy. II. The chemical elements, their distribution in nature, etc. III. Rectification and standardisation of atomic weights. IV. Numerical relations among the atomic weights. V. Origin and development of the ideas of valency and the linking of the atoms. VI. Development of synthetical chemistry. VII. Origin of stereochemistry, etc. VIII. Electricity and chemical affinity. IX. Liquefaction of gases. X. Radioactivity.

Coal Tar Distillation. Arthur R. Warnes. The Gas World, 8, Bouverie Street, London, E.C. 1913. Price 7s. 6d. net.

Volume (8¼ by 5¾ ins.) containing 175 pages of subject matter, and an alphabetical index of subjects. There are 67 illustrations. The subject matter is classified as follows:—I. Coal tar. Composition. Results of distillation, etc. II. Tar from gasworks; how received, etc. III., IV. and V. Plant used in tar distilling. VI. Distillation of coal tar. VII. Plant for recovery of cresylic and carbolic acids from oils. VIII. Recovery of cresylic and carbolic acids. IX. and X. Plant for the recovery of benzols, naphthas, etc. XI. Rectification of benzols and naphthas. XII. Plant for working up pyridine from pyridine-acid. XIII. Recovery and rectification of pyridine bases. XIV. and XV. Plant for making crude naphthalene and anthracene, etc. XVI. Pitch and pitch "getting." Sanitation of the process. Pitch cancer. XVII. Creosote. XVIII. Tar works tests.

Notions Fondamentales de Chimie Organique. Par Charles Moureu. Professeur à l'Ecole supérieure de Pharmacée de l'Université de Paris, etc. 4me édition. Gauthier-Villars. Quai des Grands-Augustins, 55. 1913. Price Fr. 9.

Volume (9 by 5½ ins.) containing 362 pages of subject matter, a table of contents, and an alphabetical index of subjects. The text is classified as follows:—I. Preliminary observations and general theories. II. Hydrocarbons. III. Oxygen compounds. IV. Nitrogen compounds. V. Organo-metallic compounds. VI. Heterocyclic compounds: (*a*) Compounds with rings of five atoms; (*b*) Compounds with rings of six atoms.

The Purification of Public Water Supplies. By George A. Johnson. [Department of the Interior. United States Geological Survey. G. Otto Smith, Director.] Water Supply Paper 315. Government Printing Office, Washington. 1913.

Volume in paper cover (9⅛ by 5⅞ ins.) containing 82 pages of subject matter, and an alphabetical index. There are 14 illustrations. The text is classified as follows:—I. Introduction. II. Polluted water. III. Sources of water supply. IV. Development of waterworks in the United States. V. Water consumption. VI. Typhoid fever in the United States. VII. Water purification. VIII. Sterilization of water. IX. Municipal water softening.

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1900. Alexander, Jerome, c/o National Gum and Mica Co., N.E. cor. 59th Street and 11th Avenue, New York City, U.S.A., Chemist.
1912. Alexander, Walter, National Gum and Mica Co., 59th Street and 11th Avenue, New York City, U.S.A., Secretary.
1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.
1891. Allan, F. H. Tielke, Donaghmore, Co. Tyrone, Ireland, Technical Chemist.
1898. Allan, John, 77, Northen Grove, West Didsbury, Manchester, Chemist.
1909. Allan, Maurice, 103, Burford Road, Nottingham, Soapmaker.
1907. Allard, M. L., c/o Century Rubber Trading Co., Plainfield, N.J., U.S.A., Chemist.
1902. Allbright, Wm. B., 4937, Madison Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Woolwich, S.E., Analytical Chemist.
1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.
1903. Allen, Chas. A., Overdale, Sunnyhurst, Darwen, Lancashire, Chemist.
1911. Allen, Harold C., Chillagoe, North Queensland, Analyst.
1911. Allen, Harry L., 25, Franklin Place, Summit, N.J., U.S.A., Chemist.
O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1908. Allen, Simeon C., 43, Ambrose Street, Rochester, N.Y., U.S.A., Consulting Chemist.
1893. Allerton, Rt. Hon. Lord, F.R.S., (Journals) Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
O.M. Allhusen, A., (Jnls.) W. Russell, Allhusen Works, Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., Mayfield, Balmoral, Belfast, Ireland, Chemical Works Manager.
1905. Allpass, Jas., 9, Albert Square, Manchester, Secretary.
1912. Almy, Charles, c/o American Vulcanized Fibre Co., Wilmington, Del., U.S.A., Chemical Engineer
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.
1910. Amin, Bhailal D., The Alembic Chemical Works Co., Ltd., Baroda, India, Chemical Agent.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1910. Anderson, Jas. R. V., School of Mines, Bendigo, Victoria, Australia, Lecturer in Chemistry and Metallurgy.

1900. Anderson, Jas. W., Madras Cement Works, Royapuram, India, Analytical Chemist.
1889. Anderson. Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow. Technical Chemist.
1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.
1905. Andreae, Dr. E. P., c/o British Glanzstoff Manufacturing Co.. Ltd., Flint, North Wales, Chemist.
1913. Andrews, Cecil G., c/o Messrs. W. Canning and Co., 100, Bagot Street, Birmingham. Chemist.
1907. Andrews, Chas. T., 14a, Finsbury Square, London. E.C., Chemist.
1889. Andrews, Dr. Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1912. Andrews, Ernest R., "Nutfield," Druce Road, Dulwich. S.E., Analytical and Consulting Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo. N.Y., U.S.A., Manager (Varnish Works).
1903. Anfilogoff, N. A., Christine House, High View Avenue, Grays, and (Journals) Central Wharf, Bow, E., Chemist and Petroleum Refiner.
O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1913. Annan, J. G., Elm Cottage, Addiewell, Midlothian, Chief Chemist (Mineral Oil Works).
1892. Annandale, C. J. R., Deneholme. Sunnyhurst Lane, Darwen, Lancs., Paper Maker.
1883. Annandale, Jas. H., Polton Paper Works, Midlothian, Paper Maker
1894. Ansbacher, L. A., 527, Fifth Avenue, New York City, U.S.A., Colour Manufacturer.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallugy.
1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1900. Appleyard, Geo. H., Arnold House, Burton Road, Hornsea, East Yorks, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 38, Whitebirk, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., Sandhutton, Hill Lane, Blackley, Manchester. Manager of Chemical Works.
1901. Ardagh, Edw. G. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.
1900. Ardern, Edw., Holmleigh Queen's Road, Urmston, Manchester, Chemist.
1907. Armstrong, Chas. F., c/o Cawnpore Sugar Works, Ltd., Marhourah Factory P.O., Chupra, Sarun, India, Technical Chemist.
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, 27, Eastern Avenue, Reading, Works Chemist.
1912. Armstrong, Prof. H. E., F.R.S., 55, Granville Park, Lewisham, S.E., Professor of Chemistry.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1911. Arnold, Prof. J. O., F.R.S., The University, St. George's Square, Sheffield, Prof. of Metallurgy.
1899. Arnott, Dr. G. W. Campbell, c o Fertiliser Manufacturers' Association, 79, Mark Lane, London, E.C., Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1912. Arny, H. V., 115, West 68th Street, New York City, U.S.A., Teacher and Chemist.
1911. Asahina, Koju, Uyeda Sericulture College, Uyeda, Shinano, Japan, Chemist.
1901. Asano, K., Ashio Copper Mine, Shimozuke, Japan, Consulting Mining Chemist.
1906. Ash, Chas. S., 180. Townsend Street, San Francisco, Cal., U.S.A., Chemist.
1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.
1903. Ashley, Frank R., c o Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Manufacturing Chemist.
1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1908. Ashworth, D. Irving. P.O. Box 38, Wappingers Falls, N.Y., U.S.A., Chemist.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11. Neville Street, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 34. Chorley New Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Box 40, P.O., Wellington, New Zealand, Chemist.
1891. Atkins, C. E., The Heath, Redbourn, Herts., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1912. Atkinson, F. C., 1864, Gent Avenue, Indianapolis, Ind., U.S.A., Chemist.
1911. Atkinson, James E., The Sheffield Testing Works, Ltd., Blonk Street, Sheffield, Analytical Chemist
1900. Atkinson, Jno. W., 310, Sansome Street, San Francisco, Cal., U.S.A., Manager, Union Sugar Co.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1901. Auden, Dr. H. A., 13, Broughton Drive, Grassendale, Liverpool, Chemist.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1911. Austin, Fred. J., 343, Sixth Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1913. Austin, Wm. L., 113, Church Lane, Charlton, S.E., Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist.
1902. Avery, D., 461, Barker's Road, Kew, Melbourne, Vic., Australia, Teacher of Chemistry.
1910. Ayers, Gilbert F., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

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1908. Babington, Fred. W., Customs Laby., Customs Dept., Ottawa, Canada, Analyst.
1912. Bacon, Charles V., 136, Liberty Street, New York City, U.S.A., Consulting and Analytical Chemist.
1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1911. Baddiley, James, c/o Levinstein, Ltd., Crumpsall Vale Chemical Works, Blackley, Manchester, Research Chemist.
1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, Harmony Park, Yonkers, N.Y., U.S.A., Research Chemist.
1912. Bagley, Fred. P., c o George H. Morrill Co., Norwood, Mass., U.S.A., Ink Manufacturer.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885 Bailey, Edwin M., Almond Hill, Pumpherston, Mid Calder, Scotland, Technical Chemist.

1908. Bailey, F. W., Overstone, Robertson Road, Buxton.

1883. Bailey, Dr. G. H., Kinlochleven, Argyll, Scotland, Chemist.

1903. Bailey, Harold J., 10, Park Road, Pendleton, Manchester, Alkali Inspector.

1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.

1888. Bailey, Dr. T. Lewis, 13, St. Alban's Road, Swansea, H.M. Inspector of Alkali Works.

1910. Baillie, Dr. Thomas B., 16, Birchdale Road, Waterloo, Liverpool, Analytical Chemist (Love Lane Sugar Refinery).

1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.

1911. Bainbridge, Edmund F., c/o American Alkali and Acid Co., Bradford, Pa., U.S.A., Chief Chemist.

1911. Baird, Douglas H., 14, Cross Street, Hatton Garden, London, E.C., Scientific Instrument Maker.

1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.

1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.

1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.

1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.

1903. Baker, Arthur, Mount Nod, Greenhithe, Kent, Chemist.

1910. Baker, C. Kerslake, 16, Change Alley, Sheffield, Analytical Chemist.

1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.

1901. Baker, F. Guy Stirling, The Brewery, Chiswell Street, London, E.C., Brewer's Chemist.

1909. Baker, Frank, c/o Nobel's Explosives Co., Ardeer, Stevenston, Ayrshire, Chemist.

1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.

1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.

1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.

1909. Baker, Robert P., Ivydene, Bexley, Kent, Technical Chemist.

1886. Baker, Theodore, 705, Du Pont Building, Wilmington, Del., U.S.A., Analytical Chemist.

1910. Baker. Dr. Thos., Westville, Doncaster Road, Rotherham, Chemist and Metallurgist.

1912. Balch, Prof. Alfred W., 416, Huntington Avenue, Boston, Mass., U.S.A., Professor of Biological Chemistry.

1912. Baldracco, Prof. Dr. Giacinto, Conceria Scuola Italiana, Via Amedeo Peyron 4, Turin, Italy, Leather Trades Chemist.

1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.

1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).

1903. Ball, S. F., 289, East 201st Street, New York City, U.S.A., Analytical Chemist.

1912. Ball, Walter W., "Sunnyside," Daybrook, Notts, Dyer.

1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.

O.M. Ballard, Edw. G., 6, Grey Friars, Chester, Alkali Works Inspector.

1910. Baly, Prof. E. C. Cyril, 14, Sunnyside, Prince's Park, Liverpool, Professor of Inorganic Chemistry.

O.M. Bamber, H. Kelway, Outram House, Addiscombe, Surrey, Consulting Chemist.

1891. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Manager.

1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.

1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.

O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.

1890. Banks, Jno. H., 80, Maiden Lane, New York City, U.S.A., Mining Engineer.

1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).

O.M. Bannister, W., Burvale, Watford, Herts, Manufacturing Chemist.

1910. Barbary, J. Ewart, "Vellansaundry," Camborne, Cornwall, Explosives Chemist.

1909. Barber, C. Douglas, Great Nelmes, Hornchurch, Essex, Chemist.

1908. Barber, Percy S., The Reform Food Stores, 84, Whitechapel, Liverpool, Chemist.

1901. Barber, Capt. René R., c/o Wm. Barber and Bros., Georgetown, Ont., Canada, Analytical Chemist.

1911. Barclay, Andrew, Oficina Anita, Antofagasta, Chile, Chemist.

1912. Barclay, William R., 50, Upper Albert Road, Meersbrook, Sheffield, Manager of Electroplate Factory and Lecturer in Electro-Metallurgy.

1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.

1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.

1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.

1912. Barker, Dr. Jonathan, 18, Sandon Street, Liverpool, Chemist.

1905. Barker, Perry, 93, Broad Street, Boston, Mass., U.S.A., Chemist.

1909. Barker, Richard F., Adams, N.Y., U.S.A., Chemist.

1895. Barlow, Clinton W., 104—112, East 25th Street, New York City, U.S.A., Merchant.

1901. Barlow, John J., Broadway, Accrington, Calico Printer's Chemist.

1899. Barlow, Wm., 2, Delamere Street, Higher Openshaw, Manchester, Analytical Chemist.

1908. Barnes, Alfred, Box 556, Pretoria, Transvaal, Dealer in Minerals.

1906. Barnes, A. G., c/o Hasland Coking Co., Grassmoor Collieries, Chesterfield, Colliery Proprietor.

1905. Barnes, F. V., Gas Works, Todmorden, Engineer and Manager.

1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.

1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.

O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.

1912. Barnett, E. de Barry, University College, Gower Street, London, W.C., Chemist.

1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.

1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).

1904. Baron, Wm. Briscoe, c/o Vulcan Boiler and General Insurance Co., Ltd., 26, Pall Mall, Manchester, Chemist.

O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.

1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.

1890. Barrett, Arthur A., 139, Viale San Martino, Messina, Sicily, Manufacturer of Essential Oils.

1907. Barrett, John H., 111, Adelaide West, Toronto, Canada, Superintendent.

1907. Barrett, Maurice, The Leeds Fireclay Co., Ltd., Burmantofts Works, Leeds.

1912. Barrow, Jas. V., c/o Messrs. W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Works Chemist.

1900. Barrow, Jos., "Woodhey," Malford Grove, South Woodford, N.E., Chemist.

1906. Barrs, Chas. E., 3A, Downshire Hill, Hampstead, N.W., Analyst.

1905. Barry, Eugene. Ayer, Mass., U.S.A., Leather Manufacturer.

1893. Barton, G. E., 227, Pine Street, Millville, N.J., U.S.A., Technical Chemist.

1903. Bartrip, Geo. F., 21, Willow Avenue, Edgbaston, Birmingham, Managing Chemist.

1905. Baruch, Edgar, 805-806, Wright and Callender Building, Los Angeles, Cal., U.S.A., Chemical Engineer.
1910. Barwick, F. W., Chamber of Commerce Testing House, Royal Exchange, Manchester.
1909. Barzano, Carlo, 24, Via Bagutta, Milan, Italy, Patent Agent.
1895. Baskerville, Dr. Chas., College of the City of New York, New York City, U.S.A., Professor of Chemistry.
1910. Bassett, Frank L., 73, St. Julian's Farm Road, West Norwood, S.E., Analyst.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Professor Henry, University College, Reading, Prof. of Chemistry.
1899. Bassett, Wm. H., Main Street, Cheshire, Conn., U.S.A., Chemist.
1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H., Eridge, Shooter's Hill, Woolwich, S.E., Chemist.
1912. Bates, D. M., Lewiston Bleachery and Dye Works, Lewiston, Maine, U.S.A., General Manager.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1910. Battye, Horace G., 28, Roman Place, Street Lane, Roundhay, Leeds, Chemist and Works Manager.
1903. Baty, E. J., c/o Thermoelectric Ore Reduction Corporation, Cobden Street, High Town, Luton, Beds, Chemist.
1903. Bauer, Geo. W., 660, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1910. Baxter, F. Stanley, 119, Albert Street, Regent's Park, London, N.W., Chemist.
1913. Baxter, Harold R., c/o Aktiebolaget J. and G. Cox, Ostrahamingatan 17, Gothenburg, Sweden, Manager (Glue Works).
1898. Baxter, John G., Riverview, Burch Road, Rosherville, Gravesend, Kent, Chemist.
1912. Bayley, Francis P., c/o F. S. Bayley, Clanahan, and Co., 79, Mosley Street, Manchester, Chemical Merchant.
1911. Bayliss, Thos. R., Belmont, Northfield, Birmingham, Mechanical Engineer and Managing Director.
1899. Bayly, Francis W., Assayer.
1908. Bayly, Percival G. W., Mines Dept. Laby., Spring Street, Melbourne, Victoria, Government Metallurgical Chemist.
1897. Beadle, Alec A., Donington Dene, Newbury, Berks, Electro-Chemist.
1886. Beadle, Clayton, Oakbank, Lansdown Road, Sidcup, Kent, Consulting Chemist.
1912. Beard, John, 17, Trearddur Square, Holyhead, Assistant Cashier, Marine Dept., L. & N.W.Ry.
1911. Beard, Stanley D., Lederle Antitoxin Laboratories, Pearl River, N.Y., U.S.A., Biological Chemist.
1907. Beardsley, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1909. Bearpark, Arthur F., Delmore, Transvaal, South Africa, Works Manager.
1908. Beasley, Fred. G., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.
1905. Beasley, Jno. K., c/o The Borneo Co., Kuching, Sarawak, Metallurgical Chemist.
1897. Beaver, Chas. J., Rangemoor, Crescent Road, Hale, Cheshire, Chemist.
1905. Beckers, Dr. Wm., 105, Underhill Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1909. Becket, Fredk. M., 31, Sugar Street, Niagara Falls, N.Y., U.S.A., Chief Metallurgist, Electro Metallurgical Co.
1912. Beckett, Dr. E. G., Hartford, South Beach Road, Ardrossan, Ayrshire, Analytical Chemist.
1899. Bedford, Alf. C., 26 Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1911. Bedforth, G. E., Aspley Dyeware Mills, Huddersfield, Works Chemist.
O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beevers, Clifford J., 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.
1899. Behr, Dr. Arno, 2944, Avalon Avenue, Berkeley, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.
1912. Belaïew, Captain Nicolai, Chem. Laby., Michael Artillery Academy, St. Petersburg, Russia, Lecturer in Metallurgy and Chemistry.
1906. Belden, A. W., U.S. Bureau of Mines, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Coke Expert.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., c/o Bank of Montreal, Montreal, Canada, Chemist.
O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Defence Dept., Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme, Manchester, Manufacturing Chemist.
1903. Benham, Keith, The Woodlands, Rowley Park, Stafford, Analytical and Consulting Chemist.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1899. Bennett, Alex. H., Via Giuseppe La Farina, Messina, Sicily, Chemist.
1907. Bennett, H. Garner, 10, Shaftesbury Villas, Beverley, Yorks, Leather Chemist.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1909. Benson, George F., Edwardsburg Starch Co., Cardinal, Ontario, Canada, President and Managing Director.
1906. Benson, Richard W., c/o Geo. Cradock and Co., Wakefield, Yorks, Analytical Chemist.
1912. Bent, Leavitt N., c/o Independent Powder Co. of Mo., Joplin, Mo., U.S.A., Manager.
1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 30, Manley Road, Whalley Range, Manchester, Technical Chemist.
1912. Bergius, Dr. Friedrich, Parkstrasse 1, Hannover, Germany, Privatdozent.
1912. Beringer, C. R., Magyar Onmüvek, Nagyteleny, Hungary, Assayer.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C. Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1908. Berlinerblau, Dr. Joseph, 8, Szpitalna Street, Warsaw, Russian Poland, Industrial Chemist.
1900. Bermingham, Jno., jun., 417, Mills Building, San Francisco, Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.
1897. Berry, Albert E., Abbotsleigh, Wanstead, Essex Works Manager.
1911. Berry, Arthur G. V., c/o Messrs. B. and R. Redwood, 4, Bishopsgate, London, E.C., Analyst.
1906. Berry, Arthur J., 11, Regent Street, Cambridge, Chemist.
1883, Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.

1889. Berry, G. F., 9, Musgrove Road, Jerningham Road New Cross, S.E., Chemical Works Manager.

1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.

1909. Beskow, K. J., Södra Storgatan 19, Helsingborg, Sweden, Head Engineer.

1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.

1901. Betts, Anson G., Stackhouse, N.C., U.S.A., Chemist.

O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.

1900. Bevan, Jno. W., Morriston Spelter Works, Morriston, R.S.O., Glamorgan, Manager of Metallurgical Works.

O.M. Beveridge, Jas., Springfield House, Chatham, N.B., Canada, Pulp and Paper Manufacturer.

1909. Bewick, R. M., Rose Cottage, Corston, Bristol, Traveller.

1909. Beynon, Donald E., 80, Hogarth Avenue, Toronto, Canada, Chemist.

1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.

1896. Bibby, John, c/o J. Bibby and Sons, Formby Street, Liverpool, Chemist.

O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.

1907. Bickerstaffe, Robt., c/o Thomas and Green, Ltd., Soho Mills, Wooburn Green, S.O., Bucks., Chemist.

1903. Bierwith, L. W., c/o Du Pont Powder Co., Haskell, N.J., U.S.A., Civil Engineer.

1910. Bigelow, Chas. A., c/o General Chemical Co., Bayonne, N.J., U.S.A., Superintendent.

1912. Bigelow, Edward P., Mellin's Food Library, 221, Columbus Avenue, Boston, Mass., U.S.A., Chemist.

1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, Scotland, Analytical Chemist.

1891. Biggart, Wm. L., Rossarden, Kilmalcolm, Scotland, Public Analyst.

1911. Biggins, J. E., c/o Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.

1910. Biggs, J. W. H., 318, High Street, Plumstead, S.E., Chemist.

O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.

1896. Billington, Chas., Heimath, Porthill, Longport, Staffordshire, Metallurgist.

1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.

1896. Bird, Arthur W., c/o S. Berger and Co., Bromley-by-Bow, E., Works Engineer.

1907. Bird, Charles S., jun., Messrs. F. W. Bird and Son, Library Dept., East Walpole, Mass., U.S.A., Paper Maker.

1896. Bird, Jno. B., 3, Brookside, Cambridge, Manure Manufacturer.

1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts., Analytical Chemist.

1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.

1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.

1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.

1884. Bishop, Fred., c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.

1903. Bishop, Howard B., 1372, Union Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.

1905. Bixby, Willard G., 46th Street and 2nd Avenue, Brooklyn, N.Y., U.S.A., Blacking Manufacturer.

1905. Bjerregaard, A. P., 10724, Kimberley Avenue, Cleveland, Ohio, U.S.A., Varnish Chemist.

1912. Björnström Steffanson, G., P.O. Box 51, Windsor Mills, Quebec, Canada, Consulting Engineer.

1909. Blacher, Prof. Carl, Polytechnicum, Riga, Russia, Chemical Engineer.

1904. Black, J. Wyclif, 67, Falcon Road, Edinburgh, Analytical Chemist.

1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.

1910. Blackie, Archibald, 223, James Street, Winnipeg, Canada, Chemist.

1894. Blackmore, H. S., P.O. Box 145, Mount Vernon, N.Y., U.S.A., Industrial Chemist.

1896. Blagden, Victor, 4, Lloyd's Avenue, London, E.C., Chemical Merchant.

1883. Blagden, W. G., Down Lodge, East Harting, near Petersfield, Hants, Chemical Merchant.

1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.

1910. Blakeley, A. G., P. and R. Coal and Iron Co., Pottsville, Pa., U.S.A., Chemist.

1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.

1913. Blanc, E. R., c/o I. Levinstein and Co., Inc., 115, 5th Street, Chelsea, Mass., U.S.A., Chemist.

1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.

1908. Blichfeldt, S. H., Merston House, South Road, Southall, Middlesex, Bacteriologist and Fermentation Chemist.

1905. Bliss, H. J. W., United University Club, Pall Mall East, London, S.W., Chemist.

1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.

1908. Blomeley, Adam Y., c/o Arbuckle Bros. Sugar Refinery, Brooklyn, N.Y., U.S.A., Chemist.

1891. Bloomer, Fred J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.

1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.

1888. Bloxam, A. G., 29, Southampton Buildings, Chancery Lane, London, W.C., Chemist and Patent Agent.

1890. Bloxam, Prof. W. Popplewell, 15, Crescent Mansions, Elgin Crescent, Holland Park, London, W.

1903. Blumenthal, Lionel, Ravensholme, Merry Bower Road, Broughton Park, Manchester, Chemist.

1886. Blundstone, E. R., 79, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.

1908. Blyth, Jas. R., c/o Penketh Tannery Co., Penketh, near Warrington, Leather Trades Chemist.

1906. Blyth, M. Wynter, Lacton House, Tankersley, near Barnsley, Yorks, Analytical and Consulting Chemist.

1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.

1908. Blythe, Fred. C., Homelands, Alderley Edge, Cheshire, Chemical Manufacturer.

O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.

1888. Boake, Edmund J., Widford Lodge, Chelmsford, Essex, Manufacturing Chemist.

1912. Boan, Robt., Laboratory, Government Railway Offices, Spencer Street, Melbourne, Vic., Australia, Engineer-in-charge.

1899. Boehm, Fred., 66, Crutched Friars, London, E.C., Chemical Agent and Merchant.

1910. Boehringer, Dr. R., 79, Milford Avenue, Newark, N.J., U.S.A., Chemist.

1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Professor of Organic Chemistry.

1903. Boissevain, Chas. E. H., 92, Van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.

1903. Bolam, Dr. H .W., Queen Margaret College, Glasgow, Lecturer on Chemistry.

1909. Bolden, Wm., Dalmellington Iron Works, Dunaskin, Ayrshire, Chemist.

1901. Bolton, E. Richards, 16, Flanchford Road, Shepherd's Bush, W., Manufacturing Chemist.

1905. Bond, John, Crowlands, Southport, Engineer,

1905. Bond, Josiah, Alto, Arizona, U.S.A., Mining Engineer.

1912. Bone, S. C., Thorn Lea Villa, Cornholme, Todmorden, Lancs., Chemical Works Manager.

1905. Bone, Dr. W. A., F.R.S., Imperial College of Science and Technology, South Kensington, London, S.W., Professor of Chemical Technology.

1892. Bookman, Dr. S., 46, East 82nd Street, New York City, U.S.A., Chemist.

1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.

1912. Boorne, Wm. H., 54, Elderton Road, Westcliff-on-Sea, Essex, Metallurgist.

1908. Booth, Jos. W., Atlantic Mills, Providence R.I., U.S.A., Superintendent.

1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.

1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.

1897. Borland, C. R., Concord, Mass., U.S.A., Smokeless Powder Manufacturer.

O.M. Borland, W. D., Beacon Lodge, Bean, *viâ* Dartford, Kent, Manufacturer of Explosives.

1906. Bornett, Siegfried, Andreaskloster 12, Cöln, Germany, Technical Chemist.

1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.

1908. Bose, R., 92–95, Upper Circular Road, Calcutta, India, Chemical Works Manager.

1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.

1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.

1912. Boswell, Maitland C., Chemistry and Mining Building, University of Toronto, Canada, Lecturer on Organic Chemistry.

O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.

1890. Bott, Dr. W. Norman. *See* Norman-Bott, Dr. W.

1884. Böttinger, Dr. H. T. von, Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Colour Manufacturer.

1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.

1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.

O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.

O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, London, N., Manager.

1905. Bourne, Lyman M., c/o Goodyear Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.

1910. Bowater, J. W., Woodville, Beeches Road, West Bromwich, Works Manager.

1905. Bowen, Henry, 776, Main Street, East Aurora, N.Y., U.S.A., Secretary.

1906. Bowen, Ralph A., c/o National Aniline and Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.

1885. Bowen, S. B., "Caeffair," Llanelly, South Wales, Chemical Manufacturer.

1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.

1909. Bower, Joshua, c/o Kynoch, Ltd., Arklow, Co. Wicklow, Ireland, Chemist.

1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.

1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.

1899. Bowley, J. Plunkett, 36, Argyll Mansions, Chelsea, London, S.W., Varnish Manufacturer.

1908. Bowman, Fred. C., 420, West 118th Street, New York City, U.S.A., Chemist.

1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.

1907. Bowman, Richard S., Raglan House, Victoria Road, West Hartlepool, Chemist.

1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.

1904. Boyce, Framroze H., 86, Hugh's Road, Chaupaty, Bombay, India, Technical Chemist.

1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.

1910. Boyee, James, 225, West 18th Street, Chicago, Ill., U S A., Chemist.

1909. Boyd, Dr. Harold de H., c/o The Southern Cotton Oil Co., Trafford Park, Manchester, Chemist.

1913. Boyd, Robert, c/o British Columbia Sugar Refining Co., Ltd., Vancouver, B.C., Canada, Chemist.

1909. Boyd, T. D., jr., Los Mochis, Sinaloa, Mexico, Sugar Refiner.

1913. Boyer, Wm. F., 2082, East Cumberland Street, Philadelphia, Pa., U.S.A., Chemist.

1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos Belemzinho, Sao Paulo, Brazil, Chemist.

1905. Brabrook, G. Hale, Manhattan, Nevada, U.S.A., Mining Engineer.

1906. Bracegirdle, Harold W., 13, Alan Road, Withington, Manchester, Chemist.

1910. Bracewell, G. A., 20, Heaton Grove, Bradford, Analytical Chemist.

1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.

1902. Bradbury, S., Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.

1912. Bradford, Francis L. W., 213, Rotton Park Road, Edgbaston, Birmingham, Chemist and Works Manager.

1895. Bradford, Henry, Strettington, Goodwood, near Chichester, Analytical Chemist.

1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.

1891. Braithwaite, Isaac, Ghyll Close, Kendal, Westmoreland, Drysalter.

1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.

1903. Brame, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.

O.M. Bramham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.

O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.

1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produktion, Aussig, Austria, Chemical Manufacturer.

1902. Branegan, Jas. Aug., 712, North 20th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.

O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.

1903. Brassard, Fred à, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.

1912. Brasse-Brossard, L., 451, Rideau Street, Ottawa, Canada, Agricultural Engineer.

1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.

1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.

1888. Breffit, Wm., Castleton, Yorks, and (Jnls.) The Cottage, Ben Rhydding, near Leeds, Glass Manufacturer.

1908. Bregowsky, Ivan M., c/o Crane Co., 836, South Michigan Avenue, Chicago, Ill., U.S.A., Chemist.

1900. Brewis, E. T., 31 Belgrave Road, Leyton, E., Chemist.

1894. Breyer, Theodor, 725, Washington Avenue, Wilmette, Ill., U.S.A., Chemist.

1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.

1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.

1893. Briggs, J. F., Auchmuty Paper Mills, Markinch, Fifeshire, Technical Chemist.

1912. Briggs, O. W. H., Harborough Rubber Co., Day and Night Mills, Market Harborough, Rubber Works Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1910. Brisbane, James W., c/o The Leather Cloth Co., Ltd., West Ham, E., Analytical Chemist.
1905. Bristol, Dr. H. Stanley, Elmhyrst, Newport, R.I., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1912. Britland, Wm. J., Pear Tree Cottage, Alvanley, near Helsby, Cheshire, Chemist.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1910. Brodribb, Noel K. S., Cordite Factory, Maribyrnong, Melbourne, Victoria, Australia, Chemist.
1912. Bromley, Henry S., Chelten and Wissahickon Avenues, Germantown, Philadelphia, Pa., U.S.A., Lace Manufacturer.
1909. Bronnert, Dr. E., Dornach, near Mülhouse, Alsace, Germany, Artificial Silk Manufacturer.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Opium Factory, Singapore, S.S., Superintendent.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1911. Brookfield, Henry M., 2, Rector Street, New York City, U.S.A., Glue Manufacturer.
1895. Brookman, Fred. W., Dewhirst, Syke, and (Jnls.) Sanitary Works, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o M. M. Simau, Benkoelen, Sumatra, Ned. Indies, Metallurgist.
1909. Brooks, Theodore, Guantanamo, Cuba, Cane Sugar Manufacturer.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1911. Brothers, Horace E., 12, St. Mary's Road, Crumpsall, Manchester, H.M. Inspector of Factories.
1909. Brothers, Wm., Meadow House, Tunstead Milton, near Whaley Bridge, Derbyshire, Chemical Manufacturer.
O.M. Brotherton, E. A., City Chambers, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., Hudson Bay Mine, Cobalt, Ont., Canada, Metallurgist.
1891. Brown, Cæsar R., 141, Victoria Avenue, Prittlewell, near Southend, Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1910. Brown, Geo Winslow, Assabet Mills, Maynard, Mass., U.S.A., Chemist.
O.M Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson and Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
1906. Brown, Percy S., c/o B. O. Bowers Co., 136, Liberty Street, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, Fisher Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 215, East Fayette Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C. *See* Cave-Browne-Cave, E. J.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1902. Brownsdon, Dr. H. W. King's Norton Metal Co., Ltd., King's Norton, Birmingham, and (Jnls.) 109, Oxford Road, Moseley, near Birmingham, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1911. Bruce, Joseph, Jnls. to General Manager, Cape Explosives Works, P.O., Dynamite Factory, West Somerset, Cape Colony, Secretary.
1908. Bruce, Robert, c/o Clark, 191, Morningside Road, Edinburgh, Works Chemist.
1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., and (Jnl.) c/o T. C. Allchin, Longfield, Kent, Director.
1892. Bruckmann, G. T., 109, 22nd Street, West New York, N.J., U.S.A., Chemical Engineer.
1911. Brunet, Louis, "Revue Générale des Sciences," 18, Rue Chauveau-Lagarde, Paris VIII, France, Chemist and Secretary.
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond, and Co., Ltd., Caxton House, Westminster, S.W., Chemical Manufacturer.
O.M. Brunner, Rt. Hon. Sir J. T., Bart., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond, and Co., Ltd., Northwich, Cheshire, Chemical Manufacturer.
1910. Brunner, Dr. Philipp, 2, Via Ghega, Trieste, Austria, Merchant.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, Scotland, Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.
1908. Bryce, Chas. C., 43-45, Great Tower Street, London, E.C., Merchant.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, Scotland, Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o La Associacion Salitrera de Propaganda, Iquique, Chili, Analyst.
1908. Buchanan, Duncan G., 27, Woodlawn Avenue East, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, John L., Braehead, Mill Road, Bromborough, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, Scotland, Chemist.
1910. Buchanan, Walter G., c/o Lautaro Nitrate Co., Taltal, Chile, Chemist.

1897. Buck, Chas. A., 521, Locust Street. South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).

1906. Buckie, Robert H., c/o West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Works Chemist.

1911. Budde, Dr. Carl, 1, Belford Road, Sunderland, Chemical Engineer.

1909. Buell, W. H., c/o Winchester Repeating Arms Co., New Haven, Conn., U.S.A., Chemist.

1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.

1902. Bull, Irving C., 100, Maiden Lane, New York City. U.S.A., Chemist.

1899. Bult, Herbert J., 140, Fenchurch Street, London. E.C., Chemist.

O.M. Bumby, H., Bellevue, Sandbach, Cheshire, Iron and Chemical Works Director.

O.M. Bunker, H. E., 310, Kingston Road, Toronto, Ont., Canada, Technical Chemist.

1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.

1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.

1910. Burbridge, Walter N., "Uplands," Foxley Lane, Upper Woodcote, Purley, Surrey, Analytical Chemist.

1896. Burford, Samuel F., The Ridgeway, Rothley, near Leicester, Analytical Chemist.

1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.

1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.

1889. Burgess, Geo., Sydney Cottage, Halebank, Widnes, Chemist.

1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.

1902. Burkard, Dr. Ernst, Solothurn, Switzerland, Chemist.

1899. Burkhardt, Dr. G. A., Württembergischestrasse 32, Berlin, W. 15, Germany, Chemist.

1897. Burland, Lt.-Col. Jeffrey, H., c/o Fraser Library, Montreal, Canada, Paper and Card Manufacturer.

1898. Burls, Herbert T., 2, Verulam Buildings, Gray's Inn, London, W.C., Mechanical Engineer.

1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith. W., Manager.

1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks, Sulphuric Acid Maker.

1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.

1909. Burnett, Arthur, c/o The Premier Waterproof and Rubber Co., Ltd., Bromley Street, Dantzic Street, Manchester, Chemist.

1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.

1900. Burnside, Chas. F., Du Pont Building, Wilmington, Del., U.S.A., Chemist.

1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.

O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.

1910. Burrell, Keith, Burrell's Wharf, Millwall, London, E., Analytical Chemist.

1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth. S.E., Rectifier.

1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.

1912. Burt-Gerrans, J. T., 46, Dewson Street, Toronto, Canada, Electro-Chemist.

1901. Burton, Alf., Canadian Dyers' Association, 2–16, Liberty Street, Toronto, Canada, Dyer and Finisher.

1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.

1904. Burton, T. R., c/o Scott, Greenwood, and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.

1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.

1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.

1913. Bush, Dr. Harry T., c/o Huntington, Heberlein, and Co., Ltd., 3, Lombard Street, London, E.C., Chemical Engineer.

1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.

1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.

1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.

1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.

1905. Butler, Dr. T. H., c/o Wm. Butler and Co., Ltd., Crews Hole, Bristol, Chemist (Tar and Rosin Distillery).

1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.

O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.

1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.

1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) 121, 59th Street, Oakland, Cal., U.S.A., Metallurgist.

1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.

1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.

O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado 8, Bilbao, Spain, Technical Chemist.

1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.

1899. Byrnes, Dr. Eugene A., 918, F. Street N.W., Washington, D.C., U.S.A. Patent Lawyer.

1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.

1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 940, Old South Building, Boston, Mass., U.S.A., Manufacturing Chemist.

1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1906. Caddick, Arthur, Minas de Rio Tinto, Huelva, Spain, Works Chemist.

1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.

1905. Cain, Dr. J. C., 24, Aylestone Avenue, Brondesbury Park, N.W., Colour Chemist.

1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.

1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.

1907. Caistor, J. W. Y., "Culverhay," Paignton, South Devon, Chemist.

1891. Caldecott, W. A., Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.

1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.

1897. Calder, W. A. S., 449, Hagley Road, Birmingham, Chemical Manufacturer.

1908. Caldwell, Dr. Robert J., Coventry House, Wilton Avenue, Southampton, Chemist and Works Manager.

1912. Caldwell, Wallace L., 1025½, North 24th Street, Birmingham, Ala., U.S.A., Engineering Chemist.

1888. Caldwell, Wm., Murray Street, Paisley, Scotland, Drysalter.

1912. Callan, Dr. Thomas, Bridge of Weir Leather Co., Bridge of Weir, Renfrewshire, Technical Chemist.

1902. Cahn, Dr. Chas. E., California Club, Los Angeles, Cal., and (Juls.) P.O. Box 1517, New York City, U.S.A., Manufacturing Chemist.

1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.

1895. Cambier, Jacob, 1401, Carteiot Avenue, Pueblo, Colo., U.S.A., Chemist.

1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.

1908. Cameron, Wm., Balik Pappan, Koetei, Fast Borneo Sugar Refinery Manager.

O.M. Cammack, J., 34, Wolseley Road, St. Helens, Lancashire, Technical Chemist.

1910. Campagne, Emile, Usine de Radet, Maule (Seine et Oise), France, Chemical Engineer.

1886. Campbell, Andrew, 51, Cluny Drive, Edinburgh, Chemist (Mineral Oil).

O.M. Campbell, Archibald, Fairview, Rugeley, Staffordshire, Technical Chemist.

1912. Campbell, Arthur F., "Westwood," Middleton, Manchester, Research Chemist.

1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.

1910. Campbell, James R., 57, Dacre Hill, Rock Ferry, Cheshire, Chemist.

1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1912. Campbell, Kennedy, c/o British Dyewood Co., Ltd., Parkhead, Glasgow, Chemist.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1911. Campbell, L. E., 5, St. Matthew's Avenue, Surbiton, Chemist.

1908. Campbell, Max E., Avila, Cal., U.S.A., Chemist.

1909. Campbell, Peter, Kearny, N.J., U.S.A., Linoleum Manufacturer.

1909. Campbell, Robt., The Nairn Linoleum Co., P.O. Box 32, Newark, N.J. U.S.A., Linoleum Manufacturer.

1911. Campbell, Wm. E., c/o Gutta Percha and Rubber, Ltd., O'Hara Avenue, Toronto, Canada, Industrial Chemist.

1909. Candee, Chas. N., 39, South Drive, Toronto, Canada, Rubber Manufacturer.

1908. Canning, Ernest R., 137, Great Hampton Street, Birmingham, Manufacturer.

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, London, E.C., Distiller.

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, W. Gordon, c/o The Salt Union, Ltd., Weston Point, Runcorn, Cheshire, Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming, and Co., Rangoon, Burmah, East India Merchant.

1907. Carlitz, Joseph S., 159, North Second Street, Philadelphia, Pa., U.S.A., Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1897. Carnell, Wm. C., 2136, North Camac Street, Philadelphia, Pa., U.S.A., Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin, Germany, Analytical Chemist.

1893. Carpenter, Dr. C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1908. Carpenter, Edwin P., Culvert Works, Sheepcote Lane, Battersea, S.W., Manager of Casein, Ltd.

1909. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1909. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

O.M. Carpenter, R. Forbes, 30, Buckingham Mansions, 359, West End Lane, West Hampstead, N.W., Ex-Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughs, Wellcome, and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1907. Carrier, C. F., jun., Sewaren, N.J., U.S.A., Manufacturing Chemist.

1904. Carter, A., Cuba Street Petone Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., 4923, Osage Avenue, Philadelphia Pa., U.S.A., Chemist.

1895. Carter, Stewart F., P.O. Box 34, Wappingers Falls, N.Y., U.S.A., Technical Chemist.

1903. Carter, Thomas, West End View, Ravensthorpe, Dewsbury, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1911. Carty, Ronald D., The Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1903. Caspari, Dr. W. A., Usines de Persan, Persan-Beaumont, France, Chemist and Physicist.

1899. Castro, J. Paul de, 1, Essex Court, Temple, London, E.C., Barrister-at-Law.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1909. Caulkin, Howard A., Mona Villa, Spencer Road, Belper, Analyst.

1906. Cave-Browne-Cave, E. J., Station Road, Brimington, Chesterfield, Works Chemist.

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

O.M. Cawley, G., 82, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, Ltd., New Bedford Road, Luton, Gelatin Manufacturer.

1906. Chadsey, Stanley B., 476, Brunswick Avenue, Toronto, Canada, Chemist.

1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.

1912. Chadwick, Walter W., 186, Wellington Street North, Hamilton, Ont., Canada, Chemist.

1910. Chakraborty, J., The Oriental Soap Factory, Goabagan, Calcutta, India, Technical Director.

1910. Challinor, Richard W., Chemical Laboratory, The Technical College, Sydney, N.S.W., Australia, Teacher of Chemistry.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 641, West Prairie Avenue, Decatur, Ill., U.S.A., Chemist.

1910. Chambliss, Prof. Hardee, Dept. of Chemistry, Oklahoma A. and M. College, Stillwater, Oklahoma, U.S.A., Professor of Chemistry.

O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

1912. Chance, Clinton F., Messrs. Chance and Hunt, Ltd., Oldbury, near Birmingham, Managing Director.

1909. Chance, Edwin M., 1200, Mahantongo Street, Pottsville, Pa., U.S.A., Chemist.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.

1912. Chandler, Lee L., Research Laboratory, Pittsburgh Plate Glass Co., Creighton, Pa., U.S.A., Assistant.

1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks, Analytical Chemist.

1890. Chapman, A. Chaston, 8, Duke Street, Aldgate, E.C., Analytical Chemist.

1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.

1906. Chapman, E. A., c/o Robert Heath and Sons, Ltd., Norton Works, Stoke-on-Trent, Works Chemist.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 3, Bedford Road, South Tottenham, N., Consulting Chemist.

1912. Charlton, H. W., Patent Office, Dept. of Agriculture, Ottawa, Canada, Chemical Patent Examiner.

1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1910. Chattopadhaya, P.C., 90, Maniktala Main Road, Harrison Road P.O., Calcutta India, Chemist.
1905. Cheeseman, Frank P. 100, William Street, New York City, U.S.A., Paint Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1894. Cheney, John P., Messrs. Cheney Bros., South Manchester, Conn., U.S.A., Chemist and Silk Manufacturer.
1913. Chiaraviglia, Dr. Dino, Via Treviso 7. Rome, Italy, Director Royal Explosives Laboratory.
1905. Chick, Oliver, 31, Auckland Road, Cranbrook Park, Ilford. Essex, Analytical Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.
O.M. Christie, J., Levenfield, Alexandria. Scotland, Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1908. Christie, Malcolm, Ardenlea, Portland Park, Hamilton, Scotland, Analytical Chemist.
1910. Christie, Dr. M. G., c/o The Otto-Hilgenstock Coke Oven Co., Tingley, near Wakefield, Assistant General Manager.
1898. Christison, Geo., 2, Kelvinside Gardens, Glasgow, Engineer.
1907. Christopher. George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's and Harvey. Ltd., Cliffe at Hoo, Kent, Research Chemist.
O.M. Church, Sir Arthur, K.C.V.O., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 27, Cedar Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U S.A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1896. Claflin, Alan A., (Communications) 88, Broad Street, Boston ; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1909. Claflin, Albert W., 190, Waterman Street, Providence, R.I., U.S.A., Manufacturing Druggist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., 20, Hornsey Road, Anfield, Liverpool, Technical Chemist.
1905. Clapp, Geo. A., 49, Federal Street, Boston, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o B. P. Clapp Ammonia Co., Providence, R.I.. U.S.A., Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, Holmdale, Camberley, Surrey, Teacher of Science.
1905. Clark, Alfred N., 920, North Washington Avenue, Lansing, Mich., U.S.A., Technical Chemist and Engineer.
1913. Clark, A. Stanley, c/o Messrs. S. Pearson and Son, The Refinery, Minatitlan, Vera Cruz, Mexico, Technical Chemist.
1910. Clark, A. W., c/o Heath and Milligan Manufacturing Co., 1832, South Canal Street, Chicago, Ill., U.S.A., Superintendent.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1908. Clark, Chas. T., 1303, Sixth Street. Bay City, Mich., U.S.A., Manufacturing Chemist.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky.. U.S.A., Professor of Chemistry.
1910. Clark, Henry, 25, Adelaide Crescent, Brighton, Oil Refiner.
1909. Clark, Hubert A., 83, Amherst Street, Montreal, Canada, Canner.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
1906. Clark, Wm. B., 11, Fox Street Greenock, Chemist.
1907. Clark, Wm. H., 16, Parson Gardens, Dunston-on-Tyne, Analytical Chemist.
1912. Clark, William M., Niles Glass Works, Niles, Ohio, U.S.A., Chemist.
1904. Clarke, Alfred R., 613-617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
1908. Clarke, Arthur F., Myrtle Cottage, Guy Road, Beddington, Surrey, Analytical Chemist.
1903. Clarke, Robt. W., Avon House, Prince's Road, Buckhurst Hill, Essex, Analyst.
1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
1889. Claus, Wm. H., c/o Claus and Co., Ltd., Clayton, Manchester, Manufacturing Chemist.
O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.
1909. Clayton, Ellis, Hazeldene, Deerpark Road, Belfast, Ireland, Lecturer on Bleaching, Dyeing, and Printing.
1895. Clayton, Dr. G. C., Croughton, near Chester.
1909. Clayton, H., "The Brae," Station Road, Crayford, Kent. Technical Chemist.
1894. Clayton, Robt. H., 1, Parkfield Road, Didsbury, Manchester, Chemist.
1910. Clayton, Will, Melville House, Accrington, Works Chemist.
1905. Clayton, W. E., Royal Edward Yard, Sydney, N.S.W., Australia, Superintendent.
1907. Clement, Leonard, Beamsley, Fairhaven, near Lytham, Lancs., Chemist.
1893. Clemes, J. H., Cheriton, Newquay, Cornwall.
1912. Clemm. Dr. W. A., Chemist.
1884. Clerk, Dugald, F.R.S., 57-58, Lincoln's Inn Fields, London, W.C.. Engineer.
1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass, U.S.A., Manager (A. Klipstein and Co.).
1906. Clifford, Jos., Laboratory, Public Works Ministry Gardens, Cairo, Egypt. Chemist.
1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
O.M. Cloud. T. C., 20, Bucklersbury, London, E.C., Metallurgist.
O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C. ; and the Grange, College Road, Dulwich. S.E., Chief Chemist (L.C.C.).
1891. Clutton, J. H., Fonderie Mines de l'Aude, Villanière par Lastours (Aude), France, Assayer.
1911. Clymer, Wm. R., Publicity Division, National Carbon Co.. Cleveland, Ohio, U.S.A., Manager.
1899 Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A.. Professor of Chemistry.
1911. Coates, Jos. E., The University, Edgbaston, Birmingham, Lecturer.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Prof. Jno. W., The University, Leeds, Prof. of Coal, Gas, and Fuel Industries.
1894. Coblentz, Dr. Virgil, 23, Vine Street, Brooklyn, N.Y., U.S.A., Research Chemist (R. R. Squibb & Co.).
1899. Cochran, Alfred, 559 Madison Street, Brooklyn, N.Y., U S.A., Chemist.
1911. Cochrane, Capt. J. B., Royal Military College, Kingston, Ontario, Canada, Professor of Physics and Chemistry.

1901. Cockburn, John A., Mayville, Stevenston, Ayrshire, Analytical Chemist.
1902. Cocking, Allan T., c/o Kynoch, Ltd., Lion Works, Witton, Birmingham, Ammunition Manufacturer.
1911. Codd, Edgar, Leather Trades Review, 24, Mark Lane, London, E.C., Editor.
1905. Coes, Chas. S., 1024, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
1909. Coffey, Æneas H., 21, Cardigan Road, Richmond, Surrey, Distiller.
1903. Coggeshall, Dr. G. W., 1807, Belmont Road, Washington, D.C., U.S.A., Chemical Manufacturer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
O.M. Cohen, Dr. J. B., 1, North Grange Mount, Headingley, Leeds, Professor of Organic Chemistry.
1897. Cohn, Alfred I., 122, East 74th Street, New York City, U.S.A., Chemist.
1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Cohoe, Prof. W. P., 131, Walmer Road, Toronto, Canada, Professor of Chemistry.
1903. Colbert, W., British S.A. Explosives Co., Ltd., Modderfontein, Transvaal, Analytical Chemist.
1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.
1893. Coleman, W. H., 3, Redclyffe Road, Withington, Manchester, Chemical Engineer.
1905. Collett, John H., Summercroft, Tuffley, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.
1887. Collett, J. M., Kimsbury House, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o Braden Copper Co., Rancagua, Chile, South America, Superintendent.
1908. Collier, F. C., 457, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.
1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, Textile Chemist.
1913. Collinge, H. G., c/o Messrs. Claus and Co., Crabtree Lane, Clayton, Manchester, Technical Chemist.
1898. Collingridge, Frank, Highstone, New Road, Llanelly, South Wales, Chemist.
1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.
1888. Collins, W. Hepworth. *See* Hepworth-Collins, W.
1899. Collis, Walter T., Parkhurst, St. Peter's Road, Harborne, Birmingham, Chemist.
1910. Collitt, Bernard, Chem. Laboratory, Messrs. Ruston, Proctor, and Co., Ltd., Lincoln, Chemist.
1910. Colman, Fred. J., c/o Brotherton and Co., Ltd., Wear Tar Works, Sunderland, Chemist.
1891. Colman, Dr. H. G., Woodthorpe, New Malden, Surrey, Analytical Chemist.
1892. Colquhoun, Ludovic, Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
1894. Colquhoun, W., Tapton Close, Tapton House Road, Sheffield, Engineer.
1910. Colson, Prof. Albert, 21, Rue Descartes, Paris, France.
1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.
1906. Comber, A. W., 23, Courtenay Gardens, Upminster, Essex, Metallurgical Chemist.
1900. Comey, Dr. Arthur M., 424, East 13th Street, Chester, Pa., U.S.A., Technical Chemist.
1911. Comey, Robert H., Wenonah, N.J., U.S.A., Bleacher.
1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.
1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.
1905. Conner, Arthur B., 217, West Boulevard, Detroit, Mich., U.S.A., Chief Chemist (Detroit Chemical Works).
1883. Connor, C. C., 10, College Gardens, Belfast, Ireland, Chemist.
1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.
1889. Conroy, Dr. Jas. T., 9, The Serpentine, Grassendale, Liverpool, Chemist.
1887. Constable, W. H., Australian Alum Works, Runcorn, Analytical Chemist.
1908. Conyngham, Wm. Boulton, c/o Benger's Food, Ltd., Manchester, Pharmaceutical Chemist.
1909. Cook, E. Bernard, 23, Cross Street, Finsbury, London, E.C., Manufacturing Chemist.
O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.
1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.
1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.
1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1891. Cooke, Arthur W., 14, Tewitwell Avenue, Harrogate, Yorks, Analytical Chemist.
1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.
1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.
1910. Coombs, Frank A., Technical College, Sydney, N.S.W., Australia, Lecturer on Tanning.
1910. Cooper, Leonard H., Royal Crown Soap Co., Calgary, Alberta, Canada, Chemist.
1901. Cooper, T. S., 276, Dickenson Road, Rusholme, Manchester, Calico Printing Chemist.
1891. Cooper, Walter J., The Elms, Lavernock, South Wales, Cement Works Manager.
1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.
1899. Cornelison, Dr. Robt. W., 275, West Summit Street, Somerville, N.J., U.S.A., Consulting Chemist.
1909. Cornell, Fred, 16, Place Royal, Montreal, Canada, Chemical Merchant.
1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) Utopia, Gloucester Road, Teddington, Analytical Chemist.
1913. Cotterill, John W., 42, Temple Street, Birmingham, Analyst.
1911. Cottrell, Henry E. P., c/o North Western Cyanamide Co., 314, Winchester House, Old Broad Street, London, E.C., Manager.
1912. Coupe, Geoffrey, 43, Hampton Road, Forest Gate, E., Chemist.
1894. Cousins, W. J., 55, Clerkenwell Close, London, E.C., Consulting Chemist and Director.
1912. Couture, Philibert, 21, Pond Street, Worcester, Mass., U.S.A., Assistant Chemist.
1909. Coventry, Bernard O., Lahore, Punjab, India, Deputy Commissioner of Forests.
1903. Cowan, A. Wallace, Bayfield, Bowdon, Cheshire, Analytical Chemist.
1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.
1912. Cowan, H. W., Bell Filtration Co., Ltd., 305, Kent Building, Toronto, Canada, Water and Sewage Specialist.
1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.
1910. Coward, Hubert F., 216, Plymouth Grove, Manchester, Lecturer in Chemistry.
1897. Cowburn, Arthur W., 20, Mount Street, Manchester, Chemical Merchant and Analytical Chemist.
1907. Cowburn, J. Robert, 10, Eastwood Road, South Woodford, Essex, Technical Chemist.
1891. Cowper-Coles, Sherard Osborn, 1 and 2, Old Pye Street, Westminster, S.W., and (Jnls.) The Cottage, French Street, Sunbury-on-Thames, Metallurgical Engineer.
1905. Cox, Harold N., c/o Lalance and Grosjean Mfg. Co., Woodhaven, N.Y., U.S.A., Chemist.

1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.

1895. Craig, Dr. Thos. J. I., c/o Peter Spence and Sons, Ltd., Alum Works, Manchester, Chemist.

1908. Craig, Wm. J., c/o Rio Tinto Co., Casa Colon, Huelva, Spain, Analytical Chemist.

1911. Crake, Ralph V., British South African Explosives Co., Dynamite Factory, Modderfontein, Transvaal, Chemist.

1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.

1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.

1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks, Teacher of Chemistry.

1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.

1902. Craven, Alfred B., Northcote, Thorpe Road, Selby, Yorks, Analytical Chemist.

1906. Craven, J. A., 119, Moorside, Armley, Leeds, Chemist.

1891. Craven, Jno., The Ark, South Bersted, Bognor, Sussex, Chemist.

1906. Craven, John I., 141, Wilmer Road, Heaton, Bradford, Chemist and Salesman.

O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.

1913. Crawford, John, c/o Lothian, 21, Briar Bank Terrace, Edinburgh, Works Chemist.

1908. Crawford, Lawrence, Lugar Iron Works, Old Cumnock, Ayrshire, Analytical Chemist.

1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.

O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and Broadway Chambers, Westminster, S.W., Chemist.

1901. Cribb, Cecil H., 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.

1909. Crichton, Charles, Kleinfontein Group C.A., Box 2, Benoni, Transvaal, Assayer.

1908. Crighton, Adam M., "London Place," Agecroft Print Works, Pendleton, Manchester, Calico Printer's Chemist.

1910. Crighton, David T., Nobel House, 195, West George Street, Glasgow, Buying Manager.

1905. Crighton, W. H., c/o Ore Concentration Co., Ltd., Glebe Road, Kingsland Road, London. N.E., Chemist.

1890. Criper, Wm. R., c/o Messrs. D. Waldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.

1911. Croasdell, Jas. F., 32, Hinden Road, Lee, S.E., Engineer.

1901. Cronquist, G. W., Torckow, Sweden, Fire Brick Works Manager.

O.M. Crookes, Sir Wm., O.M., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.

1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.

O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead; (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.

1896. Crosfield, Capt. G. R., Lodge Lane, Warrington, Soap Manufacturer.

1908. Crosland, Percy F., Dyeing Department, The University, Leeds, Technical Chemist.

1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.

1894. Crossley, Prof. Arthur W., F.R.S., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.

1904. Crossley, T. Linsey, 318, Lagauchetière Street West, Montreal, Canada, Technical Chemist.

1908. Crossley, Watson, c/o Newlands Bros., 2, St. Dunstan's Hill, London, E.C., Chemist.

1908. Croston, Henry, 583, Leonard Street, Brooklyn, N.Y., U.S.A., Foreman.

1894. Crow, Henry W., Hart's Lane, North Street, Barking, E., Tar Distiller.

1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.

1906. Crowther, R. E., c/o Ferguson Bros., Ltd., Holme Head, Carlisle, Chemist.

1884. Crowther, Walter M., Chemical Works, Gomersal, near Leeds, Manufacturing Chemist.

1912. Cruikshanks, Dr. Geo. S., Royal Technical College, Glasgow.

1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.

1906. Cruser, Dr. Fred. Van D., c/o The Diamond Match Co., Barberton, Ohio, U.S.A., Chemical Engineer.

1902. Crush, E. Hope, Mines de Pétrole d'Ain-Zeft, Saint Aimé, Oran, Algeria, Technical Chemist.

1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, and (Jnls.) 612, Salisbury House, London Wall, E.C., Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.

1897. Culmann, Dr. J., c/o G. Siegle Co., Rosebank, Staten Is., N.Y., U.S.A., Chemist and Colourist.

1905. Culver, Ralph F., c/o J. R. Bancroft and Sons Co., Wilmington, Del., U.S.A., Chemist.

1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.

1912. Cuming, Wm. F., c/o Cuming, Smith, and Co. Proprietary, Ltd., Yarraville, Victoria, Australia, Manufacturing Chemist.

1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.

O.M. Curphey, W. S., 87, Canfield Gardens, South Hampstead, N.W., Chief Alkali Works Inspector.

1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.

1903. Cushing, Robt. P., 313, Saurens Street, Olean, N.Y., U.S.A., Chemist.

1902. Cutbush, Chas. G., 59, Byne Road, Sydenham, Kent, Electrical Engineer.

1899. Cutler, Fred. F., 166, Essex Street, Boston, Mass., U.S.A., Publisher.

1904. Cutts, Henry E., c/o Stillwell and Gladding, 181, Front Street, New York City, U.S.A., Technical Chemist.

D

O.M. Dacie, J. C., Soap Manufacturer (retired).

1911. Dager, Herman J., 278, Jarvis Street, Toronto, Canada, Dominion Food Inspector.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.

1908. Dale, H. Gordon, Belmore, New Barnet, Herts, Analytical Chemist.

1908. Dalton, Leonard V., 17, Gracechurch Street, London, E.C., Geologist (Petroleum).

1884. Daniell, Louis C., Royal Standard Brewery, Tamworth, New South Wales, Brewer.

1904 Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.

1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1885. Darby, Jno. H., Howard Chambers, 155, Norfolk Street, Sheffield, Ironmaster.

O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.

1911. David, Edward J., 249, Wood Avenue, Tottenville, Staten Is., N.Y , U.S.A., Chemist and Assayer.

1900. Davidson, Alex., 173, Colinton Road, Edinburgh, Analytical Chemist.

1899. Davidson, Charles, 65, Cadder Street, Pollokshields, Glasgow, Analytical Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.

1911. Davidson, Thos. A., 57, Strathyre Avenue, Norbury, S.W., Chemist and Varnish Expert.

1905. Davidson, Dr. Wm. B., City Gas Works, Nechells, Birmingham, Chemist.

1906. Davies, Harry R., 58, Hamilton Street, Readville, Mass., U.S.A., Chemist.

1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.

1907. Davies, James, 12, Harefield Road, Brockley, London, S.E., Scientific Apparatus Maker.

1912. Davies, Jas. Gordon, c/o Curtis's and Harvey, Ltd., Powder Mills, Tonbridge, Kent, Chemist.

1911. Davies, Jas. H., c/o Lever Bros., Ltd., Royal Liver Building, Liverpool, Chemist.

1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.

1886. Davies, M. L., Standard Chemical, Iron, and Lumber Co., Toronto, Canada, General Manager.

1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.

1908. Davies, T. H., c/o John Cox and Co.'s Successors, Stillhouse Lane, Bedminster, Bristol, Tanner.

O.M. Davis, A. R., 27, Wellington Road, Heaton Chapel, Stockport, Analytical Chemist.

1901. Davis, Bernard F., 19, Holligan Road, Bromley, Kent, Metallurgical Engineer.

1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.

1902. Davis, Emerson, 203, Webb Avenue, Detroit, Mich., U.S.A., Chemist.

1912. Davis, E. Gordon, c/o Messrs. Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.

1908. Davis, G. Keville, 265, Strand, London, W.C., Chemical Engineer.

O.M. Davis, H. W., 18, Crescent Road, Kingston-on-Thames, Analytical Chemist.

1907. Davis, Robt. W., jun., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., and (Jnls.) Aspinwall, Pa., U.S.A., Chemist.

1906. Davis, V. P.,221, West Exchange Street, Providence, R.I., U.S.A., Chemist.

1897. Davis, Wm. A., 7, Carlton Bank, Harpenden, Herts, Chemist.

1911. Davis, Wm. C., 10, Richmond Hill, Langley, near Birmingham, Chemist.

1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.

1903. Dawes, Arthur W., 577, Providence Street, Albany, N.Y., U.S.A., Chemist.

O.M. Dawson, C. A., 32, Elm Hall Drive, Mossley Hill, Liverpool, Technical Chemist.

1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals) 15, Wrottesley Road, Woolwich, S.E., Technical Chemist.

1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

1913. Day, Frank E., c/o Condensed Milk Co. of Ireland, Lansdowne, Limerick, Ireland, Chemist.

1912. Day, G. A. C., Casilla No. 417, Lima, Peru (*viâ* New York), Oil Mill Manager.

O.M. Deacon, H. Wade, 8, Ullet Road, Liverpool; and (Jnls.) c/o C. E. Tyers, 186, Derby Road, Farnworth, Widnes, Alkali Manufacturer.

O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.

1911. Dean, Arthur L., Sheffield Scientific School, New Haven, Conn., U.S.A., Assistant Prof. of Industrial Chemistry.

1903. Dean, Harry, Oak Villa, Greenhead Road, Huddersfield, Chemist.

1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.

1899. Deane, Leo. Mandeville, 12, Crossbeck Road, Ilkley, Yorks, Analytical, Consulting, and Manufacturing Chemist.

1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.

1910. Deby, Bedford H., 29. Oak Hill Road, Nether Edge, Sheffield, Metallurgist and Chemist.

1899. De Castro, J. Paul. *See* Castro, J. Paul de.

1902. De Cew, J. A., 615, Canadian Express Building, Montreal, Canada, Chemical Engineer.

1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.

1884. Deering, W. H., Beauworth, Moretonhampstead, Devon, Analytical Chemist.

1900. Deerr, Noel F., Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, H.I., U.S.A., Analytical Chemist.

1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.

1911. Dehn, Dr. Frank B., Atlas Chemical Works, West Ferry Road, Millwall, E., Chemist (J. B. Lawes and Co., Ltd.).

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 94, Rue St. Lazare, Paris (IX.), Gas Engineer.

1909. De Laire, Edgar, 47, Quai de Moulineaux, Issy, Seine, France, Industriel.

1908. Delaney, Chas. R., c/o J. S. Young and Co., Ltd., Hanover, Pa., U.S.A., Chemical Engineer.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1908. Dellschaft, Dr. F. H., Winnington, Northwich, Cheshire, Manufacturing Chemist.

1910. De Meeus, Etienne, Beacon Falls, Conn., U.S.A., Chemist.

1912. Demoulins, H. D., c/o Bank of Montreal, Mexico City, D. F., Mexico, Analytical Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1909. Demuth, Rudolph, 68, Salusbury Road, London, N.W., Manufacturer.

1899. Denham, Wm. S., The United College, St. Andrews, Scotland.

1891. Denison, Joseph R., c/o Denison, Preussner, and Co., Valley Dyeworks, Bradford, Yorks, Analytical Chemist.

1911. Dennis, Louis, 26, Clapton Mount, Halifax, Yorks, Works Chemist.

1908. Dennis, Martin, 859, Summer Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.

1907. Dennison, Henry S., South Framingham, Mass., U.S.A., Manufacturer.

1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S., Government Analyst.

1912. Depierres, Gaston, The Indestructible Paint Co., King's House, King Street, Cheapside, London, E.C., Managing Director.

1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.

1913. Desch, Dr. Cecil H., Metallurgical Dept., The University, Glasgow, Lecturer.

1912. Dettmann, A. H., Stuart Street, Longueville, Sydney, N.S.W., Leather Manufacturer.

1906. Deverell, Louis C., 1, Shortlands Grove, Shortlands, Kent, Chief Chemist.

1908. Dew, Joseph A., 32, Forest Drive West, Leytonstone, N.E., Varnish Manufacturer.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Sir J., F.R.S., 21, Albemarle Street, London, W., Professor of Chemistry and Physics.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.

1904. Dewhirst, J. A., Imperial Chambers, Halifax, Yorks, Analyst.

1909. Dewhirst, Wm. B., 45, High Street, Paisley, Analytical Chemist.

1903. Diamond, Wm., c/o John Bowes and Partners, Ltd., Marley Hill Colliery, Swalwell, R.S.O., Durham, Works Manager.

O.M. Dibdin, W. J., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1913. Dick, James, c/o Canadian Explosives, Ltd., Waverley, N.S., Canada, Superintendent.

1902. Dick, John, Wharf Road, Cubitt Town, London, E., Manager and Chemist.

1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.

1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.

1901. Dickenson-Gair, C. J. *See under* Gair.

1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.

O.M. Dickinson, A. J., 178, Lewisham High Road, Brockley, S.E., Tar Distiller.

1905. Dickinson, Cyril, Southwark Town Hall, Walworth Road, London, S.E., Analytical Chemist.

1898. Dickson, Samuel, 26, Tothill Street, Westminster, S.W., Analytical Chemist.

1899. Dieckmann, Dr. Otto, 1180, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist

1908. Dickman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.

1894. Diestel, Wm., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.

1908. Dill, Colby, Perth Amboy, N.J., U.S.A., Chemist.

1906. Dillon, Fred N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.

1898. Dillon, Wm., The Lomas Gelatine Works, Southdown, Plymouth, Oil, Colour, and Varnish Manufacturer.

1911. Dissosway, Thurston N., 23, Vine Street, Brooklyn, N.Y., U.S.A.. Chemist.

1903. Divine, Robt. E., 325, McLellan Avenue, Detroit, Mich., U.S.A., Chemist.

1899. Dixon, Fred. W., P.O. Box 43, Jamestown, N.Y., U.S.A., Dyer.

1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.

1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.

1909. Dixon, W. H., c/o Bryant and May, Ltd., Fairfield Works, Bow, London, E., Match Manufacturer.

1892. Dobb, Thos., c/o J. T. Dobb and Son, West Bar, Sheffield, Pharmaceutical Chemist.

O.M. Dobbie, J. J., F.R.S., Government Laboratory, Clement's Inn Passage, London, W.C., and (Jnls.) 4, Vicarage Gate, Kensington, W., Director.

O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.

1908. Dobbs, Ernest J., 16–17, Devonshire Square, Bishopsgate, London, E.C., Analytical Chemist.

1890. Dodd, A. J., Meadholme, Blackheath Park, S.E., Oil Manufacturer.

1907. Dodd, Arthur, Lyndhurst, Woolwich Road, Belvedere, Kent. Assistant Works Manager.

1889. Dodd, W. Ralph, Burton Grange, Goff's Oak, near Cheshunt, Chemical Works Manager.

1913. Dodds, Herbert H., c/o Kynoch, Ltd., Umbogintwini, Natal, Explosives Chemist.

1906. Dodds, Thos., c/o Reckitt and Sons, Ltd., and (Journals) 7, The Oval, Garden Village, Hull, Works Manager and Chemist.

1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.

1897. Doerflinger, Wm. F., Rosebank, Staten Island, N.Y., U.S.A., Research Chemist.

1912. Doggett, Prof. Charles S., Textile Dept., Clemson College, S.C., U.S.A., Professor of Textile Chemistry and Dyeing.

1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.

1905. Dolan, H., Westbourne, Belvoir Road. Lower Walton, Warrington, Chemist.

1897. Dolge, Carl B., Westport, Conn., U.S.A.. Manufacturer of Instruments and Antiseptics.

1903. Donald, Dr. Jas. T., 318, Lagauchetière Street West, Montreal, Canada, Consulting Chemist.

1912. Donald, R. M., c/o Lever Bros. Co., 174, Broadway, Cambridge, Mass., U.S.A., Soapworks Manager.

1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.

1902. Donaldson, Thos., c/o British South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.

1905. Donnan, Prof. F. G., F.R.S., Muspratt Laboratory, The University, Liverpool, Professor of Physical Chemistry.

1886. Doolittle, Orrin S., 388, Palisade Avenue. Yonkers, N.Y., U.S.A., Chemist.

1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.

1890. Dore, Jas., Copper Works. High Street, Bromley-by-Bow, E., Distiller's Engineer.

1911. Dorée, Dr. Charles, 58, Gore Road, South Hackney, London, N.E., Head of Chemistry Department, Borough Polytechnic.

1896. Doremus, Dr. Chas. A., 55, West 53rd Street. New York City, U.S.A., Professor of Chemistry.

O.M. Dott, D. B., Ravenslea, Musselburgh, Scotland, Analytical Chemist.

1911. Dougall, Jas. S. N., 305, Manufacturers Street. Montreal, Canada, Varnish Manufacturer.

1897. Douglas. Geo., Farfield Hall, Addingham, Yorks, Dyer.

1894. Douglas. Loudon M., Authors' Club, Whitehall Court, London. S.W.. Chemical Manufacturer.

1909. Douglas, Robt. P., Prudential Buildings, Nelson Square, Bolton, Chemist.

1884. Douglas. William, Grafton House, Berkhamsted, Herts., Chemical Engineer.

1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.

1900. Dow, Allan W., 126, Joralemon Street, Brooklyn, N.Y.. U.S.A.. Chemical Engineer.

1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.

1908. Dow, John W., 564, Park Avenue West, Mansfield, Ohio, U.S.A., Manufacturing Chemist.

1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.

1912. Doxey, Carl W., c/o Whalley Abbey Printing Co., Whalley, near Blackburn, Printworks Chemist.

1901. Doxrûd, Christian, Technical School, Christiania, Norway. Professor of Chemical Technology.

1907. Doyle, B. W., 11, Pine Street, Leominster, Mass., U.S.A., Manufacturer.

1911. Drackett, H. R., 448, Claremont Avenue, Westmount, P.Q.. Canada, Works Superintendent.

1902. Drake, Bryant S., 5830, Colby Street, Oakland, Cal., U.S.A., Chemist.

1911. Drake, Joseph W. D., Three Mills Distillery, Bromley-by-Bow, London, E., Distillery Brewer.

1912. Drake, Louis L., 138, North La Salle Street, Chicago, Ill., U.S.A.. Editor and Publisher.

1886. Dreaper, W. P., 14, Old Queen Street, Westminster, S.W., Consulting Chemist.

O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.

1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.

1912. Drewitt, George E., Poste Restante, G.P.O., Sydney, N.S.W., Consulting Chemical Engineer.

1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.

O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.

1904. Dreyfus, Dr. L. A., Maple Avenue, Rosebank, S.I., N.Y., U.S.A., Chemist.

1893. Dreyfus, S., Peel House, Peel Street, Denton, near Manchester, Chemist.

1899. Dreyfus, Dr. Wm., 57, East 96th Street, New York City, U.S.A., Chemist.

1899. Drobegg, Dr. G., 11, Bartlett Street. Brooklyn, N.Y., U.S.A., Superintending Chemist.

1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.

1910. Drury, Chas. Dru, Hendon Gas Works, Sunderland, Engineer.

1899. Ducas, B. P., 25-27, South William Street, New York City, U.S.A., Chemical and Dyestuff Importer.

1907. Ducca, Dr. Wilhelm A., c/o India Rubber Co., New Brunswick, N.J., U.S.A., Chemist.

1905. Duché, E., 6, Eastcheap, London, E.C., and (Jnls.) Usines Duché, Vilvorde, Belgium, Merchant.

1909. Duchemin, Réné P., 6, Rue Chanoinesse, Paris IV., France, Chemical Engineer.

1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., and (Jnls.) Vanbrugh Castle, Blackheath, S.E., Chemical Manufacturer.

1908. Duckworth, G. F., North Bay, Ont., Canada, Works Manager.

1905. Duckworth, Harry S., Garner Printworks and Bleachery, Garnerville, Rockland Co., N.Y., U.S.A., Printworks Chemist.

1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.

1913. Duff, Alex. R., 211, Fern Avenue, Toronto, Canada, Rubber Chemist.

1899. Duff, Wm. S., Merrie Lands, Westbury Road, Buckhurst Hill, Essex, Manufacturing Chemist.

1905. Duffus, W. B., 118, Braid Road, Edinburgh, Chemist.

1901. Dufty, Lawrence, "Lynwood," Tom Lane, Nether Green, Sheffield, Analytical Chemist.

1905. Duggan, Edw. J., c/o Warner Chemical Co., 141, Broadway, New York City, U.S.A., Vice-President.

O.M. Duggan, T. R., 52, East 41st Street, New York City, U.S.A., Analytical Chemist.

1898. Duisberg, Dr. Carl, The Bayer Co., Ltd. (Journals) Farbenfabrik, Leverkusen, bei Cöln a/R., Germany: (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist.

1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.

1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.

1889. Duncan, Arthur W., c/o J. Woolley, Sons and Co., Ltd., Victoria Bridge, Manchester, Analytical Chemist.

1909. Duncan, Jas., c/o Steel Bros. and Co., Ltd., 6, Fenchurch Avenue, London, E.C., Merchant.

1908. Duncan, Prof. Robert Kennedy, 4715, Wallingford Street, Pittsburg, Pa., U.S.A., Prof. of Industrial Chemistry.

1904. Duncan, W. W., 19, Upland Road, Watertown. Mass., U.S.A., Chemist (Hood Rubber Co.).

1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.

1912 Dunkelsbuhler, F. S., 63, Brook Street, Grosvenor Square, London, W., Technical Chemist.

1905. Dunlop, Harry, 231, St. Vincent Street, Glasgow, Chemist.

1892. Dunn, Fred, 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.

O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.

O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.

1908. Dünschmann, Dr. Max, c/o Meister, Lucius, und Bruning, Ltd., Ellesmere Port, Cheshire, Manager.

1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.

1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.

1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1897. Durant, H. T., Larchthorpe, Foxley Lane, Purley, Surrey, Metallurgist.

1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.

1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.

1911. Durkin, Jos. A., c/o Butterworth Judson Co., Newark, N.J., U.S.A., Chemical Superintendent.

1907. Durrans, Thos. H., 10, Titchfield Terrace, Regent's Park, London, N.W., Chemist.

1899. Duryea, Chester B., 120, 85th Street, Brooklyn, N.Y., U.S.A., Starch Manufacturer.

1906. Dushman, Saul, Research Laboratory, General Electric Co., Schenectady, N.Y., U.S.A., Electrochemist.

1891. Dvorkovitz, Dr. P., 1, Broad Street Place, London, E.C., Technical Chemist.

1912. Dyche-Teague, F. C., 28, King Street, Portman Square, London, W., Analytical Chemist and Bacteriologist.

O.M. Dyer, Dr. B., 17, Great Tower Street, London. E.C., Analytical and Consulting Chemist.

1907. Dyes, Dr. W. A., 32, New Bridge Street, London, E.C.

1911. Dyke, F. Montague, Spital Road, Bromborough, Cheshire, Analytical Chemist.

O.M. Dyson, C. E., Flint, North Wales.

1902. Dyson, George W., 24, Clarkehouse Road, Sheffield, Analyst.

1892. Dyson, Septimus, Nyddcombe, Warlingham, Surrey, Manufacturing Chemist.

E

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.

1912. Eames, A. Spencer, 176, Tower Bridge Road, London, S.E., Registrar, Leathersellers' Technical College.

1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.

1910. Eardley, J. F., Elmsdale, Broomhall Park, Sheffield, Pharmaceutical Chemist.

O.M. Earp, W. R., Preston Brook, near Warrington, Chemical Manufacturer.

1910. Easterfield, Prof. Thomas H., Victoria College, Wellington, New Zealand, Prof. of Chemistry.

1884. Eastick, C. E., 13, King Edward Street, Whitechapel, E., Sugar Refinery Director.

1909. Eastick, J. C. N., 49A, Clapton Common, London, N.E., Electrochemist.

O.M. Eastick, J. J., 2, St. Dunstan's Hill, London, E.C., Consulting Sugar Expert.

1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Consulting Petroleum Engineer.

1909. Eastlake, William H., c/o Imperial Wire and Cable Co., Montreal, Canada, Chemist.

1885. Eastwood, Edward, c/o Siam Industries Synd., Si Phya Road, Bangkok, Siam, Soapmaker.

1909. Eberlin, Leon W., 11, First Street, Rochester, N.Y., U.S.A., Chemist.

1907. Eckenstein, Thos. C., 19, Huskisson Street, Liverpool, Analytical Chemist.

1892. Eddy, Harrison P., 14, Beacon Street, Boston, Mass., U.S.A., Superintendent.

1885. Edge, Anthony, 79, West Milton Street, Readville, Mass., U.S.A., Chemist.

1909. Edge, J. Harold, "Great Marld," Smithills, Bolton Lancashire, Technical Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1911. Edmondson, Joseph E., 22, Lonsdale Road, Fallowfield, Manchester, Engineer.

1908. Edmunds, Wm. T., c/o Famentina Development Corporation, Chilecito, Argentina, Assayer.

1911. Edwards, Alfred, The Laboratory, Meadow Lane Gas Works, Leeds, Analytical Chemist.

1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.

1902. Edwards, H. Leaton, The Shanty. Banks Avenue, Meols, Hoylake, Cheshire, Analyst.

1906. Egleson, J. E., c/o General Chemical Co., Marcus Hook, Pa., U.S.A., Superintendent.

1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1910. Eilsberger, Dr. Ernst, Deutsche Solvaywerke, Bernburg (Anhalt), Germany, Director.

1909. Eisenhart, M. H., c/o Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Chemist.

1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.

1901. Elkan, Leo A., c/o Gutmann and Co., 10, West Michigan Street, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 116, Prospect Street, East Orange, N.J., U.S.A., Civil Engineer.

1912. Elliott, Edward, c/o Reckitts, (Over-Sea) Ltd., Burke Street, Redfern, N.S.W., Australia. Chemical Engineer.

1884. Elliott, Dr. A. H., 165, Broadway, New York City, U.S.A., Consulting Engineer and Chemist.

1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.

1896. Elliott, Dr. J. F., O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1905. Ellis, Carleton, 143, Gates Avenue, Montclair, N.J., U.S.A., Chemical Engineer.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

1913. Ellis, Henry D., 30, Blackheath Park, S.E., Metallurgical Engineer.

1912. Ellis, Percival W., 30, Bramham Gardens, South Kensington, S.W., Tanning Material Merchant.

1910. Ellis, Ridsdale, 55–56, Chancery Lane, London. W.C., Patent Agent.

1910. Ellis, Rowland H., c/o Olympia Oil and Cake Co., Barlby Road, Selby, Yorks, Analytical Chemist.

1891. Ellis, Prof. W. Hodgson, 74, St. Alban Street. Toronto, Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks, Manufacturing Chemist.

O.M. Elmore, A. S., 72, Gloucester Terrace, Hyde Park, London, W., Electro-Metallurgist.

1907. Elsden, A. Vincent, 10, Gourock Road, Eltham, Kent, Analytical Chemist.

1911. Elsdon, Geo. D., Analytical Department, 44, Broad Street, Birmingham, Analyst.

1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.

1909. Ely, Benjamin, The Limes, Pye Bridge, near Alfreton, Tar Distiller.

1910. Emanuel, Louis V., 165, Rector Street, Perth Amboy, N.J., U.S.A., Metallurgical Engineer.

1910. Embley, Dr. E. H., 245, Latrobe Street, Melbourne, Victoria, Australia.

1902. Emery, Arthur L., c/o Smith, Emery, and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1911. Emery, Earle C., c/o American Alkali and Acid Co., 43, Main Street, Bradford, Pa., U.S.A., Manager.

1899. Emery, E. G., c/o Pacific Coast Condensed Milk Co., Seattle, Wash., U.S.A., Technical Chemist.

1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis. Minn.. U.S.A., Chemist.

1907. Emslie, B. Leslie, 1102-1105, Temple Building, Toronto, Canada, Agricultural Chemist.

1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.

1904 Englehard, Charles, 30, Church Street, New York City, U.S.A., Platinum Importer.

1895. English, Frank H., 21, Shelley Avenue, Manor Park, E., Analytical Chemist.

1899. Enright, Bernard, 233, North 4th Street, Allentown, Pa., U.S.A., Chemist.

1906. Ephraim, Dr. Julius, II, Königgraetzerstrasse 69, Berlin, S.W., Germany, Chemist and Patent Agent.

1911. Epps, James W., Holland Street, London, S.E., Chemist.

1909. Epstein, Harry M., 281. Edgecomb Avenue, New York City, U.S.A., Works Manager.

1907. Erdoes, Julius, 1100, Brook Avenue, New York City, U.S.A., Chemical Engineer.

1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.

1904. Ermen, Walter F. A., c/o Cia. Industrial Mineira, Mariano Procopio, E.F.C.B. Mines, Brazil, Analytical Chemist.

1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.

1897. Escher, Paul, c/o Swift and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.

1884. Esilman, A., 38, Norwood Avenue, Southport, Lancashire, Analytical Chemist.

1912. Espenhahn, E. V., "Sandersleben," Woolwich, Sydney, N.S.W., Australia, Works Chemist.

1910. Esslemont, Alfred S., Royal Exchange Buildings. Hood Street, Newcastle-on-Tyne, Electrical Engineer.

O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.

1905. Etheridge, Arthur T., Research Dept., Royal Arsenal, Woolwich, S.E., Chemist.

1903. Euler, C. G., 18–20, Platt Street, New York City, U.S.A., Chemical Agent.

1912. Evans, Edward V., South Metropolitan Gas Co., Old Kent Road, London, S.E., Chief Chemist.

1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.

1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.

1908. Evans, Prof. Nevil Norton, Redpath Library, McGill University, Montreal, Canada, Associate Professor of Chemistry.

1889. Evans, R. E., Brewery Street, Stratford-on-Avon, Brewing Chemist.

1912. Evans, Sam, 7, Moore Avenue. Dunston-on-Tyne, Chemist.

1912. Evans, Ulick R., 28. Victoria Street, Westminster, S.W., Consulting Electrochemist.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

1909. Everette, Dr. W. E., 3512, South 11th Street, Tacoma, Wash., U.S.A., Consulting Chemical Engineer.

1904. Everitt, Walter, Norwood Wharf. Southall, Middlesex, Analyst.

1910. Everitt, William, Gas Works, Ilkley, Yorks, Manager.

1912. Evers, Norman, c/o Allen and Hanbury's, Ltd., Bethnal Green, London, E., Analytical Chemist.

O.M. Evershed, F., c/o Clarke, Nickolls, and Coombs, Hackney Wick, N.E., Chemist.

1907. Eves, Archie P., c/o J. L. Gibney Tire and Rubber Co., Conshohocken, Pa., U.S.A., Chemist.

1894. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.

1905. Eynon, Lewis, 4, Stag Lane, Buckhurst Hill, Essex, Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7–9, Frankfort a/M., Germany, Chemist and Director.
1902. Faill, Jas., 52, Robertson Street, Glasgow, Technical Chemist.
1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.
1911. Fairchild, B. Tappen, 74, Laight Street, New York City, U.S.A., Analytical Chemist.
1910. Fairclough, Brereton, Quarry House, Appleton, near Warrington, Cheshire, Miller.
1911. Fairfield, Thos. J., c/o W. T. Glover and Co., Trafford Park, Manchester, Analytical Chemist.
1903. Fairhall, E. J., 96, Blackstock Road, Finsbury Park, N., Chemist.
O.M. Fairley, T., 17, East Parade, and (communications) 8, Newton Grove, Leeds, Analytical Chemist.
1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, Manufacturing Chemist.
1902. Fairweather, Wallace C., 62, St. Vincent Street, Glasgow, Engineer.
1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.
1908. Fales, Harold A., 308, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Secretary (The W. N. Fales Co.).
1911. Farey, Frank O., 614, Canadian Express Building, Montreal, Canada, Chemist.
1910. Farr, Harry, Free Library, Cardiff, Librarian.
O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.
1913. Farrar, Stanley C., Royal College of Science, South Kensington, S.W., Chemical Technologist.
1897. Farrell, Frank J., 15, Sandown Road, Great Yarmouth, Analytical Chemist.
O.M. Farrington, T., 4, Waterloo Place, Cork, Ireland, Chemical Engineer.
1909. Fath, Dr. Arthur, 42, Boulevard St. Liévin, Ghent, Belgium, Chemical Engineer.
1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.
1903. Fawsitt, Dr. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.
1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.
1892. Feld, Walther, Linz a. Rhein, Germany, Chemical Works Director.
1909. Fell, Wm. M. W., 27, Clarendon Road, Garston, Liverpool, Chemist.
1905. Felton, Herbert L., 516, East Second Street, South Boston, Mass., U.S.A., Distiller.
1900. Ferguson, Prof. Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.
O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
1909. Ferrey, Cuthbert E. C., 28, Temple Grove, Golder's Green, N.W., Analyst.
1893. Fiebing, John H., 238, Reed Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
1911. Field, Allan J., 583, Riverside Drive, New York City, U.S.A., Chemist.
1885. Field, E. W., Brewer.
1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.
1891. Field, Wm Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.
1900. Fillis, Frank, 106, London Road, Neath, South Wales, Cement Works Manager.
1907. Finch, Archibald M., Vitriol and Chemical Works, Cattedown, Plymouth, Chemical Manufacturer.
1910. Findlater, James, c/o Price's Patent Candle Co., Ltd., Bromborough Pool, near Birkenhead, Chief Chemist.
1910. Findley, Albert E., Dept. of Applied Science, The University, Sheffield, Lecturer.
1899. Fingland, Jno. J., Kaslo, B.C., Canada, Analytical Chemist.
1911. Fink, F. W., Spencer Arms, 69th Street and Broadway, New York City, U.S.A., Manufacturing Chemist.
1904. Finn, Cornelius P., Hemsworth Colliery, near Wakefield, Yorks, Coke Ovens Manager.
1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.
1903. Fish, Chas. C. R., 439, Boylston Street, Boston, Mass., U.S.A., Chemist.
1905. Fish, Chas. H., P.O. Box 1593, Boston, Mass., U.S.A., Printworks Manager.
1911. Fish, Charles W., Rose Hill, Rawcliffe Bridge, S.O., Yorks, Chemist and Paper Technologist.
1900. Fisher, Henry, 16, East 96th Street, New York City, U.S.A., Teacher of Chemistry.
1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.
1904. Fitch, A. J., 8, Waldgrave Gardens, Hall Lane, Upminster, Essex, Brewer's Chemist.
1900. Fitz-Randolph, R.B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Wurttemburg, Germany, Manufacturing Chemist.
1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.
1913. Fleming, M. D., c/o Messrs. Beattie and Co., Media Luna, Manzanillo, Cuba, Analyst.
1893. Fletcher, E. Morley, 30, Grosvenor Place, Newcastle-on-Tyne, Alkali Works Inspector.
O.M. Fletcher, F. W., c/o Fletcher, Fletcher, and Co., Ltd., Holloway, N., Manufacturing Chemist.
1907. Fletcher, H. T., c/o The Bauxite Refining Co., Hebburn-on-Tyne, Works Manager.
1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.
1904. Fletcher, Wm. E., 411, West Broad Street, Tamaqua, Pa., U.S.A., Chemist.
1912. Flürscheim, Dr. Bernhard J., Rushmoor, Fleet, Hampshire, Research Chemist.
1899. Focht, Louis, 12, Atterbury Avenue, Trenton, N.J., U.S.A., Civil Engineer.
1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.
1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.
1901. Folsom, Herbert A., Fairmount, Hyde Park, Mass., U.S.A., Chemical and Dyeware Manufacturer.
1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.
1911. Ford, Edward J., 29, Rue Joseph Claes, St. Giles, Brussels, Chemist.
1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
1889 Ford, Jno. S., Abbey Brewery, Edinburgh Analyst.
1905. Foregger, Dr. R. von, c/o Roessler and Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City U.S.A., Chemist.
1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.
1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.
1898. Forrest, J. Kerr, 271, Carlisle Street, St. Kilda, Victoria, Australia, Manufacturing Chemist.
1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.
1905. Forrester, H. A., Fabrica de Productos Quimicos, Acevedo 1710, Palermo, Buenos Ayres, S. America, Chemical Works Manager.
1909. Forshaw, Arthur, c/o John Wright and Co., Ltd., Essex Works, Aston, Birmingham, Works Chemist.
1902. Forstall, Alf. E., 84, William Street, New York City, U.S.A., Consulting Gas Engineer.
1901. Forster, Miss E. L. B., Sidmouth Lodge, Park Road, Richmond, S.W., Analyst.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, and (Jnls.) The River House, Burton-on-Trent, Chemist.

1907. Forster, Francis, c/o Champion, Druce, and Co., Ltd., 6, Laurence Pountney Hill, London, E.C., Lead Manufacturer.

1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1884. Forster, Sir Ralph C., Bart., c/o Messrs. Bessler, Waechter, and Co., Salisbury House, Finsbury Circus, London, E.C., Chemical Merchant.

1884. Forth, Henry, Stoke Lacy, Marple, Cheshire, Drysalter.

1907. Forward, Charles C., Dept. of Inland Revenue Laby., 317, Queen Street, Ottawa, Canada, Chemist.

1906. Foster, Robt. K., Church Street, Middle Brighton, Melbourne, Victoria, Pharmaceutical Chemist.

O.M. Foster, R. Le Neve, Fulshaw Cottage, Wilmslow, Cheshire, Manufacturing Chemist.

1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1906. Foucar, J. Louis, 15, Morden Road, Blackheath, S.E., Chemist.

1891. Fowler, Dr. Gilbert J., Rufford, Dickenson Road, Rusholme, Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).

1898. Fowler, Theo. V., P.O. Drawer 15, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1909. Fowler, Wm., Glenwood, Bearsden, Glasgow, Chemist.

1896. Fox, A. Stanley, Uplees, Faversham, Kent, Explosives Works Manager.

1912. Fox, Charles P., 395, Doyle Street, Akron, Ohio, U.S.A., Chemist.

1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.

1911. Fox, Dr. John J., 6, Alkham Road, Stamford Hill, N., Government Analyst.

1909. Fox, J. J., 19, Blackheath Rise, Lewisham, S.E., Managing Director, Tidman and Son, Ltd.

O.M. Fox, T., jun., c/o Fox Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.

1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

O.M. Francis, G. Bult, The British Drug Houses, Ltd., 22–30, Graham Street, City Road, London, N., Wholesale Druggist.

O.M. Francis, W. H., 11, Bramham Gardens, South Kensington, London, S.W., Wholesale Druggist.

1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Frank, Prof. Dr. A., Bismarckstrasse 10. Charlottenburg, Germany, Chemist.

1908. Frank, Dr. Fritz, Lützowstrasse 96, Berlin, W., 68, Germany, Public Analyst.

1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, Indiarubber Manufacturer.

1912. Frankenburg, Sydney, Hefferston Grange, Weaverham, Cheshire, Indiarubber Manufacturer.

1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.

1904. Frankl, A., Clothilde Chemical Works, Nagy Bocskó, Hungary, Manager.

O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbrough, Analytical Chemist.

O.M. Frankland, Prof. P. F., F.R.S., The University, Edgbaston, Birmingham, Professor of Chemistry.

1906. Fraps, Dr. Geo. S., Texas A. and M. College, College Station, Texas, U.S.A., Professor of Chemistry.

1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.

1900. Frasch, Herman, Whitehall Building, 17, Battery Place, New York City, U.S.A., Oil Refiner.

1910. Fraser, Arthur, Casilla 1464, Valparaiso, Chile, Analyst.

1891. Fraser, L. McG., Engineering Works, Dagenham, Essex, Chemical Engineer.

1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.

1885. Freear, H. M., Church Square, Ampthill, Beds, Analytical Chemist.

1900. French, Thos., 806, Stanley Street, Nelson, B.C., Canada, Chemist.

1911. French, Wm., Heron Chemical and Colour Works, Lancaster, Manager.

1903. Frerichs, Dr. F. W., 4320, Washington Boulevard, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1907. Freytag, Henry, c/o O. Isler and Co., 35, Dickinson Street, Manchester, Chemical Merchant.

1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.

1902. Fries, Jno. W., Winston Salem, N.C., U.S.A., Cotton Manufacturer.

1899. Fritzsche, Karl, c/o Schimmel und Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.

1884. Frost, Joe, Rocky Mount, Somerset Road, Huddersfield, Manufacturing Chemist.

O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.

1903. Fudge, T., 32, West 38th Street, Bayonne, N.J., U.S.A., Chemist.

1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 87, Nassau Street, New York City, U.S.A., Chemical Merchant.

1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.

1902. Fuller, Henry C., Institute of Industrial Research, Washington, D.C., U.S.A., Analytical Chemist.

1899. Fuller, Robt. F., Neston Park, Corsham, Wilts, Rubber Manufacturer.

O.M. Fuller, Wm., Vanbrugh Cottage, Maze Hill, S.E., Chemist.

1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.

1909. Fulweiler, W. H., c/o United Gas Improvement Co., Broad and Arch Streets, Philadelphia, Pa., U.S.A., Engineer.

1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

O.M. Gabbett, E. R., 64, Vanbrugh Park, Blackheath, S.E.; and (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.

1909. Gaede, Chas. W., c/o National Silk Dyeing Co., Williamsport, Pa., U.S.A., Silk Dyer.

1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1907. Gaines, Richard H., 147, Varick Street, New York City, U.S.A., Chemist (Board of Water Supply).

1904. Gair, C. J. Dickenson, 39, Cranston Road, Forest Hill, S.E., Analytical Chemist.

1912. Gajjar, M. J., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.

1890. Gajjar, Prof. T. K., The Lines, Surat, India, Consulting Chemist.

1912. Gale, R. C., 38, Scarsdale Villas, Kensington, W., Technical Chemist.

1884. Gall, Henry, 2, Rue Blanche, Paris, France, Technical Chemist.

1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.

1911. Gallagher, Jas. L., c/o Lever Bros., Ltd., Sydney, N.S.W., Australia, Chemist.

1897. Galletly, J. C., c/o Newlands and Warner, 135, St. Vincent Street, Glasgow, Rubber Chemist.

1901. Gallivan, Dr. Frank B., 113, Third Street, South Boston, Mass., U.S.A., Chemist.

1903. Gallum, Albert F., 1000, North Water Street, Milwaukee. Wis., U.S.A., Tanner.

1901 Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.

1901. Galpin, Harry T., 57, West 57th Street, New York City, U.S.A., Chemist.

1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.

1887. Gamble, Jas. N. (Journals) A. E. Anderson, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.

1894. Gane, Eustace H., 91, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.

1901 Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus, & Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.

1911. Garbutt, C. Durham, 2, Hartington Road, Garston, Liverpool, Analytical Chemist.

1911. Garcia-Robles, L., San Rafael Paper Co., Apartado 469, Mexico City, Mexico, Chemist.

1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.

1910. Gardner, Arthur L., 233, Water Street, Perth Amboy, N.J., U.S.A., Chemical Engineer.

1907. Gardner, Edward, The Tryst, Bigwood Road, Meadway, Hendon, N.W., Metallurgical Chemist.

1909. Gardner, Henry A., Institute of Industrial Research, Washington, D.C., U.S.A., Chemist.

1913. Gardner, Henry D., jun., 138, Bath Street, Rugby, Technical Chemist.

1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemical and Dyeing Departments.

1897. Garfield, Jos., Thackley, Bradford, Yorks, Civil Engineer.

1888. Garibaldi, Joachim A., 21. Church Place, Gibraltar, Chemist.

1910. Garland, Charles S., 57, Garratt Lane, Wandsworth, S.W., Chemist and Works Manager.

1907. Garland, Herbert, P.O. Box 417, Cairo, Egypt, Chemist (Government Laboratory).

1905. Garle, John L., 17, John Street, Bedford Row, London, W.C., Consulting Chemist.

1911. Garner, John H., Sewage Works, Deighton, Huddersfield, Chemist.

1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.

1900. Garrigues, W. E., 1304, Shelby Street, Louisville, Ky., U.S.A., Chemical Engineer.

1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.

1908. Garson, Jas. W., 12, Avenue Road, Crouch End, N., Managing Director, Lewis Berger & Sons, Ltd.

O.M. Garton, Sir Richard, Messrs. Hill, Garton, and Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.

1886. Gascoyne, Dr. W. J., 27, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.

O.M. Gaskell, Holbrook, Erindale, Frodsham, Cheshire, Alkali Manufacturer.

1902. Gaskell, Holbrook, jun., Hillcroft, Church Road. Woolton, near Liverpool, Engineer.

1908. Gatehouse, Frank B., 3, Lawrence Road, Romford, Essex, Chemist and Technical Journalist.

1912. Gates, Alfred E. c/o Messrs. T. Lye and Sons, Luton, Beds., Works Chemist.

O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.

1906. Gaunt, Percy, Macclesfield Corporation Sewage Works, Prestbury, near Macclesfield, Chemist.

1912. Gee, Wm. J., 48, Kingsmead Road, Tulse Hill, London, S.W., Chemical Engineer.

1907. Geer, William C., 50, Hawthorne Avenue, Akron, Ohio U.S.A., Chemist.

1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison Street, New York City, U.S.A., Consulting Chemist.

1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.

1907. Gemmell, Wm., 13, Albany Gardens, Whitley Bay, Northumberland, Analytical Chemist.

1901. Gent, Percy W., Trentholme, Misterton, near Gainsboro', Chemist.

1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.

1905. George, J. K., 347, Fifth Avenue, New York City, U.S.A., Manufacturer.

1912. Georgeson, George, Mutual Life Building, corner George and Wynyard Streets, Sydney, N.S.W., Manager of Oil Companies.

1906. Gerkensmeyer, Henry H., 207, Mississippi Avenue, Joliet, Ill., U.S.A., Chemist.

O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.

1912. Ghislain, Raoul, 18, Rue du Mont de Piété, Mons, Belgium, Chemical Engineer.

1908. Gianoli, Prof. Guiseppe, Piazza Cordusio 2, Milano, Italy, Chemical Engineer and Editor (L'Industria).

1912. Gibb, W. Doig, South Metropolitan Gas Co., 709, Old Kent Road, London, S.E., Chief Engineer.

1911. Gibbings, Walter A., Tandjong Poera, Lower Langkat, Sumatra, Works Manager and Chemist.

1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.

1910. Gibbins, Roland B., 18, Wheeley's Lane, Birmingham, Chemical Manufacturer.

1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.

1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.

O.M. Gibbs, Wm. P., The Sulphite Pulp Mills, Hjerpen, Sweden, Analytical Chemist.

O.M. Gibson, Dr. J., Chemical Department, Heriot Watt College, Edinburgh, Chemical Lecturer.

O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *viâ* Chester, Brick and Tile Manufacturer.

1905. Gibson, John, 360-366, Collins Street, Melbourne, Vic., Australia, Concrete Manufacturer.

1905. Gibson, Wm. F., 18, Cautley Avenue, Clapham Common, S.W., Works Chemist.

1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.

1892. Gilbard, J. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.

1905. Gilbertson, Isaac H., 33, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.

1903. Gilby, Joseph W., c/o Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffs, Works Chemist.

O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Reform Club, Pall Mall, London, S.W., Metallurgist.

1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.

1900. Gildersleeve, W. H., Johnson City, Tenn., U.S.A., Chemist.

O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.

1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Professor of Technical Analysis.

1909. Gill, John H., 16, Premier Road, Gregory Boulevard, Nottingham, Soapworks Chemist.

1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.

1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.

1910. Gillett, Horace W., c/o The Aluminium Castings Co., Detroit, Mich., U.S.A., Research Chemist.

1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1891. Gimingham, Edw. A., Croyland, Clapton Common, N., Technical Electrician.

1886. Girdwood, Dr. G. P., 615, University Street, Montreal, Canada, Professor of Chemistry.

1906. Girtin, Thomas, H. L. Raphael's Refinery, 48, Thomas Street, Burdett Road, London, E., Bullion Refiner.

1903 Gladding, Thos. S., 181, Front Street, New York City, U.S.A., Analytical Chemist.

1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.
1906. Glasel, Dr. Chas. J., Genthinerstrasse 35, Berlin, Germany, Tanner.
1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.
1906. Glass, A. Melville, 291, Camden Road, London, N.W., Patent Agent.
1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, Scotland, Calico Printer.
1884. Glendinning, H., Winnington House, Northwich, Cheshire, Technical Chemist.
1888. Gloag, Robt. F., Lothian Road, Middlesbrough, Secretary.
1912. Gloag, Vivian F., Millbury House, Darlington Road, Ferryhill, Co. Durham, Chemical Works Manager.
O.M. Glover, G. T., 23, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.
1896. Glover, H., 6445, Emlen Street, Germantown, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.
O.M. Glover, William, Albareda 27, Seville, Spain, Technical Chemist.
1911. Gmach, Ludwig T., Kew Bridge Label Works, Chiswick, W., Manufacturer.
1911. Goetschius, John M., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Sales Manager.
1898. Golding, Jno., University College, Reading, Agricultural Chemist.
1906. Goldschmidt, Dr. Karl, Chemical Works, Essen-Ruhr, Germany, Manufacturing Chemist.
O.M. Goldschmidt, Dr. S. A., 11, Broadway, New York City, U.S.A., President (Columbia Chemical Works).
1897. Goldschmiedt, Dr. Guido, Wasagasse 9, Wien IX, Austria, Professor of Chemistry, University of Vienna.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Dr. Jno. N., 67, Chancery Lane, London, W.C., Chemist.
1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.
1909. Goodban, Leonard, 43, Addison Gardens, Kensington, London, W., Works Chemist.
1912. Gooderham, J. Leys, 42, Elm Avenue, Toronto, Canada, Chemist.
1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1904. Gooding, E. Claude, Willow House, Washford, Somerset, Chemist.
1898. Goodrich, Chas. C., Broad Exchange Building, 25, Broad Street, New York City, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.
1913. Goodwin, H. W., Westbury Leigh, Westbury, Wilts, Analytical Chemist.
1894. Goodwin, Dr. W. L., Library Dept., The School of Mining, Kingston, Canada, Professor of Chemistry.
O.M. Goppelsroeder, Prof. Dr. F., Leimenstrasse 51, Basel, Switzerland, Professor of Chemistry.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1909. Gosse, Abel, 122, Boulevard St. Germain, Paris, France, Engineer (Poulenc Frères).
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.
1903. Govers, Francis X., c/o Borden's Condensed Milk Co., 108, Hudson Street, New York City, U.S.A., Chief Chemist.
O.M. Gowland, Prof. W., F.R.S., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).
1886. Goyder, G. A., 110, Gawler Place, Adelaide, South Australia, Chemist and Assayer.
1890. Grabfield, Dr. J. P., c/o Morris and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
O.M. Graham, C. C., Oriel House, Scarborough, Yorks, Technical Chemist.
1908. Graham, C. W., 54, Dingwall Avenue, Toronto, Canada, Chemist.
1883. Grandage, H., c/o S. Smethurst and Sons, Woolfold Dye and Bleach Works, Bury, Lancashire, Dyer.
1897. Granger, Dr. J. Darnell, 57, Holmwood Street, Newtown, Sydney, N.S.W., Australia, Analytical Chemist.
1905. Grant, Alexander, 15, Hermitage Drive, Edinburgh, Baker.
1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1911. Gray, Dr. G. W., c/o The Texas Co., Houston, Texas, U.S.A., Chairman, Manufacturing Committee.
1910. Gray, H. Le Breton, c/o Eastman Kodak Co., Rochester, N.Y., U.S.A., Superintendent, Film Department.
1907. Gray, Henry M., Broompark, Duffield, Derby, Engineer.
1904. Gray, Jas., P.O. Box 5254, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, The Cottage, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.
1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).
1896. Gray, Prof. Thos., Royal Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Durban, Natal, South Africa, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.
1894. Greaves, Wm., c/o The Otto Coke Oven Co., Ltd., Post Office House, Leeds, Chemical Engineer and Chemist.
1909. Greeff, R. H., Thames House, Queen Street Place, London, E.C., and (Jnls.) Broad Oak, Chislehurst, Kent, Chemical Merchant.
1894. Greeff, R. W., Thames House, Queen Street Place, London, E.C., and (Jnls.) Elm Bank, Bromley, Kent, Chemical Merchant.
O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and Clothworkers' Department, The University, Leeds, Professor of Tinctorial Chemistry.
1907. Green, Clarence, c/o Nicholson's Raincoat Co., Beaumont Works, St. Albans, Herts, Chemist.
1906. Green, Ernest, 98, Cheadle Road, Cheadle Hulme, Cheshire, Science Teacher.
O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
1910. Green, Robert M., 351, Blackburn Road, Accrington, Chemist.
1908. Green, Dr. W. Heber, Chemical Laboratory, The University, Melbourne, Victoria, Lecturer in Chemistry.
O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1909. Greenhough, George D., 21, Mincing Lane, London, E.C., Chemical Broker.
O.M. Greenway, T. J., c/o Potter's Sulphide Ore Treatment, Ltd., 369, Collins Street, Melbourne, Australia, Metallurgist.

1902. Greenwood, Conrad V., Noyna, Dowhills Road, Blundellsands, Liverpool, Cotton Mill Manager.
1907. Greenwood, Herbert W., "Buenos Ayres," Los Barreros, Cartagena, Spain, Metallurgical Chemist.
O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Technical Chemist.
1897. Gref, Anthony, 117, Hudson Street, New York City, U.S.A., Patent Lawyer.
1909. Gregory, Cecil H., The Morgan Crucible Co., Ltd., Battersea Works, London, S.W., Crucible Manufacturer.
1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.
1912. Gresham, Harold E., County Laboratories, 36, Dansie Street, Liverpool, Analytical Chemist.
1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., c/o Oxford Paper Co., Rumford, Maine, U.S.A., Manager of Chemical and Electro-Chemical Department.
1912. Griffiths, Clement S., Central Queensland Meat Export Co., Ltd., Lake's Creek, Rockhampton, Queensland, Chemist.
1902. Griffiths, Manfred E., Caizley House, Temple Road, Stowmarket, Suffolk, Explosives Chemist.
1912. Grimké-Drayton, Norman, Royal Mint Refinery, 19, Royal Mint Street, London, E., Metallurgist.
1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.
1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.
O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.
1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.
1909. Grist, John M., c/o Curtis's and Harvey, Ltd., Explosives Works, Cliffe-at-Hoo, Kent, Chemist.
1912. Groeling, Alb. von, 3, Lombard Street, London, E.C., Civil and Consulting Engineer.
1906. Groenewoud, Sidney H., 36, Grosvenor Road, Highbury, N., Analytical Chemist.
O.M. Grossmann, Dr. J., 157, Plymouth Grove, Manchester, Consulting Chemist and Chemical Engineer.
1896. Grosvenor, Dr. W. M., Chemists' Building, 50, East 41st Street, New York City, U.S.A., Consulting Chemical Engineer.
1909. Grove, Daniel, Pastoral Chambers, Inverell, N.S.W., Australia, Diamond Buyer and Mine Owner.
O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).
1907. Groves, J. Stuart, c/o E. I. du Pont de Nemours Powder Co., Georgetown, S.C., U.S.A., Chemist.
1899. Gudemann, Dr. E., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.
1906 Guess, Prof. Geo. A., 306, Stair Building, 123, Bay Street, Toronto, Canada, Professor of Metallurgy.
1911. Guild, Edward J., 5, Grove Terrace, Leek, Staffs, Analytical Chemist.
1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.
1909. Gullick, Wm. A., Government Printing Office, Sydney, N.S.W., Government Printer.
1906 Gulline, Percy, 197, Pawtucket Street, Lowell, Mass., U.S.A., Printworks Superintendent.
1904. Gundlach, Walter, 249, West 104th Street, New York City, U.S.A., Superintendent of Colour Works.
1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.
1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs, Paper Mill Chemist.
1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., Thames House, Queen Street Place, London, E.C., Merchant.
1910. Günther, C. M., Pyrmont Sugar Refinery, Sydney, N.S.W., Sugar Chemist.
1903. Guthrie, Alan, Dept. of Industries, Post Box 112, Madras, India, Leather Chemist.
1901. Guthrie, John M., 199, Ferry Road, Leith, Scotland, Analytical Chemist.
1909. Guttmann, Camillo J., 60, Mark Lane, London, E.C., Chemical Engineer.
1903. Guttmann, Dr. Leo F., School of Mining, Queen's University, Kingston, Ont., Canada, Research Chemist.
1912. Guy, Wm. W., 6, Cecil Road, Upton Manor, E., Analytical Chemist.

H

1904. Hacking, D. H., Enfield Soap Works, Clayton-le Moors, near Accrington, Soap Manufacturer.
1900. Haddock, Arthur G. *See* Haydock.
1887. Hadfield, Sir Robert A., Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) c/o J. E. Mortimer, 220, Newhall Road, Attercliffe, Sheffield, Steel Founder.
1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.
O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.
1904. Hadley, Geo., Waterfall Lane, Blackheath, Staffs, Spelter Works Manager.
1906. Hagen, Dr. Carl, c/o E. I. du Pont de Nemours Powder Co., 20, Bishopsgate, London, E.C., Representative.
1887. Haig, Robert, Dollarfield, Dollar, Scotland, Chemical Engineer.
1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks, Chemical Engineer.
1896. Haigh, De Lagnel, 39, Hill Crest, Summit, N.J., U.S.A., Chemist.
1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.
1910. Hailstone, Harold J., 44, Cordley Street, West Bromwich, Works Chemist.
1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.
O.M. Hake, C. Napier, Chemical Adviser.
1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.
1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.
1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1898. Hall, Clarence A., 18, McPherson Street, Mount Airy, Philadelphia, Pa., U.S.A., Chemist.
O.M. Hall, Edgar, Silver Spur, Queensland, Australia Technical Chemist.
1909. Hall, Harold, 98, Birkin Avenue, Hyson Green, Nottingham, Analyst.
1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.
1885. Hall, Lt.-Col. Jno. A., Langston, Esquimault Old Road, Victoria, B.C., Canada, Analytical Chemist.
1908. Hall, John S., Manor House, Overseal, Ashby-de-la-Zouch, Chemist.
1912. Hall, Robert H., Weardale Tar Works, Spennymoor, Co. Durham, Chemical Works Manager.
1896. Hall, S. Godfrey, East London Soap Works, Bow, E., Soap Maker.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.
1912. Halliday, McDonald, c/o The Lagunas Synd., Ltd., Oficina North Lagunas, Iquique, Chile, Analytical Chemist.

1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.

1900. Hallock, Dr. Albert P., 3, James Street, Yonkers. N.Y., U.S.A., Chemist.

1892. Hamaguchi, Gihei, IV., Toyoharacho, Komatsubaratori, Wakayamashi, Japan, Soy Manufacturer.

1897. Hambly, Fred J., Buckingham, Quebec, Canada, Chemist.

1901. Hambuechen, Carl, 217, South Mills Street, Madison, Wis., U.S.A., Consulting Chemical Engineer.

1910. Hamburg, Dr. Max, c/o The British Diamalt Co., Sawbridgeworth, Herts, Chemist and Manager.

1911. Hamilton, David J., 9, Montgomerie Quadrant, Glasgow, W., Oil Refiner and Paint Manufacturer.

1904. Hamilton, Edward H., Virginia Smelting Works, West Norfolk, Va., U.S.A., Manager.

1912. Hamilton, James, 9, Esplanade Avenue, Whitley Bay, Northumberland, Analytical Chemist.

1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, Ayrshire, Works Manager.

1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.

1911. Hammersley, Wm., 70, Winsor Terrace, Beckton, E., Manufacturing Chemist.

1898. Hammersley, W. Stanley, Rue Champbertrand, Sens (Yonne), France, Tanner.

O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.

O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.

1905. Hancock, Thos. J., 4029, North Springfield Avenue, Chicago, Ill., U.S.A., Chemist.

1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.

1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.

1889. Handy, Jas. O., Pittsburgh Testing Laboratory, Seventh and Bedford Avenues, Pittsburgh, Pa., U.S.A., Chemist.

1888. Hanks, Abbot A., 630, Sacramento Street, San Francisco, Cal., U.S.A., Assayer.

1901. Hanna, Charles E., P.O. Box 600, Montreal, Canada, Secretary.

1905. Hanson, H. Norman, Field Head, Brighouse, Yorks, Research Assistant.

1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.

1909. Harbord, F. W., 16, Victoria Street, Westminster, S.W., Metallurgist.

1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.

1904. Hard, Dr. James M. B., 2A, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.

1901. Hardcastle, G. Fred., 307, East Park Road, Leicester, Teacher of Science and Technology.

1894. Harden, Dr. Arthur, F.R.S., 5, Cambridge Gardens, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.

1910. Hardie, Thos., Newcastle and Gateshead Gas Co., Tyneside Road, Newcastle-on-Tyne, Gas Engineer.

1909. Harding, Herbert, 54, Streathbourne Road, Upper Tooting, S.W., Assistant Examiner (H.M. Patent Office).

1908. Hardman, Benj., c/o Kodak, Ltd., Wealdstone, Middlesex, Analytical Chemist.

1912. Hardwick, Walter A. N.. Taranaki (N.Z.) Oil Wells, Ltd., New Plymouth, New Zealand, Chemist.

1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.

1905. Hardy, Chas. H., c/o Reckitt and Sons, Ltd., Hull, Chemist.

1907. Harfeld, Louis E., c/o Messrs. Ohlenschlager Bros., Shanghai House, Botolph Lane, London, E.C., Merchant.

1906. Hargreaves, Frank, Hough Green, Widnes, Chemist.

1896. Hargreaves, James, May Villa, Peel House Lane, Widnes, Chemical Engineer.

O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.

1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.

1909. Harland, Robert M., 37, Lombard Street, London, E.C., Analytical Chemist and Assayer.

1893. Harlock, E. B., Newton House, Middlewich Chemical Manufacturer.

1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.

1905. Harper, Dr. Henry W., University of Texas, 2216, Rio Grande Street, Austin, Texas, U.S.A., Professor of Chemistry.

1912. Harper, J. G., Kynochtown, Stanford le Hope, Essex, Managing Chemist.

1913. Harper, Wm., Agenaruo, Naruomura, Hyogoken, Japan, Works Chemist.

1912. Harran, Dr. Edward B., Abbey Field, Sandbach, Cheshire, Chemist.

1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.

1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.

1897. Harris, Fred. W., 38, Cochrane Street, Glasgow, Public Analyst.

1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.

1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.

1907. Harris, Thos. E., c/o The Union Acid Co., 17. Cooper Street, Manchester, Chemical Merchant.

1906. Harris, Wm. G., jun., 21, Fraser Avenue, Toronto, Canada, Metallurgist.

1905. Harrison, E. F., Langholm, Edgar Road, South Croydon, Analytical Chemist.

1909. Harrison, Edwin D., 86, Harrison Place, Irvington, N.J., U.S.A., Celluloid Manufacturer.

1883. Harrison, G. Herbert, Hagley, Stourbridge, Firebrick Maker.

1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Chemist.

1907. Harrison, W., 85, Atwood Road, Didsbury, Manchester, Technical Investigator.

1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.

1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.

O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.

1890. Hart, H. W., Winthrop, Ansdell Road, Lytham, Lancashire, Analytical Chemist.

1897. Hart, Wm. Beamont, Manchester Laboratory, 8. Exchange Street, Manchester, Consulting Chemist.

1908. Hartley, Bernard C., 56, Wood View, Manningham, Bradford, Analytical Chemist.

1912. Hartley, Harold, c/o The Richmond Gas Stove and Meter Co., Ltd., Warrington, Research Chemist.

1883. Hartley, Joseph, 73, East Road, Stockport Road, Longsight, Manchester, Technical Chemist.

1912. Hartley, Thos., 64, Westlecot Road, Swindon Wilts, Teacher of Technical Chemistry.

1905. Hartshorne, Wm. D., Arlington Mills, Methuen, Mass., U.S.A., Agent.

1901. Hartwell, S. Warren, 120, North Fourth Street, Easton, Pa., U.S.A., Chemist.

1908. Harvey, Arthur J., 265, Burdett Road, Limehouse, E., Chemist.

1885. Harvey, Ernest W., 36, Arthur Road, Wimbledon Park, London, S.W., A.R.S.M., Engineer.

1913. Harvey, Hildebrand W., Hutton Mount, Brentwood, Essex, Research Chemist.

1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.

1899. Harvey, Thos. F., 69, North Road, West Bridgford, Nottingham, Analyst (Drug Co.).

1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1908. Harvey, Wm. Ross, c/o R. Lehmann and Co., Ltd., Peninsular House, Monument Street, London E.C., Starch Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.

1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubbs, W., Starch Works Manager.

1906. Havercroft, Arthur E., Glenholme, Burton Road, Hornsea, Yorks, Chemist.

1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.

1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.

1910. Hawkes, Cornelius A., Dovercourt, Painswick Road, Gloucester, Analytical Chemist.

1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.

1897. Hawkins, Ernest M., Watling Chambers, Canterbury, Analytical Chemist.

1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.

1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.

1887. Hawliczek, Josef, c/o United Alkali Co., Sullivan Works, Widnes, Consulting Chemical Expert.

1899. Haworth, Dr. Edw., Ivy Bank, Moughland Lane, Runcorn, Cheshire, Chemist.

1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).

1910. Haworth, John, 117, Millhouses Lane, Sheffield, Chemist and Sewage Works Superintendent.

1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.

1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.

1910. Hay, J. Gordon, 37, Worcester Road, Bootle, Liverpool, Analytical Chemist.

O.M. Haydn-Morris, J., 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1900. Haydock, A. G., c/o The Castner-Kellner Alkali Co., Wallsend-on-Tyne, Technical Chemist.

1909. Haydon, James R., 91, Ampthill Road, Aigburth, Liverpool, Works Manager and Chemist.

1894. Haynes, David O., 82, Fulton Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."

1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Pharmaceutical Chemist.

1906. Hayworth, W. P., Park View, Park Road, Dartford, Kent, Chemist.

1905. Hazard, Fred R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).

1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.

1894. Heal, Carlton, Hall Nook, Penketh, near Warrington, Tanner.

1912. Healey, E., jun., St. Mary's Mills, Leicester, India-rubber Manufacturer.

O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.

1905. Heathcote, Henry L., c/o Rudge-Whitworth, Ltd., Coventry, Research Chemist.

1904. Heaton, Noel, 72, Abbey Road, London, N.W., Colour Manufacturer.

1905. Heberlein, Dr. Edw., c/o H. T. Enthoven and Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.

1889. Hecht, Jos. L., c/o French and Hecht, Davenport, Iowa, U.S.A., Analytical Chemist.

1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.

1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.

1912. Hedley, Dr. Edgar P., c/o Kynoch, Ltd., Umbogintwini, Durban, South Africa, Chemist.

1902. Heebner, Prof. C. F., 42, Gerrard Street East, Toronto, Canada, Professor of Pharmacy.

1903. Hegeman, John W., 8, Glenada Place, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.

1908. Helps, James W., Gas Works, Waddon, Croydon, General Manager, Gas Co.

1898. Hemingway, Frank C. R., 17, Battery Place, New York City, U.S.A.

1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1910. Henderson, Ernest G., c/o Canadian Salt Co., Ltd., Windsor, Ont., Canada, Vice-President and Manager.

1883. Henderson, Prof. G. G., Royal Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Stranord, West Kilbride, Ayrshire, Professor of Chemistry and Physics.

1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, Scotland, Oil Works Manager.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.

1906. Henius, Dr. Max, 1135—1147, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1912. Henley, Andrew T., 9, Minerva Terrace, College Road, Cork, Ireland, Technical Chemist.

1904. Henley, Hon. F. R., 9, Beaufort Gardens, London, S.W., Brewers' Chemist.

1905. Henning, Albert, c/o Hedley and Co., 92, Harrow Road, Leytonstone, N.E., Ester Manufacturer.

1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Experimental Station, P.O. Henry Clay, Del., U.S.A., Chemist.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1910. Hepburn, Edward, Priory Works, Dartford, Kent, Tanner.

1888. Hepworth-Collins, W., Junior Constitutional Club, Piccadilly, London, W.; retain Journals, Civil Engineer.

1906. Herig, Harry W., c/o General Chemical Co., Hudson River Works, Edgewater, N.J., U.S.A., Chemist.

1897. Heriot, T. H. P., Royal Technical College, Glasgow, Lecturer in Sugar Manufacture.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.

1903. Herreshoff, J. B. F., 620, West End Avenue, New York City, U.S.A., Chemical Engineer.

1887. Herriot, Wm. Scott, Clarewood, Thorntonhall, Lanarkshire, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Associate Professor of Metallurgy.

1898. Hersey, Dr. Milton L., P.O. Box 1086, Montreal, Canada, Consulting Chemist.

1903. Herstein, Dr. Bernard, Appraisers' Stores, Christopher Street, New York City, U.S.A., Chemical Examiner.

1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.
1906. Herz, Dr. Albert, c/o John Crossley and Sons, Ltd., Halifax, Yorks, Chemist.
1907. Hess, Arthur F., c/o A. Hess and Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.
1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1904. Heurich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.
1910. Hewitt, Arthur, c/o Consumers' Gas Co., 19, Toronto Street, Toronto, Canada, General Manager.
O.M. Hewitt, Dr. D. B., Grove Mount, Davenham, Cheshire, Alkali Manufacturer.
1896. Hewitt, Dr. J. Theo., F.R.S., Clifford House, Bedfont, Middlesex, Lecturer.
1890. Hewlett, John C., 40—42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1907. Hewson, Geo. W., Grasmere, Field Terrace, Jarrow-on-Tyne, Analytical Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1894. Heyl, G. Edward, King's House, Kingsway, London, W.C., Chemical and Electrical Engineer.
1906. Heys, Charles H., Toronto Arcade, Toronto, Canada, Consulting Chemist.
1901. Hiby, Dr. Walter, c/o The Otto Hilgenstock Coke Oven Co., Ltd., Post Office House, Leeds, Chemical Engineer.
1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.
1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.
1886. Higgins, C. L., 41, Knowsley Road, Cressington Park, Liverpool, Manufacturing Chemist.
1905. Higgins, Dr. Eric, 12, Elleray Park Road, Wallasey, Cheshire, Chemist.
1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.
1908. Higgins, S. H., Luncarty Bleachfield, Perth, Chemist and Asst. Manager.
1909. Higson, Frank, 52, Chapel Street, Salford, Manchester, Analytical Chemist.
1909. Higuchi, Ken-ichi, 118, Honmurachō, Azubuku, Tokyo, Japan, Chemical Engineer, Japanese Department of Agriculture and Commerce.
1911. Hilditch, T. P., Birchdene, Cross Lane, Grappenhall, Warrington, Research Chemist.
1909. Hill, Arthur E., British P.O., Salonica, Turkey, Technical Chemist.
1903. Hill, Chas. Alex., c/o British Drug Houses, Ltd., 22—30, Graham Street, City Road, N., Chemist.
1897. Hill, Dr. Herbert M., 20, West Eagle Street, Buffalo, N.Y., U.S.A., City Chemist.
1907. Hill, James A., 122, Greenway Road, Runcorn, Cheshire, Technical Chemist.
1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, Mining Engineer.
O.M. Hill, J. K., 13, Osborne Place, Ibrox, Glasgow, Manufacturing Chemist.
1892. Hill, Sydney, c/o Blundell, Spence, and Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.
1902. Hill, Wm. G., jun., c/o Apsley Rubber Co., Hudson, Mass., U.S.A., Chemist.
1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.
O.M. Hills, W., Oxford Works, Tower Bridge Road, London, S.E., Pharmaceutical Chemist.
1899. Hinchley, J. W., 55, Redcliffe Road, London, S.W., Chemical Engineer.
1904. Hinckley, J. F., 550, East 7th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.
1909. Hinks, Edward, 16, Southwark Street, London, S.E., Analyst.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertrand C., Coventry House, South Place, Finsbury, London, E.C., Metallurgical Chemist.
1912. Hinman, Jack J., jun., 1021, Central Avenue, Indianapolis, Ind., U.S.A., City Analyst.
1909. Hirsch, Fritz, 51, Ferndale Avenue, Wallsend-on-Tyne, Analytical Chemist.
1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.
1907. Hirt, Wilhelm B., c/o Cuming, Smith, and Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.
1907. Hirtz, Dr. Heinrich, Kühlingsgasse 32, Duisburg, Germany, Chemist.
1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, Gas Engineer and Manager.
1913. Hitchcock, Thos. J., 209, South Esk Road, Forest Gate, Essex, Technical Chemist.
1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A., North Station, Providence, R.I., U.S.A., Printworks Superintendent.
1906. Hobsbaum, Isaac B., Analytical Chemist.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1907. Hochstetter, Robt. W., Oak and Bellevue Avenues, Mount Auburn, Cincinnati, Ohio, U.S.A., Superintendent.
1909. Hodgart, Matthew, Vulcan Works, Paisley, Engineer.
1894. Hodge, Andrew, Hockerley Lane, Whaley Bridge, near Stockport, Printworks Chemist.
O.M. Hodgkinson, Dr. W. R., 89, Shooter's Hill Road, Blackheath, S.E., Professor of Chemistry.
O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1910. Hodsman, Henry J., Dept. of Fuel and Coal Gas Industries, The University, Leeds, Chemist.
1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1886. Hogben, W., Post Office, Port Talbot, South Wales, Chemical Expert (Celluloid, etc.).
O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.
1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
1884. Holgate, Thos., 61, Calton Road, Dulwich, S.E., Gas Engineer.
O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1909. Holliday, F. E., 81, Fulton Street, New York City, U.S.A.

1896. Hollings, J. Spencer, Brymbo, North Wales, Works Manager.

1909. Hollingworth, David V., Birchenwood Collieries, Kidsgrove, Stoke-on-Trent, Gas Analyst.

1903. Hollinshead, Peter, The Beeches, Weston Road, Runcorn, Cheshire, Chemist.

1900. Hollinshead, Dr. Warren H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.

1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.

1890. Holloway, G. T., 9—13, Emmett Street, Limehouse, London, E., Analytical and Consulting Chemist.

1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.

O.M. Holmes, F. G., Thames Tar Works, Lower Road, Northfleet, Kent, Tar and Ammonia Distiller.

1913. Holt, Dr. Alfred, Dowsefield, Allerton, Liverpool, University Reader in Physical Chemistry.

1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts, Chemist.

1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.

1892. Holton, E. C., 601, Canal Road N. W., Cleveland, Ohio, U.S.A., Chemist.

1893. Holzapfel, Max, c/o Holzapfels, Ltd., Felling-on-Tyne, Manufacturer.

1893. Homfray, D., c/o La Fabrica de Papel, San Rafael, Est. de Mexico, Mexico, Analytical Chemist.

1909. Hook, Russell W., 8, Holton Street, West Medford, Mass., U.S.A.

1904. Hooker, A. H., c/o Hooker Electrochemical Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.

O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, London, S.W., Chemist.

1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.

1888. Hope, Jas., The Nickel Co., Kirkintilloch, Scotland, Nickel Works Manager.

1904. Hopewell, Fredk., 59, William Street, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Geneva, N.Y., U.S.A., Consulting Chemist.

1905. Hoppenstedt, A. W., c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chemist.

1911. Hord, Arthur R., 8, Kenilworth Road, Westmoreland Road, Newcastle-on-Tyne, Analytical Chemist.

1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.

1904. Hornsey, J. W., 49, Wall Street, New York City, U.S.A., Chemical Engineer.

1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.

1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.

1906. Hoseason, Jas. H., Sun Buildings, 2, Bridge Street, Manchester, Chemical Manufacturer.

1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.

1899. Hoskins, Wm., 2009, Harris Trust Building, 111, West Monroe Street, Chicago, Ill., U.S.A., Chemist.

1911. Hough, Samuel, c/o Lever Bros., Ltd., Balmain, Sydney, N.S.W., Australia, Chemist.

1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.

1892. Houston, John, 30, Princess Street, Manchester, Drysalter.

O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.

1901. Howard, Bernard F., Firbank, Loughton, Essex, Chemist.

O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.

1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.

1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.

1902. Howard, Nelson A., c/o General Chemical Co. of California, 705, Royal Insurance Building, San Francisco, Cal., U.S.A., General Manager,

O.M. Howard, W. D., 11, Cornwall Terrace, Regent's Park, London, N.W., Chemical Manufacturer.

1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.

1912. Howe, Dr. Percy R., 536, Pleasant Street, Belmont, Mass., U.S.A., Dentist.

1909. Howell, Harry, c/o W. C. Holmes and Co., Whitestone Iron Works, Huddersfield, Chemical Engineer.

1904. Howell, Walter L., Room 314, Custom House, New Orleans, La., U.S.A., Chemist.

1899. Howles, Fred., c/o McDougall Bros., 66—68, Port Street, Manchester, Chemist.

1912. Howlett, Arthur E., Wakefield, Mass., U.S.A., Chemical Technologist.

1889. Howorth, F. Wise, 10, New Court, Lincoln's Inn, W.C., Technical Chemist and Chartered Patent Agent.

1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.

1909. Howse, Geo. H., 67, Union Street, Smethwick, Birmingham, Paint Manufacturer.

1906. Hoyler, Fritz, 93, Market Street, Perth Amboy, N.J., U.S.A., Chemist.

1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.

1900. Hübner, Julius, Linden, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).

1909. Hudson, Baker, Public Library, Middlesbrough, Librarian.

1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.

1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.

O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.

1898. Hughes, Raymond M., Miami University, Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.

1908. Hughes, Wm. E., Chemical Laboratory, Messrs. W. Canning and Co., Great Hampton Street, Birmingham, Electro Chemist.

1906. Hulme, Robert B., 1162, Union Avenue, Memphis, Tenn., U.S.A., Chemical Engineer and Manager.

1909. Hultman, G. H., St. Paulsgatan 31, Stockholm, Sweden, Gas Engineer.

1905. Hulton, H. F. E., 15, Oak Hill Court, Putney, S.W., Chemist.

1905. Humel, Edward J., 1474, Clarence Avenue, Lakewood, Cleveland, Ohio, U.S.A., Chemist.

1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.

1902. Humphrey, Richard L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.

1903. Humphreys, A. C., 165, Broadway, New York City, and (Jnls.) Stevens Inst. of Technology, Hoboken, N.J., U.S.A., Engineer.

1913. Humphreys, Dr. R. E., 229, Laporte Avenue, Whiting, Ind., U.S.A., Chemist.

1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.

1912. Humphries, Herbert B. P., Queen Anne's Chambers, Westminster, S.W., Consulting Chemist.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.

1900. Hunt, Arthur V., 19, Park Road, Port Sunlight, Cheshire, Analytical Chemist.

O.M. Hunt, Chas., 17, Victoria Street, Westminster London, S.W., Civil Engineer.

1909. Hunt, Edwin J., The Grange, Walsall, Staffs. Managing Director, Chance and Hunt, Ltd.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.

1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 14A, Finsbury Square, London, E.C., Analytical and Consulting Chemist.

1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.

1894. Hurry, E. H., Llanover, Churt, Farnham, Surrey, Mechanical Engineer.

1894. Hutcheson, Jno. F., 39, St. Enoch Square, Glasgow, Chemical Manufacturer.

1912. Hutchin, C. D., c/o Messrs. Meredith and Drew, Ltd., High Street, Shadwell, London, E., Biscuit Manufacturer.

O.M. Hutchinson, C. C., K.C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.

1900. Hutchinson, E. George, Gas Dept., Engineer's Office, Workington, Manager.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1909. Hutchison, Chas. F., Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Photographic Emulsion Maker.

1909. Hütz, Dr. R., 32, India Street, Boston, Mass., U.S.A., Colour Chemist.

O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.

1906. Huyett, Miles C., 1005, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, 11, Broadway, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.

1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

I

1912. Ibbotson, E. C., 28, Westwood Road, Porter Glen, Sheffield, Steel Manager.

1900. Ichioka, Dr. Tajiro, 19, Maruyama, Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.

1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1909. Imison, C. S., The Cottage, Runcorn, Cheshire, Chemist, United Alkali Co.

1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By-Products Plant Manager.

1900. Ingalls, Walter R., 505, Pearl Street, New York City, U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, 6, Highfield Terrace, Kingston Road, Leeds, Organic Chemist.

1909. Ingleby, G. W., c/o John L. Seaton and Co., Ltd., Sculcoates, Hull, Director.

1906. Inglis, Dr. Jno. K. H., University of Otago, Dunedin, New Zealand, Professor of Chemistry.

1912. Inglis, Robert J. C., Greenmount, Gravesend, Kent, Analytical Chemist.

1911. Innes, Dr. Alfred G., Fabrique de Soie Artificielle, Tubize, Belgium, Technical Chemist.

1909. Innes, R. Faraday, c/o The British Chrome Tanning Co., St. Andrew's Tannery, Northampton, Chemist.

1906. Innes, Dr. Wm. Ross, 9, Stag Lane, Edgware, Middlesex, Chemist.

1910. Irvine, Prof. J. C., Chemical Research Laboratory, The University, St. Andrews, Scotland, Professor of Chemistry.

1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

1911. Irwin, George C., c/o S. H. Johnson and Co., Ltd., Carpenter's Road, Stratford, E., Manager (Engineering Works).

1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.

O.M. Irwin, W., Derwent Lodge, Cockermouth, Analytical Chemist.

1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.

1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

1912. Ivatt, Albert, The Engadine, Histon, Cambridge, Chemist (Foods).

1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.

O.M. Jackson, Edward, Raven's Cliff, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.

1904. Jackson, Ernest W., Godrevy, Saltburn, Yorks, Analytical Chemist.

1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.

1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.

1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

1901. Jackson, Percy G., c/o National Boiler Insurance Co., St. Mary's Parsonage, Manchester, Chemist.

1890. Jackson, Saml., 3, Buckingham Gardens, Perambore Barracks, Madras, India, Analytical Chemist.

1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).

1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.

1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.

1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).

1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.

1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.

1900. Jacoby, Areli H., c/o American Dyewood Co., 80, Maiden Lane, New York City, U.S.A., Chemist.

1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.

1886. Jago, Wm., 1, Garden Court, Temple, London, E.C., Barrister-at-Law,

1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.

1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.

1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.

1911. Jamieson, R. H., 264, St. Patrick Street, Montreal, Canada, Varnish and Paint Manufacturer.

1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.

O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.

1911. Jarrom, Harry G., 41, Wilberforce Road, Hendon, N.W., Managing Director (Gallenkamp and Co.).
1900. Jarvie, Jas., Ferndale, Kenmure Avenue, Bishopbriggs, Scotland, Chemist.
1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.
1910. Jayne, David W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manager.
1913. Jeans, Harold, 165, Strand, London, W.C., Metallurgist.
1908. Jeffery, John H., 10, Daysbrook Road, Streatham Hill, London, S.W., Chemist and Metallurgist.
1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
1905. Jenkins, Chas. D., 408, Burton Halls, Cambridge, Mass., U.S.A., Chemist.
1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1912. Jenkins, Leslie C. W., 26, Ulundi Road, Blackheath, S.E., Chemist (Wood Dyeing).
1912. Jenkins, Rees, 5, Grange Avenue, Auckland Park, Bishops Auckland, Co. Durham, Analytical Chemist.
1894. Jenks, Robt. L., 1, Chamock Place, Calcutta, India, Chemist.
1911. Jennens, John H., 4, Highbridge Road, Wylde Green, nr. Birmingham, Analytical Chemist.
1908. Jennison, George, Beechwood, Tatton Road South, Heaton Moor, Stockport, Chemist.
1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.
1904. Jepson, John Elliott, c/o Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, 23, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jewson, F. T., Earith, near St. Ives, Hunts, Chemist.
1896. Job, Robt., 649, Roslyn Avenue, Westmount, Quebec, Canada, Analytical Chemist.
1906. John, David, Haileybury, Ontario, Canada, Chemist.
1908. Johnson, Arthur, 25, Nursery Street, Pendleton, Manchester. Chemist.
1886. Johnson, A. E., 24, Parkdale, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, West House, Hartford, Cheshire, Chemical Engineer.
1891. Johnson, Edmond E., c/o Adcocks, Drayton Park Works, Highbury, N., Chemical Engineer.
1904. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
O.M. Johnson, J. E. J., 133, Earlham Grove, Forest Gate, E., Manufacturing Chemist.
1895. Johnson, Jesse F., P.O. Box 94, St. Anne de Bellevue, Quebec, Canada, Chemical Engineer.
1900. Johnson, John, c/o John Johnson and Co., 37th Street, and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. Haigh, West Riding Rivers Board, Wakefield, Yorks, Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1904. Johnston, Thos. J., 4, Garrioch Drive Maryhill, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Prince Bay, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W.E.
O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
1910. Johnstone, E. J., 43—44, National Bank and Loan Building, Watertown, N.Y., U.S.A., Chemist.
O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, Meridian Drug and Essence Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
1907. Jolliffe, Ernest H., Technical High School, 149, College Street, Toronto, Canada, Works Chemist.
1905. Jolliffe, Frank, 27, Riseldine Road, Honor Oak Park, S.E., Chemist.
1912. Jone, Hugo, 752, Broadway, Brooklyn, N.Y., U.S.A., Chemist.
1909. Jones, Arthur, c/o Grout and Co., Ltd., Silk Crape Works, Great Yarmouth, Technical Chemist.
1904. Jones, Arthur B., 981, Central Avenue, Plainfield, N.J., U.S.A., Superintendent.
1912. Jones, B. Vaughan, P.O. Box 27, Petersburg, Va. U.S.A., Chemist and Manufacturer.
1912. Jones, Charles, c/o Middleton Estate and Colliery Co., Ltd., Broom Pit, Leeds, Coke Plant Manager.
1902. Jones, David R., c/o Laurentian Chemical Co., Mont Tremblant, Quebec, Canada, Chemical Engineer.
1908. Jones, D. Trevor, "Mountain Ash," Ravenglass, Cumberland, Works Chemist.
1911. Jones, Edgar D., 3, Neville Road, Waterloo, near Liverpool, Analytical Chemist.
1912. Jones, E. Gabriel, City Analyst's Laboratories, Ashton Street, Liverpool, Assistant Public Analyst for Liverpool.
1910. Jones, E. Protheroe, The Golden Horseshoe Estates Co., Salisbury House, London Wall, London, E.C., Secretary.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
1909. Jones, E. Willis, 22, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.
O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 39, Pembury Road, Clapton, N.E., Technical Chemist.
1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.
1912. Jones, G. P., Cameron Powder Manufacturing Co., Emporium, Pa., U.S.A., General Manager.
1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
1907. Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham, Analytical Chemist.
1893. Jones, Herbert. *See* Sefton-Jones, H.
1901. Jones, Herbert J., 40, Reginald Road, Forest Gate, E., Chemist.
1910. Jones, Ivor R., 54, Atlantic Chambers, Manchester, Chemical Merchant.
1905. Jones, J. E. Stacey, 92, Little Park Street, Coventry, Consulting Chemist and Technical Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1894. Jones, M. W., Stonebeck, Brislington, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 135, William Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.
1903. Jones, Wm. App, c/o Boston Artificial Leather Co., 200, Fifth Avenue, New York City, U.S.A., Chemist.
1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
1912. Jordan, Walter L., 918, West 5th Street, Glendale, Cal., U.S.A., Chemical Engineer.

908. Joselin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.
905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.
900. Josephson, Edgar, c/o Pantazote Leather Co., Passaic, N.J., U.S.A.
906. Joshua, Dr. Walter P., c/o Cordoba Copper Co., Ltd., Cerro Muriano, nr. Cordoba, Spain, Chemist.
891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
887. Joüet, Dr. C. H., 238, East 2nd Avenue, Roselle, N.J., U.S.A., Technical Chemist.
889. Journaud, Louis, Pont Evêque, près Vienne (Isère), France, Technical Chemist.
904. Jowett, Dr. H. A. D., Phœnix Mills, Dartford, Kent, Research Chemist.
903. Joyce, Clarence M., P.O. Box 23, Arlington, N.J., U.S.A., Chemist.
O.M. Justice, Philip M., 55–56, Chancery Lane, London, W.C., Patent Agent.

K

896. Kalbfleisch, Franklin H., 31, Union Square West, New York City, U.S.A., Chemical Manufacturer.
1908. Kalenski, Edmund, The Argyll Club, 52 Russell Square, London, W.C., Chemist.
1908. Kaliski, Dr. Maximilian S., 118, West 119th Street, New York City, U.S.A., Technical Chemist.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1912. Kampen, Kurt van, The London Electric Works, Ltd., Horseferry Road, Limehouse, E., Managing Director.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1910. Kaufmann, George von, Solotwina, Ost-Galizien, Austria, and (Journals) Christ's College, Cambridge, Director (Austrian Petroleum Co.).
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1910 Kaufmann, Dr. W. P., c/o J. J. McLaughlin, Ltd., 145—155, Sherbourne Street, Toronto, Canada, Manufacturing Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
1912. Kay, Jas. H., Hazle Bank, Bolton Road, Ramsbottom, Lancashire, Soap Manufacturer.
O.M. Kay, Wm. E., 349, The Cliff, Broughton Park, Manchester, Printworks Chemist.
1910. Kaye, Henry R., c/o Cuming, Smith, and Co., Port Melbourne, Vic., Australia, Analytical Chemist.
1904. Kaye, Thos., 26, Rose Crescent, Perth, Scotland, Analytical Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
O.M. Kearns, H. W., Baxenden, near Accrington, Dyer.
1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., 1322, Park Road, Washington, D.C., U.S.A., Chief of Drug Laboratory, Department of Agriculture.
1908. Keeble, A. J., Wereham Hall, Stoke Ferry, Norfolk, Land Owner.
1910. Keeler, Warren I., 214, Main Street, New Britain, Conn., U.S.A., Analytical Chemist.
1911. Keenan, Thomas J., 117, East 24th Street, New York City, U.S.A., Paper Chemist.
1908. Keiller, P. A., c/o Colombo Commercial Co., Ltd., Colombo, Ceylon, Agricultural Analyst.
1910. Keillor, John, Hamilton Gas Light Co., Hamilton, Canada, Gas Engineer.
1886. Keiser, Prof. E. H., Library of Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1908. Keith, Jas. W., c/o C. Tennant and Co., Ltd., Carnoustie, Forfarshire, Analytical Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 69, Barclay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, H. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1909. Kelso, Jas. A., c/o Canada Cement Co., Exshaw Alta, Canada, Chemist.
1910. Kemmerich, Dr. Wm. E., Farbenfabr. vorm. F. Bayer und Co., Leverkusen, bei Cöln, Germany, Chemist.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1901. Kennedy, Alex., Kenmill House, Bothwell, Scotland, Rosin Distiller.
1912. Kennedy, Carl D., Apartado 176, Torreon, Coahuila, Mexico, Chemist.
1912. Kent, Raymond W., c/o The Sweinhart Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1906. Kepner, S. H., 22, Tenth Street, Long Island City, N.Y., U.S.A., Superintendent.
1888. Ker, Alan D., 14, Wilton Mansions, Glasgow, and (Journals) c/o J. C. Barr, 180, West Regent Street, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 275, Lafayette Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., c/o Pittsburg Plate Glass Co., Creighton, Pa., U.S.A., Ceramic Research Chemist.
1912. Kerr, R. Vaughan, 27, Highbury Gardens, Seven Kings, Ilford, Essex, Technical Chemist.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., 712, La Fayette Building, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1909. Kesava-Menon, A., 86, Messina Avenue, West Hampstead, N.W., Chemist.
1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.
1900. Kewley, Jas., c/o Anglo-Egyptian Oilfields, Ltd., Suez, Refinery Manager.
1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.
1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer and City Biologist.
1913. Kilby, Jos. N., 87, Deepdale Road, Garrowtree, Rotherham, Assistant Manager (Steel Plant).
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1912. Killheffer, Elvin H., c/o Kalle and Co., 530, Canal Street, New York City, U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer
O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1912. Kind, George E., 33, King Street, Covent Garden, London, W.C., Bookseller and Publisher.
O.M. King, A. J., Elleray, Windermere, Bleacher and Finisher.
1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.
1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.
1911. King, Harold, 24, The Brent, Dartford, Kent, Chemist.

O.M. King, J. Falconer, 30, Chambers Street, Edinburgh, Consulting Chemist.
1910. King, John, Summerville Gardens, Latchford, Warrington, Lancashire, Works Manager.
1913. King, Robert C., 68, Schlusselburg Road, St. Petersburg, Russia, Chemist.
1895. King, Sidney J., Brean, Upton Road, Bexley Heath, Kent, Analytical Chemist.
O.M. King, Walter R., 16, Mincing Lane, London, E.C.; and (Journals) Torville, The Cliffs, Southend-on-Sea, Chemical Manufacturer.
1905. King, Warren C., 72, Front Street, New York City, U.S.A., President, Independent Chemical Co.
1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.
1908. Kingsbury, Percy C., German-American Stoneware Works, 50, Church Street, New York City, U.S.A., Civil Engineer.
1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.
O.M. Kingzett, C. T., Newlands, St. George's Avenue, Weybridge, Surrey, and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.
1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.
1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.
1908. Kirkhope, T. Bertram, Sandbank, Gwithian, Hayle, Cornwall, Explosives Works Chemist.
1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.
1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.
1900. Kirkpatrick, Prof. Stafford F., 84, Gore Street, Kingston, Ont., Canada, Professor of Metallurgy.
1911. Kirstein, H. C., 3, Lombard Street, London, E.C., Consulting Engineer.
1910. Kirwan, P. T., jun., Capelton, P.Q., Canada, Chemist.
1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.
1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.
1900. Kittredge, H. G., c/o The Kay and Ess Co., Dayton, Ohio, U.S.A., Chemist.
1908. Klaber, Wm., c/o Castle Kid Co., Camden, N.J., U.S.A., Chemist.
1900. Kleber, Dr. Clemens, Clifton Chemical Laboratory, Passaic, N.J., U.S.A., Director.
1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.
1911. Klein, C. A., 4, Brimsdown Avenue, Enfield Highway, Middlesex, Works Chemist.
1908. Klein, Dr. Friedrich, 762, Melrose Avenue, New York City, U.S.A., Chemist.
1909. Klemm, Wilfred E., c/o Messrs. Charles Greaves, 217, Chester Road, Manchester, Chemist.
1908. Klien, Dr. J. L., c/o Aboshi Celluloid Co., Aboshi, Harima, Japan, Works Manager.
1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.
1889. Klipstein, A., 644—654, Greenwich Street, New York City, U.S.A., Chemical Manufacturer.
1902. Klipstein, Ernest C., 93, Prospect Street, East Orange, N.J., U.S.A., Chemical Merchant.
1891. Knaggs, Alfred B., 37, Mannville Terrace, Bradford, Technical Chemist in Dyeworks.
1911. Knapp, Arthur W., c/o Cadbury Bros., Ltd., Bourneville, nr. Birmingham, Analytical Chemist.
1911. Knapp, Harry P., 38—44, Middle Street, Lowell, Mass., U.S.A., Chemical Manufacturer.
1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.
1904. Kniffen, Frederick, 823, North Franklin Street, Wilmington, Del., U.S.A., Chemist.
1887. Knight, A. H., 51, Highfield Street, Liverpool, Assayer.
1903. Knight, Harley F., 14, Old Queen Street, Westminster, S.W., Analyst.
1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.
O.M. Knight, J. Baillie, Royal Primrose Soapworks, Silvertown, London, E., Soap Manufacturer.
1887. Knights, J. West, 67, Tenison Road, Cambridge, Analytical Chemist.
1885. Knipler, F., "Strathberg," Greensborough, near Melbourne, Victoria, Starch Manufacturer.
1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.
1910. Knott, E. Anthony F., The Priestman Collieries, Ltd., Ottovale Coke Works, Blaydon-on-Tyne, Works Chemist.
1911. Knowland, Daniel P., c/o Geigy-ter-Meer, 69, Barclay Street, New York City, U.S.A., Chemist.
1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.
1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.) c/o Parbury, Henty, and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.
1906. Knudsen, Kristian Hv., Tofte Cellulosefabrik, Norway, Chemist.
1905. Koch, Dr. Geo. W., 905, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.
1911. Kochs, A. Victor, 301, Glossop Road, Sheffield, Gas Engineer.
1904. Koebig, Dr. J., 414, I. W. Hellman Building, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.
1909. Koekkoek, Patrick R., c/o Messrs. Blacklock and Macarthur, 165—173, West Street, Tradeston, Glasgow, Works Chemist.
1911. Koelle, Dr. G., Metallbank und Metallurgische Gesellschaft, Bockenheimer Anlage 45, Frankfurt a/M., Germany, Chemist.
1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.
1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.
1910. Komuro, S., c/o Mrs. Ohtani, Karasumaru, Sawaragi, Nishie, Iru, Kyoto, Japan, Technical Chemist.
1912. Koopman, M., 170, Rue Belliard, Brussels, Belgium, Chemical and Consulting Engineer.
O.M. Kraftmeier, E., Bank Buildings, St. James's Street, London, S.W., Explosives Manufacturer.
1906. Krais, Dr. Paul, Lustnauer Allee, Tuebingen, Germany, Chemist.
1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).
O.M. Krause, Prof. Dr. G., Cöthen (Anhalt), Germany, Chemist.
1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.
1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.
1910. Krone, L. J., c/o "The Metal Industry," 99, John Street, New York City, U.S.A., Consulting Metallurgist and Editor.
1900. Kunheim, Dr. Erich, Niederschöneweide, near Berlin, Germany, Chemist.
1904. Kunz, Dr. George F., c/o Tiffany and Co., 409, 5th Avenue, New York City, U.S.A., Gem Expert.
1905. Kurt, Franklin T., 553, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.
1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.
1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.
1909. Kwoh, See Kwain, c/o Ta-Chou Electrical Lighting Co., Lily Pond, Chinkiang, China, Chemical Engineer.
O.M. Kynaston, J. W., 3, Oak Terrace, Beech Street, Liverpool, Chemical Engineer.
1907. Kynaston, Wm. C. R., 9, Harland Road, Higher Tranmere, Birkenhead, Analyst.

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1897. Labonde, Dr. Leon, 3418, South Flower Street, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.

1906. Lacell, Harold G., Ardoch, Nether Street, Finchley, N., Chemist.

1890. Lacey, E. C., St. Julian's Lodge, St. Julian's Farm Road, West Norwood, Manufacturing Chemist.

1903. Lachman, Dr. Arthur, 3037, Wheeler Street, Berkeley, Cal., U.S.A., Chemical Engineer.

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

O.M. Lake, G., jun., Lee Mount, Glossop, Derbyshire, Analytical Chemist.

1907. Lake, Henry B., c/o Philip Harris and Co., Ltd., Birmingham, Chemical Engineer.

1900. Lamar, Wm. R. Lamar Chemical Works, 8—14, Johnson Street, Newark, N.J., U.S.A., President.

1898. Lamb, Morris Chas., Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Chemist.

1912. Lampitt, Leslie H., La Meunerie Bruxelloise, Haren Nord, Brussels, Belgium, Research Chemist.

1912. Lancaster, Harry C., 135, Ladbroke Road, Kensington, W., and 94, Gracechurch Street, London, E.C., Managing Director.

1907. Lancaster, Harry M., Laboratory, Provincial Board of Health, Toronto, Canada, Chemist.

1910. Landrum, R. D., c/o General Gas Light Co., Kalamazoo, Mich., U.S.A., Chemical Engineer.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1910. Lane, J. Henry, 3, Arbour Square, Stepney, London, E., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., c/o Nashua Gummed and Coated Paper Co., Nashua, N.H., U.S.A., Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.

1898. Langstaff, Wm., 39, Orchard Street, Elizabeth, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks, Chemist and Manager.

1909. Lantsberry, Fred. C. A. H., Birmingham Small Arms Co., and (Journal) 63, Walford Road, Sparkbrook, Birmingham, Metallurgical Chemist.

1906. Lantz, Alfred, 139, Rue La Fayette, Paris, France, Colour Works Manager.

1903. Larter, Alfred T., 86, Inderwick Road, Stroud Green, N., Chemist.

1907. Lasché, Prof. Alfred, The Lasché Institute, 2809, Vine Street, Milwaukee, Wis., U.S.A., Chemist and Bacteriologist.

1904. Lasher, F. G., 251, Bush Street, Brooklyn, N.Y., U.S.A., Chemist.

1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Chemist.

1909. Law, Douglas J., Trent Bridge Leather Works, Nottingham, Chemist.

1907. La Wall, Chas. H. 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Lawrence, Jas., Box 737, Joplin, Mo., U.S.A., Explosives Manufacturer.

1911. Lawrence, Wm. A., Laboratory, 11, Vandewater Street, New York City, U.S.A., Director.

1904. Lawson, Jos. H. S., Rodney Street Works, Oldham Road, Manchester, Salesman.

1900. Lawson, Wm. L., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and 1, King's Arms Yard, London, E.C., Chairman of Bovril, Ltd.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1907. Leach, Dr. F. P., Briarswood, Chester Road, Erdington, Birmingham, Research Chemist.

1908. Leake, Percy C., Deanbank Terrace, Ferryhill Village, Co. Durham, Tar Works Manager.

1898 Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Agricultural Research Institute, Pusa, Bengal, India, Government Chemist.

1913. Lebach, Dr. Hans, c/o The Bakelite Co., Ltd., Orb Works, Cowley, near Uxbridge, Middlesex, Chief Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1907. Lecco, Prof. Marco T., Belgrade, Servia, Professor of Chemistry.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 39, West 38th Street, New York City, U.S.A., Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1911. Lee, Joseph, c/o Mr. Gill, 280, Alma Street, Rockhampton, Queensland, Works Chemist.

1885. Lee, S. Wright, 6-10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.

1912. Lees, Arnold, 2, Arthington Place, Hunslet Lake, Leeds, Analytical Chemist.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, University of Alberta, Strathcona, Alberta, Canada, Professor of Chemistry.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, c/o Companhia de Gaz, Parà, North Brazil, Gas Works Manager.

1902. Leighton, A. E., Commonwealth Cordite Factory, Maribyrnong, Victoria, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield. Aniline Dye Manufacturer.

1912. Leitch, P. T., Plant No. 12, Canada Cement Co., Ltd., Exshaw, Alberta, Canada, Chief Chemist.

1904. Le Maistre, Fred J., Room 727, Du Pont Building, Wilmington, Del., U.S.A., Research Chemist.

1898. Leman, Wm. T., P.O. Box 747, Chicago, Ill., U.S.A., Oil and Asphalt Agent.

1908. Lemeland, Dr. P., 8, Rue Alfred de Vigny, Paris, France, Chemist.

1883. Lennard, F., Messrs. Forbes, Abbott, and Lennard, Ltd., Chemical Works, Shoreham, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII^e.), France.

1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1907. Leslie, Dr. Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemist.

1894. Leslie, Hugh M., 10, St. Andrew's Drive, Pollokshields, Glasgow, W., Chemical Engineer.

1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.

1912. Lessner, C. B., Carril, Spain, Metallurgical Chemist.

1892. Lester, J. H., Grange Drive, Monton Green, Eccles, Lancs., Analytical Chemist.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1891. Lever, Sir Wm. H., Bart., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1909. Lever, W. Hulme, Heathfield, Bebington, Cheshire, Soap Manufacturer.

1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Dr. Louis E., 781, Sherman Boulevard, Milwaukee, Wis., U.S.A., Chemist.

1912. Levin, Isaac H., 11, Marshall Street, Newark, N.J., U.S.A., Chemist.

1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1901. Levinstein, Dr. Herbert, c/o Levinstein, Ltd., Blackley, near Manchester, Chemist.

O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 1927, Madison Avenue, New York City, U.S.A., Chemist.

1909. Levy, Louis S., 80, Maiden Lane, New York City, U.S.A., Editor, "American Perfumer."

1901. Levy-Mond, Dr. Albert. *See* Mond, Dr. Albert L.

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.

1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.

1904. Lewis, Edw. W., c/o J. G. Ingram and Sons, London India Rubber Works, Hackney Wick, N.E., Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1905. Lewis, F. W., Aetna Powder Co., 143, Dearborn Street, Chicago, Ill., U.S.A., Secretary.

1900. Lewis, John, 76, Underhill Road, Lordship Lane, S.E., Cashier (Paint Works).

1909. Lewis, Reginald J., Govt. Explosives Office, 423, Flinders Lane, Melbourne, Australia, Chemist.

1900. Lewis, Dr. S. Judd, 122, Newington Causeway, London, S.E., Analytical Chemist.

1889. Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.

1907. Leyson, Lewis T., c/o Standard Bank of South Africa, Johannesburg, Transvaal, Analytical Chemist.

1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.

1904. Lichtenthaeler, Robt. A., Rhode Island Agricultural Experiment Station, P.O. Box 112, Kingston, R.I., U.S.A., Chemist.

1904. Lieber, Dr. Hugo, 25, Madison Avenue, New York City, U.S.A., Chemist.

O.M. Liebmann, Dr. A., The Whim, Weybridge, Surrey, Consulting Chemist.

O.M. Lightfoot, T. E., Fernleigh, Accrington, Calico Printer's Chemist

1905. Liley, Thos. A., 46, Westover Road, Bramley, Leeds, Chemist.

1911. Lilja, Sten Gustaf, Misterton, Gainsborough, Chemical Engineer.

1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.

1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).

1908. Lindfield, James H., 135, Putney Bridge Road, Putney, S.W., Technical Chemist.

1897. Lindsay, Robt., P.O. Box 54, Cleveland, Transvaal, Chemist.

1911. Line, Chas. A., 39, Beaufort Road, Edgbaston, Birmingham, Technologist.

1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, London, E.C., Consulting Chemist.

1908. Linthicum, J. Francis, c/o The Spanish-American Iron Co., Felton, Oriente, Cuba, Chemist.

1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.

1896. Lishman, Geo. P., Lambton Coke Works, Fence Houses, Co. Durham, Colliery Chemist.

1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.

O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.

1911. Liu, Hamilton C., Dept. of Public Works, Board of Interior Affairs, Pekin, China, viâ Siberia, Chemist.

1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.

1886. Liversedge, A. J., c/o Venesta, Ltd., 1—4, Great Tower Street, London, E.C., Mechanical Engineer.

1906. Liversedge, S. G., City Laboratory, Castle Street, Dublin, Ireland, Analytical Chemist.

1904. Liverseege, J. F., Analytical Dept., 44, Broad Street, Birmingham, City Analyst.

O.M. Liversidge, Prof. A., F.R.S., Field Head, Combe Warren, Kingston, Surrey, Professor of Chemistry.

1907. Liversidge, Bernard, Cliffhurst, Clifton Crescent North, Rotherham, Yorks, Analytical Chemist.

1883. Livingston, W. J., 30, Fountayne Road, Stoke Newington Common, London, N., Analytical Chemist.

1903. Llewellyn, Ivor P., Goole Alum Works, Goole, Chemist.

1907. Llewellyn, W. B., 61, Belgrave Road, New Moston, Manchester, Chemist.

1909. Lloyd, Edward, 27, Broomgrove Road, Sheffield, Chemical Engineer.

1913. Lloyd, Prof. Francis E., Dept. of Botany, McGill University, Montreal, Canada, Prof. of Botany.

1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.

1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks, Lecturer in Chemistry.

1908. Lloyd, Capt. M. B., 3, Neville Terrace, Onslow Gardens, London, S.W., Director of Curtis's and Harvey, Ltd.

1900. Lloyd, Thos. H., c/o Quibell Bros., Newark-on-Trent, Analyst.

1888. Lodge, Edw., 33, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.

1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.

1907. Lomax, Ernest L., c/o Mower and Co., 8–12, Sparkes Street, Rangoon, Burmah, Chemist.

1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.

1909. Long, George, Cudahy, Wis., U.S.A., Glue Maker.

1898. Longstaff, Dr. Jas. P., Chemical Department, The University, Edinburgh, Assistant.

1908. Longwell, Alex., 404, Lumsden Building, Toronto, Canada. Mining Engineer.

1902. Loomis, Henry M., 33, Appraisers' Building, San Francisco, Cal., U.S.A., Chemist.

1890. Lord, F. J., Winmarleigh, Southbourne, Christchurch, Hants, Analytical Chemist.

1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs, Chemist and Manager.

O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.

1904. Lorimer, John H., 280. West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.

1905. Loring, Lindsley, 40, Central Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).

1909. Lorleberg, C., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.

O.M. Lorrain, Jas. G., Staple Inn Buildings, Holborn, London, E.C., Chartered Patent Agent.

1904. Lossen, Dr. Clemens F., Boulevardul Independentei 8, Ploesti, Roumania, Chemist.

O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.

O.M. Louis, D. A., 123, Pall Mall, London, S.W., Metallurgist and Mining Engineer.

1894. Louis, Prof. Henry, Armstrong College, and (Jnls.) Northern Scientific Club, Bolbec Hall, Westgate Road, Newcastle-on-Tyne, Professor of Mining.

O.M. Love, Dr. E. G., 80, East 55th Street, New York City, U.S.A., Analytical Chemist.

1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).

1895. Lovejoy, Frank W., 22, Seneca Parkway, Rochester, N.Y., U.S.A., Chemical Engineer.

O.M. Lovibond, J. W., The Pleasaunce, Lake, near Salisbury, Tintometer Manufacturer.

O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.

1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.

1911. Lowcock, J. Harold, Garstang, Kemerton Road, Beckenham, Kent, Chemist.

1913. Lowe, Austin, 21, Lavender Sweep, Battersea, S.W., Research Chemist.

1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.

1905. Lowe, Houston, The Lowe Bros. Co., 452, East Third Street, Dayton, Ohio, U.S.A., Paint and Varnish Maker.

O.M. Lowe, W. F., 18, Hough Green, Chester, Analytical Chemist.

1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.

1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.

1895. Lucas, Alf., Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analyst.

1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.

O.M. Luck, A. Courtenay, Laboratorio de Explosivos, Darsena Norte, Buenos Aires, Argentina, Explosives Chemist.

1900. Lummus, Walter E., 39, Bassett Street, Lynn, Mass., U.S.A., Manager.

1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, Scotland, Technical Chemist.

1910. Lumsden, William W., 39, Caledonia Road, Saltcoats, Scotland.

1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.

1888. Lundholm, Carl O., 220, Winchester House, Old Broad Street, London, E.C., Explosives Works Manager.

1898. Lundteigen, Andreas, c/o Ash Grove Lime and Portland Cement Co., Grand Avenue Temple, Kansas City, Mo., U.S.A., Chemist.

O.M. Lunge, Dr. G., Carmenstrasse 37, Zürich, Switzerland, Professor of Chemistry.

1913. Lunn, Chas. A., Laboratory, The Yaryan Naval Stores Co., Brunswick, Ga., U.S.A., Chemical Engineer.

1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.

1884. Lüthy, Otto, P.O. Box 63, Maywood, N.J., U.S.A., Analytical Chemist.

1895. Luxmoore, Dr. Chas. M., 19, Disraeli Gardens, Putney, S.W., Lecturer on Chemistry.

1913. Lycett, P. J., c/o The County Chemical Co., Ltd., Bradford Street, Birmingham, Chemist.

1903. Lye, Ernest B., Leagrave Hall. near Luton, Beds, Straw Plait Dyer and Bleacher.

1885. Lye, W. T., Leagrave Hall, near Luton, Beds, Straw Dyer.

1884. Lyle, James, Ardesco, West Silvertown, E., Sugar Refiner.

1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.

1896. Lymn, Arthur H., 53, Hampstead Way, London, N.W., Consulting Chemical and Gas Engineer.

1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.

1902. Lyon, Edwd. H., 520, West 27th Street, New York City. U.S.A., Manufacturing Chemist.

O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks, Tar Distiller.

1906. Lyons, Robert H., c/o Canadian Explosives, Ltd., Vaudreuil Station, Quebec, Canada. Chemist.

O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

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1908. Maas, Milton A., 92, William Street, New York City, U.S.A., Manufacturing Chemist.

1911. Mabbitt, Alan T., 3, Wallwood Road, Leytonstone, N.E., Analytical Chemist.

1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.

1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.

1912. McAfee, Dr. A. M., c/o The Texas Co., Port Arthur, Texas, U.S.A., Chemist.

1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.

1894. McAlley, Robt., Bankside, Falkirk, Scotland, Paint Works Manager.

1892. Macara, Thos., jun., 13, Ridge Road, Stroud Green, N., Chemist.

1912. McArly, T. P., Mount Lyell Mining and Railway Co., Queenstown, Tasmania, Chemist and Assayer.

1887. McArthur, James B., Price's Patent Candle Co., Limited, Belmont Works, Battersea. S.W., Chemist.

O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.

1901. Macarthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.

1892. McArthur, Thos., 711, Tower Building, Water Street, Liverpool, Drysalter and Dyewood Extractor.

1912. Macaulay, J. W., 17, Ridley Street, Gateshead-on-Tyne, Metallurgical Chemist.

1911. McBride. K. R., Glens Falls, N.Y., U.S.A., Colour Chemist.

1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.

O.M. McCallum, J. M., Southdene, Paisley, Scotland, Soap Manufacturer.

1894. McCann, Owen, c/o Messrs. Jas. A. Kemp and Co., Ferry Works, Seacombe, Cheshire, Printing Ink Manufacturer.

1905. McCaw, Lt.-Col. W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.

1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.

1910. McColl, A. L., Santa Barbara, Cerro Azul, Peru, Chemist.

1907. McConnan, Dr. Jas., 15, Grosvenor Road, Birkdale, Lancashire, Chemist.

1903. McCourt, Cyril D., 45, Braxted Park, Streatham Common, S.W., Chemist.

1912. McCoy, James P. A., Research Division, Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., U.S.A., Analytical Chemist.

1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.
1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgwater, Cider Manufacturer.
1911. McCulloch, Norman G., Rhodes Works, Rhodes, Manchester, Chemist and Calico Printer.
1903. McCully, R. E. J., 7, London Road, Northfleet, Kent, Analytical Chemist.
1910. Macdonald, Alexander, Brampton House, Camphill Avenue, Langside, Glasgow, Clerk.
1912. McDonald, Allan D., "Belgrano," Milngavie, near Glasgow, Manufacturing Chemist.
O.M. Macdonald, Andrew, 72, Great Clyde Street, Glasgow.
1912. McDonald, Donald, Cleeve House, Bexley Heath, Kent, Analytical Chemist.
1897. MacDonald, G. W., Whitefriars, Rochester, Kent, Chief Explosives Research Chemist (Curtis's and Harvey, Ltd.).
1910. Macdonald, J. L. A., 13, Howard Place, St. Andrews, Fife, Scotland.
O.M. Macdonald, J. W., 8, Prince of Wales Terrace, Kensington, W., Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
O.M. McDonald, T. McG., Walilabo Estate, St. Vincent, West Indies, Sugar Chemist.
1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, City Analyst.
1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Chemical Manufacturer.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.
1906. McDowall, Wm., 42, Herriet Street, Pollokshields, Glasgow, Analytical Chemist.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1901. McEwen, Duncan C., Chiksan Mines, Seikwan Station, Chosen (Korea), Metallurgical Chemist.
1908. McEwen, Stewart R., c/o Chemical Laboratories, Ltd., 148, Van Horne Street, Toronto, Canada, Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1910. McFarlane, John, 6, Gordon Terrace, Shettleston, Glasgow, Metallurgist.
O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Works Manager.
1901. McFarlane, Walter, The Lodge, Brinscall, near Chorley, Printworks Manager.
1890. McFarlane, W. W., East 20th Street, Chester, Pa., U.S.A., Dyeworks Manager.
1893. McGhie, T. Burns, c/o Bwana M'Kubwa Copper Mining Co., Bwana M'Kubwa, Northern Rhodesia, Metallurgist.
1904. McGill, Dr. A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.
1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, c/o D. Clouston, Drayton Hall, Nagpore, C.P., India, Technical Chemist.
1906. McGregor, Russell, 194, High Street, Scunthorpe, Lincolnshire, Analytical Chemist.
1896. McIlhiney, Dr. Parker C., 7, East 42nd Street, New York City, U.S.A., Chemist.
O.M. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand, Public Analyst and Consulting Chemist.
1903 McIntire, Benj. Gould, 2226, West 17th Street, Wilmington, Del., U.S.A., Chemist.
1909. McIntyre, George D., c/o Canadian Explosives Co., Ltd., Beloeil Station, P.Q., Canada, Analytical Chemist.
1910. Mackay, Angus, Laboratory, Wellpark Brewery, Glasgow, Brewer's Chemist.
1911 Mackay, F., c/o Lautaro Nitrate Co., Ltd., Taltal, Chili, Analytical Chemist.
1912. McKechnie, Alex., Chad Hill Cottage, Edgbaston, Birmingham, Copper Smelter.
O.M. McKechnie, D., Heath House, Runcorn, Copper Extractor.
O.M. McKechnie, D. M., The Grange, Halewood, near Liverpool, Copper Extractor.
1904. McKechnie, R. D., c/o The Pyrites Co., Ltd., Roanoke, Va., U.S.A., Chemical Engineer.
1887. McKellar, W. G., c/o United Alkali Co., Ltd., St. Rollox Works, Glasgow, Technical Chemist.
1895. McKenna, Dr. Chas. F., 50, Church Street, New York City, U.S.A., Chemist.
1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass., U.S.A., Colour Mixer.
1909. Mackenzie, Kenneth G., c/o The Texas Co., Bayonne, N.J., U.S.A., Chemist.
1893. McKerrow, C. A., 56, Ramillies Road, Bedford Park, W.; and (Journals) c/o Mitchells, Ashworth, and Co., 23-24, Old Bailey, London, E.C., Consulting Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1911. McKey, Arthur W., 216, Milk Street, Boston, Mass., U.S.A., Sales Agent.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1912. McKillop, G. F., Oilworks, Broxburn, West Lothian, Scotland, Works Chemist.
1890. McKillop, Jno., 32, Aynho Road, Hammersmith, W., and (Jnls.) c/o W. Müller, 16, Grape Street, Oxford Street, W., Metallurgist.
1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.
1908. McLaren, Alex., 22, Moss Lane, Walton, Liverpool, Analytical Chemist.
1908. McLaren, Alex. W., 3, Hayfield Terrace, Langside, Glasgow, Analytical Chemist.
1898. McLaurin, Robt., Homesteads, Cambusbarron, Stirling, Chemist.
1909. MacLaurin, Dr. Robert D., University of Saskatchewan, Saskatoon, Saskatchewan, Canada, Chemist.
1905. McLellan, Basil G., c/o Rowntree and Co., Ltd., The Cocoa Works, York, Technical Chemist.
1910. MacLellan, George A., 1, Montague Terrace, Glasgow, W., Rubber Manufacturer.
1910. MacLennan, Alex., Tannery, Ross, Herefordshire, Rubber Chemist.
1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick, Dumbartonshire, Analytical Chemist.
1892. McLeod, Jas., Gas Works, Greenock, Manager.
1903. MacMahon, F. W., Netherhay, The Common, Warlingham, Surrey, Chemist (Oxychlorides, Ltd.).
1896. McMaster, Daniel, 108, Somerset Street, Rumford, Maine, U.S.A., Paper Mill Manager.
1912. McMaster, Prof. Le Roy, Washington University, St. Louis, Mo., U.S.A., Assoc. Prof. of Chemistry.
1904. McMullen, Alan, Saint James' Gate, Dublin, Ireland, Brewer.
1889. McMurtrie, J. M., 212, West Regent Street, Glasgow, Brass Founder.
1900. McMurtrie, Dr. Wm., 264, Riverside Drive, New York City, U.S.A., Chemist.
1895. McMurtry, G. C., Templemore, Richmond, Nelson New Zealand, Manager.
O.M. Macnab, W., 10, Cromwell Crescent, London, S.W., Analytical Chemist.
1907. McNaughton, Wm. G., Port Edwards, Wis., U.S.A., Chemist.
1908. McQueen, James, jun., Phœnix Chemical Works, Pollokshaws, Glasgow, Chemical Manufacturer.
1912. McRae, J. A., 184, University Avenue, Kingston, Ont., Canada, Research Chemist.
1909. McWhirter, James, c/o Wm. Beardmore and Co., Laboratory, Parkhead Forge, Glasgow, Metallurgical Chemist.
1910. Madge, Norman, c/o Continental Rubber Co. of New York, 11, Vandewater Street, New York City, U.S.A., Chemist.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture Richmond, Va., U.S.A., Chemist.

1885. Mahon, R. W., N.Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.

1912. Main, Hugh, Almondale, Buckingham Road, South Woodford, N.E., Analytical Chemist.

1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.

1904. Mair, William, 37, Morningside Drive, Edinburgh, Chemist.

1905. Major, Ernest, " Seafield," Day Street, Drummoyne, Sydney, N.S.W., Manufacturing Chemist.

O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks, Tar Distiller and Chemical Manufacturer.

1910. Male, C. E., Brookland House, Cottenham, Cambs, Chemist.

1886. Mallinckrodt, Edw., Library, Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1908. Mander, C. Arthur, Varnish and Colour Works, Wolverhampton, Varnish Manufacturer.

1912. Manley, Chas. E., 8, Wilmington Gardens. Barking, Essex, Paint and Colour Works Manager.

1893. Mann, Harold H., Agricultural College, Poona , Bombay, India, Research Chemist.

1899. Mann, Jas. S., 19, Stopford Road, Upton Manor, Essex, Analyst.

1891. Mann, John C., 33, Nicholls Street, West Bromwich, Staffs, Chemist.

1903. Mannhardt, Hans, 1104, Oakdale Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.

1909. Manns, Dr. J., c/o C. W. Schmidt, Varnish Works, Stratford, E., Chemist.

1892. Mansbridge, Wm., 4, Norwich Road, Wavertree, Liverpool, Chemist.

1904. Marckworth, O. S., Ohio Testing Laboratory, 426, Chamber of Commerce, Columbus, Ohio, U.S.A., Director.

1883. Markel, Dr. K. E., 20, Queen's Gate Terrace, South Kensington, S.W., Technical Chemist.

1905. Marland, Percy, Lake Lock, Stanley, Wakefield, Technical Chemist.

1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.

1912. Marly, Dr. Simon M., 58, Oak Street, Southport, Analytical Chemist.

1904. Marris, H. C., 68, Schlüsselburg Prospect, St. Petersburg, Russia, Analytical Chemist.

1901. Marsden, Dr. Fred., Office of Industries, Poonmallee Road, Madras, India, Chemist.

1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.

O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.

1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.

1895. Marshall, Arthur, Waverley Cottage, Naini Tal, India, Chief Chemical Examiner.

1895. Marshall, Francis G., 56, Bewick Road, Gateshead, Technical Chemist.

1891. Marshall, Dr. Hugh, Chemical Dept., University College, Dundee, Professor of Chemistry.

1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.

1883. Marshall, Wm., Laboratory, Ladybrook Road, Cheadle Hulme, Cheshire, Dyer.

1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.

1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.

1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.

1895. Martin, Chas. H., 50, Longmead Road, Claremont, Pendleton, Manchester, Oil and Soap Works Manager.

1913. Martin, Edwin J., c/o Jas. Martin and Sons, Luton, Beds, Bleacher and Dyer.

1911. Martin, Dr. G., 4, Bertram Road, Hendon, N.W., Science Teacher and Industrial Chemist.

1911. Martin, G. F. Wesley, Castle Park, Lancaster, Chemist.

O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.

1899. Martin, Wm. E., 111, Belle Vue Road, Durban, Natal, South Africa, Chemist.

1911. Martin, Wilmot S., 2, Coronation Terrace, Truro, Cornwall, Analyst and Assayer.

1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.

1907. Martius, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Dyestuff Manufacturer.

1894. Martyn, T. Graham, Box 5, Maraisburg, Transvaal, South Africa, Metallurgist.

1909. Marx, Robert J., 133–139, Finsbury Pavement, London, E.C., Engineer.

1908. Mason, Douglas H. C., 448, Confederation Life Building. Toronto, Canada, Manufacturer.

1904. Mason, Dr. Edward D., 32, Vernon Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.

1911. Mason, Francis A., c/o Murphy and Lonsdale, 4, Queen Square, Leeds. Analytical Chemist.

1906. Mason, Dr. Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.

1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.

1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.

1910. Mason, James H., 180, Richmond Street West, Toronto, Canada, Metallurgist.

1906. Mason, M. Edgar, 1030, North Branch Street, Chicago, Ill., U.S.A., Consulting Chemist.

1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.

O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.

1908. Masson, R. Duncan, c/o Messrs. R. Silcock and Sons, Stanley Hall, Union Street, Liverpool, Analytical Chemist.

1902. Masujima, Prof. Bunjiro, c/o K. Takebe, 25, Gazenbocho, Azabuku, Tokyo, Japan, Prof. of Applied Chemistry.

1902. Masury, Fred L. M., L.D. 545, Sharon, Pa., U.S.A., Explosives Manufacturer.

1910. Matchet, Andrew S., 13, Bute Gardens, Muirend, Cathcart. Glasgow, Analytical Chemist.

1911. Mather, Hubert, Lonsdale Terrace, Whitefield, Lancashire, Chemist.

O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.

1904. Mather, J. Cecil, Works Chemist.

1900. Mather, Wm., c/o The Standard Chemical Co., St. Henri, Montreal, Canada, Chemist.

1907. Matheson, A. Greville E., 38–40, Lloyd Street, Manchester, Engineer.

1890. Matheson, W. J., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.

1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.

1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Managing Director.

1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.

1913. Mathuram, Dr. A., Guru Medical Hall, Trichinopoly, South India, Pharmacist.

1888. Mátos, Dr. Louis J., (Comms.) 103, North 19th Street, East Orange, N.J., and (Jnls.) c/o Cassella Color Co., 182–4, Front Street, New York City, U.S.A., Chemist.

1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.

1912. Matthewman, Fred. P., Analyst's Office, L.B. and S.C. Railway Co., Brighton, Chief Chemist.

O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1907. Matthews, Dr. F. E, Ashlawn, The Glebe, Blackheath, S.E., Technical Research Chemist.

1899. Matthews, Dr. J. Merritt, 19, Wilcox Place, East Orange, N.J., U.S.A., Professor of Chemistry and Dyeing.

1912. Maude, A. H., 10, Norfolk Street, Strand, London, W.C., Technical Chemist.

1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1903. Maxim, Hudson, Landing, N.J., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, Cumberland, and (communications) English Street, Carlisle, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., c/o West Virginia Pulp and Paper Co., Luke, Md., U.S.A., Chemist.
1911. May, Clarence E., 320, South Walnut Street, Bloomington, Ind., U.S.A.
1897. May, George H., 35, Graycliff Road, Newton Centre, Mass., U.S.A., Assistant Chemist.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Mayer, Frederick J., Hudson Terminal Building, 30, Church Street, New York City, U.S.A., General Manager.
1896. Mayfield, A. S., Oakdene, Newland Park, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1900. Maywald, F. J., 89, Pine Street, New York City, U.S.A., Technical Chemist.
1909. Meanwell, Chas. W., 15, Woodlands Crescent, Muswell Hill Road, London, N., Analytical Chemist.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatsheaf Works, Alexandria, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.
O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1911. Mellerio, Lucien P., 5, Coburg Mansions, Brunswick Square, London, W.C., Technical Assistant.
1912. Melling, S. E., Lynton, Prestwich Park, Manchester, Analytical Chemist.
O.M. Mellon, W. W., Woodlands, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
1910. Mellor, Dr. Jos. W., 19, Villas, Stoke-on-Trent, Ceramic Chemist.
1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.
1900. Melville, Robt. L., Box 655, G.P.O., Auckland, N.Z., Chemist.
1912. Mennell, Harold, 41, Wolverton Road, Stony Stratford, Bucks, Analytical Chemist.
1893. Mensching, Dr. C., Mersey Chemical Works, Bromborough, Cheshire, Chemist.
O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1890. Merck, Dr. E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., 45, Park Place, New York City, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.
1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
[illegible] Merriman, C. E. B., 74, Trent Boulevard, West Bridgford, Nottingham, Technical Chemist.
1900. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.
1905. Merrin, A. C., 194–200, Bishopsgate, London, E.C., Assistant Editor and Analyst.
1904. Merry, Jno. B., 74, Park Hill Road, Harborne, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks, Chemist.
1905. Merz, Eugene, Newark, N.J., U.S.A., Superintendent, Heller and Merz Co.
1897. Meslans, Prof. M., 6, Rue de Navarin, Paris, France, Professor of Chemistry.
O.M. Messel, Dr. R., F.R.S., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1913. Metcalf, Frederick A., c/o U.S. Finishing Co., Passaic, N.J., U.S.A., Chemist.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accrington, Tar Distiller.
1908. Metcalfe, Ernest D., Messrs. Curtis's and Harvey, Ltd., Cannon Street House, London, E.C., Secretary.
1906. Methley, Bernard, Ferndale, Moorgate, Rotherham, Yorks, Engineering Chemist.
1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.
1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.
1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
1912. Michie, Arthur C., The Wallsend Laboratories, Wallsend-on-Tyne, Technical Chemist.
1909. Michie, John L., 9, Townhead Terrace, Paisley.
1907. Micklethwait, Miss Frances M. G., Royal College of Science for Ireland, Dublin, Chemist.
1911. Middlemass, Alphonso, 59, Promenade, Portobello, Midlothian, Works Chemist.
1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.
1896. Miles, G. Wellington, Room 214, 88, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1912. Millar, Chas. J., c/o Turner, Morrison, and Co., Paint Dept., 6, Lyons Range, Calcutta, India, Analytical Chemist.
1899. Millar, Jas. H., P.O. Box 4975, Johannesburg, Transvaal, Manufacturing and Analytical Chemist.
1909. Millar, Jas. Hill, Chief Chemist's Laboratory, St. James' Gate Brewery, Dublin, Chemist.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1889. Miller, Geo., Thornlea, Beaconsfield Road, Farnworth, Widnes, Technical Chemist.
1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.
1883. Miller, Dr. H. von. *See* Miller-Aichholz, Dr. H. von.
1894. Miller, Dr. John A., 44–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1908. Miller, Lt.-Col. John B., 98, Wellesley Street, Toronto, Canada, Lumber and Iron Manufacturer.
1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.
1888. Miller, J. Hopkins, 86, North Frederick Street, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1907. Miller, R. H., c/o The Flavell Co., Box 924, Asbury Park, N.J., U.S.A., Chemical Manufacturer.
1901. Miller, Stuart B., c/o du Pont Powder Co., Emporium, Pa., U.S.A., Chemical Engineer.
1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.

1883. Miller-Aichholz, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
O.M. Mills, Prof. E. J., F.R.S., 64, Twytord Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.
1909. Mills, Harry P., 19, Winchester Street, Toronto, Canada, Chemist.
1904. Mills, Dr. J. E., University of South Carolina, Columbia, S.C., U.S.A., Analytical and Consulting Chemist.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., Finsbury Court, Finsbury Pavement, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, The Cedars, Holborough, near Rochester, Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., Park Print Works, Halifax, Yorks., Chemist.
1909. Mindeleff, Chas., c/o American Smelting and Refining Co., Maurer, N.J., U.S.A., Chemist.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1889. Miniati, T. K., Penketh, near Warrington, Chemist.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1898. Mitchell, G. D. H., c/o 559, Summer Avenue, Newark, N.J., U.S.A., Chemist.
1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.
1904. Mitsugi, R., Second Shiba Gasworks, Shibaura, Tokio, Japan, Chemist.
O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.
1908. Miyake, Hanzaburo, Ensuiko Sugar Factory, Shineisho, Formosa, Japan, Chemist.
1910. Miyama, Kisaburo, 37, Ushigome Kitacho, Tokyo, Japan, Technical Chemist.
1909. Miyoshi, K., Osaka Gas Works, Iwasakisho, Nishiku, Osaka, Japan, Engineer.
1909. Mock, Hugo, 220, Broadway, New York City, U.S.A., Lawyer.
1905. Modi, Dr. E. M., Meher Buildings, Tardeo, Bombay, India, Manufacturing and Analytical Chemist.
1910. Moe, Carl, 4, Rue Royale, Three Rivers, P.Q., Canada, Chemist.
1906. Moe, Eldor H., Box 266, Salt Lake City, Utah, U.S.A., Chemist.
1911. Mohan, Richard T., 93, MacNab Street North, Hamilton, Ont., Canada, Chemist.
O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1894. Mole, Herbert B., Royal Albert Brewery, Queen's Road, Reading, Brewer.
1910. Möller, Dr. Wilhelm, Lawes Chemical Manure Works, Ltd., Barking Creek, Essex, Managing Chemist.
1901. Mond, Dr. Albert L., c/o Hubers and Mond, 19, Southampton Buildings, Chancery Lane, London, W.C., Chemical Engineer.
1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.
1891. Mond, Dr. Robt. L., Winnington Hall, Northwich, Chemist.
1906. Monier-Williams, G. W., Chessington, Surrey.
1908 Monk, Chas. W., 102, Bloomfield Road, Plumstead, Kent, Chemist.
1909. Monk, Reginald H., 388, Grosvenor Avenue, Westmount, P.Q., Canada, Chemical Engineer.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, Scotland, Analytical Chemist.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Barrister-at-Law.
1898. Moody, Dr. Herbert R., College of the City of New York, and (Journals) 330, Convent Avenue, New York City, U.S.A., Professor of Chemistry.
1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.
1902. Mooney, Luke, Box 1085, Fort Worth, Texas, U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.
1901. Moore, Dr. Chas. W., c/o Crosfield and Sons, Ltd., Laboratory, Warrington, Chemist.
1907. Moore, Ernest P., c/o The Steel Co. of Canada, Hamilton, Ont., Canada, Chemist.
1911. Moore, Ernest W., c/o T. G. Tickler, Pasture Street Works, Grimsby, Lincolnshire, Analytical Chemist.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
1906. Moore, F. H., Messrs. G. H. Ogston and Moore, 87–89, Aldgate, London, E., Analytical Chemist.
1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1912. Moore, Joseph W., Kinderton House, Runcorn, Works Chemist.
1905. Moore, Leslie R., 14, Elm Street, Concord, Mass., U.S.A., Chemist.
1899. Moore, Quintin, jun., c/o Wm. Beardmore and Co., Ltd., Parkhead Forge, Glasgow, Works Manager.
1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.
1899. Moore, Dr. Russell W., 121, Madison Avenue, New York City, U.S.A., Chemist.
1890. Moore, Thos., Compton Park Villas, Plymouth, Analytical Chemist.
1910. Moorhouse, Samuel, 138, New Road, Blackley, Manchester, Secretary and Oil Specialist.
1905. Moorwood, F. Colin, c/o W. H. Dyson, The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Steel Manufacturer.
1903. Moran, Geo. A., 611½, Central Avenue, Dover, N.H., U.S.A., Chemist.
1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.
1902. More, Andrew, Ellesmere, King's Road, Walton-on-Thames, Analytical Chemist.
1908. Morfey, Harold, c/o The Mitchell Main Colliery Co., Wombwell, near Barnsley, Yorks., Manager of By-Products Works.
1901. Morgan, Dr. Gilbert T., Royal College of Science for Ireland, Dublin, Ireland, Professor of Chemistry.
1905. Morgan, Prof. Jerome J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Instructor in Engineering Chemistry.
1912. Morgan, Sidney, Petaling Estate, Selangor, Federated Malay States, Analytical Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.
1898. Morgan, T. M., 370, Wood Avenue, Westmount, Quebec, Canada, Cement Works Manager.
O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.
1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.
1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.
1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.
1906. Morris, A. H., c/o Magee, Marshall, and Co., Crown Brewery, Bolton, Lancs., Brewer.
1898. Morris, Edgar F., 60, Millgate, Stockport, Research Chemist.
1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.
1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.
O.M. Morris, J. Haydn. *See* Haydn-Morris, J.
1908. Morris, Wm. J., 31, Prince Alfred Road, Wavertree, Liverpool, Chemist.

1911. Morrison, G. R., Oficina Reducto, Santa Catalina, Iquique, Chile, Chemist.
1910. Morrison, J. A. S., 8, Rokeby Gardens, Ash Road, Headingley, Leeds, Leather Chemist.
1910. Morrison, John W., Gas Offices, Sheffield, Gas Engineer.
1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.
1906. Morrow, Jas. M., 665, Beverley Street, Winnipeg, Man., Canada, Analytical Chemist.
1901. Morse, Willard S., Seaford, Del., U.S.A., Manager.
1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.
1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.
1907. Morton, George A., 27, Hillside Road, Menlove Avenue, Mossley Hill, Liverpool, Chemist.
1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.
1905. Moseley, F. A. D. H., Box 1657, Johannesburg, Transvaal, Analytical Chemist.
1911. Mosenthal, E. Macqueron de, 9, Rue Neuve, Versailles, France, Chemist.
1912. Moss, J. Miles, jun., c/o Lever Bros., Ltd., Eastern Avenue, Toronto, Canada, Chemist.
1894. Moszczenski, J. B., 216, Ovington Avenue, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1897. Motion, Jno., c/o The Joseph Dixon Crucible Co., Jersey City, N.J., U.S.A., Assistant Superintendent.
1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.
1884. Moult, J., 3, Gladstone Terrace, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.
1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).
1905. Mrazsek, F. M., 23, West Cromwell Road, London, S.W., Consulting Chemist.
1904. Muckenfuss, A. M., University, Miss., U.S.A., State Chemist.
1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Muir, Jas. Stanley, 23, Lilybank Gardens, Glasgow, Chemist.
O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.
1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.
1900. Munsell, Dr. Chas. E., c/o Devoe and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
1900. Munton, Fred. T., Craigmore, Winsford, Cheshire, A.R.S.M., Analytical Chemist.
1904. Murdoch, Alexander, 507, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.
1912 Murdoch, Barclay B., c/o Messrs. Wm. Gossage and Sons, Soap Works, Widnes, Lancs., Technical Chemist.
1886. Murdoch, R. H. M., Norwood, Saltcoats, Ayrshire, Explosives Chemist.
1890 Murphy, Albert J., 3 and 4, Queen Square, Leeds, Brewer's Chemist.
1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.
1898 Murray, Ed., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
1908. Murray, Dr. Thos. J., Municipal Technical School, Wolverhampton, Lecturer on Chemistry.
1905. Murray, Wm. Wallace, c/o D. B. Martin Co., Union Stock Yards, Baltimore, Md., U.S.A., Chemist.
1905. Murrill, Dr. Paul I., c/o Du Pont Powder Co., Wilmington, Del., U.S.A., Representative.
O.M. Muspratt, Dr. E. K., Seaforth Hall, near Liverpool, Alkali Manufacturer.
1894. Muspratt, Max, The Grange, Fulwood Park, Liverpool, Technical Chemist.
O.M. Muspratt, S. K., 9, Church Street, Flint, North Wales, Alkali Manufacturer.
1907. Musso, Louis A., Box 956, G.P.O., Sydney, N.S.W., Australia, Technical Chemist.
1895. Muurling, I. J. R., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.
1911. Myers, Ernest M., Sharrow, Basford Park, Stoke on Trent, Coke Oven Manager and Chemist.
1891. Myers, Dr. Wm. S., 71, Nassau Street, New York City, U.S.A., Director.

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1902. Naef, Dr. Ernest E., Clydach, Swansea, South Wales, Chemist.
1913. Nagase, Denzo, 28, Alexandra Road, Bedford Park, W., Engineer.
1908. Nagle, J. C., Fern Bank, Edge Lane, Stretford, Manchester, Glucose and Starch Manufacturer.
1897. Nairn, Michael, Dysart House, Fife, Linoleum Manufacturer.
1909. Nakai, S., Miike Colliery Office, Omuta-machi, Chikugo, Japan, Engineer.
1903. Nakayama, T., c/o Fuji Paper Co., Mill No. 1, Iriyamase, Fuji-Gori, Suruga, Japan, Chemist.
1901. Nanabhai, Krishnalal, "Latini Nivas," Girgaum Back Road, Bombay, India, Technological Chemist.
1912. Nanavati, Balabhai J., Rickey Road, Ahmedabad, India, Oil Manufacturer.
1893. Napier, Jno. W., Gas Works, Alloa, Scotland, Manager and Chemist.
1904. Napper, Sidney S., c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry, Chemist.
1903. Nash, A. Douglas, Beech Street, Waldheim, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, L. Myddleton, Westlands, Princess Road, Finsbury Park, N., Works Chemist.
1910. Nash, N. C., Treleaven, Darling Street, Balmain East, Sydney, N.S.W., Works Chemist.
1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
1908. Nasmith, M. E., Turtle Creek P.O., Albert County, New Brunswick, Canada, Baker.
1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Ardeer, Stevenston, Ayrshire, Superintendent, Nobel's Explosives Works.
1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.
O.M. Naylor, W. A. H., The British Drug Houses, Ltd., 22–30, Graham Street, City Road, London, N., Manufacturing Chemist.
1909. Neal, C. S., Acme White Lead and Colour Works, Detroit, Mich., U.S.A., Manager.
1899. Neate, Percy J., 49, Frognal, Hampstead, N.W., Director of Cement Co.
1905. Neech, Herbert R., 12, Colegrave Street, Lincoln, Chemical Engineer.
1905. Needham, Edward R., c/o The Northern Chemical Co., 16, Blythswood Square, Glasgow, Manufacturing Chemist.
1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Neil, Dr. Archibald A., c/o Thos. Riley, 39, Victoria Crescent, Eccles, Manchester, Chemical Engineer.
1890. Neill, Geo. D., Drumslea, Greenock, Sugar Refiner.
1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.

1911. Neilson, R. G., c/o Burmah Oil Co., Ltd., P. Box 67, Rangoon, Burmah, Assistant Works Manager.
1910. Neiman, Howard S., Suite 1579, 50, Church Street, New York City, U.S.A., Patent Attorney.
1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.
1911. Nello, Vincent, Baldwin's Hill, Loughton, Artists' Colour Manufacturer.
1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
1906. Nestell, Raymond J., 1919, Cordova Street, Los Angeles, Cal., U.S.A., Analytical Chemist.
1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.
1903. Neumann, Dr. Max, Dambachthal 9, Wiesbaden, Germany.
O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.
1905. Newall, Jos., Morley Road, Runcorn, Cheshire, Chemist.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.
O.M. Newlands, W. P. R., 10, Cricklade Avenue, Streatham Hill, S.W., Sugar Chemist.
O.M. Newton, Jno., Verney Road, Rotherhithe New Road, London, S.E., Manure Manufacturer.
1912. Newton, Leonard O., 41, Bennett Park, Blackheath, S.E., Analytical Chemist.
1901. Nibelius, Axel W. T., c/o Neptune National Powder Co., Emporium, Pa., U.S.A., Chemist.
1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).
1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, Dr. Wm. H., 25, Broad Street New York City, U.S.A., Chemical Manufacturer.
1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.
1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, Chemist.
1903. Nicoll, Frank, Clevedon, Bankfield Lane, Southport, Chemist.
1905. Nieghorn, Albert, c/o Nichols Chemical Co., Toronto, Canada, Agent.
1900. Nield, J. H., c/o General Chemical Co., Edgewater, N.J., U.S.A., Superintendent.
1906. Nielsen, Dr. Carl, 157, Coleman Street, Bridgeport, Conn., U.S.A., Chemist.
1898. Nightscales, Geo., 642, Holderness Road, Hull, Oil Merchant.
1899. Nihoul, Dr. Edw., 204, Rue St. Laurent, Liège, Belgium, Director of the Liège Tannery School.
O.M. Nimmo, Jas., 35, Whitworth Road, South Norwood, S.E., Analytical Chemist.
1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.
1885. Nishigawa, T., 20, Hirakawa Cho, Go Chome, Tokyo, Japan, Works Director and Chemical Engineer.
1898. Nishikawa, Prof. Dr. T., Dept. of Applied Chemistry, Kyushu Imp. University, Fukuoka, Japan, Prof. of Applied Chemistry.
1908. Noble, Sir Andrew, Bart., K.C.B., F.R.S., Jesmond Dene House, Newcastle-on-Tyne.
O.M. Nölting, Prof. Dr. E., 27, Lazarethstrasse, Mülhouse, Alsace, Germany, Professor of Chemistry.
O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
1890. Norman-Bott, Dr. Wm., 17, St. Helen's Place, London, E.C., Consulting Chemist.
1908. Norris, Wm. H. H., 19, Littlemoor Hill, Smethwick, Birmingham, Chemist.
1902. North, Barker, 33, Ashgrove, Great Horton Road, Bradford, Assistant Professor of Chemistry.
1909. Northcote, Reginald S., 28, Wellington Street East, Toronto, Chemist.
O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.
1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1911. Norton, Samuel J., 22, Bushnell Road, Balham, S.W., Engineer and Manager.
1887. Norton, Dr. T. H., c/o Wm. Bryce, 54, Lothian Street, Edinburgh, U.S. Consul.
1899. Noyes, Henry, c/o Noyes Bros., 153–7, William Street, Melbourne, Victoria, Engineer.
1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).

O

1910. Oakden, W. E., c/o American Optical Co., Southbridge, Mass., U.S.A., Director of Research Laboratory.
1905. Oakes, F. J., jun., 141, Milk Street, Boston, Mass., U.S.A., Secretary, Oakes Manufacturing Co.
1904. Oberländer, Dr. Otto, 29, Queen Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Malgrave, Cairns, North Queensland, Supervising Chemist.
1900. O'Brien, Frederick, Lynwood, Grange Road, Bishopsworth, near Bristol, Analytical Chemist.
1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).
1902. Oekel, Reinhold, Schumannstrasse 31, Bonn a Rhein, Germany, Technical Chemist.
1901. O'Connor, Chas. P., 7, Fairfield Street, Montclair, N.J., U.S.A., Analytical Chemist.
1908. O'Day, John, 32, India Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1911. Oehler, Prof. John, Carlstadt, N.J., U.S.A., Assoc. Prof. of Chemistry (Columbia University).
1908. Ogilvie, Jas. P., Homedale, Hendon Lane, Church End, Finchley, N., Chemist.
1901. Ogston, Alex. G., Heath Park, near Aberdeen, Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., Shanghai House, Botolph Lane, London, E.C., Chemical Merchant.
1905. Ohliger, Willard, c/o F. Stearns and Co., Detroit, Mich., U.S.A., Chemist.
1907. Oke, Alfred W., 32, Denmark Villas, Hove, Sussex, Solicitor.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1912. Oliver, Ralph R., c/o Southern Fibre Co., Portsmouth, Va., U.S.A., Paper Chemist.
1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1910. Oliver, Willie, 270, Spotland Bridge, Rochdale, Works Chemist.
O.M. Ollerenshaw, S., 96, Davyhulme Lane, Urmston, Manchester, Technical Chemist.
1906. Olmsted, Fred. A., c/o Willamette Pulp and Paper Co., Oregon City, Oregon, U.S.A., Chemical Engineer.
1904. Olney, Prof. L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.
1905. Ormandy, Dr. W. R., 53a, Barton Arcade, Manchester, Consulting Chemist.
1898. Ormerod, Dr. Ernest, Oak Lodge, St. Anne's-on-Sea, Lancashire, Consulting Chemist.
1894. Ormerod, John, Globe Leather Works Castleton, Manchester, Tanner and Currier.

O.M. Orr, A., 80, Hunter Street, Sydney, New South Wales, Analytical Chemist.

O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.

1899. Orr, Thos. W., c/o W. Orr, 20, Renfield Street, Glasgow; and (Journals) Lethnot, Burnside, Rutherglen, Glasgow, Chemist.

1907. Ortved, Niels C., c/o Hiram Walker and Sons, Ltd., Walkerville, Ont., Canada, Chemist and Fermentologist.

1900. Osbourne, Jno. P., 6, Garrioch Drive, Maryhill, Glasgow, Analytical Chemist.

1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.

1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Chemistry (University of Sheffield).

1912. Osius, George, Canadian Ammonia Co., Ltd., Foot of Meldrum Street, Detroit, Mich., U.S.A., Secretary and Treasurer.

1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.

1912. Oswald, Jacob, c/o Messrs. Fels and Co., 73rd Street and Woodland Avenue, Philadelphia, Pa., U.S.A., Soap Works Technical Manager.

1905. Otsuki, Prof. Chiri, Chemical Laboratory, Kyoto Imperial University, Kyoto, Japan. Professor of Applied Chemistry.

1912. Otto, Chas. W., 154, East 175th Street, New York City, U.S.A., Chemist.

1898. Oushkoff, John P., Warwarka 5, Moscow, Russia, Chemical Manufacturer.

1906. Oxley, Horace F., c/o Jos. Crosfield and Sons, Ltd., Warrington, Chemist.

1908. Oxley, John C., Claycroft, Guiseley, near Leeds, Aniline Colour Merchant.

1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

P

1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.

O.M. Packard, E., jun., Bramford, near Ipswich, Manure Manufacturer.

1904. Page, Edwin P., Glenroy, Highland Grove, Worksop, Notts., Chemist.

1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.

1892. Paine, Augustus G., 200, Fifth Avenue, New York City, U.S.A., President of Paper Making Co.

1912. Painter, G. Macaulay, Demonstrator in Chemistry.

1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President (Atteaux Dye and Chemical Co.).

1903. Palmenberg, O. W., 50, East 41st Street, New York City, U.S.A., Consulting Chemist and Fuel Engineer.

1902. Palmer, Fred. G., c/o Japanese Explosives Co., Hiratsuka, Sagami, Japan, Chemist and Acid Superintendent.

1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.

1887. Palmer, Thos. C., c/o W. J. Fraser and Co., Ltd. Dagenham, Essex, Engineer.

1907. Palmer, Wm. J., c/o W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Analytical Chemist.

1911. Paniker, Ramni, Consejo de Ciento 288, 2º, 2ª, Barcelona, Spain, Leather Trades Chemist.

1891. Parker, Edw., Laburnum House, Rushford Avenue, Levenshulme, Manchester, Analytical Chemist.

1894. Parker, Dr. J. Gordon, Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Principal.

1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.

1901. Parker, Richard H., 147, Seymour Avenue, Newark, N.J., U.S.A., Analytical Chemist.

O.M. Parker, Thos., Severn House, Iron-bridge, Salop, Electrical Engineer.

1894. Parker, Thos. J., 25, Broad Street, New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.

1903. Parker, Wm. B., 1, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).

1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraisers).

1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.

1905. Parr, Prof. S. W., University of Illinois, Urbana, Ill., U.S.A., Professor of Applied Chemistry.

1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.

1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.

1909. Passmore, Dr. Francis W., 81, Queen Victoria Street, London, E.C., Consulting Chemist.

1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.

1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.

1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.

1887. Paton, J. M. C., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.

1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.

1901. Patterson, Chas. A., Woodbury, N.J., U.S.A., Analytical Chemist.

O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.

1909. Patterson, G. H., Ivanhoe, Linden Grove, West Hartlepool, Works Manager.

1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.

O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, Sugar Works Manager.

1902. Patterson, Wm. Hamilton, Monksferry Chemical Laboratory, Birkenhead, Technical Chemist.

O.M. Pattison, Jas., Drimnamona, Kilmalcolm, Chemical Merchant.

1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.

1909. Patton, H. G., c/o Fred Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.

1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.

1908. Paul, David M., c/o Japanese Explosives Co., Hiratsuka, Sagami, Japan, Chemist.

1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.

1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.

1904. Payne, A. G. C., 6, Bradford Place, Penarth, near Cardiff, Chemist.

O.M. Payne, J. B., 13, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.

1912. Peachey, S. J., 10, Abington Road, Brooklands, near Manchester, Lecturer in Chemistry.

1910. Peacock, Samuel, Suite 910, 165, Broadway, New York City, U.S.A., Chemist and Metallurgist.

1912. Pearce, Geoffrey V., 14, Park Crescent, Portland Place, London, W., Chemical Manufacturer.

1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.

1897. Pearce, Richard, 6, Beach Lawn, Waterloo, Liverpool, Metallurgist.

1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.

1903. Pearcy, A. C., 43, Marlborough Mansions, Cannon Hill, London, N.W., Director, Explosives Co.

1912. Pearson, Herbert P., c/o The Cravenette Co., 8th and Madison Streets, Hoboken, N.J., U.S.A., Technical Chemist.

1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.

O.M. Péchiney, A. R., Villa Les Rochers, Hyères (Var), France, Chemical Engineer.

1898. Peck, Dr. Ernest L., High Lawn, Bromborough, Cheshire, Chemist.

1894. Peden, Jno., 30, Ardgowan Street West, Greenock, Analytical Chemist.

O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).

1886. Pedler, J. R., 47, Tregunter Road. South Kensington S.W., Clerk.

1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o F. J. Willott, Victoria Garesfield Colliery, Rowlands Gill, Co. Durham, Colliery Owner.

1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

1897. Pellew, Chas. E., 111, East 78th Street, New York City, U.S.A., Adjunct Professor of Chemistry.

1912. Pellizza, Dr. A., Sta. Rosa, Necoxtla, Estada Vera Cruz, Mexico. Colourist.

1904. Pelly, Russell George, 3, Wingate Road. Hammersmith, W., Analytical Chemist.

1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.

1890. Pennock, J. D., c/o Solvay Process Co.. Syracuse, N.Y., U.S.A., Technical Chemist.

1885 Pentecost, S. J., Alexandra Mount, Mapperly Hill, and (Journals) Lenton Works, Nottingham, Lace Dresser.

1887. Pentermann, H. T., 37, Clifton Crescent, Peckham. S.E., Brewing Chemist.

1892. Peploe, D. H. T., Underriver House, Sevenoaks. Kent.

1885. Perkin, A. G., F.R.S., Grosvenor Lodge, Grosvenor Road, Leeds, Technical Chemist.

1898. Perkin, Dr. F. Mollwo, 199, Piccadilly, London, W., Head of Chemical Department, Borough Polytechnic.

1887. Perkin, Dr. W. H., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.

1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.

1899. Perks, Walter G., Lisnalee, Woodcote Grove Road. Coulsdon, Surrey, Manufacturer.

1912. Perrin, Wm. R., jun., 530, King Street East, Toronto, Canada, Secretary and Treasurer.

1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A., Bleach and Dyeworks Chemist.

1887. Perry, David, 15, Woodlands Terrace, Glasgow, and (Journals) Forth and Clyde Chemical Works. Nitshill, near Glasgow, Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester. Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W.. Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, 3500, Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A.. President (Harrison Bros. and Co.).

1897. Peter, Dr. A. H., 2508, Broadway. New York City, U.S.A., Chemist.

1908. Peters, John M., c/o National Lead Co., 111, Broadway, New York City, U.S.A., White Lead Manufacturer.

1893. Pethybridge, Walter, 3, Rhodesia Road. Stockwell, S.W., Chemist and Assayer.

1909. Petrie, A. Swanston, c/o Gibbs and Co., Iquique, Chile, S. America, Analytical Chemist.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Peuchen, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.

O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham. Chemical Manufacturer.

1912. Pfleiderer, Kurt, Westwood Works. Peterborough. Mechanical Engineer.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth. Electro-Metallurgist and Electrical Engineer.

1908. Philip, Dr. James C., Imperial College of Science and Technology, South Kensington, S.W., Chemist.

1903. Philipp, Herbert, 152. High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1912. Phillips, G. A., Laboratory, The Powell Duffryn Co., Aberdare, Mon., Chemist.

O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1911. Phillips, Henry A., Royal Gunpowder Factory, Waltham Abbey, Essex, Chemist.

1910. Phillips. Prof. Percy P., Thomason College, Rurki, United Provinces, India. Professor of Chemistry.

1895. Phillips. S. Chas., 47, Cannon Street. London, E.C., Chemical Engineer.

1904. Phillips, V. C., Chemist.

1911. Phillips, William E., 45. Ben Lamond Avenue. Toronto, Canada.

1898. Phillips, Wm. H., 100. Milton Avenue, East Ham, E., Soap Works Chemist.

1894. Picard, Hugh F. K., 44. London Wall. London, E.C., Metallurgist.

1905. Pickard, Greenleaf W., Amesbury, Mass.. U.S.A., Electrical Engineer.

1902. Pickard, Dr. R. H., Billinge, Blackburn, Teacher and Analyst.

1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.

1888. Pilkington, G., 9, Knowsley Street, Bury, Lancashire. Analytical Chemist.

1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.

1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.

1906. Pincott, Emile S., 222. St. James Street, Montreal. Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).

1910. Pinnock, Douglas R., c/o The Nucoa Butter Co., 4th Street and Avenue A. Bayonne, N.J., U.S.A., Chemist.

1905. Pinnock. H. T., 11, Arthur Road. Edgbaston, Birmingham, Chemist.

1883. Pipe, Jas., Woodburn. Irvine. Scotland. Chemical Manufacturer.

1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1910. Pisart, F., 74, Avenue Blonden, Liége. Belgium, Chemical Engineer.

1907. Pitman, Brig.-Gen. John. 167, Berkeley Avenue. Orange. N.J., U.S.A., U.S. Army (retired).

1913. Pitt, Septimus A., Central Public Library, Coventry, Librarian.

1902. Pittard, Jno.. 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.

1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne. Technical Chemist.

1909. Piutti, Prof. Dr. Arnaldo, Instituto Chimico-farmaceutico, R. Universita, Napoli. Italy. Director.

1899. Pizey, Jas. H., c/o S. Pearson and Son, The Refinery, Minatitlan, Vera Cruz, Mexico, Chemist.

1896. Platten, Frank, c/o Elliot's Metal Co., Selly Oak Works, near Birmingham, Metallurgical Chemist.

1890. Platts, Jno. C. "Sandygate," Chapel Lane, Wilmslow, Cheshire, Metallurgical Chemist.

1896. Plaut, Albert, P.O. Box 380, New York City, U.S.A., Wholesale Druggist.

1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.

1891. Pocklington, Hy., 11, Regent Park Terrace, Headingley, Leeds.

1907. Poetschke, Paul, 39, West 38th Street, New York City, U.S.A., Chemist.

1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).

1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.

1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.

1893. Pollitt, R. B., c/o Gudgeons, Peecock, and Prentice, Stowmarket, Suffolk, Civil Engineer.

1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.

1912. Polson, Neil C., 317, University Avenue, Kingston, Ont., Canada, Wholesale Druggist.

1890. Pomeroy, Dr. Chas. T., Bramhall Road, Rahway, N.J., U.S.A., Ink Manufacturer.

1909. Pond, Dr. Francis J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Chemistry.

1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.

O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.

1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.

1895. Pont, Pierre S. du, c/o Dr. C. L. Reese, E.I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A., Explosives Manufacturer.

1912. Pope, Chester H., 39, Waldemar Avenue, Winthrop, Mass., U.S.A., Ink Manufacturer.

O.M. Pope, S., 34, Clarendon Road West, Chorlton-cum-Hardy, Manchester, Chemical Works Manager.

1899. Pope, Thos. H., The University, Edmund Street, Birmingham, Chemist and Lecturer on Brewingl

1900. Pope, Prof. W. J., F.R.S., University Chemica- Laboratory, and (Journals) Holmesdale, Brooklands Avenue, Cambridge, Professor of Chemistry

1912. Porritt, B. D., c/o North British Rubber Co., Ltd., Castle Mills, Edinburgh, Chief Chemist.

1911. Porteous, Jas. W., c/o Bolckow, Vaughan, and Co., Ltd., Grange Hill, Bishop Auckland, Co. Durham, Chemist and Coke Oven Manager.

1902. Porter, J. Edw., P.O. Box 785, Syracuse, N.Y., U.S.A., Chemist.

1901. Porter, Jno. L., Water Purification Station, P.O. Box 791, Station B., New Orleans, La., U.S.A., Chemist.

1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.

1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.

O.M. Potter, E. P., Salwick Hall, near Preston, and (Journals) c/o E. P. Potter and Co., Ltd., Little Lever, near Bolton, Alkali Manufacturer.

1900. Potts, Geo. E., 200, Fifth Avenue, New York City, U.S.A., Explosives Manufacturer.

1910. Potts, Harold E., c/o Hubers and Mond, 19, Southampton Buildings, London, W.C., Research Chemist.

1900. Pough, Frank H., 149, Columbia Heights, Brooklyn, N.Y., U.S.A., Manager.

1900. Powell, Harry J., 125, Thurlow Park Road, Dulwich, S.E., Glass Manufacturer.

1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.

1907. Powers, Wm. A., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.

1902. Powney, Wm. E. F., 35, Priory Avenue, Hornsey, N., Analytical Chemist.

1912. Prasad, Prof. H., Victoria College, Lashkar, Gwalior, India, Professor of Science.

1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.

1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.

1903. Prentice, Jas., "Carsaig," Scotstounhill, Glasgow, Chemist.

1911. Prescott, Alfred, 63, Corporation Street, Manchester, Chemical Agent.

1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Assoc. Prof. of Ind. Biology.

1905. Preston, Jas. F., 403, Andover Street, Lowell, Mass., U.S.A., Manufacturing Chemist.

O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.

1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.

1904. Prichard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.

1904. Prideaux, Dr. E. B. R., Muspratt Laboratory, The University, and (Jnls.) 33, Jermyn Street, Prince's Park, Liverpool, Research Chemist.

1905. Priest, Geo. Wesley, c/o Eclipse Tanning Co., Newark, N.J., U.S.A., Manufacturer.

1899. Prinsen-Geerligs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.

1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.

1912. Pritchard, Thos. W., Wilmington, N.C., U.S.A., Wood Distiller.

1912. Prittie, Frank H., 1, High Park Boulevard, Toronto, Canada, Assistant Chemist (South Pacific Rly.).

1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.

O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Lecturer on Tanning.

1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.

1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.

O.M. Proctor, C., 118, Grosvenor Road, London, S.W., Analytical Chemist.

1901. Propach, C., 146, West Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.

1912. Propach, Dr. Wilhelm, Dynamit Act.-Ges. vorm. A. Nobel und Co., Alsterdamer 391, Hamburg, Germany, Chemist.

1906. Pudney, S. H., 156, Bellwood Avenue, Toronto, Canada, Foreman.

1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge-Whitworth, Ltd.).

1899. Pullar, Edmund, Keirfield, Bridge of Allan, Scotland, Manufacturer.

O.M. Pullar, R. D., Pullar's Dyeworks, Perth, Dyer.

1913. Pulsifer, Lanson V., c/o Messrs. Valentine and Co., 364, Manhattan Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.

1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, Professor of Chemistry.

1905. Pyman, Dr. Frank Lee, Carlee, Selborne Road, Sidcup, Kent, Chemist.

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1903. Queeny, Jno. F., Monsanto Chemical Works, 1800, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.

1903. Queneau, Augustin L. J., Jemeppe sur Meuse, Belgium, Metallurgical Engineer.

1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.

1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent.

R

1911. Race, Joseph, City Hall, Ottawa, Canada, City Bacteriologist.

1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal Austria, Chemical Manufacturer.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood. S.E.
1911. Rae, J. S., 17, Park Place East, Sunderland, Manufacturing Chemist.
1901. Ralston, Wm., 42, Derby Road, Withington, Manchester, Chemist.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C. ; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird, and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1911. Ramsay, Wm. G., Ahornstrasse 19, Berlin-Steglitz, Germany, Research Chemist.
1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.
1909. Randall, George, The Limes, Kenilworth, Warwickshire, Tanner.
1911. Randolph, Charles E., 37, Middleton Road, Ilkley, Yorks, Analytical Chemist.
1910. Ranken, Charles, 19, Stockton Road, Sunderland, Analytical and Consulting Chemist.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts, Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., St. Stephen's House, Victoria Embankment, Westminster, S.W., Consulting Engineer.
1910. Ransome, A. Oswald, Beechwood, Greenock Road, Paisley, Works Chemist.
1904. Rapelje, Walter S., 568, Jamaica Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
1908. Rassow, Prof. Dr. Berthold, Stephanstrasse 8, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.
1893. Ratcliff, Frank D., Stourbank House, Stourport, Vinegar Brewer.
1904. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
O.M. Rawson, Chris., 22, Cumberland Street, Manchester, Consulting Chemist.
1909. Rawson, H. Wyatt, c/o Chartered Bank of India, Taiping, Perak, Fed. Malay States.
1909. Rayner, Arthur B., Normanhurst, Alexandra Park Road, Muswell Hill, N., Chemical Broker.
1912. Rayner, Edgar A., 71, Welldon Crescent, Harrow-on-the-Hill, Analytical Chemist.
1895. Read, E. J., Dart Villa, Victoria Avenue, Westgate-on-Sea, Analyst.
1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.
1908. Reavell, J. Arthur, 181, Queen Victoria Street, London, E.C., Engineer.
1912. Reddie, J. A., Sewage Disposal Works, Halifax, Yorks, Chemist.
1902. Redfern, C. G., 15, South Street, Finsbury, London, E.C., Patent Agent.
O.M. Redwood, Sir Boverton, Bart., 4, Bishopsgate, London, E.C., Petroleum Expert.
1887. Redwood, Robt., 4, Bishopsgate, London, E.C., Secretary.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1902. Reed, Herbert C., 227-229, Fulton Street, New York City, U.S.A., Cons. Tanning Chemist.
1906. Reed, William, Victoria Leadworks, 306, Burdett Road, Limehouse, E., Works Manager.
1893. Reekie, J. A., Buckton Grange, Stalybridge, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., El Dorado Oil Works, West Berkeley, Cal., U.S.A., Chemist.
1906. Rees, Walter J., 36, Holly Lane, West Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1913. Regan, Colston J., 14, Penerley Road, Catford, S.E., Analytical Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1909. Reid, David E., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1909. Reid, Howard E., c/o Lawrence Portland Cement Co., Siegfried. Pa., U.S.A., Chemist.
1906. Reid, James, Caldercruix Mills, by Airdrie, Scotland, Chemist.
1905. Reid, Dr. John H., Cranford, Barton Heys Road, Formby, Lancs, Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.
O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks, Chemist.
1906. Reinhold, Gustave, 26, Kidbrook Park Road, Blackheath, S.E., Works Manager.
1910. Reiter, Dr. Kaspar, 17, Osborne Road, Brimsdown, Middlesex, Chemist.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands. R.S.O., Lancs, Consulting Chemist.
1903. Remsen, Professor Ira, Johns Hopkins University, Baltimore, Md., U.S.A., Professor of Chemistry.
1911. Renaud, Paul, 8, Rue Nouvelle, Paris (9^{e}), France, Consulting Engineer.
O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1911. Rentschler, Mahlon J., c/o Oakland Chemical Co., Rossville, Staten Is., N.Y., U.S.A., Bacteriologist.
1901. Renwick, Frank F., Sunny Side, Weald Road, Brentwood. Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Pacific Mills Printworks, Laurence, Mass., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 10, Doune Terrace, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 68, Cliff Street, New York City, U.S.A., Chemist.
1912. Reuter, Dr. L., Apartado 6, Torreon, Coahuila, Mexico, Glycerin Manufacturer.
1905. Revis, Cecil, 5, Carlton Villas, Station Road, Barnes, S.W., Analyst.
O.M. Reynolds, Dr. J. Emerson, F.R.S., 3, Inverness Gardens, Kensington, W., Professor of Chemistry.
1912. Reynolds, Wm. Colebrook, "Wharfdale," Upminster, Essex, Manufacturing Chemist.
1908. Rhoads, J. Edgar, 2211, Shallcross Avenue, Wilmington, Del., U.S.A., Leather Chemist.
O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1888. Richardson, Dr. Clifford, 30, Church Street, New York City, U.S.A., Chemical Engineer.

1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884 Richardson, F. W., County Analyst's Office, Bradford, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., 57, Cavendish Drive, Rock Ferry, Cheshire, Manager.
1905. Richardson, L. G., Newtown View, Glenpatrick Road, Elderslie, Johnston, Scotland, Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., Linfield, Wood Lane, Headingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1886. Richmond, H. Droop, 3, Coleraine House, Nassau Street, London, W., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. R., The Hollies, Blurton, Longton, Staffs., Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., 62, London Wall, London, E.C., Mining Engineer.
O.M. Ridsdale, C. H., Laboratory, 3, Wilson Street, Middlesbrough, Analytical Chemist.
1899. Riederer, Emil J., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., 711, Monroe Avenue, Scranton, Pa., U.S.A., Chemist.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 19, Cedar Street, New York City, U.S.A., Merchant.
O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1912. Riley, Walter A., 100, King Street, Norwich, Brewer.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., "Lauriston," Ardrossan, Ayrshire, Explosives Chemist.
1901. Ripley, Philip F., 7, Abbott Street, Andover, Mass., U.S.A., Chemist.
1909. Roberts, Alfred R., c/o Canada Cement Co., Plant No. 9, Shallow Lake, Ontario, Canada, Chemist.
1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., and Jnls. to H. Shankster, 90, Courtland Avenue, Ilford, Chemical Manufacturer.
1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1911. Roberts, H. W., Dynamite Factory, Somerset West, Cape Province, South Africa, Chemist.
1907. Roberts, Percy R., P.O. Box 62, Wilmington, Del., U.S.A., Leather Chemist.
1902. Roberts, Wm. H., 4, Sugnall Street, Liverpool, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1910. Robertson, Arthur F., National Chemical Works, 27, St. Jean Baptiste Street, Montreal, Canada, Chemist.
1910. Robertson, Charles, c/o Messrs. S. Allsopp and Sons, Ltd., Burton-on-Trent, Brewer.
1900. Robertson, Jas., Barncraig, South Medrox, by Glenboig, Analytical Chemist.
1910. Robertson, Dr. Joseph G., Braidwood, Tollcross, Glasgow, Manufacturer.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Research Chemist.
1910. Robertson, William, Chemical Dept., City and Guilds College, Exhibition Road, London, S.W., Lecturer and Research Chemist.
1910. Robin, Alex. G., Castlehill, Hamilton, Scotland, Chemical Merchant.
1913. Robins, Edmund A., c/o Messrs. Kodak, Ltd., Wealdstone, Middlesex, Assistant Works Manager.
1897. Robinson, Clarence J., 708, Jewett Avenue, West New Brighton, N.Y., U.S.A., Chemist.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. Robinson, H. H., 42, Penywern Road, Earl's Court, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
1911. Robinson, Jas. H., 11, East Street, Rugby, Analytical Chemist.
O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow: and (communications), The Villa, Nitshill, Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., The Peña Copper Mines, Ltd., 736, Salisbury House, London Wall, E.C., Manager.
1909. Rody, Franz A., 37, Oakland Terrace, Newark, N.J., U.S.A., Chemist.
1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1910. Roessler, Dr. F., 89, High Street, Perth Amboy, N.J., U.S.A., Chemist.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., 32, Chudleigh Road, Brockley, S.E., Chemist.
1908. Rogers, Harry V., Ash Street, Ilkeston, Derbyshire, Engineer.
1907. Rogers, Henry L., Casilla 1118, Buenos Aires, Argentina, Analytical Chemist.
1909. Rogers, Herbert, 52, Cannon Street, London, E.C., Rubber Works Chemist.
1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.
1910. Rogers, L. Joslyn, Chemical and Mining Building, The University, College Street, Toronto, Canada.
1911. Röhm, Dr. Otto, Weiterstädterstrasse 4/6, Darmstadt, Germany, Chemist.
1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.
1898. Roller, H. C., 493, Central Avenue, Newark, N.J., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
1909. Rollin, Hugh, Overdene, Riding Mill-on-Tyne, Chemical Manufacturer.
O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.
1905. Romanes, J. W., Craigknowe, Slateford, Edinburgh Chemical Engineer.
O.M. Roscoe, Rt. Hon. Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Rose, Jno. Leonard, 3, Florence Road, Ealing, W Chemist.
1902. Rosebrugh, Prof. T. R., 150, West Newell Street, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.

1897. Rosengarten, Dr. Geo. D., P.O. Box 1625, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1893. Ross, Arthur. 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.

1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.

1910. Ross, Thos. M., c/o Burmah Oil Co., Ltd., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.

1911. Ross, Prof. W. J. Clunies, 12, Church Street, Ashfield, Sydney, N.S.W., Australia, Prof. of Chemistry (Sydney Technical College).

1910. Rossati, Guido, 226, Lafayette Street, New York City, U.S.A., Agricultural Chemist.

1911. Rossi, Dr. Carlo, 29, Via Leopardi, Milano, Italy, Electro-chemist.

1906. Rossi, Louis M., c/o General Bakelite Co., Perth Amboy, N.J., U.S.A., Works Manager.

1913. Rossini, Jas. L., c/o New Oil Refining Process, Ltd., Bradfield Road, Silvertown, E., Oil Works Manager.

1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.

1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.

O.M. Rottenburg, Dr. Paul, 55, West Regent Street, Glasgow, Chemical Merchant.

1903. Rouse, Wm., Woodburn, Arthurlie Street, Barrhead by Glasgow, Chemist.

1906. Rowell, Herbert W., 36. Thornbury Road, Osterley Park, W., Analytical Chemist.

O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.

1904. Rowley, Ernest W., Chemical Laboratory, C.M.E. Department, North Eastern Railway, Darlington, Analytical Chemist.

1908. Rowley, Frank, 4, Doughty Street, London, W.C., Metallurgist.

1901. Rowley, Walter Eugene, c/o National Aniline and Chemical Co., 100, William Street, New York City, U.S.A., Chemist.

1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.

1896. Royal-Dawson, H., Beechlands, Park Avenue, Ashton-on-Mersey, Chemist.

1898. Royle, Chas. L., c/o Cartavio Sugar Co., Trujillo, Peru, Sugar Chemist.

O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.

1902. Rücker, Dr. Hermann von, 91, Lancaster Avenue. Buffalo, N.Y., U.S.A., Chemist.

1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.

1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.

1911. Rudnick, Paul, c/o Armour and Co., Union Stock Yards, Chicago, Ill., U.S.A., Chemist.

1908. Rudolf, Prof. Norman S., Dept. of Applied Chemistry, Indian Institute of Science, Bangalore, India, Professor.

1909. Rudorf, Dr. G., c/o Messrs. T. Morson and Son, Ponders End, N., Manufacturing Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts, Consulting Chemist and Electrician.

1905. Rüger, Richard, 389, New Chester Road, Rock Ferry, Cheshire, Chemist.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co.. 100. William Street, New York City, U.S.A., Chemical Merchant.

1909. Ruiloba, J. A., c/o U.S. Steel Corporation, 71, Broadway, New York City, U.S.A., Engineer.

1910. Rule, Dr. Alexander, The University, Liverpool, Lecturer in Chemistry.

O.M. Rumble, C., 169, Glenеldon Road, Streatham, S.W., Chemist.

1899. Rumbold, Wm. R., Calverley Lodge, Tunbridge Wells, Kent, Electro-Metallurgist.

1895. Rump, Ernest, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1911. Runeckles, A. R., c/o Brotherton and Co., Ltd., Litherland Tar Works Liverpool, Technical Chemist.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., Oak View, Batley, Yorks, Analyst.

1906. Russell, David, Rothes, Markinch, Fife, Scotland, Paper Maker.

1912. Russell, George H., c/o Michaelis, Hallenstein, and Co. Propy., Ltd., Foots-cray, Vic., Australia, Leather Trades Chemist.

1912. Russell, Thomas F., 137, Steade Road, Sheffield, Analytical Chemist.

1910. Russell, William, 146, Peel House Lane, Widnes, Lancashire, Chemist.

1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.

1909. Ryall, W. E., c/o North-West Soap Co., Calcutta, India, Soapworks Chemist.

1905. Ryan, Prof. F. G., c/o Parke, Davis, and Co., Detroit, Mich, U.S.A., Manufacturing Chemist.

1910. Ryan, Leo G., 10. Travancore Apartments, Montreal, Canada, Druggist.

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1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.

1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.

1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.

1908. Sadtler, Philip B., 945, Monadnock Building, Chicago, Ill., U.S.A., Consulting Chemist and Engineer.

1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.

1896. Sadtler, Dr. S. S., c/o Samuel P. Sadtler and Son, 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical and Consulting Chemist.

1897. Sage, C. Edward, 10, London Street, London, E.C., Consulting Chemist.

1902. Sahm, Louis N., c/o The Heller and Merz Co., 505, Hudson Street, New York City, U.S.A., Chemist.

1907. Saiki, Kenkichi, 91, Nishiokubo, Okubomura, Tokyo-Fuka, Japan. Chemist.

1913. St. Armande, Arthur V., "The Toll," Prestwick, Ayrshire, Technical Chemist.

1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.

1885. Salamon, Jno., Ferry Road, Rainham, S.O., Essex. Manufacturing Chemist.

1911. Salamon, Maurice S., 79, Mark Lane, London, E.C., Consulting Analyst.

1884. Salis-Mayenfeld, Dr. E. von, 24, South Allen Street, Albany, N.Y., U.S.A., Technical Chemist.

1907. Samuel, Marcus R. A., c/o Compania General de Tabacos Filipinas, 37, Fenchurch Street, London, E.C., Merchant.

O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.

1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.

1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.

1909. Sandberg, Sixten, Skutskärs Sulphite and Soda-pulp Mills, Skutskär, Sweden. Chemist and Mill Manager.

1910. Sandeman, Archibald. Ruchill Oil Works, Glasgow, Chemist.

1906. Sanders, J. McConnell, P.O. Box 3033, Mexico, D. F., Analytical and Consulting Chemist.

1902. Sanders, Warren W., 127, Vernon Street, Gardner, Mass., U.S.A., Chemist.

1895. Sanderson, John, c/o B. S. Cohen, Ltd , Neasden Lane, London, N.W., Chemist.

1907. Sandig, A., P.O. Box 702, Chicago, Ill., U.S.A., Sales Manager.

1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham. Analytical Chemist.
1901. Sargent, Dr. Geo. W., c/o Crucible Steel Co. of America, Oliver Building, Pittsburgh, Pa., U.S.A., Chemist and Metallurgist.
1910. Sargent, R. N., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.
1911. Sauer, J., 121, Van Breestraat, Amsterdam, Holland, Sugar Chemist.
1910. Sauerschnig, José, P.O. Box 313, Mexico City, Mexico, Acid Manufacturer.
1903. Saunders, Lewis E., 123, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
1911. Saville, W. B., 94, Vassall Road, Brixton, S.W., Analytical Chemist.
1895. Sawers, Wm. D., 7, Minard Road, Partick Hill, Glasgow, Chemist.
1907. Saxe, Joel B., P.O. Box 1086, Montreal, Canada, Chemist.
1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.
1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Schack-Sommer, Dr. G., 87, Victoria Street, London, S.W., Sugar Refiner.
1908. Schad, Dr. Philip, The Gables, Hartford, Cheshire, Manufacturing Chemist.
1910. Schaeter, Dr. George L., New York Quinine and Chemical Works, 105, North 11th Street, Brooklyn, N.Y., U.S.A., Chemist and Technical Manager.
1903. Schanche, H. G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1912. Schapiro, Hugo H. B., Wadsworth, Ohio, U.S.A., Chemist.
1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.
1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.
1903. Scheidel, Dr. Aug., c/o Commonwealth Portland Cement Co., 4, O'Connell Street, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beech Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, c/o Merck and Co., Box 1443, New York City, U.S.A.
1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1905. Schill, Dr. Emil, The Chemists' Club, 52, East 41st Street, New York City, U.S.A., Chemist.
1909. Schlagintweit, Theo., 94, Market Street, Manchester, Imperial German Consul.
1902. Schlegel, Jno. Wm., New York Sugar Refinery, Long Island City, N.Y., U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1902. Schlesinger, Barthold E., 68, Northampton Street, Boston, Mass., U.S.A., Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., Cambridge "C." Boston, Mass., U.S.A., Chemist.
1906. Schneible, Joseph, 934–6, People's Gas Building, Chicago, Ill., U.S.A., Chemical Engineer.
1899. Schniewind, Dr. F., 6, Church Street, New York City, U.S.A., President Schniewind Coke Oven Co.
1894. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1907. Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1904. Schoeller, Dr. Walter R., c/o Simeons and Co., 17, Wilson Street, Finsbury, E.C., Analytical Chemist.
1902. Schofield, Prof. Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
1908. Scholefield, Fred., c/o Messrs. Burgess, Ledward, and Co., Ltd., Dyehouse Dept., Walkden, Manchester, Works Chemist.
O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1906. Schroeder, C. M. E., Rutherford, N.J., U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Dwight Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Schüll, Gustav, Messrs. Carl Schleicher und Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.
1893. Schüpphaus, Dr. R. C., 1466, Dean Street, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1912. Schwabacher, Dr. Hermann, Consulting Engineer.
1908. Schwalbe, Dr. Carl G., Neuekreugstrasse 17, Eberswalde, bei Berlin, Germany, Professor (Kgl. Forstakademie).
1907. Schwamm, Chas. A., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.
1889. Schweich, Emile. *See* Mond, Emile S.
1894. Schweitzer, Dr. H., Riverside Mansions, corner 113th Street and Riverside Avenue, New York City, U.S.A., Chemical Expert.
1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President.
1906. Scott, Alex. C., 34, Sinclair Road, Kensington, W., Explosives Manufacturer.
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1889. Scott, Ernest G., c/o Ernest Scott and Co., Ltd., Kingsway House, Kingsway, London, W.C., Chemical Engineer.
1912. Scott, Harold M., 28, Ravenoak Road, Cheadle Hulme, Cheshire, Works Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, Annislea, Clermiston Road, Corstorphine, Edinburgh, Analytical Chemist.
1912. Scott, Jno. William, 576, Church Street, Toronto, Canada.
1902. Scott, Walter, 119-122, Merchants' Exchange, Cardiff, Chemist.
1913. Scott, Wm. Chas., c/o The Bay View Foundry Co., Sandusky, Ohio, U.S.A., Chemist.
1907. Scott, Wm. F., c/o Madison Woollen Co., Madison, Maine, U.S.A., Manager.
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical and Consulting Chemist.
1904. Scoville, Wilbur L., c/o Parke, Davis, and Co., Detroit, Mich., U.S.A., Analytical Chemist.
O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.
1898. Searle, Alfred B., The White Building, Fitzalan Street, Sheffield, Analytical Chemist.
1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).
1905. Seebohm, H. C. A., 117, Hudson Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.
1905. Seeker, A. F., 160, Midwood Street, Brooklyn, N.Y., U.S.A., Food Analyst.
1907. Seelemann, Dr. A., Klosterallee 24, Hamburg, Germany, Managing Director of Explosives Works.

1893. Sefton-Jones, Herbert, 285, High Holborn, London, E.C., Chemist and Patent Agent.
1907. Seidensticker, Lewis J., c/o Warner Sugar Refining Co., Edgewater, N.J., U.S.A., Chief Chemist.
1896. Seldner, Rudolph, 1395, Dean Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1904. Seligman, Dr. Richard, Point Pleasant, Putney Bridge Road, Wandsworth, S.W., Chemist.
1908. Sellen, Elijah, Gasworks Laboratory, M.L.H. & P. Co., Elm Station, Montreal, Canada, Chemist.
1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.
1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.
1910. Sen, Prof. Rajendara Nath, Engineering College, Sibpur, Bengal, India, Professor of Tinctorial Chemistry.
1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.
1911. Serra y Carbo, Jos., Cassá de la Selva, Prov. de Gerona, Spain, Chemist.
1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.
1905. Sewell, B. F. Brooke, P.O. Box 70, Washington, D.C., U.S.A., Chemical Engineer.
1896. Seyler, Clarence A., Public Analysts' Office, Nelson Terrace, Swansea, Chemist and Assayer.
1907. Seymour, Tom G., Kilton, Northway, Wavertree, Liverpool, Analytical Chemist.
1911. Seymour-Jones, R. A., Oaklands, Hilltop, Latchford, Warrington, Research Chemist.
1903. Shacklady, T. G., Hope Point, Cliffe at Hoo, Kent, Technical Chemist.
1911. Shah, Prof. P. G., 759, Sankdi Sheri, Ahmedabad, India Professor of Chemistry, Forman Christian College.
1906. Shah, Prof. S. J., c/o C. M. Shroff, 124, Girgaum Back Road, Bombay, India, Chemist.
1905. Shainwald, R. L., jun., 100, William Street, New York City, U.S.A., Chemist.
1906. Shankland, George A., Manager.
1892. Shanks, Arch., 5, Green Lodge Terrace, Greenhead, Glasgow, Chemist.
1908. Shanks, John, Dalmeny Park, Barrhead, near Glasgow, Sanitary Engineer.
1904. Sharples, G H., Ivy Cottage, Middlewich, Cheshire, Works Chemist.
1905. Sharples, Philip P., 332, Waverley Street, Belmont, Mass., U.S.A., President (Natl. Coal Tar Co.).
1884. Sharples, Stephen P., 560, Concord Avenue, Belmont, Mass., U.S.A., Analytical Chemist.
1911. Sharrock, Charles W., Lion Works, West Thurrock Grays, Essex, Cement Manufacturer.
1900. Sharwood, Dr. Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1912. Shaw, W. D. Hamilton, c/o Coppée Coke Oven Co., Ltd., King's House, Kingsway, London, W.C., Technical Chemist.
1912. Shearman, Cecil H., The Tees Bone Mill, Thornaby-on-Tees, Managing Director.
1904. Shedden, Frank, 25, Middleborough Road, Coventry, Science Master.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
1912. Shelley, F. F., Apothecaries Hall, Blackfriars, London, E.C., Analytical Chemist.
1912. Shelley, Wm. E., 20, Mount Street, Manchester, Engineer.
1911. Shelton, James, 44, Barclay Road, Fulham, S.W., Chemist.
1911. Shen, Buechok, Sien Teh Lane, Burkill Road, Shanghai, China, Chemist.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester. Analytical Chemist.
1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.
1906. Shepard, Jas. H., Experiment Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.
1907. Shepheard, Fred. G., Clarencefield, Ruthwell, R.S.O., Dumfriesshire, Chemist.
1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.
1893. Shepherd, H. H. B., Crayside. Bexley, Kent, Chemist.
1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.
1909. Shepherd, Stephen W., c/o Brotherton and Co , Ltd., Nechells Chemical Works, Birmingham, Works Manager.
1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1896. Shimomura, Prof. K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.
1888. Shishkoff, Sergius A., Mojga, Government of Viatka, Russia, Glass Manufacturer.
1905. Shoffstall, Arthur S., 1, Park Street, Tarentum, Pa., U.S.A., Chemist.
1899. Sholes, Chas. E., 80, Maiden Lane, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 10, Dartmouth Road, Hendon, N., Analytical Chemist.
1897. Shores, Dr. Jeff. H., 20, Saltwell View, Gateshead-on-Tyne, Chemist.
1904. Short, Andrew, 3, Prudhoe Terrace, Tynemouth, Northumberland, Works Chemist.
1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1910. Shrimpton, Jno. K., Redshaw House, Ripon, Yorks, Works Manager.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Fredericktown, Mo., U.S.A., Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.
1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.
1902. Sibley, Samuel E., Hawthorne, King Street, Raudwick, Sydney, N.S.W., Australia, Technical Chemist.
1907. Siebel, Fred. P. 960–962, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.
1902. Siebold, Alfred, 5, Elgin Road, Sutton, Surrey, Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1912. Sillars, Daniel, The Laboratory, Bolckow, Vaughan, and Co., Ltd., South Bank, S.O., Yorks, Metallurgical Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
1901. Sim, Wilfrid A., c/o Wm. Sim and Sons, 40, Jane Street, Leith, Scotland, Colour Manufacturer.
1912. Simmance, John F., 1, Westminster Palace Gardens, Victoria Street, Westminster, S.W., Managing Director (Alexander Wright and Co.).
1911. Simmons, Thos. A., 298, Ditchling Road, Brighton, Analytical Chemist.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 80, Bishopsgate, London, E.C., Chemical Engineer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, via Singapore, S.S., Engineer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 26, Austen Avenue, Sherwood Rise, Nottingham, Works Chemical Assistant.
O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chemist.
1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.

1894. Sinclair, Dr. W., 250, Ferry Road, Leith, Scotland, Chemist.
1890. Sindall, R. W., 2, Oxford Court, Cannon Street, London, E.C., Paper Chemist.
1911. Singh, Shersingh W., N.W. Railway, Kasur, Punjab, India, Engineer.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., 321, Great Clowes Street, Higher Broughton, Manchester, Demonstrator of Chemistry.
1885. Skaife, Wilfred T., 3, Trafalgar Avenue, Montreal, Canada, Sugar Chemist.
1912. Skellon, Herbert, Helsby Cable Works, Helsby, near Warrington, Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., 71, West Chestnut Street, Wakefield, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., 8, Morecambe Terrace, Morecambe, Lancashire, Research Chemist.
1912. Skita, Prof. Dr. A., 18, Wendtstrasse, Karlsruhe, Baden, Germany, Professor, Techn. Hochschule.
1911. Skjold, E., Elm View, The Avenue, Erith, Kent, Technical Manager and Chemist.
1904. Skowronski, S., c/o Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1913. Slade, Roland E., Muspratt Laboratory, The University, Liverpool, Lecturer in Physical Chemistry.
1904. Slator, Dr. Arthur, 174, Ashby Road, Burton-on-Trent, Lecturer and Demonstrator.
1912. Slattery, F. J., 42, Mathews Park Avenue, Stratford, E., Analytical Chemist.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1883. Smail, J. I., Warren Wood, Hayes Common, Beckenham, Kent, Chemical Manufacturer.
1908. Small, Bertram G., Lealnurst, Broughton Park, Manchester, Engineer.
1895. Small, Fritz H., 28, Berwick Street, Worcester, Mass., U.S.A., Chemist.
1904. Smart, Bertram J., Government Testing Laboratory, Lithgow, N.S.W., Australia, Chemist.
O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1895. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.
1897. Smith, Allan, 30, Fountainhall Road, Edinburgh, Chemist.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.
1895. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1912. Smith, Arthur R., c/o Messrs. J. Watson and Son, Ltd., Whitehall Soap Works, Leeds, Chemist.
1893. Smith, Edgar B., c/o Dominion Tar and Chemical Co., 517, New Birks Building, Montreal, Canada, Manager.
1906. Smith, E. A. Cappelen, c/o American Smelting and Refining Co., 165, Broadway, New York City, U.S.A., Metallurgical Engineer.
1913. Smith, Edward C., 18, Constance Street, and c/o Canadian National Carbon Co., Ltd., 99, Paton Road, Toronto, Canada, Superintendent.
1895. Smith, Dr. E. Ellsworth, Suite 80, Chemists, Building, 50, East 41st Street, New York City, U.S.A., Consulting Physiological Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1911. Smith, E. Woodhouse, Central Laboratory, City Gasworks, Nechells, Birmingham, Research Chemist.
1903. Smith, Ewing, c/o The Century Tire Co., Plainfield, N.J., U.S.A., Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 131—133, East 23rd Street, New York City, U.S.A., Chemist.
1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
O.M. Smith, G., Rosehall Terrace, Falkirk, Scotland, Explosives Works Manager.
1908. Smith, George A., 1433, President Street, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).
1907. Smith, George D., 247, Atlantic Avenue, Boston, Mass., U.S.A., Salesman.
1890. Smith, Harry, Newyn, Fleetwood Road, Southport, Cons. Chemist (Paints and Pigments).
1890. Smith, Harry E., 36, Beersford Place, East Cleveland, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Highfield, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1905. Smith, Hugh Dunford, 7 and 9, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.
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1897. Smith, James, Sunnyside, Groes Road, Cressington, near Liverpool, Analytical Chemist.
1903. Smith, James, "Lyndhurst," Frodsham, and (Jnls.) Ditton Copper Works, Widnes, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 41, Grange Avenue, Scarborough, Yorks., Analytical Chemist.
1901. Smith, J. Cruickshank, King's House, King Street, London, E.C., Technical Chemist.
O.M. Smith, Dr. J. H., 21, Rue de la Pointe, Garenne-Colombes, Seine, France, Chemist.
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O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., 1615, West Genesee Street, Syracuse, N.Y., U.S.A., Alkali Works Manager.
1910. Smith, L. Hewgill, c/o The New Transvaal Chemical Co., Delmore, Transvaal, Technical Chemist.
1911. Smith, N. Garrett, c/o Edison and Swan U.E.L. Co., Ltd., Lamp Dept. Laboratory, Ponders End, N., Analytical Chemist.
1898. Smith, R. F. Wood, 90, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
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1911. Smith, Stuart, 1408, Third Avenue East, Owen Sound, Ont., Canada, Chemist.
1897. Smith, Theophilus R., 217, Hylton Road, Sunderland, Chemist.
1907. Smith, Thorn, 49, West Larned Street, Detroit, Mich., U.S.A., Chemist.

910. Smith, Vincent, c/o Smith, Stone, and Knight, Ltd., Birmingham Paper Mills, Cattells Grove, Birmingham, Technical Chemist.
896. Smith, Walter E., 141, Cypress Street, Providence, R.I., U.S.A., Instructor in Chemistry.
903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
908. Smith, Dr. Watson, jun., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
910. Smith, W. C., c/o The Anchor Cable Co., Leigh, Lancashire, Analytical Chemist.
909. Smith, Wm. G., 23, Wickham Way, Parklangley, Beckenham, Kent, Chemical Merchant.
.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
.M. Smithers, F. O., 171, Adelaide Road, London, N.W., and (Jnls.) c/o W. E. Harrison, Technical School, Goldshill Road, Handsworth, near Birmingham, Chemical Agent.
902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
909. Smoot, Chas. C., III., c/o C. C. Smoot and Sons Co., North Wilkesboro', N.C., U.S.A., Tanning Chemist.
902. Smythe, Dr. J. S., 22, Rawlinson Road, Southport, Analytical Chemist.
888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
908. Snell, Professor John F., Macdonald College P.O., Prov. Quebec, Canada, Professor of Chemistry.
896. Snowdon, J., jun., Messrs. Snowdon, Sons and Co., Millwall, E., Chemical and Oil Manufacturer.
900. Sodeau, Dr. Wm. H., Torpedofabrik, Fiume, Hungary, Chemist.
903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors Nobelkrut).
894. Sohn, Chas. E., 52, Fore Street, London, E.C., and (Journals) 82, Wightman Road, Harringay, N., Analyst.
912. Solomon, J. Bernard, 56, Priory Road, London, N.W., Tannery Chemist.
906. Solomon, M., Birmingham Carbon Works, Witton, Birmingham, Manager.
895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
884. Sommer, Adolf, Corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
909. Sommer, Dr. Albert, Munchnerplatz 14 pt, Dresden, Germany, Engineer Chemist.
912. Sorley, Jas., Novara, Mount Vernon, Glasgow, Analytical Chemist.
904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
904. Southerden, F., 11, Gordon Road, Exeter, Teacher of Chemistry.
890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.
887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
910. Spackman, Henry S., 2211, Chestnut Street, Philadelphia, Pa., U.S.A., President of Engineering Co.
904. Sparre, Fin. c/o E. I. du Pont de Nemours Powder Co., Experimental Station, Henry Clay P.O., Del., U.S.A., Director.
904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
905. Speight, W. E., Hacken Sewage Works, Great Lever, Bolton, Chemist.
909. Speirs, Wm., c/o W. N. Gemmill and Co., 142, Queen Street, Glasgow, Chemical Broker.
883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1911. Spence, Dr. David, Research Laboratory, The B.F. Goodrich Co., Akron, Ohio, U.S.A., Director.
1900. Spence, Howard (Journals), Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1909. Spence, Jno., 74, Buchanan Street, Glasgow, Analyst.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, 601—603, Canadian Express Building, Montreal, Canada, Chemist.
1902. Sperry, Elmer A., 100, Marlborough Road, Prospect Park South, Brooklyn, N.Y., U.S.A., Electrical Engineer.
1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.
1884. Spiegel, Dr. Adolf, Messel bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, Dr. P.E., 21, Cadogan Gardens, London, S.W., Chemist.
1906. Spiera, Dr. V. G., c/o Inchiostrificio-Veneto, Treviso, Italy, Chemist.
1889. Spies, Adolph, 21, Broadwater Down, Tunbridge Wells, Chemical Merchant.
1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.
O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.
1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
1909. Sprague, F. O., c/o Cattarangus Tanning Co., Olean, N.Y., U.S.A., Chemist.
1912. Sprent, Dr. Colin, 17, Milton Mansions, Queen's Club Gardens, West Kensington, W., Chemical Engineer.
O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.
1910. Stadler, Hans, c/o Herr Kommerzienrat J. Stadler, Prague, Austria, Technical Chemist.
1896. Stafford, Chas. H., c/o The Birkacre Printing Co., Chorley, Lancs, Colourist.
O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.
1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.
1905. Stalmann, Otto, 317, McCornick Building, Salt Lake City, Utah, U.S.A., Metallurgical Engineer.
1904. Standfast, Jno. T., Prince Regent's Wharf, Silvertown, E., Chemist.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.
O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.
1896. Statham, Noel, c/o West Virginia Pulp and Paper Co., 200, Fifth Avenue, New York City, U.S.A., Engineer.
1907. Staud, Joseph E., c/o W. W. Lawrence and Co., Pittsburg, Pa., U.S.A., Chemist.
1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.
1895. Stead, J. Christopher, 55, Chancery Lane, London, W.C., Technical Chemist.
O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.
O.M. Stebbins, Dr. J. H., 50, East 41st Street, New York City, U.S.A. Analytical Chemist
1896. Steel, Fred. W., c/o General Chemical Co., Ltd., Auburn, Sydney, Australia, Works Manager.
1900. Steel, Jno. S., Achernar, Blackburn, Melbourne, Vic., Australia, Chemist.
O.M. Steel, Thos., Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.
1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.

1912. Steiner, Bernard C., Enoch Pratt Free Library, Baltimore, Md., U.S.A., Librarian.
1897. Steinhart, Dr. Oscar J., c/o Twite and Steinhart, 65, London Wall, London, E.C., Consulting Metallurgist.
1912. Steinhoff, Fred., 24, Wallbrook, London, E.C. Chemical Manufacturer.
1903. Stell, S. F., 25, Henry Street, Keighley, Yorks, Teacher of Chemistry.
1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.
1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.
1904. Stephen, A. E., Rydal Mount, Webb's Avenue, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.
1911. Stephens, C. E., c/o Spies Bros. and Co., 102, Fenchurch Street, London, E.C., Chemical Merchant.
1884. Stephens, H. Chas., Avenue House, Finchley, N., Ink Manufacturer.
1892. Stephens, M. E., 57—60, Aldersgate Street, London, E.C., Ink Manufacturer.
1913. Stephenson, Guy, Bankfoot Laboratory, Crook, Co. Durham, Analyst.
1909. Stephenson, Henry H., Royal Doulton Potteries, Lambeth, S.E., Technical Chemist.
1909. Stephenson, Herbert F., 8, The Park, Mitcham, Surrey, Analytical Chemist.
1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.
1912. Sterne, Edward T., School of Mining, Queen's University, Kingston, Ont., Canada, Chemist.
O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, Oilworks Chemist.
1903. Steven, A. B., Royal Technical College, Glasgow, Lecturer on Dyeing.
1907. Steven, Michael M., Laboratory, Glenochil Distillery, Menstrie, Scotland, Analytical Chemist.
1899. Stevenot, G. A., 280, Baltic Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.
1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.
1908. Stevens, J. Venn, c/o Central Chile Copper Co., Panulcillo, Coquimbo, Chile, Analytical Chemist.
1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.
1903. Stevens, T. R. B., c/o The Sons of Gwalia, Ltd., Gwalia, West Australia, Metallurgical Chemist.
O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.
1912. Stewart, Allan E., 136, Bedford Road, Toronto, Canada, Chemist.
1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.
1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.
1909. Stewart, Jeffrey, India Refining Co., McKean and Swanston Streets, Philadelphia, Pa., U.S.A., Works Manager.
1890. Stewart, Robt., 46, Westbourne Road, Luton, Chemical Works Manager.
O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, Fife, Technical Chemist.
1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.
1904. Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.
1904. Stiff, John T., Post Office, Rosherville, near Gravesend, Kent, Works Chemist.
1903. Stilwell, Albert G., 76½, Pine Street, New York City, U.S.A., Chemist.
1903. Stingelin, Dr. Fritz, 31, Hongger-strasse, Zürich, 6, Switzerland, Chemist.
1886. Stirk, Jos., The Sunnyside Hydro, Southport, Brewer's Engineer.
1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.
1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks, Colour Mixer.
1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.
1887. Stocks, H. B., 12, Victoria Road, West Kirby, Cheshire, Analytical Chemist.
1903. Stoddard, Jesse D., Detroit Testing Laboratory, 1111, Union Trust Building, Detroit, Mich., U.S.A.
1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.
1912. Stoffels, Emile, "Superphosphates et Guanos" Société Anonyme, Ghent, Belgium, Fertiliser Manufacturer.
1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.
1910. Stokes, Edward S., c/o Metropolitan Board of Water Supply and Sewerage, Pitt Street, Sydney, N.S.W., Australia, Medical Officer.
1906. Stokes, Francis J., 17th and Cambria Streets, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1900. Stone, Geo. C., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Engineer.
1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.
1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.
O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.
1902. Storr, Bertram V., 26, The Square, Garden Suburb, Ilford, Essex, Chemist.
1909. Strachan, Jas. T., c/o Hendon Paper Works Co., Ltd., Sunderland, Works Chemist.
1912. Strange, E. Halford, 7, Staple Inn, Holborn, London, W.C., Technical Research Chemist.
1908. Stratford, Alfred W., Vicarage Road, King's Langley, Herts, Chemist.
1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.
1912. Strevens, J. E., c/o Messrs. Palmer and Co., Victoria Oil and Candle Works, Stratford, E., Technical Chemist.
1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1909. Strivens, Percy R., Ash Villa, St. Andrew's Road South, St. Annes-on-Sea, Lancs., Analytical Chemist.
1911. Stuart, F. A., 534, Waterloo Street, London, Ont., Canada, Teacher.
1896. Stuart, Harry T. R., Know Mill House, Entwistle, near Bolton, Printworks Manager.
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1896. Stubbs, Augustus J., 16, Avenida del Tibidabo, Barcelona, Spain.
1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India, Assistant Superintendent.
1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.
1895. Sudborough, Dr. J. J., Indian Institute of Science, Bangalore, India, Lecturer in Chemistry.
1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1910. Sulzer, Albert F., 16, Beverly Street, Rochester, N.Y., U.S.A., Chemical Engineer.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
1907. Sundar-Ram, Minakshi, c/o Parry and Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.
1913. Sundeman, G., c/o Portsmouth Cotton Oil Refining Corporation, Portsmouth, Va., U.S.A., Chemist.
1912. Sutcliffe, J. A. L., City Analyst's Office, 44, Broad Street, Birmingham, Analytical Chemist.
1906. Sutermeister, Edwin, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Chemist.

1884. Sutherland, D. A., 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist.

1909. Sutherland, Daniel M., Ashgrove, Sunbury Common, Middlesex, Works Manager.

1894. Sutherland, Geo., Croft Cottage, Bonhill, Scotland, Chemist.

1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.

1906. Sutherland, John, c/o The Bauxite Refining Co., Ltd., Hebburn-on-Tyne, Manager.

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1886. Sutton, F. Napier, 6, Grosvenor Gardens, Cricklewood, N.W., Alkali Works Inspector.

1900. Sutton, W. Lincolne, Redwell Street, Norwich, Public Analyst.

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1905. Swenarton, W. Hastings, 2, Rector Street, New York City, U.S.A., Patent Lawyer.

1904. Swindells, Seth, Liverpool Road, Kidsgrove, Stoke-on-Trent, Chemist.

1912. Swinden, Thos., 28, Holland Road, Highfield, Sheffield, Metallurgist.

1901. Swinton, Ralph S., c/o W. J. Bush and Co., Inc., Linden, N.J., U.S.A., Analytical Chemist.

1912. Sykes, Charles D., 95, Vicarage Road, Langley, near Birmingham, Chemical Works Manager.

1902. Sylow, Paul L. P. G., New Farm Sugar Refinery, Brisbane, Queensland, Analytical Chemist.

1906. Symes, Langford P., Belfast Freezing Works, Christchurch, New Zealand, Chemist.

1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow, E., Colour Manufacturer.

1910. Szilagyi, L. F., 13, St. Helen's Place, London, E.C., Consulting Engineer.

T

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1910. Tainsh, Peter, Belmont, Sorbie Road, Ardrossan, Ayrshire, Technical Chemist.

1909. Tait, Walter Scott, c/o Messrs. Chris. Thomas and Bros., Ltd., Broad Plain, Bristol, Works Manager.

1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.

1910. Takahashi, Kakuichiro, Su-i-ta, near Osaka, Japan, Chemist.

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1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).

1912. Talley, Herbert, c/o Independent Powder Co. of Mo., Joplin, Mo., U.S.A., General Manager.

1910. Tanahashi, Dr. T., 486, Sendamachi, Fukagawa, Tokyo, Japan, Manufacturing Chemist

1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.

1900. Tankard, Arnold R., City Analyst's Office, 40, Lowgate, Hull, and (Journals) 12, Feren's Avenue, Cottingham Road, Hull, Analytical Chemist.

1907. Tartar, Herman V., Corvallis, Oregon, U.S.A., Analytical Chemist.

1911. Tarver, Percy, 2095, East 36th Street, Cleveland, Ohio, U.S.A., Chemist (Sherwin-Williams Co.).

O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.

1910. Tatlock, Chas. S. A., 156, Bath Street, Glasgow, Analytical Chemist.

O.M. Tatlock, R. R., 156, Bath Street, Glasgow, Consulting Chemist.

1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.

1906. Tattersfield, Frederick, 96, Bewick Road, Gateshead-on-Tyne, Analyst.

1907. Taussig, Dr. Rudolf, Würthgasse 8, Vienna XIX., Austria, Chemist.

1905. Taveau, René de Mortemer, 2100, Chestnut Street, Philadelphia, Pa., U.S.A., Chemist.

1901. Tayler, Jno. Bernard, Anglo-Chinese College Tientsin, North China, Chemist.

1903. Taylor, Alvin M., c/o General Chemical Co., Hegowisch, Ill., U.S.A., Chemist.

1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.

1907. Taylor, C. Marshall, Port Reading, N.J., U.S.A., Chemist.

1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.

1886. Taylor, G. Crosland, Crane House, Crane Wharf, Chester, Electrical Engineer.

1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.

1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.

O.M. Taylor, H. E., 1, Alexandra Park Gardens, Glasgow, Lead Works Manager.

1883. Taylor, Jas., "Adderton," Dundas, N.S.W., Australia, Government Metallurgist.

1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.

1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.

1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, Sidney H., 258, Eccleshall Road, Sheffield, Works Chemist.

1898. Taylor, Walter, 475, Grosvenor Place, Limefield, Bury, Lancs., Technical Chemist.

1905. Taylor, Wm. H., 36, Glenhouse Road, Eltham Park, Kent, Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Marion, Va., U.S.A., Chemist.

1913. Tebbutt, Oswold N., 4, Salisbury Villas, Cambridge, Cement Works Manager.

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

1905. Teeple, Dr. J. E., 50, East 41st Street, New York City, U.S.A., Director.

1908. Teichfeld, Arnold, Tasna 6, Warsaw, Russia, Chemist in Ceramic Industry.

1904. Teller, George L., 31, North State Street, Chicago, Ill., U.S.A., Chemist.

1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.

1884. Tennant, Jas., Fairlie, Ayrshire, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.

1908. Terleski, Fred. H., 11, Oaklands Road, Kersal, Manchester, Technical Chemist.

1911. Terrey, Augustus G., c/o The Limmer Asphalte Paving Co., Ltd., Leamouth Wharf, Orchard Place, Blackwall, E., Chemist.

1884. Terry, Hubert L., (Journals) Fairfield House, Brook Road, Fallowfield, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, Chemist.

1908. Thatcher, Dr. C. J., 1352, Hudson Terminal Building, New York City, U.S.A., Consulting Chemist and Patent Expert.

1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.

1909. Thaxter, Gerald N., c/o Brewer and Co., Worcester, Mass., U.S.A., Chemist.

1908. Theis, Dr. Friedrich C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.

1908. Thiele, Dr. Ludwig, Holland, Mich., U.S.A., Manager, Holland Gelatine Works.

1910. Thom, T. Mathieson, Woodlands, Cheshunt, Herts, Chemical Engineer.

1908. Thom, Wm. H., 1024, Dovercourt Road, Toronto, Canada, Chemist.

1911. Thomas, Benjamin F., 678, McCallie Avenue, Chattanooga, Tenn., U.S.A., President, Cocalola Bottling Co.

1911. Thomas, D. Hibbert, 56, Waun Road, Morriston, Glamorganshire, Chemical Works Manager.

1912. Thomas, Frederick, c/o Williams Bros. and Co., Colour Manufacturers, Hounslow, Middlesex, Chemist and Works Manager.

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1909. Thomas, John, Highfield, Brettell Lane, near Stourbridge, Analytical Chemist.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1908. Thomas, Oswald J. D., c/o Canada Cement Co., Ltd., Plant No. 2, Long Point, Montreal, Canada, Analytical Chemist.

1888. Thomas, S. Percy, Technical Chemist.

1898. Thomas, Wm. Harrison, jun., South Norwalk, Conn., U.S.A., Printworks Chemist.

1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.

1905. Thompson, Alf. J., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., Froyle House, 42, Westcombe Park Road, Blackheath, S.E., Manufacturing Chemist.

1909. Thompson, Edwin, 25, Sefton Drive, Liverpool, Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1912. Thompson, Kenworthy J., 644, Mabbett Avenue, Milwaukee, Wis., U.S.A., Chemist, Federal Rubber Works.

1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.

O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.

[illegible]. Thomson, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.

[illegible]. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.

1907. Thomson, H. N., P.O. Box 337, Tooele, Utah, U.S.A., Metallurgist.

[illegible]. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).

[illegible]. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.

[illegible]. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.

O.M. Thomson, W., Royal Institution Laboratory, 79a, Princess Street, Manchester, Analytical and Consulting Chemist.

1890. Thomson, Wm. Thos., Royal Gunpowder Factory, and (Journals) Forest View, Honey Lane, Waltham Abbey, Essex, Explosives Chemist.

1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist

1910. Thorne, Carl B., c/o Riordan Paper Co., Hawkesbury, Ontario, Canada, Manager.

O.M. Thorne, Dr. L. T., Highlands, The Crescent, Belmont, Surrey, and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.

1907. Thornewell, A. R., 139, Vicarage Road, Langley, near Birmingham, Works Chemist.

O.M. Thorneycroft, Wallace, (Jnls.) Plean House, Plean, Stirling, and 113, St. Vincent Street, Glasgow, Technical Chemist.

1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.

1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.

1899. Thornton, Wm., c/o J. S. MacArthur and Co., Porcupine, North Ontario, Canada, Chemist.

1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.

1911. Thorp, John W., Granville Street, Barnsley, Yorks, Tar Works Manager.

1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.

1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.

O.M. Thorpe, Sir Edward, C.B., F.R.S., Whinfield, Salcombe, South Devon, Professor of Chemistry

1905. Thorpe, Dr. J. F., F.R.S., 5, Endcliffe Hall Avenue, Sheffield, Lecturer.

1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.

1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.

1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.

1909. Thwaites, John, c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Textile Finisher.

1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.

1908. Tillberg, Erik W., Westervik, Sweden, Extract Manufacturer.

1900. Tilley, Jas. W., 95a, Southwark Street, London, S.E., Research Chemist.

1906. Tillson, Henry E., 223, South 61st Street, Philadelphia, Pa., U.S.A., Dyer.

1901. Timmans, W. G., The Basford Chemical Co., Ltd., Basford, Nottingham, Chemical Manufacturer.

1912. Timmis, Shirley S., Messrs. Wm. Gossage and Sons, Ltd., Soap Works, Widnes, Lancs, Soap Manufacturer.

1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.

1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.

1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.

1911. Tobitt, Miss Edith, Omaha Public Library, Omaha, Neb., U.S.A., Librarian.

1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y.; and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist.

1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.

1911. Todd, Fred. W., Gunpowder Works, Tonbridge, Kent, Chemist.

O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.

1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.

1909. Tonry, Wm. S., 57, Spring Valley Avenue, Hackensack, N.J., U.S.A., Chemical Engineer.

1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsands, Liverpool, Engineer.

1911. Tower, Clement B., jun., 68, Western Avenue, Boston, Mass., U.S.A., Gelatine Manufacturer.

O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.

1907. Towler, A. E., c/o Sulphide Corporation, Cockle Creek, N.S.W., Australia, Chemist.

1909. Townend, Harry, Public Library, Bury, Lancashire, Librarian.

1897. Towse, Walter, Elswick Leather Works, Newcastle-on-Tyne, Technical Chemist.

1904. Toyne, Francis D., c/o Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale, Chemist.

1899. Trantom, Dr. Wm., York Road, Grappenhall, Warrington, Chemist.

1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.

1900. Traquair, Jno., Glenfield Starch Works, Paisley, Analytical Chemist.

1904. Trautwein, A. P., Carbondale, Pa., U.S.A., President (Carbondale Instrument Co.).

1906. Travell, Norman E., Grosvenor Avenue, Mapperley Park, Nottingham, Lace Dresser.

1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India, Director.

1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.

1911. Trechmann, C. T., Warren Cement Works, Hartlepool, Cement Manufacturer.

1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.

1885. Trewby, Herbert, Lampetts, Fyfield, Essex, Analytical Chemist.

1909. Trier, Thorvald G., 237, West 22nd Street, New York City, U.S.A., Technical Chemist.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1898. Tripp, Dr. E. Howard, 26, Chaucer Road, Bedford, Science Master.

O.M. Trobridge, A., c/o Trobridge and Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.

1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.

1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.

1887. Tsukiyama, S., 2nd of No. 2116, Fukiai-chō, Kobe, Japan, Paper Mills Chemist.

1894. Tucker, Alex. E., 55, Station Street, Birmingham, Metallurgist and Chemist.

1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1886. Tuer, Arthur H., Douglas House, Worthington, near Wigan, Analytical Chemist.

1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.

1909. Tulloch, Capt. T. G., Bank Buildings, St. James' Street, London, S.W., Director of Public Companies.

1901. Tulloch, Wm. F., 30, George Square, Glasgow, Merchant.

1909. Tunks, Dr. F. R., Powder Mills, Tonbridge, Kent, Manager.

1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.

1899. Turnbull, Dr. Andrew, 18, Hackins Hey, Liverpool, Consulting Chemist.

1888. Turnbull, G. W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.

1884. Turnbull, W. S., 38, Bath Street, Glasgow, Chemical Manufacturer.

1911. Turner, Prof. A. J., Technical Institute, Byculla, Bombay, India, Professor of Chemistry.

1902. Turner, Basil, 83, Pitt Street, Sydney, N.S.W., Australia, Metallurgist.

1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., and (Jnls.) Azo House, Birkby, Huddersfield, Chemist.

1905. Turner, Prof. Thomas, Springfields, Selly Hill, Birmingham, Professor of Metallurgy.

1897. Turney, Fred. N., 12, Dieghem Straat, Saventham, near Brussels, Belgium, Leather Dresser.

1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.

1908. Turnill, Thos. W., c/o Atlas Preservative Co., Windmill Lane, Deptford, S.E., Works Chemist.

1905. Tutwiler, Carrington C., Real Estate Trust Building, Philadelphia, Pa., U.S.A., Consulting Gas Chemist.

1890. Tweedy, Jas., 245, Burdett Road, Limehouse, E., Metallurgical Chemist.

1905. Twigg, Geo. F., 77, Arthur Street. Derby, Gas Works Chemist.

1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.

1913. Twomey, Jerome, 21, Onslow Road, Elm Park. Liverpool, Research Chemist.

O.M. Twynam, T., Wynyard House, Coatham Road, Redcar, Yorks, Metallurgist.

1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.

O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.

O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.

U

1907. Udal, John P., Ridge Road, Berea, Durban, Natal, Engineer.

1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.

1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.

O.M. Umney, C., Fernbrake, Branksome Wood Road, Bournemouth; and (Journals) 48, Southwark Street, London, S.E., Manufacturing Chemist.

1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.

1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.

1885. Underwood, G. R., 10, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.

1908. Underwood, Norman, Bureau of Engraving and Printing, Treasury Dept., Washington, D.C., U.S.A., Chemist.

1904. Uyeda, Toyokitsu, 54, Matsugayechō Kitaku, Osaka, Japan, Chemist.

V

1907. Vail, Jas. G., c/o Philadelphia Quartz Co., Delaware Avenue and Howell Street, Chester, Pa., U.S.A., Chemist.

1911. Vakil, Kapibram H., No. 5, Santa Cruz, Bombay, India, Chemist.

1896. Van der Linde, Harold, c/o Century Rubber Co., Plainfield, N.J., U.S.A., President.

1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.

1913. Van Doren, W. V., 1646, Garfield Boulevard, Chicago, Ill., U.S.A., Chemist.

1903. Van Dyck, Edwin M., c/o Ault and Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.

1897. Van Gelder, Arthur P., c/o Hercules Powder Co., Kenvil, N.J., U.S.A., Superintendent.

1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.

1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.

1897. Van Marken, J. C., 10, Amalia Straat, The Hague, Holland, Chemical Engineer.

1888. Vargas-Vergara, J.M., Apartado No. 120, Bogota, Colombia, S. America, Metallurgical Chemist.

1910. Vass, David, Gas Works, Perth, Manager.

1912. Ventress, Ernest W. S., c/o Messrs. Lever Bros., Kabushiki Kaisha, P.O. Box Sannomiya 174, Kobe, Japan, Oil Mill Manager.

1898. Verity, Ben, 550, Hood Street, Fall River, Mass., U.S.A., Print Works Chemist.

1897. Verity, Victo., 10, Minot Street, North Woburn, Mass., U.S.A., Chemical Works Foreman.

1904. Vernon, R. H., Chemie Gebäude, Polytechnikum, Zurich, Switzerland, Chemical Engineer.

1908. Vickers, Benj. Threlfall, Gascoigne Street, Boar Lane, Leeds, Oil Merchant.

O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.

1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.

1908. Vieweg, Dr. Walter, Gross-Auheim, bei Hanau a/M., Germany, Chemist.

1909. Virolleaud, Leopold, 3, Rue de Paris, St. Denis, Seine, France, Chemical Engineer.

1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.

O.M. Voelcker, E. W., 1, Tudor Street, London, E.C., Analytical and Consulting Chemist.

1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.

1901. Vogel, G. C., 409, Terrace Avenue, Milwaukee, Wis., U.S.A., Tanner.

1897. Vogel, Julius L. F., 27, Old Jewry, London, E.C., Engineer.

1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.

1899. Voorhees, Samuel S., Bureau of Standards, Washington, D.C., U.S.A., Chemist.

1902. Vorisek, Dr. Anton, College of Pharmacy, 115—119, West 68th Street, New York City, U.S.A., Instructor.

1885. Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.

1899. Voss, Walter A., Carlton Chemical Works, Glengall Road, Millwall, E., Manufacturing Chemist.

W

1896. Wachtel, Gregory, Alexandrowski Prospect 15, St. Petersburg, Russia, Chemical Engineer.

1905. Waddell, Montgomery, 30, Church Street, New York City, U.S.A., Consulting Engineer.

1911. Waddock, Wm. P., 666, Harris Street, Ultimo, Sydney, N.S.W., Milk Analyst.

1902. Wade, Frank, 26, St. Ronan's Avenue, Southsea, Analytical Chemist.

1899. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.

1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.

1911. Waele, Armand de, c/o Linoleum Manufacturing Co., Staines, Technical Chemist.

1897. Wagner, Dr. Theodore B., Room 2229, 17, Battery Place, New York City, U.S.A., Chemist.

1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.

1906. Wagstaffe, Dr. E. A., 22, Blackfriars Street, Manchester, Analytical Chemist.

1906. Wahl, Dr. Robert, 1135—1147, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.

1903. Wainwright, J., Ellerslie, The Wiend, Lower Bebington, Cheshire, Soap Works Manager.

1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.

1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.

1908. Wait, Douglas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.

1901. Waite, C. Nelson, c/o The Jessop and Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.

1899. Wakefield, Wm. C., Mill Street East, Savile Town, Dewsbury, Chemical Manufacturer.

1905. Waldenberger, Dr. C. A., 62, Mercer Street, Jersey City, N.J., U.S.A., Chemist.

1894. Waldman, Louis J., 78, Willett Street, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.

1895. Waldstein, Dr. Martin E., 23, Broadwater Down, Tunbridge Wells, Kent, Manufacturing Chemist.

1887. Walker, Archibald, Newark Castle, Ayr, Scotland, Distiller.

1908. Walker, George, c/o Anglo-Persian Oil Co., Mohammera, Persia, viâ Bombay, Analytical Chemist.

1897. Walker, H. V., 193, Lincoln Avenue, Newark, N.J., U.S.A., Chemist.

1894. Walker, Prof. Jas., D.Sc., F.R.S., 5, Wester Coates Road, Edinburgh, Professor of Chemistry (University of Edinburgh).

1897. Walker, Jas. W., Marine Lodge, Irvine, Scotland, Chemical Manufacturer.

1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on Trent, Assayer.

1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.

1910. Walker, John S., Hiratsuka, Sagami, Japan, Explosives Chemist.

1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.

1912. Walker, Prof. W. O., Dept. of Chemistry, School of Mining, Kingston, Ont., Canada, Professor of Chemistry.

1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.

1897. Wallace, Edwin C., 306, South Street, Jamaica Plain, Boston, Mass., U.S.A., Chemist.

1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.

1897. Wallace, Robt. A., 66, Holland Road, London, W., Chemical Manufacturer.

O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.

1906. Wallerstein, Leo, 177, West 72nd Street, New York City, U.S.A., Chemist.

1899. Wallerstein, Dr. Max, 24—26, West 30th Street, New York City, U.S.A., Chemist.

1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.

1901. Walsh, Lionel O. P., c/o Dominion Tar and Chemical Co., Ltd., Sydney, Cape Breton, Canada, Chemist.

1903. Walsh, Peter H., P.O. Box 569, Magog, Quebec, Canada, Analytical Chemist.

1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.

1908. Walton, Robert H., Railway Stores, Eveleigh, Sydney, N.S.W., Analyst.

1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1911. Walton, Wm. Keighley, Beechwood, Upper Rushton Road, Thornbury, Bradford, Analyst.

1895. Want, W. Philip, 194—200, Bishopsgate, London, E.C., Pharmacist and Editor.

1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.

1904. Warburton, George H., 21, Buckley Road, Brondesbury, N.W., Analytical Chemist.

1896. Warburton, Thos., 14, Sunny Bank Road, Longsight, Manchester, Chemist.

1912. Ward, Alfred B., 25, Crieff Road, Wandsworth Common, S.W., Infants' Food Manufacturer.

1912. Ward, Dudley R., 163, St. Paul's Street, St. Catherine's, Ontario, Canada, Analytical Chemist.

O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.

1891. Ward, G. J., Hallam Fields, Ilkeston, Notts., Civil Engineer.

1898. Ward, John. Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.

1899. Ward, Wm. J., 11, Manor Road, Sale, Manchester, Chemist.

1908. Wardleworth, Theo. H., 168, Côte Saint Antoine Road, Westmount, Montreal, Canada, Manufacturing Chemist.

1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.

1899. Warnes, Arthur R., 13—17, Green Lane, Hull, Consulting Technical Chemist.

1912. Warren, E. Bruce, c/o India Rubber and Gutta Percha Telegraph Works Co., Silvertown, E., Consulting Analytical Chemist.

1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Paper Manufacturer.

1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.

1907. Warren, W. H., Gas Works, Beckton, E., Gas Engineer.

1912. Warriner, C. E., City Analyst's Office, Fort William, Ont., Canada, Analyst and Bacteriologist.

1911. Washburn, Frank S., Stahlman Building, Nashville, Tenn., U.S.A., President, American Cyanamid Co.

1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.

1902. Watkins, E. J., 1, St. Mary's Road, Peckham, S.E., Works Chemist.

1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.

1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.

1884. Watson, Chas., Rose Bank, School Road, Moseley, Birmingham, Manufacturing Chemist.

1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.

1908. Watson, C. I. Wilkinson, c/o Wailuku Sugar Co., Wailuku, Maui, Hawaiian Islands, Chemist.

1890. Watson, Eric E., c/o Straits Trading Co., Butterworth, Penang, S.S., Chemist.

1901. Watson, Herbert J., 68, Peel House Lane, Widnes, Chemist.

1903. Watson, H. W., Rose Villa, Roper Avenue, Gledhow, Leeds, Analytical Chemist.

1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.

1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.

1905. Watson, James, 62, Goddington Road, Strood, Kent, Cement Works Manager.

1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.

O.M. Watson, Jno. C., 230, Butler Avenue, Providence, R.I., U.S.A., Printworks Chemist.

O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.

1901. Watt, Francis L., 10, Northcote Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Analytical Chemist.

1906. Watt, Dr. H. E., Blandfield Chemical Works, Wheatfield Road, Edinburgh, Chemist.

1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.

1908. Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.

1910. Watts, Reginald H. Pole, 57, Leagrave Road, Luton, Beds., Research Chemist.

1907. Waumsley, Harry, Hanley Lodge, Springfield Road, Chelmsford, Chemical Engineer.

1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.

1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.

1905. Webber, W. J., 40, Central Street, Boston, Mass., U.S.A., Manufacturing Chemist.

1912. Weber, Dr. Max G., 151, Water Street, Perth Amboy, N.Y., U.S.A., Works Manager.

1901. Webster, Geo. J., Room 506, Manning Chambers, Toronto, Canada, Secretary.

1902. Webster, Jno., Laboratory of Pathological Chemistry, St. Mary's Hospital, London, W., Analyst.

1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.

1904. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.

1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.

1902. Weed, Hy. T., 181, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.

1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.

1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., Stockton-on-Tees, Chemist.

1910. Weinberg, Dr. Arthur von, "Buchenrode," Forsthaus-strasse, Frankfurt a/M, Germany, Dyestuff and Chemical Manufacturer.

1906. Weir, James, c/o Imperial Varnish and Color Co., 6—24, Morse Street, Toronto, Canada, Chemist.

1902. Weiskopf, Dr. Erich, c/o Japanese Explosives Co., Ltd., Hiratsuka, Japan, Works Manager.

1910. Weiss, John M., c/o Barrett Manufacturing Co., Research Dept., Hudson Heights, N.J., U.S.A., Chemist.

1908. Weissmuller, Edward F., Hill Crest, Runcorn, Cheshire, Chemist.

1905. Weissmüller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.

1910. Welch, Bertie M., 80, Hunter Street, Sydney, N.S.W., Australia, Assayer.

1912. Weld, Fred. C., 263, Fairmount Street, Lowell, Mass., U.S.A., Analytical Chemist.

1899. Weldon, Leonard E., 154, Egypt Road, New Basford, Nottingham, Dyer.

1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.

1912. Wells, Jas. H., 18, Alwyne Place, Canonbury, London, N., Metallurgist.

1894. Wells, Pierson L., Patent Lawyer and Engineer.

1885. Welsh, Jas., Standard Mills, Ferguson Road, Bombay, India, Printworks Manager.

1890. Welsh, Thos. L., 3, Prince's Gardens, Downhill, Glasgow, Analytical Chemist.

O.M. Welsh, W., Holt Town Oil Works, Manchester.

1905. Welt, Dr. Ida, 101, West 109th Street, New York City, U.S.A., Chemist.

1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.

1909. Wescott, J. P., jr., 55, Washington Park, Newtonville, Mass., U.S.A., Manager, Atlas Chemical Co.

1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill. U.S.A., Consulting Chemist.

1889. Wesson, D., 111, South Mountain Avenue, Montclair, N.J., U.S.A., and (Jnls.) c/o Southern Cotton Oil Co., Trafford Park, Manchester, Technical Chemist and Cotton-oil Expert.

1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.

1903. West, Leonard, Selworthy, Quarndon, Derby, Manufacturing Chemist.

1909. West, Percy C. H., 153, Barnsbury Road, London, N., Analytical Chemist.

1900. Westenfelder, B. D., 1414, Race Street, Cincinnati, Ohio, U.S.A. Chemist.

1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.

1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.

1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass. U.S.A., Chemist and Bacteriologist.

1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.

1890. Wetter, Jasper, 37—39, Essex Street, Strand, London, W.C., Patent Agent.

1912. Weyman, Geoffrey, 70, Manor House Road, Jesmond, Newcastle-on-Tyne, Technical Chemist.
O.M. Whalley, L. J. de, 18, Brandram Road, Lee, S.E., Sugar Chemist.
1909. Wharton, Fredk. M., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Chemist.
1908. Wheaton, H. J., Spondon, near Derby, Chemical Engineer.
1909. Wheeler, Edward, 144, Earlsdon Lane, Coventry, Demonstrator of Chemistry.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., Chemist.
1907. Wheeler, R. Vernon, Home Office Experimental Station, Eskmeals, Cumberland, Chemist.
1912. Wheeler, Thorne L., c/o Edible Products Co., 156—186, East 22nd Street, Bayonne, N.J., U.S.A., Chemist.
1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.
1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.
O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1899. Whitaker, Milton C., Columbia University, New York City, U.S.A., Chemist.
1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.
O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks, Manufacturing Druggist.
1901. White, H. Graham, 28, Brancote Road, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, "Eastville," Norwood Road, Sheffield, Manufacturing Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
1911. White, John W., c/o E.C. Powder Co., Green Street Green, Dartford, Kent, Works Chemist.
O.M. White, Paul T., Hortonfield House, West Drayton, Chemical Manufacturer.
1910. White, P. Winzar, Hortonfield House, West Drayton, Middlesex, Manufacturing Chemist.
1911. White, Walter W., c/o Citro Chemical Co., Maywood, N.J., U.S.A., Secretary and Manager.
1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.
1912. Whitehead, Charles E., 20, Albion Road, Chesterfield, Derbyshire, Chemist.
1903. Whitehouse, P. L., 16, Lombard Street, West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1911. Whitley, George, jr., c/o Ridley, Whitley, and Co., Ltd., Angel Road Works, Edmonton, N., Linoleum Manufacturer.
1912. Whitney, Wm. L., c/o U.S. Graphite Co., Saginaw, Mich., U.S.A., Chemist.
1885. Whittaker, C. J., Winthrop, Ansdell Road, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 78, Brinkerhoff Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs., Bleacher.
1910. Whymper, R., St. Clare's, St. Mary's Road, Ditton Hill, Surbiton, Chemist.
1899. Wiarda, Jno. C., 259-273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1908. Wickes, Clarence S., 28, Franklin Avenue, Merchantville, N.J., U.S.A., Factory Superintendent.
1905. Widmann, Eugene A., 495, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., Wiggin Street Works, Birmingham, Nickel Refiner.
1897. Wigglesworth, H., 25, Broad Street, New York City U.S.A., Manufacturing Chemist.
1906. Wikner, Sigurd A., 82, Gravelly Hill, Birmingham, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham Kent Analytical Chemist.
1893. Wilder, F. L., 10, Forest Rise, Walthamstow, Essex, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.
1911. Wildt, Dr. Edwin, c/o Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Technical Chemist.
1912. Wiley, Samuel W., 15, South Gay Street, Baltimore. Md., U.S.A., Analytical Chemist.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1899. Wilkens, H. A. J., 60, Broadway, New York City, U.S.A., Mining Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1911. Wilkinson, Frank, West Lodge, Handsworth, near Sheffield, Chemical Manufacturer.
1904. Wilkinson, Prof. J. A., South African School of Mines and Technology, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1903. Willard, C. T., c/o The Singer Manufacturing Co., Elizabethport, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C., Patent Agent.
1911. Willcox, Stuart J., 46, Mulgrave Street, Liverpool, Chemist.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist and Assayer.
1912. Williams, Egbert R., 43, Kendall Avenue, Toronto, Canada, Chemist.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., 12, Clevedon Road, Beckenham Road, Penge, Chemist.
1904. Williams, Jno. T., 815, Madison Avenue, New York City, U.S.A.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, 19, Tankerville Road, Streatham Common, S.W., Chemist.
1885. Williams, Rowland, 79, Queen Square, Lancaster, Analytical Chemist.
1912. Williams, Samuel B., Penelvan, Roskear, Camborne, Cornwall, Metallurgist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, 150, Mystic Street, West Medford, Mass., U.S.A., Textile Engineer.
1887. Williams, W. Collingwood, 36, Dansie Street, Liverpool, Analytical Chemist.

O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.

1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.

1911. Williamson, John, jun., Alne Hill, Camp Road, Maryport, Cumberland, Tanner.

O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.

1912. Willis, Benjamin A., 28, St. Sulpice Street, Montreal, Canada, Representative (Merck and Co.).

1903. Wills, J. Lainson, c/o Otto F. Stifel's Union Brewing Co., Gravois and Michigan Avenues, St. Louis, Mo., U.S.A., Technical and Brewing Chemist.

1905. Wills, Wm. H., 23, Willow Street, Waltham, Mass., U.S.A., Dyer.

1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.

1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.

1910. Wilson, Dr. Forsyth J., Royal Technical College, Glasgow, Lecturer.

1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.

1903. Wilson, Geo. C., 298, Byars Road, Hillhead, Glasgow, Chemist.

O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

1902. Wilson, Geo. W., Viaduct House, Dinting, near Manchester, Works Chemist.

1899. Wilson, Gordon, Benallan, Kirkintilloch, and (Journals) Apartado 92, Zacatecas, Mexico, Chemist and Assayer.

1886. Wilson, Jno., Tyneside, 381, Hagley Road, Birmingham, Technical Chemist.

1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.

1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chem. Dept.

1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.

1906. Wilson, J. Murray, c/o Canadian Explosives, Ltd., Transportation Building, Montreal, Canada, Technical Chemist.

1902. Wilson, Leonard P., 8, Chester Street, Coventry, Technical Chemist.

1910. Wilson, Leslie, West Bank, Doxey, near Stafford.

O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.

1912. Wilson, S. Siddons, 154, Burges Road, East Ham, Essex, Analytical Chemist.

1909. Wilson, Wm. J., 12, Vicarage Park, Plumstead, Kent, Chemist.

1908. Wilson, William James, Tirohanga, North End Road, Devonport, Auckland, New Zealand, Consulting Cement Engineer.

1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.

1911. Wilton, Norman, c/o The Chemical Engineering Co., Hendon, N.W., Chemical Engineer.

1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.

1912. Windsor, P. L., Library, University of Illinois, Urbana, Ill., U.S.A., Librarian.

1892. Wingfield, T. R., 12, Suffolk Road, Bournemouth West, Brewer.

O.M. Wingham, A., 57, Victoria Road South, Southsea, Hants, Metallurgical Chemist.

1908. Winkler, Hermann, Bockenheimer Anlage 43, Frankfurt a/Main, Germany, Merchant.

O.M. Winser, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.

1907. Winsloe, Louis S., 1, Booth Street, Manchester, Manufacturing Chemist.

1892. Winstanley, W. Hy., Birch House, Cheadle Hulme, Cheshire, Technical Chemist.

1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.

1907. Winther, Dr. A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany Chemist.

1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.

1889. Wishart, Jno., Oakbank Oil Co., Ltd., 29, St. Vincent Place, Glasgow, General Manager.

1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.

1906. Withey, Wm. S., Burry Port, South Wales, Chemist.

O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend, bei Berlin, Professor of Chemistry.

1904. Wolf, August S., 104, West 71st Street, New York City, U.S.A., Chemist.

1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.

1912. Wolff, Dr. Salamon, c/o Messrs. Mather and Platt, Park Works, Manchester, Chemical Engineer.

1911. Wollaston, T. Roland, Dirleton House, Priory Road, Sale, Cheshire, Consulting Engineer.

1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.

1906. Wood, E. Escott. Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.

1900. Wood, Frank, Ardsley House, near Barnsley, Yorks, Assistant Manager (Glass Works).

1901. Wood, Frank S., 12, Carlton Avenue, Hornsea, East Yorks., Cement Works Chemist.

1909. Wood, Hubert R., c/o Fenner and Alder and Co., Fenner's Wharf, Millwall, E., Works Chemist.

1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.

1906. Woodall, Sir Corbett, Palace Chambers, Westminster, London, S.W., Civil Engineer.

O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Chemist

1910. Woodhead, Arthur E., Dyeing Dept., The University, Leeds, Research Student.

1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.

1900. Woodrow, John, 84, Harpenden Road, Manor Park, E., Chemist.

1906. Woodward, Horace A., Cowell Avenue, West Orange, N.J., U.S.A., Chemist.

1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.

1913. Woolf, Douglas Y., 150, Claremont Avenue, Montclair, N.Y., U.S.A., Textile Chemist.

O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.

1905. Woore, N. L., "Tallandra," Walker Street, North Sydney, N.S.W., Australia, Assayer.

1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.

1909. Work, Charles O., 22, Cambridge Road, Great Crosby, Liverpool, Analytical Chemist.

O.M. Worrall, H., Culmington House, Stanton Lacey, Ludlow, Dyer.

1903. Worstall, Robt. A., 21, North La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.

1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.

1896. Wrampelmeier, T. J., 565, Monadnock Building, San Francisco, Cal., U.S.A., Chemist.

O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.

1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).

1912. Wright, Arthur, 111, Broadway, New York City, U.S.A., Lawyer.

1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India (July). Wynder, Burley-in-Wharfedale, Chemist.

1908. Wright, C. Harold, Government Laboratory, Port of Spain, Trinidad, B.W.I., Analytical Chemist

1904. Wright, Chas. L., 123, South Madison Avenue, La Grange, Ill., U.S.A., Chemical Engineer.

1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.

1907. Wright, John Henry, 16, Norwood Avenue, Shipley, Yorks. Technical Chemist.

1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.

O.M. Wright, L. T., Junior Constitutional Club, Piccadilly, London, W., Chemical Engineer.

1910. Wright, Robert, 122, York Street, Jarrow-on-Tyne, Blast Furnace Manager.

1911. Wright, Robt., c/o Thos. Adams, Ltd., Sherwood Hill Works, Nottingham, Bleacher and Dyer.

1900. Wright, Walter J., 59, Stone Street, Faversham, Kent, Chief Chemist (Cotton Powder Co.).

1890. Wulfing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.

1907. Wurster, Oscar H., c/o Lever Bros., Ltd., Toronto, Canada, Soap Works Chemist.

1906. Wuth, Dr. B., 6, Wettsteinplatz, Basle, Switzerland, Chemist.

1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.

1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.

O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.

1908. Wyler, Dr. Max, c/o Levinstein, Ltd., Blackley, Manchester, Manufacturing Chemist.

1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Taptonville Road, Sheffield, Professor of Chemistry.

Y

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.

1897. Yates, W. H., 10, Curzon Road, Southport, Technical Chemist.

1913. Yeomans, Wm. W., c/o American Agricultural Chemical Co., Lewis and Lyman Streets, Buffalo, N.Y., U.S.A., Chemist.

1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.

1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.

1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.

1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.

1900. Yoshitake, E., Nishihara Machi, Koishikawa, Tokyo, Japan, Chemist.

1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.

1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.

1902. Young, Chas. C., c/o Farbenfabriken of Elberfeld Co., 117, Hudson Street, New York City, U.S.A., Colourist.

1890. Young, Dr. Geo., Bradda, Church Crescent, Church End, Finchley, N., Chemist.

1913. Young, Hamish, Springfield, Brownside Road, Cambuslang, by Glasgow, Chemist.

1904. Young, James, 45, Palace Grove, Bromley, Kent Chemist.

O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.

1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.

1909. Young, John, P.O. Box 164, Akron, Ohio, U.S.A., Analytical Chemist.

1904. Young, Jno H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.

1898. Young, J. W., 22, Maxwell Drive, Glasgow, S., Inspector under Alkali Acts.

1912. Young, Robert, 1, Kelvinside Terrace West, Glasgow, W., Chemist.

1909. Young, R. F., c/o Institution of Mining and Metallurgy, Salisbury House, London, E.C., Chemist and Metallurgist.

1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.

O.M. Young, W. C., Laboratory, 24, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.

1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks, Chief Chemist.

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1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.

1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.

1912. Zanetti, Joaquin E., c/o Ministerio de Industrias, Montevideo, Uruguay, Chemist.

1906. Zaremba, Edw., 707, D. S. Morgan Building, Buffalo, N.Y., U.S.A., President (Zaremba Co.).

1906. Zdanowicz, Joseph, 37, Queen's Gate Gardens, South Kensington, S.W., Chemical Engineer (Artificial Silk).

1899. Zilz, Henry, 20—26, Brunswick Place, City Road, London, N., Agent (Badische Anilin und Soda Fabrik).

O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.

1905. Zimmermann, Chas., 9 and 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.

1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.

1913. Zortman, Dr. Israel H., c/o Messrs. Rosenberg and Co., 259, High Holborn, London, W.C., Research Chemist.

1912. Zwingenberger, Dr. Otto K., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.

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